TIGHT BINDING BOOK

UNIVERSAL
LIBRARY

OU_166992

UNIVERSAL
LIBRARY

Presented

With the Compliments of



THE DEPARTMENT OF STATE

OF

THE UNITED STATES OF AMERICA

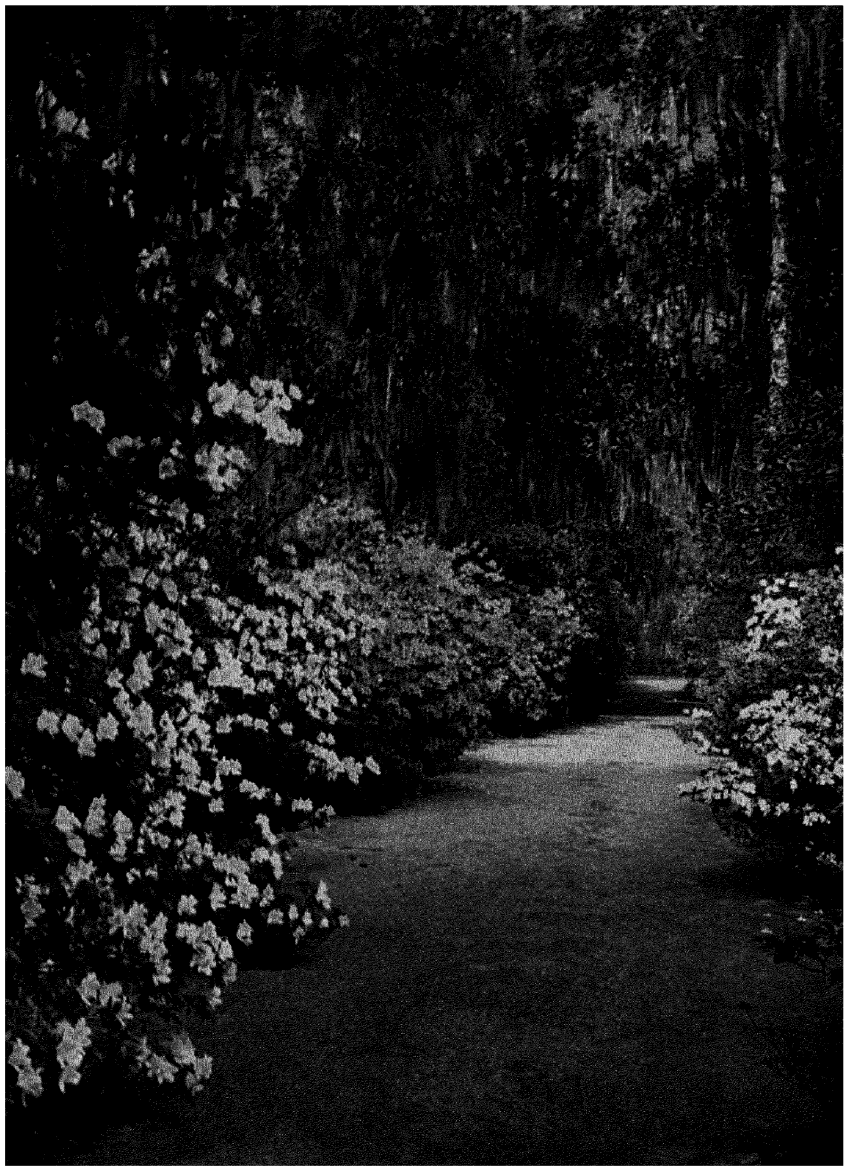
THE STANDARD CYCLOPEDIA OF HORTICULTURE



THE MACMILLAN COMPANY
NEW YORK · BOSTON · CHICAGO · DALLAS
ATLANTA · SAN FRANCISCO

MACMILLAN AND CO., LIMITED
LONDON · BOMBAY · CALCUTTA · MADRAS
MELBOURNE

THE MACMILLAN COMPANY
OF CANADA, LIMITED
TORONTO



I. The azalea walk.—Magnolia, South Carolina

THE STANDARD CYCLOPEDIA OF HORTICULTURE

A DISCUSSION, FOR THE AMATEUR, AND THE PROFESSIONAL AND COMMERCIAL GROWER, OF THE KINDS, CHARACTERISTICS AND METHODS OF CULTIVATION OF THE SPECIES OF PLANTS GROWN IN THE REGIONS OF THE UNITED STATES AND CANADA FOR ORNAMENT, FOR FANCY, FOR FRUIT AND FOR VEGETABLES; WITH KEYS TO THE NATURAL FAMILIES AND GENERA, DESCRIPTIONS OF THE HORTICULTURAL CAPABILITIES OF THE STATES AND PROVINCES AND DEPENDENT ISLANDS, AND SKETCHES OF EMINENT HORTICULTURISTS

BY

L. H. BAILEY

Illustrated with Colored Plates, Four Thousand Engravings in the Text, and Ninety-six Full-page Cuts

IN THREE VOLUMES

VOL. 1—A–E

PAGES 1-1200. FIGS. 1-1470

Being Vols. I and II of Original Edition

New York

THE MACMILLAN COMPANY

1950

COPYRIGHT, 1900, 1914, BY THE MACMILLAN COMPANY

REWRITTEN, ENLARGED AND RESET

COPYRIGHT, 1928, 1942, BY L. H. BAILEY

All rights reserved—no part of this book may be reproduced in any form without permission in writing from the publisher, except by a reviewer who wishes to quote brief passages in connection with a review written for inclusion in magazine or newspaper

---

Vol I Set up and Electrotyped Published March 25, 1914 Vol II Set up and Electrotyped Published July 22, 1914 Reprinted May, 1917, March, 1919 Reissued with corrections March 1922 Reprinted (Vol I and II combined), January, 1925, January, 1927 July, 1928, May 1930 February, 1933, February 1935 Popular Edition, Published October, 1935, November, 1935, October, 1937, May, 1939, March 1941, March, 1943, April, 1944, January, 1947, November, 1947, May, 1950

PREFACE

FOURTEEN years ago the present Editor wrote the preface to Volume I of the Cyclopedia of American Horticulture. The purpose of that work was "to make a complete record of the status of North American horticulture as it exists at the close of the nineteenth century;" it was the effort to include "all the species which are known to be in the horticultural trade," together with outlines of "the horticultural possibilities of the various states, territories and provinces," to present biographical sketches of eminent American horticulturists not then living, and in general to discuss the cultivation and handling of horticultural crops. In the preface to Volume IV of that work the Editor expressed the hope that the Cyclopedia would never be revised. "If new issues are called for, mere errors should be corrected; but beyond this, the plates should be left as they are," for it was the purpose of the book that it should stand as a measure of that time. The different volumes have been separately reprinted, but about eight complete re-issues of that Cyclopedia have been made, with such corrections of errors as have been reported; in one restricted edition, published by Doubleday, Page & Co., the same work was bound in six volumes, together with an enlarged preface and a key to the families and genera.

The present Cyclopedia, although founded on the former compilation, is a new work with an enlarged scope. While the older work will no longer be published, it nevertheless stands by itself; and the two should be quoted as independent cyclopedias. The geographical boundaries are wider in the present work, due to the fact that the United States and Canada have both acquired new tropical connections and interests in recent years. It has not been the effort to cover completely the horticultural floras of Porto Rico, Hawaii, and other islands, for that would involve the tropical flora of the globe; but it is the intention to include the most outstanding species grown in a horticultural way in those islands. A fuller treatment has also been given of the plants grown in southern Florida, southern California, and the other southernmost areas of the continental United States.

The treatment in the former Cyclopedia was confined closely to species in "the trade,"—to those plants "sold in the United States and Canada." The present work accepts this basis in general, for the lists of nurserymen, seedsmen, and fanciers indicate very closely the plants that actually are grown, and it would manifestly be impossible as well as undesirable to include all the plants that may be found in botanic gardens, or in the grounds of specialists and amateurs who collect specimens from original sources, or those introduced for purposes of experiment or test or only for scientific study: but "the trade" is interpreted more liberally in this work, to include the offerings of

many European dealers because those dealers supply American customers, to account for species mentioned prominently in European horticultural periodicals as well as in American periodicals, and to insert such plants as are known to be subjects of exchange or to be frequently in cultivation in any region, even though their names may not be found in a commercial list. While it is intended to account for all the species in the trade, it is not intended to name the garden varieties; for the variety lists change too rapidly for discussion in cyclopedic works. The mention of varieties in the leading group-articles is more a matter of record than of recommendation.

Care has been exercised to exclude species that are evidently not now of interest to horticulturists, even though their names may be found in the literature; for the introduction of many dead entries would not only violate the purpose to make a current record, but would make the books too voluminous and would confuse the student with too many names and details. It is desired that the treatment shall be contemporaneous, and that it shall be rescued as far as desirable from the older glasshouse method of transatlantic work. The Cyclopedia aims to account for the plants horticulturally grown within its territory which are now the subjects of living interest or likely to be introduced, to discuss the best practices in the growing of the staple flower and fruit and vegetable crops, to depict the horticultural capabilities of the states and provinces, to indicate the literature of the field, and incidentally to portray briefly the lives of the former men and women who have attained to a large or a national reputation in horticultural pursuits.

The method in the Cyclopedia, in other words, turns about two purposes,—the identification of species, and the cultivation of plants. Both are essential to an understanding of horticulture. The former lends itself readily to usual cyclopedic treatment, the latter expresses itself as a manual of practice. The combination produces an irregular literary product, but it is hoped that the result is not inharmonious.

The cultural details involve special difficulties. The North American continent presents so many conditions that advice for outdoor work cannot be too specific in a work of this kind without leading to serious mistakes. What is advised by a good grower in one place may be contradicted by a good grower in another place. Even in under-glass treatment, in which conditions are largely artificial, difficulties often arise in trying to apply in America the instructions given for European practice. It is not possible for one to grow plants by a book; in this work the cultural details are not directions so much as statements of standard practice: this practice will need to be considerably modified in many cases if the best result for special conditions or objects is to be secured. In the former Cyclopedia the culture was often presented by two persons of unlike experiences for the express purpose of meeting the needs of amateurs; but readers seem to think this to be confusing and the practice has not been followed in the present work. However, special effort has been made to secure the best cultural advice for the plants requiring peculiar or particular handling, and this advice will be found in the discussion of the different crops and plants under their respective heads

and in addition many practical class-articles have been prepared for the aid of the cultivator and designer. These class-articles are mostly as follows:

Alpine Plants
Annuals
Ants
Aquatics
Arboretum
Arboriculture
Autumn-Gardening
Banks
Basket Plants
Bedding
Bees
Biennials
Birds
Border
Botanic Garden
Bouquet
Bulbs
Conservatory
Culinary Herbs
Cut-Flower Industry
Cuttings
Design, Floral
Diseases and Insects
Drainage
Dwarfing
Evaporating Fruit
Evergreens
Everlastings
Exhibitions
Ferns
Fertilizers
Floriculture
Florists' Plants
Forcing
Forestry
Frost
Fruit-growing
Fungi
Grafting
Grasses
Greenhouse
Hedges
Herbs
Horticulture
Hotbeds and Coldframes
House-Plants
Inspection
Irrigation
Kitchen-Garden
Labels
Landscape-Gardening
Layers
Machinery and Implements
Manure
Market-Gardening
Marketing
Muckland-Gardening
Mushrooms
Nursery
Nut-Culture
Nuts
Orchids
Packages
Palms
Perfumery-Gardening
Pergolas
Planting
Potting
Pruning
Railroad-Gardening
Rock-Gardening
Seeds and Seedage
Storage
Transplanting
Transportation
Vegetable-Gardening
Walks, Drives and Pathways
Watering
Windbreaks
Window-Gardening

There is marked growth in outdoor horticulture in North America. The largest extension in the present Cyclopedia, so far as taxonomic work is concerned, is in the description of trees and shrubs. There is widespread interest in these subjects. We are beginning to realize our native resources in woody plants, to understand how to make use of our many climates and natural conditions; and to incorporate freely into our cultivated flora many of the trees and shrubs of China and other regions, under the stimulus of the Arnold Arboretum and other agencies. The resources of the Arboretum have been placed at the command of the Cyclopedia through the careful and original work of Alfred Rehder. Similar aids have been extended from other sources, and particularly from the Foreign Seed and Plant Introduction service of the United States Department of Agriculture.

While hardy plants and outdoor gardening seem to be increasing rapidly in favor, there is a decided tendency toward the breaking-up of large fanciers' collections, in private establishments, of old-time glasshouse plants. It is now quite impossible, for example, to find in this country any large private collections of the species of begonias or of the varieties of camellias or of the show pelargoniums; orchid collections of notable extent are few. The demand of the trade is for relatively few species, and the commercial collections are mostly concerned with a few stock kinds and florists' plants, together with a small addition of annual novelties, rather than with the former long lists of many separate and interesting species and varieties. Even private places, especially private greenhouses, are devoted very largely to cut-flowers and florists' plants. It is incumbent on a cyclopedia of this kind, however, to preserve the accounts of these begonias, orchids, palms, cacti, succulents, "stove plants," and others, even though many of them may be known to very few; and the Editor hopes that the amateur will regain his ascendancy and that collections of plants because they are plants may not perish from amongst us.

There has been great extension in recent years in commercial floriculture and in the

forcing of vegetables. We now think in terms of cropping under glass. The range of species of plants involved in these industries is relatively small, but the areas are large, the business is receiving the attention of able men and women, and the glasshouse industries are making important contributions to the lives of the people. The recent growth of the commercial fruit-growing industry is also notable. Once largely restricted to narrow regions and to "fruit belts," the growing of fruits for market has now assumed the proportions of a great industry comparable with the staple agricultural productions. An effort has been made to catch something of the spirit of all these large efforts, as well as to provide information and advice for the amateur and the home gardener.

When the Cyclopedia of American Horticulture was made, there were few specialists in the systematic botany of cultivated plants. The Editor hopes that the publication of that Cyclopedia has contributed something to the acceleration of interest in this long-overlooked subject. Howbeit, the number of competent specialists, and of those intelligently interested in the subject, is now large enough to have enabled the Editor to cover many of the important groups. The cacti have been placed mostly in the hands of J. N. Rose; a number of tropical plants have been handled anew by W. E. Safford; the orchids, aroids and bromeliads by George V. Nash; euphorbiads by J. B. S. Norton, Citrus and related genera by Walter T. Swingle, Nymphæaceæ by H. S. Conard; the ferns by R. C. Benedict; most grasses by A. S. Hitchcock, special groups by Norman Taylor, chiefly among the composites, palms, and tender araliads; suggestions on cultivated forms and on cultivation have been contributed by C. P. Raffill, of the tropical department, Kew; the survey of families of plants and most of the editorial work on the general introductory key have been in the hands of K. M. Wiegand; and many small groups and special genera have found new treatment by persons who have given them careful study over a considerable period of time. The results of modern scientific studies are now beginning to be positively reflected in the identification of garden plants, and in the advice for the cultivation and handling of horticultural crops and products. With so many persons partaking, it is of course impossible to secure uniformity of taxonomic handling in the various groups, but the gain of having the contributions of specialists will abundantly offset this small technical disadvantage.

And yet, it is true that very much of the work is necessarily compiled from literature rather than constructed from a direct study of the plants themselves. There is no herbarium or other complete and authentic repository of all the species of plants sold by dealers. The best that can be done in very many cases is to accept the name appearing in a catalogue and to attach to it the most authentic or most adaptable description of a recognized botanical species of the same name; there is no telling whether the dealers' plant is properly determined or whether it represents the botanical species bearing the same name. It is impossible now to know how many wrong determinations, inaccurate

and insufficient descriptions, and faulty judgments have been perpetuated from author to author through long series of years. All these matters must be worked out in years to come, when the horticultural plants in the various groups shall have been systematically studied with care. The Editor repeats the hope expressed in the preface written fourteen years ago "that every entry in this book will be worked over and improved within the next quarter century."

Many persons aside from the leading authors have contributed to the enterprise in the most helpful spirit. The Editor's daughter has borne much of the burden of the office and editorial detail. Gardeners, fruit-growers, florists, vegetable-growers, teachers and experimenters, botanists, and the printers, have responded with good fellowship and with something like patriotic pride. Their names will be recorded in the concluding volume; and the public that uses the book will reward them with its gratitude.

Nor should the institutions that have afforded all these persons the opportunities to make their contributions be overlooked. Aside from those agencies already mentioned, the Cyclopedia is under special obligation for the use directly or indirectly of books and collections to Cornell University, the United States Department of Agriculture, the New York Botanical Garden, the Brooklyn Botanic Garden, the Missouri Botanical Garden, the Gray Herbarium, the Royal Botanic Gardens, Kew, the agricultural colleges and experiment stations, and others. Seed merchants, nurserymen, and other commercial establishments of standing, have been very ready with suggestions and help.

Many new illustrations have been added, representing the work of several artists. Most of the new work has been made by B. F. Williamson, New York City; F. Schuyler Mathews, Cambridge, Mass.; Miss M. E. Eaton, of the New York Botanical Garden; Mrs. M. W. Gill, Washington; C. H. L. Gebfert, Boston; and Miss Matilda Smith, of the Royal Botanic Gardens, Kew, England, whose initials will be recognized on the plates of the famous Botanical Magazine. By permission of Professor Sargent, much of the accurate and beautiful work of C. E. Faxon and others in Garden and Forest, a journal that was discontinued more than fifteen years ago and is now out of the market, has been adapted and made available for the present reader; record is made in the text of the pictures of species, at the places where they are used. Some of the work in the old government surveys of the great West has also been brought to the use of the general public.

It is not wholly with satisfaction that one puts forth a work of this magnitude. The responsibility increases with the largeness of the enterprise, for users do not readily purchase new and corrected editions of a work of this extent. Every care has been taken to present an accurate and faithful account, and this is as far as the responsibility can extend. The Editor can not expect to make another cyclopedia of horticulture; but he hopes that these six volumes will comprise another step in the collecting, assorting and appraising of our horticultural knowledge.

L. H. BAILEY.

ITHACA, NEW YORK.
December 30. 1913.

PREFACE TO SECOND EDITION

IN THE five years that have intervened since the Standard Cyclopedia of Horticulture was completed and published, relatively little change has occurred in the general introduction of plants new to cultivation in North America. Many species have been disseminated in an experimental way, as by the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture, and other agencies, but for the most part they have not yet become a regular part of the commerce in horticultural plants although many of them promise important results. The extensive discoveries of E. H. Wilson, exploring in China and elsewhere for the Arnold Arboretum of Harvard University, are likely to add many riches to our horticulture as they become distributed and known. The unrecognized or improperly named species long in the country are probably many, and it is the part of investigators to uncover them. The introduction of plants from many parts of the world into Florida, southern Texas, California, and other mild regions newly settled has been rapid within the past generation, and the material has not been sufficiently studied. The cultivated flora as a whole is in need of careful exploration. The more than 27,000 Latin-named species and varieties admitted in the Cyclopedia comprise in themselves an extensive flora. How many of these things are now in active cultivation, what their adaptabilities may be, what satisfaction is gained in the growing of them, are problems awaiting the attention of thoughtful students.

If to this imperfectly known flora are added the probabilities of introductions in the future to supply the vast domain of the continent, together with the wide variations and the hybridizations likely to result, the imagination scarcely runs to the limits of the subject. In the marginal regions, as along northern and southern boundaries and in the developing semi-arid parts, great experiments are still to be made in the adaptability of plants, undoubtedly calling for the introduction of species yet strange to us. Species of the native flora are now regularly collected, grown, and introduced to the public, and many of these will probably yield important variations and changes in the future.

The lists of horticultural varieties of fruits, vegetables, and flowers undergo constant changes and fluctuations. Varieties are supplanted by new and often by better ones; fashions and demands change; the legitimate desire for novelty must be met. It is fortunate that the vegetable kingdom is plastic. As these horticultural varieties are often fugitive, and as their adaptation varies so widely in different parts of the country, they are purposely not treated in this Cyclopedia, as well as because the space at the

command of the volumes precludes such extended discussion. Yet, even if the varieties come and go, they are nevertheless one of the first concerns of the horticulturist, particularly in these days when it is so necessary to meet specific requirements of markets and connoisseurs. This knowledge of varieties is to be obtained as other current information is acquired, whether in horticulture, engineering, zoölogy, or medicine,—by means of the trade periodicals, publications of commercial firms and of institutions, correspondence, discussions in societies, and other kinds of alertness.

The special mark of the horticulture of this day is its strong commercial trend. This means that the demand is good for plants and their products. Floriculture, once the exclusive domain of amateurs, has now become a staple industry and a source of national wealth. The same is true of fruit-growing and other fields, although they developed earlier. The investigations of experiment-stations have supplied a base of fact and determinable knowledge on which to build and to protect these industries. Machines and many clever devices have aided their extension. The facilities for communication, transportation, storage, and distribution have aided them as they have assisted other activities. The publication of technical and trade journals tends always to standardize the industries and to make men resourceful. The commercial movement in horticulture tends to reduce the number of species and varieties, as compared with an unorganized amateur activity.

The amateur interest in horticulture preserves the species and the miscellaneous varieties, inasmuch as the plants are grown for the human interest in them. This amateur activity is large. Probably it is larger than ever before, although it may be distanced by the commercial activities and by the market movements. In fact, to a large extent, the amateur is the market. This is true of the trade in species and varieties of iris, peonies, gladioli, and others. By every means, the amateur spirit in horticulture is to be encouraged as a resource to the people and as one of the means of providing a satisfying background to life.

The first volume of this Cyclopedia was published in 1914 and the sixth in 1917. Those years saw considerable activity in the introduction of plants. These introductions, numbering 89 species and Latin-named varieties, are described in the addendum to Vol. VI, pages 3565–3573. This is much less than one-half of one per cent of the total number described in the Cyclopedia. In 1917, the United States entered the World War, and Canada was already in. We are not to expect so great activity in plant introduction in those fateful years. It would scarcely be worth while to revise the Cyclopedia throughout for the purpose of entering the novelties.

Attention should be called to the Finding-List, published as a supplement to Vol. VI, beginning page 3575. This list was made for the purpose of harmonizing current trade names with the botanical names in the Cyclopedia. It was compiled in coöperation with the American Joint Committee on Horticultural Nomenclature representing the national horticultural associations of the country, and it was separately published by the Committee. The Finding-List is practically a current trade index

to the Cyclopedia, and it also includes a few changes in nomenclature. The user of the Cyclopedia should understand the significance of this List.

In the present issue of the Cyclopedia, certain typographical corrections have been made. It has not been thought necessary to introduce such changes in nomenclature as have resulted from new studies of certain genera by different authors, particularly as some of the changes are of doubtful significance in horticulture.

L. H. BAILEY.

CONTENTS

VOL. I

	Pages
A SYNOPSIS OF THE VEGETABLE KINGDOM	1– 78
Index to the Synopsis	78
KEY TO THE FAMILIES AND GENERA	79–136
Index to the Key	137–147
NAME-LIST: English equivalents of the Latin names of species	148–159
GLOSSARY of usual botanical and horticultural technical words	160–170
TEXT, A AND B	171–602

FULL-PAGE PLATES

	Facing page
I. The azalea walk, Magnolia, South Carolina (in color)	*Frontispiece*
II. Vegetation areas.—Aquatic, marsh and upland floras, and showing the relation of farm lands	18
III. Desert vegetation.—The giant cactus (*Carnegiea gigantea*); also bushes of *Opuntia fulgida*, and in the foreground the low fine growths of *Bigelovia Hartwegii*	42
IV. Upland vegetation.—Trees on a wind-swept plateau	79
V. *Anemone coronaria*, an old garden favorite	171
VI. A good example of aquatic gardening, with water-lilies and Japanese iris	230
VII. The flowers of the apple tree	313
VIII. The York Imperial apple (in color)	331
IX. Arboretum.—Plantation of American oaks at the Arnold Arboretum; *Solidago canadensis* underplanting	352
X. Arboriculture.—*Picea pungens*, the Colorado blue spruce	373
XI. Arboriculture.—A palm plantation, with *Corypha umbraculifera* in the foreground	389
XII. Asparagus, variety Colossal	412
XIII. Bean.—The bush lima (in color)	460
XIV. Foliage begonias well grown in banks, with ferns and similar plants	479
XV. The American blackberry.—The Agawam, about natural size	510
XVI. Botanic garden.—The formal garden of the Johns Hopkins University	523
XVII. The arrangement of bouquets	534
XVIII. Canadian orchard development.—The tidewater country in Nova Scotia	562
XIX Canadian orchard development.—The bench lands of British Columbia	575
XX. A border of hardy bulbs (in color)	594

Facing page

XXI. Cherry.—Specimen fruits of one of the heart cherries (in color) . . . 612

XXII. Carnations.—Types of the American winter-flowering varieties 630

XXIII. *Cattleya Lawrenceana* . . . 686

XXIV. *Cœlogyne cristata*, one of the popular and easily grown orchids 710

XXV. Celery.—The cultivation under field conditions, at the hilling-up or banking stage (in color) 724

XXVI. Sweet cherry in flower and fruit 741

XXVII. Coconut in flower and fruit. Southern Florida. (Fla. Photo. Concern) 773

XXVIII. Stowell Evergreen sweet corn . . 803

XXIX. Cranberry-picking in a New Jersey bog. (Photo. by Elizabeth C. White) 832

XXX. Chrysanthemum.—Two of the florist's types (in color) 861

XXXI. The White Spine cucumber . . 901

XXXII. The Fay currant, one of the leading red varieties 917

XXXIII. *Cycas circinalis*, the male plant. (Photograph by Henry Pittier) 931

XXXIV. Dahlia.—Jeanne Charmet, one of the most beautiful Decorative dahlias (in color) 953

XXXV *Dendrobium superbum* as grown in the American tropics . . 978

XXXVI. A border of dianthus and digitalis . . 1009

XXXVII. *Dracæna Goldieana*, a "foliage plant" from tropical Africa . . 1069

XXXVIII. The California poppy.—*Eschscholtzia californica* 1120

XXXIX. *Eucalyptus viminalis* in California 1148

EXPLANATIONS

The main account of each genus, in large type and separate paragraph for each species, represents the plants probably now in cultivation or at least of major importance.

The "supplementary lists" in smaller type at the end of the articles include names of plants not known to be in the trade but which may be mentioned in horticultural literature, and also such Latin-form names of the trade as are imperfectly understood and cannot be placed under their proper species. These parts are less critical finding-lists of other or extra species.

The Cyclopedia undertakes to account for the species in cultivation within its territory to the close of the year 1912; but in practice the introductions are included to the date of the closing of the different pages.

The size-marks on the illustrations, as (× ⅛), indicate the amount of reduction as compared with natural size, this scale being determined merely by measuring the flat diameter of a drawing and not representing bulk or perspective.

AUTHORSHIP

The practice of the Cyclopedia of American Horticulture in signing the leading and most important articles with the name of the author is here retained. The original author, so far as living or as he has desired, has revised or rewritten his articles for the present work. In very many cases, another person has now revised the articles, and the name of the reviser is indicated by a dagger (†) If the revision has amounted practically to a complete rewriting of the article, the original author's name may not appear, even though some small parts or features of the original article may be retained; this is for the purpose of safeguarding the original author as well as recognizing the work of the present author: the first Cyclopedia stands as the record of its own work.

A name in parentheses, as "(G. W. Oliver)," at the close of a paragraph, indicates that the person is the author of that particular paragraph and of no other in the article. When a person is responsible for more than one paragraph in an article, his part is set off by a separate heading in such a way that it cannot be mistaken.

It is desired to secure experts and specialists for the articles; when this has not been accomplished, the task of revision has fallen to the Editor.

Effort has been made to bring the different parts of the work into as much uniformity of plan and treatment as is possible in an undertaking of this kind; references have been compared; proofs have been submitted to two or more persons in case of difficult or doubtful subjects; and the advice as to cultivation has been checked by practical growers.

NOMENCLATURE

The nomenclature follows in the main the regulations of the "Vienna code," being the principles adopted by the International Botanical Congress held in Vienna in 1905. This code was adopted by the International Horticultural Congress held at Brussels in 1910, with adaptations to horticultural practice. When no combination has yet been made under the Vienna code, the prevailing usage for the particular genus (as expressed in latest monographs) is followed. That is, there is no attempt to reduce all names to one system except so far as combinations have already been made under the international rules, both because a cyclopedia of horticulture is hardly the place in which to make original combinations (except incidentally), and because there is little likelihood that any of the formal systems will have permanency The subject of nomenclature, and the attitude of the Editor, will be discussed under "Names and Nomenclature" in Vol. IV. Botanical names should not be changed lightly, or for the purpose of regularizing any particular scheme or plan, or to make them always conform to an arbitrary set of rules Botanical names do not belong to botanists, to do with them as they will. The public has good rights in these names; and this is particularly true in the names of cultivated plants, for they may then have standardized commercial value. The only stability, of course, is usage; and usage can rarely be forced into hard-and-fast regulations In this Cyclopedia, the interest is in stability of names rather than in priority of names, therefore it accepts the principle of the "nomina conservanda" of the Vienna code, so far as it retains generic names that have been established in general usage for fifty years following their publication, even though the particular names in that list may not have been adopted in every instance.

Not all the changes in names arise from the application of rules of nomenclature. Many of them are the results of taxonomic studies, which make new definitions for genera and species. In this Cyclopedia, there are marked examples of such changes in the citrus genera, in the cacti, and other groups. These changes are to be expected as a result of closer studies of the various groups, of accumulation of specimens from many regions, and the progressive modification of views as to the constitution of genera and species; they are expressions of a living botany. Such changes will be particularly demanded in horticultural plants, for most of these groups have not yet been studied with critical care.

PRONUNCIATION

Attention is called to the fact that the names of genera and species in this work are marked to indicate the accepted pronunciation. The indications are accent marks placed over a vowel. The accent designates (1) stress, or the emphatic syllable, and (2) the length of the emphatic vowel. Following the American custom, as established by Gray and others, a grave accent (ˋ) is employed to designate a long vowel, and an acute accent (ˊ) a short vowel

Thus *officinàle* is pronounced offici-*nay*-li; *microcárpus* is pronounced micro-*cár*-pus. It should be remembered that the final *e* terminates a separate syllable, as *commù-ne*, *vulgà-re*, *gran'-de* This final *e* takes the short sound of *i*, as in *whip*

Ordinarily in diphthongs the mark is placed over the second letter. Thus, in *aùrea* the *au* is meant to have its customary long sound, as if written *awe*. In *eùit* has practically the long sound of u, as in *Pseùdo-Quìna*, *Pseùd-Acàcia* Double vowels take their customary English sounds, as *ee* and *oo*. Thus, the *oo* in *Hoòkeri* is to be pronounced as in *hook*. In most cases, the letters *oi* (from the Greek, meaning *like to*) are to be pronounced separately· if the *i* is the penultimate syllable (next to the last), it is long, as in *yuccoì-des;* if the *i* is the antepenultimate syllable (third from the end), it is short, as in *rhomboí-dea* In *dioicus* and *monoicus*, however, the *oi* is a true diphthong, as in *moist*

These pronunciations follow, in general, the common English method of pronouncing Latin names. However, many of the Latinized forms of substantive and personal names are so unlike Latin in general construction that the pronunciation of them may not follow the rule As a matter of fact, biological nomenclature is a language of itself thrown into a Latin form, and it should not be a source of regret if it does not closely follow classical rules in its pronunciation of outlying or non-Latin names.

It has seemed best to make an exception to strict literary rules in the case of personal commemorative names in the genitive: we retain, so far as possible, the pronunciation of the original name. Thus, a plant named for Carey is called *Cà-reyn*, not *Carèy-i;* for Sprenger, *Spréng-eri*, not *Sprengèr-i;* for Forbes, *Forbs'-ii*, not *Forbès-ii*. It cannot be expected that uniform consistency has been attained in this matter. It is not always known how the person pronounced his name; and many personal names do not make conformable Latinized words No arbitrary method of pronouncing personal names is likely to be satisfactory.

It may be well to add what are understood to be the long and short sounds of the vowels

à as in *cane*	**ò** as in *cone.*
ă as in *can*	**ŏ** as in *con.*
è as in *mete.*	**ù** as in *jute.*
ĕ as in *met.*	**ŭ** as in *jut.*
ì as in *pine.*	
ĭ as in *pin.*	

y is often used as a vowel instead of i.

SPELLING

The original spelling of generic and specific names is preferred; that is, the spelling used by the person who made the name. In some cases this original orthography does not conform to the etymology of the name, particularly if the name is made from that of a person Such a case is *Diervilla*, named for Dierville. Ideally, the name should be spelled *Diervilla*, but Tournefort and Linnæus did not so spell it

In accordance with the best authorities, the digraph *æ* is used in the words cærulea, cærulescens, cæspitosa, cæsia, *æ* is used in cœlestis and cœlestinum.

The type ligatures *æ* and *œ* have been dropped from Latin-made names that have come into the vernacular. Thus, as a common or English name, Spiræa becomes spirea, Pæonia becomes peonia or peony, Brodiæa becomes brodiea, Cratægus becomes crategus.

THE KEYS

There are two groups of keys in the Cyclopedia,—the main key, in Vol I, to leading families and genera, and the keys to the species in the different genera in all the volumes. The user of the Cyclopedia should forthwith familiarize the method of the keys Page 79

To facilitate the study of the plants, the species have been arranged systematically or horticulturally, under the genus, rather than alphabetically, and in large or complex genera, an alphabetical index has been supplied for rapid reference The grouping of the species is founded preferably on horticultural rather than on botanical characters, so that the arrangement does not always express botanical relationships.

The species-keys are arranged primarily to aid the gardener in making determinations. Every effort is made sharply to contrast the species rather than to describe them A word of explanation will facilitate the use of the keys The species are arranged in coördinate groups of various ranks, and groups of equal rank are marked by the same letter. Thus, group A is coordinate with AA and with AAA, and group B with BB and BBB; and the B groups are subordinate to the A groups, and the C groups to the B groups, and so on. Moreover, whenever possible, the coördinate keys begin with the same catchword: thus, if A begins "flowers," so do AA and AAA; and this catchword is not used for keys of other rank. As an example, refer to Abutilon, page 177. Look first at A, beginning "Lvs.," then at AA, also beginning "Lvs." Under AA are the coördinate divisions B and BB, each with "Foliage" for the catchword. Under B there are no subdivisions, but under BB there are divisions C and CC, each with "Fls." for a catchword. Under C there are no subdivisions, but CC has two coördinate divisions, D, DD, each with "Blossoms" for a catchword. Again, D happens to have no division, but DD has the divisions E and EE with "Lf.-blades" as the catchword. In other words, if the plant in hand does not fall under A, the inquirer goes at once to AA. If it falls under AA, then he determines whether it belongs to B or to BB, and so on.

A display of a scheme would stand as follows:

A. Leaves, etc.
  B. Flowers, etc.
    C. Fruits, etc.
      D. Pods, etc.
      DD. Pods, etc.
        E. Seeds, etc
        EE Seeds, etc.
    CC. Fruits, etc.
  BB Flowers, etc.
AA. Leaves, etc.
  B. Roots, etc.
    C. Flowers, etc
      D. Margins of leaves, etc.
      DD Margins of leaves, etc
    CC. Flowers, etc.
  BB. Roots, etc.
  BBB. Roots, etc.
AAA. Leaves, etc.

When the genus is large or the treatment is complicated, the key may be placed separately at the beginning rather than to be divided among the paragraphs; this allows the student to see the entire scheme or plan at once. See Acer, page 196

ABBREVIATIONS OF BOTANICAL TERMS AND GENERAL EXPRESSIONS

caps. . . . . . capsule.
cult. . . . . . cultivated, cultivation.
diam. . . . . . diameter.
E. . . . . . East.
fl. . . . . . flower
fls. . . . . . flowers.
fld. . . . . . flowered (as few-fld.).
fr. . . . . . fruit.
frs. . . . . . fruits
ft. . . . . . foot, feet.
in. . . . . . inch, inches
incl. . . . . . including.
infl. . . . . . inflorescence (cluster).
intro. . . . . . introduced.
lf. . . . . . leaf
lflt. . . . . . leaflet.
lflts. . . . . . leaflets.
lvd. . . . . . leaved.
lvs. . . . . . leaves.
N. . . . . . North.
Prop. . . . . . propagated, propagation.
S. . . . . . South.
segm., segms. . . . . segment., segments.
st. . . . . . stem.
sts. . . . . . stems.
subfam. . . . . . subfamily.
syn. . . . . . synonym.
Trop . . . . . tropics, tropical.
var. . . . . . variety.
W. . . . . . West.
† . . . . . reviser (of an article).
∞(sign of infinity) . . . numerous, many.

BOOKS AND PERIODICALS

To aid the student in the verification of the work, and to introduce him to the literature of the various subjects, citations are made to the portraits of plants in the leading periodicals to which the American referrer is most likely to have access These references to pictures have been verified, as far as possible, both in the MS and in the proof A uniform and regular form of citation is much to be desired, but is extremely difficult to secure because periodicals rarely agree in methods. It was decided to omit the year in most cases, because of the pressure for space, but the student who lacks access to the original volumes may usually ascertain the year by consulting the bibliographical notes below.

An arbitrary and brief method of citation has been chosen. At the outset it seemed best to indicate whether the cited picture is colored or not. This accounts for the two ways of citing certain publications containing both kinds of pictures, as The Garden, Revue Horticole, and Gartenflora The figures given below explain the method of citation, and incidentally give some hints as to the number of volumes to date, and of the number of pages or plates in one of the latest volumes

Standard works on the bibliography of botany are Pritzel's "Thesaurus" and Jackson's "Guide to the Literature of Botany," also, Jackson's "Catalogue of the Library of the Royal Botanic Gardens, Kew" Rehder's "Bradley Bibliography," a guide to the literature of the woody plants of the world, is invaluable The Catalogue of the Library of the Arnold Arboretum, Harvard University, now being printed, will afford an excellent guide to the literature of botany, particularly as it relates to woody plants

A F. . . . The American Florist Chicago A trade paper founded August 15, 1885 The volumes end with July Many pictures repeated in "Gng" (14 1524=vol and page)

A.G. . . . American Gardening New York. Represents 14 extinct horticultural periodicals, including The American Garden (1888–1890) (20 896=vol and page)

B. . . . . The Botanist Edited by Maund No years on title pages Founded 1839 Eight vols, 50 colored plates in each vol (8.400=vol and col plate.) Cumulative index

B B . . . Britton & Brown An Illustrated Flora of the Northern U S, etc New York, 1896–98 Ed 2 in 1913 (3 588=vol and page of ed 1, (ed 2) 3 =vol and page of ed 2)

B.H. . . . La Belgique Horticole Ghent. 35 vols. (1851–1885).

B.M. . . . Curtis' Botanical Magazine. London. Founded 1787 The oldest current periodical devoted to garden plants The vol. for 1912 is vol 138 of the whole work. Index to first 107 vols by E. Tonks. London (7690=col plate.)

B.R. . . . Botanical Register (1815–1847) Vols 1–14 edited by Edwards, vols 15–33 by Lindley In vols 1–23 the plates are numbered from 1–2014 In vols 24–33 they are numbered independently in each vol. There are 688 plates in vols. 24–33. "An Appendix to the First Twenty-three Volumes" (bound separately or with the 25th vol.) contains an index to the first 23 vols. An index to vols. 24–31 may be found in vol. 31. (1198=col. plate. 33:70=vol. and col. plate.)

B.S.D. . . Bulletin de la Société dendrologique de France Paris. Founded 1906. One vol. each year. Illustrated (1907:198=year and page.)

B.T. . . . Britton. North American trees. New York. 1908 All American trees illustrated

C.L.A.. . . Country Life in America. Founded Nov. 1901. Two volumes a year. (12:75=vol and page)

C.O. . . . Cogniaux Dictionnaire Iconographique des Orchidées Colored plates, with descriptions. (6=col plate)

Em. . . . . Emerson, G B Trees and Shrubs of Massachusetts. Boston. 2 vols. 149 plates

F. . . . . The Florist London 1840–1884 (1884: 192=year and page opp col plate) Editors and title pages changed many times. Known as the Florist, Florist's Journal and Florist and Pomologist. Sometimes improperly called British Florist.

F.C. . . . Floral Cabinet Knowles & Westcott. London 1837–1840 3 vols, 4to

F.E. . . . The Florists' Exchange New York A trade paper, whose pictures sometimes are repeated in "A G" Founded Dec 8, 1888. (11:1298=vol and page)

F.M. . . . Floral Magazine London Series I 1861–1871, 8vo Series II 1872-1881, 4to. (1881 450=year and col plate)

F.R. . . . Florists' Review Chicago A trade paper. Vol 1, Dec. 2, 1897, to May 26, 1898. Two vols a year (4 660=vol and page)

F.S. . . . Flore des Serres. Ghent (1845–1880) Inconsistent in numbering, but the plate numbers are always found on the plate itself or on the page opposite Valuable but perplexing indexes in vols 15 and 19 23 vols. (23:2481 =vol and col plate)

F.S.R. . . Flora and Sylva London 1903–1905 Edited by W Robinson 3 vols (2.24=vol and page opposite colored plate 2, p. 31=vol. and page containing black figure)

F.W. . . . The Floral World and Garden Guide London Edited by Shirley Hibberd 1858–1880 No plates until 1868 (1875.33=year and col. plate)

G. . . . . Gardening, Illustrated London Founded March 1, 1880 Vols begin with the March number (10.25=vol and page)

G.C. . . . The Gardeners' Chronicle London. Series I. (1841–1873) is cited by year and page. Series II or "New Series" (1874–1886), is cited thus II 26.824=series, volume and page Series III is cited thus III 26·416. Two vols a year, beginning 1874 A select index is scattered through 1879 and 1880. Consult II. 12. viii (1879), and similar places in subsequent vols.

G.F. . . . Garden and Forest New York. 1888–1897. (10·518=vol. and page)

G L. . . . Garden Life London Incorporates The Gardening World after May 1, 1909 Cited only from vol 16 (16.54=vol and page)

G.M. . . . Gardeners' Magazine London Ed by Shirley Hibberd Founded 1860 Cited from vol 31 on. (42 872=vol and page)

Gn. . . . . The Garden London Founded 1871 Two vols. a year through 1906 Since then one vol (56:458=vol. and page opp. xxl. plate. 56, p 458=vol and page containing black figure) An Index of the first 20 vols was separately published Complete Index of Colored Plates to end of 1897 in vol. 54, p 334.

Gng. . . . Gardening. Chicago. Founded Sept. 15, 1892. Vols. end Sept. 1. (7:384=vol. and page.)

Gn. M. . . The Garden Magazine. Garden City, N. Y. Founded 1905. (7:543=vol. and page.)

Gn. W. . . Gardening World. Founded 1884. Incorporated after 1909 in Garden Life. (7:118=vol. and page.)

G.O.H. . . Guimpel, Otto & Hayne. Abbildungen der fremden in Deutschland ausdauernden Holsarten. Berlin, 1825. 144 col. plates.

Gt. . . . . Gartenflora. Berlin. Founded 1852. (Gt. 48:1470=vol. and col. plate. Gt. 48, p. 670=vol. and page containing black figure)

G.W. . . . Die Gartenwelt. Founded 1896 The first year it appeared under the title "Hesdorffers Monatshefte fur Blumen- und Gartenfreunde" (13.58=vol and col plate. 13, p. 58=vol and page)

G.W.H. . . Guimpel, Willdenow and Hayne Abbildung der deutscher Holzarten. 2 vols Berlin 1815–20 216 col. plates.

G.Z. . . . Illustrirte Garten-Zeitung. Founded Oct 1856. One col plate in each month. (4:88=vol. and col. plate.)

HBK. . . . Humboldt, Bonpland & Kunth. Nova Genera et Species, etc. Paris. 1815–25 7 vols Folio

H.E. . . . Hooker, Exotic Flora. London, 1823–7. 232 col plates

H.F. . . . L' Horticulteur Français 1st series 1851–1859 2nd series 1859–1872 (1853 273=1st series, year and col plate II 1860 381 =2nd series, year and col plate)

H.H. . . . Hough, Handbook of Trees of the Northern States and Canada Lowville, N Y 1907 All trees of the region illustrated, all parts of the trees, including bark represented by photographic reproductions

H.I. . . . . Hooker's Icones Plantarum London. Founded in 1837 Contains up to 1913 3,000 black plates in 30 vols The plates with botanical descriptions in Latin

H.U.. . . . L'Horticulteur Universel Paris 1839–1845. 8 vols with col plates The first 6 vols edited by C Lemaire Vol 7 and 8 called Deuxième and Nouvelle série (7.28=vol. and plate)

H.W. . . . Hempel and Wilhelm Baume und Sträucher des Waldes Wien, 1889-99 3 vols 60 beautiful col plates and numerous black illustrations in the text (3.45=vol and col plate, 3, p 113=vol and page containing black figure).

I.H. . . . L'Illustration Horticole Ghent (1854–1896) (43 72=vol and col plate) The volumes were numbered continuously, but there were 6 series. Series I=1854–63 Series II=1864–9 Series III=1870–80 Series IV =1881–6 Series V=1887–93 Series VI =1894–6 The plates were numbered continuously in the first 16 vols from 1 to 614 in vols 17–33 they run from 1 to 619 in series V from 1 to 190 in Series VI they begin anew with each vol Valuable indexes in vols 10 and 20 Series V in 4to, the rest 8vo.

I.T. . . . . Icones Seiectæ Horti Thenensis Bruxelles, 1899–1909. 6 vols with 240 plates (6 220= vol and black plate)

J. . . . . Jardin, journal bi-mensuel d'horticulture générale Paris Founded in 1887 (10 36 =vol and page opp col plate, 10, p 345 =vol and page containing black figure)

J.C.T. . . Journal of the College of Science, Imperial University Tokyo, Japan Founded in 1886, 33 vols up to 1913 Contains black plates and figures in the text of plants of E. Asia. (6:3=vol. and plate)

J.F. . . . . Le Jardin Fleuriste Ghent 1851–1854. Edited by C Lemaire 4 vols with 430 col plates and black figures in the text. (4.421=vol and col plate, 4, p 66=vol and page containing black figure.)

J.H. . . . . Journal of Horticulture. London Founded in 1848 as The Cottage Gardener. Series III only is cited, beginning 1880 (III. 39:504=series, vol, page)

J.H.F. . . Journal de la Société d'horticulture de France Paris. Founded in 1827 as Annales et Journal de la Société roy d'horticulture de Paris. Only series IV is cited, beginning 1900 (IV 1:209=series, vol. and page containing black figure.)

J.H.S. . . **Journal of the Horticultural Society of London.** Founded in 1846. 9 vols. from 1846–55. A new series started in 1866 The earlier series is cited by the year, the new series by the volume (1846.188=year, page opposite plate, 28.394, fig. 96=vol , page opposite black plate or containing black figure, and fig in case of several figures)

L.B.C. . . The Botanical Cabinet Loddiges 1817–33. 100 plates in each vol Complete index in last vol (20.2000=vol and col. plate.)

L.D. . . . Loiseleur-Deslongschamps, Herbier général de l'amateur Paris, 1816–27. 8 vols with 574 col plates There is a second series, 1839-44 in 4 vols with 309 plates which is very rare and not quoted

L.I. . . . Lavallée, Arboretum Segrezianum; Icones selectae Paris, 1880–5 36 black plates of trees and shrubs

Lind . . . Lindenia Ghent Founded 1885. Folio. Devoted to orchids

Lowe. . . . Beautiful Leaved Plants E J Lowe and Howard London 1864. (60=col plate)

M. . . . A. B. Freeman-Mitford The Bamboo Garden London 1896 (224=page)

M D. . . . Mittealungen der Deutschen dendrologischen Gesellschaft Bonn Founded in 1892. (1912, p 161=year and page containing black figure, 1910.1=year and page opp. col plate)

M D.G. . . Moller's Deutsche Gartner-Zeitung Erfurt. Founded 1886 (1897 425=year and page)

Mn . . . . Meehan's Monthly Germantown, Philadelphia Founded 1891 (9 192=vol and page opp col plate)

Mn N. . . Meehan The Native Flowers and Ferns of the United States Philadelphia 1878–80. 4 vols. in 2 series (II 2 3=series, vol and plate.)

Mx. . . . . Michaux Histoire des arbres forestiers de l'Amérique septentrionale Paris, 1810–13 3 vols with 138 plates The English translation under the title The North American Sylva has 156 plates (3 4=vol and plate)

N.D. . . . Nouveau Duhamel Traité des arbres et arbustes Paris, 1801–19 7 vols with 488 col plates The first edition by Duhamel du Monceau was published in 1755 and contains only 250 black plates, the second edition was edited by several botanists and is really an entirely new work (7 33=vol and plate)

O. . . . . Orchis Beilage zur Gartenflora (1910 88=year and col plate 1910, 'p. 88=year and page)

O.R. . . . Orchid Review London Founded 1893. (18: 169=vol and plate.)

P G . . . Popular Gardening Buffalo. 1885–90. (5:270 =vol and page)

P.M. . . . Paxton's Magazine of Botany. London. 1834–49 (16 376=vol and page opposite col. plate) Vol 15 has index of first 15 vols.

R. . . . . Reichenbachia Edited by Fred Sander. London. Founded 1886 Folio.

R.B. . . . Revue de l'Horticulture Belge et Etrangère. Ghent Founded 1875. (23:288=vol and page opp col. plate)

R.F.G. . . Reichenbach Icones Florae Germanicae et Helveticae Leipzig. Founded in 1834 25 vols. with more than 3,000 col. plates issued up to 1913.

R.H. . . . Revue Horticole. Dates from 1826, but is now considered to have been founded in 1829. (1899:596=year and page opp. col. plate 1899, p. 596=year and page opp. black figure.)

S. . . . . Schneider. The Book of Choice Ferns. London. In 3 vols. Vol. 1, 1892. Vol. 2, 1893. Vol. 3, 1894. (1 390=vol. and page)

S.E.B. . . Sowerby, English Botany Ed. 3. London, 1863–1902. 13 vols. with 1952 plates The first edition was published 1790–1814 in 36 vols. Only the third edition is quoted.

S.H. . . . Semaine Horticole. Ghent. Founded 1897. (3:548=vol and page.)

S.I.F. . . . Shirasawa Iconographie des essences forestières du Japon. Tokyo. 1900–8. 2 vols. with 161 col. plates. (2:73=vol. and plate.)

S.M. . . . Sargent. Manual of the Trees of North America Boston and New York, 1905. (810=page containing black figure.)

S.O.B. . . Schmidt Oesterreich's allgemeine Baumzucht. Wien, 1792–1822 4 vols with 240 col. plates. (4.237=vol and plate.)

S.S. . . . . Sargent. The Silva of North America. 13 vols. Vol 1, 1891 Vol 12, 1898 (12:620=vol and plate, not colored)

S.T.S. . . . Sargent Trees and Shrubs Boston and New York, 1902–13 2 vols 200 black plates of trees and shrubs, native and foreign. (2:147=vol and plate)

S.Z. . . . . Siebold & Zuccarini. Flora Japonica. Vol. 1, 1835–44 Vol 2 partly by Miquel, 1845–70. (2.150=vol and plate)

V. . . . . Vick's Magazine Rochester, N Y. Founded 1878 Vols numbered continuously through the 3 series Vols begin with Nov. (23.250 =vol and page)

V.F. . . . Vilmorin & Bois Fruticetum Vilmorinianum. Paris, 1904 (205=page containing black figure)

V.O. . . . James Veitch & Sons A Manual of Orchidaceous Plants, cultivated under glass in Great Britain London 1887–94.

W.D.B. . . Watson, Dendrologia Britannica London,1825 2 vols. with 172 col. plates (2:160=vol. and plate.)

THE AUTHORS OF BOTANICAL NAMES

By common consent, the Latin name of a plant, in order to be considered by botanists, must first be regularly published by a reputable author in a reputable book or periodical As an index to this name, the name of its author is published with it whenever an accurate account of the species is given Thus, *"Berberis aristata,* DC." (p. 490) means that this name was made by De Candolle. This citation at once distinguishes De Candolle's *Berberis aristata* from any other *Berberis aristata,*—for example, from Sims' (p. 492). It is always possible that some other author may have given the same name to some other plant, in which case the older name must stand In some cases, the fact that there are two plants passing under one name is indicated in the citation. *"Berberis sinensis,* Hemsl., not Poir " (p. 490, nos. 10, 11) means that Hemsley and Poiret applied the name *B. sinensis* to different plants. *B ilicifolia,* Forst , is not the same as *B. ilicifolia,* Hort. (p 492, nos 27, 31); "Hort " means that the particular name is one in use amongst horticulturists,—that it is a garden name.

The citation of authorities gives a clue to the time and place of publication of the species It is an index to the literature of the subject. It is no part of the idea merely to give credit or honor to the man who made the name. It is held by some that the authority is an integral part of the name, and should always go with it; but common usage dictates otherwise, for the authority is never pronounced with the Latin words in common speech. The authority is a matter of identification, not of language.

Following are the authors most frequently cited in this Cyclopedia:

ADANS Michael Adanson, 1727–1806 France.

AIT. William Aiton, 1731–1793 England

AIT f. William Townsend Aiton, the son, 1766–1849. England.

ALL. Carlo Allioni, 1725–1804. Italy.

ANDERS, T. Thomas Anderson, Director of Botanic Garden in Calcutta

ANDR Henry C. Andrews, botanical artist and engraver, conducted The Botanists' Repository from 1799–1811, and illustrated books on heaths, geraniums and roses

ANDRE Edward André, 1840–1911, first editor of Illustration Horticole, later editor-in-chief of Revue Horticole.

ANT. Franz Antoine, director of the royal gardens at Schönbrunn, 1815.

ARN. George Arnold Walker Arnott, 1799–1868. Scotland.

ASCHERS Paùl Ascherson, professor of botany, Berlin. 1834–1913

AUBL. J B C F. Aublet, 1720–1778 France.

AUCT, AUTH. Authors, referring to usage by various or many writers.

BACKH J. Backhous, English botanist and traveler.

BAILL H Baillon, author of the great natural history of plants in French

BAKER John Gilbert Baker, formerly keeper of the Herbarium of the Royal Gardens, Kew, England.

BALT Charles Baltet, frequent contributor to Revue Horticole

BART William P. C Barton, 1787–1856 Pennsylvania.

BARTR William Bartram, 1739–1823 American botanist.

BATEM James Bateman, writer and student of orchids. England.

BEAUV. Ambroise Marie François Joseph Palisot de Beauvois, 1755–1820 France.

BECC O. Beccari, Italian botanist and writer on E Indian botany

BECK Lewis C Beck, 1798–1853. New York.

BEISSN. L Beissner, Inspector of the Botanic Gardens at Bonn, and Instructor at Poppelsdorf. Pub. "Handbuch der Nadelholzkunde"

BENTH George Bentham, 1800–1884, one of the distinguished botanists of England, one of the authors of Bentham & Hooker's "Genera Plantarum"

BENTH & HOOK. George Bentham and J. D. Hooker authors of "Genera Plantarum." England.

BERGER. Ernst Berger, died 1853. Germany.

BERNH Johann Jacob Bernhardi, 1774–1850 Germany.

BERT Carlo Guiseppe Bertero, 1789–1831. Died between Tahite and Chile.

BIEB Friedrich August Marschall von Bierberstein, 1768–1826 German botanist, lived later in Russia.

BIGEL Jacob Bigelow, 1787–1879. Massachusetts

BLUME Karl Ludwig Blume, born 1796 at Braunschweig, died 1862 at Leyden. Wrote much on Javan plants.

BOIS. Désiré Georges Jean Marie Bois, editor of Revue Horticole Paris.

BOISS Edmond Boissier, 1810–1886 Switzerland. Author of "Flora Orientalis" and other works.

BOJER W Bojer, 1800–1856, author of a Flora of Mauritius Austria.

BONPL Aimé Bonpland. 1773–1858. France.

BORKH. Moritz Balthasar Borkhausen, 1760–1806. Germany

BR., N. E. N. E. Brown, Royal Botanic Gardens, Kew, England.

BR., R. Robert Brown, born 1773, Scotland, died 1858, London Author of many important works.

BRIT. Nathaniel Lord Britton, Director of New York Botanical Garden, New York City.

BRONGN Adolphe Théodore Brongniart, 1801–1876. France.

BUCH.-HAM Francis Buchanan, later Lord Hamilton, wrote on Indian plants.

BUCKL Samuel Botsford Buckley, 1809–1884. United States

BULL William Bull, plant merchant London.

BULL. Pierre Bulliard, 1742–1793, author of the great "Herbier de la France" in 12 folio volumes, with 600 plates

BUNGE Alexander von Bunge, 1803–1890 Russia.

BURM Johannes Burmann, 1706–1779, professor at Amsterdam, wrote on plants of Ceylon and Malabar.

BURM f Nickolous Laurens Burmann, 1734–1793. Son of Johannes

CARR. Elie Abel Carrière, 1816–1896, distinguished French botanist and horticulturist, editor of Revue Horticole.

CASP Robert Caspary, professor of botany at University of Konigsberg 1818–1887

CASS Alexandre Henri Gabriel Cassini, Comte de 1781–1832 France

CAV Antonio José Cavanilles, 1745-1804. Spain.

CERV Vincente Cervantes, 1759(?)–1829 Spanish botanist.

CHAM. Adalbert von Chamisso, poet and naturalist, 1781–1838 Germany

CHAPM Alvan Wentworth Chapman, 1809–1899, author of "Flora of the Southern United States"

CHOIS Jacques Denys Choisy, 1799–1859 Switzerland.

CLOS Dominique Clos, professor of botany and director of the gardens at Toulouse Born 1821.

COGN Alfred Cogniaux, French botanist.

COLEBR Henry Thomas Colebrooke, 1765–1837. England.

COLLA Luigi Colla, 1766–1848 France

COULTER John M Coulter, University of Chicago

CUNN Richard Cunningham, 1793–1835 Colonial botanist in Australia

CUNN, A. Allan Cunningham, born 1791, Scotland, died 1839, Sidney, Australia Brother of Richard

CURT. William Curtis, 1746 1799 England Founder of the Botanical Magazine, now known as Curtis' Botanical Magazine

CURTIS. Moses Ashley Curtis, 1808–1873. North Carolina.

DC Augustin Pyramus De Candolle, 1778–1841, projector of the Prodromus, and head of a distinguished family Alphonse De Candolle, the son (1806–1893), and Casimir De Candolle, the grandson, are also quoted in this work.

DECNE. Joseph Decaisne, 1809–1882. France.

D DON. See Don, D.

DESF. René Louiche Desfontaines, 1750–1833. France.

DESV. Augustin Nicaise Desvaux, 1784–1856. France.

DEVR Willem Hendrik de Vriese, 1807–1862, professor of botany at Leyden Wrote on medical plants and plants of the Dutch East Indies.

DICKS. James Dickson, 1738–1822, Scotch writer on flowerless plants

DIELS Ludwig Diels, professor of botany, Marburg, Germany.

DILL. Johann Jacob Dillenius, professor of botany in Oxford. 1687–1747.

DIPP. Dr. L. Dippel, of Darmstadt, Germany. Dendrologist, pub. "Handbuch der Laubholzkunde"

DON. George Don, 1798–1856 England.

DON, D. David Don, brother of George, 1800–1841. Scotland.

DONN. James Donn, 1758–1813, author of "Hortus Cantabrigiensis" England.

DOUGLAS David Douglas, 1799–1834, collector in northwestern America Scotland

DRUDE Prof O. Drude, of Dresden, Germany.

DRY Jonas Dryander, 1748–1810 Sweden.

DUCHESNE Antoine Nicolas Duchesne, 1747–1827. France.

DUMORT. Barthélemy Charles Dumortier, 1797–1878. Belgium

DUNAL. Michel Felix Dunal, 1789–1856 France.

DUNN. Stephen Troyte Dunn, Kew, England

DYER W T Thistleton-Dyer, Director of Kew Gardens, 1885–1905, editor of the Flora of Tropical Africa, etc

EATON, A Amos Eaton, 1776-1842, author of a "Manual of Botany for North America," 1st ed. 1817; 8th ed. 1841

EATON, D C Daniel Cady Eaton, professor at Yale College, and writer on ferns

EHRH. Friedrich Ehrhart, 1742–1795 Germany.

ELL Stephen Elliott, 1771–1830 South Carolina.

ELLIS John Ellis, 1711-1776 England

ENDL Stephan Ladislaus Endlicher, 1804–1849, professor at Vienna Numerous works

ENGELM George Engelmann, 1809–1884 Missouri.

ENGLER Prof A. Engler, of Berlin, joint author of Engler and Prantl's "Naturlichen Pflanzenfamilien."

ESCH Johann Friedrick Eschscholz, 1793 1831 Germany.

FEE Antoine Laurent Apollinaire Fée, 1789–1874. France

FENZL Edward Fenzl, professor and custodian of botanical museum at Wiens, 1808–1879.

FERN Merritt Lyndon Fernald, assistant professor of botany, Cambridge, Mass

FISCH Friedrich Ernst Ludwig von Fischer, 1782–1854. Russia

FORB John Forbes, catalogued heaths, willows, conifers, and other plants at Woburn Abbey

FORSK Pehr Forskal, 1736–1768, collected in Egypt and Arabia

FORST Johann Reinhold Forster, 1729–1798 Germany. (Also Georg Forster, the son)

FRANCH. A Franchet, Jardin des Plantes, Paris 1834–1900.

FRASER John Fraser, 1750–1811, traveled in America 1785–96 Had a son of same name

FROEL Joseph Aloys Froelich, 1766–1841 Germany.

F v. M Ferdinand von Mueller, royal botanist of Australia, author of many works on economic plants. See Muell.

GAERTN. Joseph Gaertner, 1732–1791 Germany.

GAGNEP. François Gagnepain. French botanist, writing chiefly on Asiatic plants.

GAUD. Charles Gaudichaud-Beaupré, 1789–1864 France.

GAWL. See Ker.

GMEL. Samuel Gottlieb Gmelin, 1743–1774. Russia.

GOEPP. Heinrich Robert Goeppert, 1800–1884, professor at Breslau. Wrote much on fossil botany.

GORD. George Gordon, 1806–1879, author of the "Pinetum," London, 1858.

GRAEBN Paul Graebner, professor of botany Berlin

GRAY. Asa Gray, 1810–1888, Harvard University, Massachusetts. America's most noted botanist

GREENM. J. M. Greenman, writes from Harvard University on Mexican plants. Now at the Field Museum, Chicago

GRIFF William Griffith, 1810–1845 England.

GRISEB, GRIS Heinrich Rudolph August Grisebach, 1814–1879 Germany

HARMS Prof Hermann Harms Berlin.

HASSK Justus Karl Hasskarl, born 1811 Germany.

HAYNE. Friedrich Gottlob Hayne, 1763–1832, professor at Berlin Medicinal plants, trees and shrubs

HAW Adrian Hardy Haworth, 1772–1833 England

HBK Friedrich Alexander von Humboldt, 1796–1859. Germany. Aimé Bonpland, 1773–1858 France Karl Sigismund Kunth, 1788–1850 Germany Authors of a great work on plants of the New World

HEMSL. W. Botting Hemsley, Keeper at Kew, has written many reviews of genera of horticultural value in The Gardeners' Chronicle and elsewhere

HENFR. Arthur Henfrey, 1819–1859 English botanist.

HENRY Augustine Henry, collector of Chinese plants. Cambridge, England

HENRY, L. Prof Louis Henry Writer on woody plants. Paris.

HERB. William Herbert, 1778–1847 England.

HOCHST Christian Friedrich Hochstetter, 1787–1860, described many African plants

HOFFM Georg Franz Hoffmann, 1761–1826 Germany.

HOOK. William Jackson Hooker, 1785–1865. England.

HOOK. f Joseph Dalton Hooker, the son, 1817–1911 England.

HORT. Hortorum, literally *of the gardens* Placed after names current among horticulturists, but not necessarily all horticulturists Often used with less exactness than names of authors Frequently indicates garden or unknown origin Many of these plants have never been sufficiently described

HOST Nicolaus Thomas Host, 1761–1834 Germany.

JACQ Nicolaus Joseph Jacquin, 1727–1817 Austria

JAUB Hippolyte François de Jaubert French botanist. Born 1798

JUSS Antoine Laurent Jussieu, 1748–1836, the first to introduce the natural families of plants France.

KARSTEN Hermann G K W. Karsten German botanist, 1817–

KARW Wilhelm Karwinsky von Karwin, collector in Brazil, died 1855

KAULF. Georg Friedrich Kaulfuss, professor at Halle, died 1830 He described the ferns collected by Chamisso

KER. John Bellenden Ker, 1765 (?)–1871, botanist, wit and man of fashion First known as John Gawler. In 1793 was compelled to leave army because of sympathy with French Revolution His name was changed in 1804 to John Ker Bellenden, but he was known to his friends as Bellenden Ker First editor of Edwards' Botanical Register

KER-GAWL. See Ker.

KIRCHN G. Kirchner, writer of the botanical part of "Arboretum Muscaviense"

KLATT Friedrich Wilhelm Klatt, a German botanist.

KLOTZSCH. Johann Friedrich Klotzsch, 1805–1860, curator of Royal herbarium at Berlin, monographer of Begoniaceæ.

KOCH. Karl Koch, 1809–1879 Germany.

KOEHNE Emil Koehne, professor at Berlin. Pub. "Deutsche Dendrologie."

KOMAR. Vlademir Leontyevitch Komarov, writer on plants of eastern Asia St. Petersburg.

KOST Vincenz Franz Kosteletzky. Bohemian botanist.

KOTSCHY Theodor Kotschy, assistant curator at Vienna, 1813–1866. Wrote on oriental plants.

KRÄNZL F. Kränzlin, Berlin, writes on orchids in The Gardeners' Chronicle.

K. SCH See Schumann.

KUNTH See HBK.

KUNTZE Otto Kuntze German botanist; chiefly known as a strong advocate of priority in nomenclature. 1843–1907

LAG. Mariano Lagasca, 1776–1839, one of Spain's most distinguished botanists.

LAM Jean Baptiste Antoine Pierre Monnet Lamarck, 1744–1829, author of the Lamarckian philosophy of organic evolution France

LANGS Georg Heinrich von Langsdorf, 1774–1852, Russian consul-general in Brazil

LAUTH Thomas Lauth, 1758–1826, professor of anatomy at Strassburg, wrote a 40-page monograph on Acer in 1781

LECQ Henry Lecoq, born 1802, once professor at Clermont-Ferrand, wrote an elementary botany, a dictionary of botanical terms, a book on hybridization, etc.

LECONTE John Eaton LeConte, 1784–1860 Pennsylvania.

LEDEB Karl Friedrich von Ledebour, 1785–1851. Russia

LEHM Johann Georg Christian Lehmann, 1792–1860, professor at Hamburg, wrote several monographs, and described many new plants

LEHM, F C. F C. Lehmann, German collector in South America

LEICHT. Max Leichtlin, horticulturist, Baden-Baden, Germany

LEM Charles Lemaire, 1800–1871, works on cacti and botany of cultivated plants Belgium.

LEVEILLE Augustine Abel Hector Léveillé, professor of botany, Le Mans, France

L'HER C L L'Héritier de Brutelle, 1746–1800 France.

LICHTST. August Gerhard Gottfield Lichtenstein, 1780–1851 Germany

LIND & ROD L Linden and E Rodigas, once administrator and editor, respectively, of L'Illustration Horticole

LIND J Linden, 1817–1898 Belgium. For many years director of L'Illustration Horticole.

LIND, L Lucien Linden, associated with J. Linden for some years on L'Illustration Horticole

LINDL John Lindley, 1799–1865, one of the most illustrious of English horticulturists.

LINGELSH Alexander Lingelsheim Breslau, Germany.

LINK Heinrich Friedrich Link, 1767–1851. Germany.

LINN Carolus Linnæus (Carl von Linné), 1707–1778, the "Father of Botany," and author of binomial nomenclature Sweden

LINN. f Carl von Linné, the son, 1741–1783. Sweden.

LIPSKY Vladimir Ippolitovitch Lipsky, writer chiefly on plants from Central Asia. St. Petersburg.

LODD Conrad Loddiges, nurseryman near London, conducted Loddiges' Botanical Cabinet from 1817–33, 20 vols, 2,000 colored plates.

LOES Theodor Loesener, professor of botany, Berlin.

LOISEL Jean Louis Auguste Loiseleur-Deslongchamps, 1774–1849 France

LOUD. John Claudius Loudon, 1783–1843, an extremely prolific English writer.

LOUR. Juan Loureiro, 1715–1796, missionary in China. Portugal.

MAKINO Tomitaro Makino. Tokyo, Japan.

MARSH. Humphrey Marshall, 1722–1801. Pennsylvania.

MART. Karl Friedrich Philipp von Martius, 1794–1868, professor at Munich, monographer of palms, founder of the great Flora Brasiliensis, and author of many works.

MAST. Maxwell T. Masters, late editor of The Gardeners' Chronicle, wherein he has described great numbers of new plants of garden value, author of "Vegetable Teratology," etc 1833–1907

MATSUM Jinzo Matsumuro Tokyo, Japan

MAXIM. Karl Johann Maximowicz, 1827–1891, one of the most illustrious Russian systematic botanists; wrote much on Asian plants

MEDIKUS Friedrich Casmir Medikus, 1736–1808, director of the garden at Mannheim, wrote a book of 96 pages in German on North American plants in 1792

MEISN. Karl Friedrich Meisner, 1800–1874 Switzerland.

METT. Georg Heinrich Mettenius, 1823–1866, professor at Leipzig, wrote on flowerless plants

MEY. Ernst Heinrich Friedrich Meyer, 1791–1851. Prussia

MEY, C A Carl Anton Meyer, 1795–1855, director botanic garden at St. Petersburg, wrote on Russian botany

MEZ. Dr Karl Mez, director of the botanic garden at Königsberg, monographer of the bromeliads

MICHX André Michaux, 1746 1802 France, but for ten years a resident of North America

MICHX f. François André Michaux, the son, 1770–1855. France

MILL Philip Miller, 1691–1771, of Chelsea, England, author of a celebrated dictionary of gardening, which had many editions

MIQ Friedrich Anton Wilhelm Miquel, 1811 1871. Holland

MITFORD. A B. Freeman-Mitford, English amateur, author of "The Bamboo Garden"

MOENCH Konrad Moench, 1744–1805 Germany

MONCH See Moench

MOORE Thomas Moore, 1821–1887, curator of Chelsea Botanic Garden, author of "Index Filicum," and other well-known works.

MOQ Alfred Moquin-Tandon, 1804–1863 France

MORR Charles Jacques Edouard Morren, of Ghent. 1833–1886

MOTT S Mottet, frequent contributor to Revue Horticole, translator of Nicholson's "Dictionary of Gardening"

MUELL ARG Jean Mueller, of Aargau, 1828–1896, wrote for De Candolle's "Prodromus," vol 16

MUELL, C Carl Mueller, 1817–1870, who edited vols. 4–6 of Walpers' "Annuals"

MUELL, F Ferdinand von Mueller, royal botanist at Melbourne, has written much on Australian and economic botany 1825–1896

MUHL. Henry Ludwig Muhlenberg, 1756–1817. Pennsylvania

MURR. Johann Andreas Murray, 1740–1791 Germany

MURR., A. Andrew Murray, 1812–1878, author of "The Pines and Firs of Japan." London, 1863

NAUDIN. Charles Naudin, 1815–1899, botanist, frequent contributor to Revue Horticole

N. E. BR. N. E. Brown describes many new plants in Gardeners' Chronicle. See Br., N E.

NEES. Christian Gottfried Nees von Esenbeck, 1776–1858 Prussia

NICHOLS George Nicholson, curator at Kew, author of "The Dictionary of Gardening." 1847-1908

NUTT Thomas Nuttall, 1786-1859 Massachusetts.

O'BRIEN James O'Brien, current writer on orchids in The Gardeners' Chronicle

OLIV Daniel Oliver, once curator at Kew, and founder of the Flora of Tropical Africa

ORPH Theodor Georg Orphanides, professor of botany at Athens Died 1886.

ORTEGA, ORT. Casimiro Gomez Ortega, 1740–1818. Spain

OTTO Friedrich Otto, 1782-1856 Germany.

PALL. Peter Simon Pallas, 1741–1811, professor and explorer in Russia Germany.

PAMPAN Renato Pampanini, writer on Chinese plants. Florence, Italy

PAV See Ruiz & Pav

PAX Ferdinand Pax, professor at Breslau, Germany.

PAXT Joseph Paxton, 1802–1865 England

PERS Christian Hendrick Persoon, 1755-1837 Germany.

PHIL Rudolph Amandus Philippi, 1808–1904. Santiago, Chile

PLANCH Jules Emile Planchon, professor at Montpellier France 1833–1900

POHL Johann Emmanuel Pohl, 1782–1834, professor at Vienna, wrote a large book on travels in Brazil

POIR Jean Louis Marie Poiret, 1755–1834 France.

PRAIN Sir David Prain, Director of the Royal Botanic Gardens, Kew, since 1905

PRESL Karel Borivog Presl, 1794–1852 Bohemia

PURSH Frederick T Pursh (or Pursch), 1774–1820. Germany, but for twelve years in the United States.

RADDI Guiseppe Raddi, 1770-1829 Italy

RAF Constantino Samuel Rafinesque-Schmaltz, 1784–1842. Professor of Natural history, Transylvania University Lexington, Kentucky

R BR Robert Brown, born 1773, Scotland, died 1858, London Author of many important works

REGEL Eduard von Regel, 1815–1892, German, founder of Gartenflora, Director Botanic Garden at St Petersburg

REHD Alfred Rehder, Arnold Arboretum, Massachusetts

REICHB Heinrich Gottlieb Ludwig Reichenbach, 1793–1879 Germany

REICHB f Heinrich Gustav, 1823–1889, son of the preceding Orchids

RICH John Richardson, 1787–1865. Scotland.

RICHARD Louis Claude Marie Richard, 1754–1821. France

RIDDELL John Leonard Riddell, 1807–1865, professor of chemistry in Cincinnati and New Orleans

ROB. B L Robinson, Director Gray Herbarium of Harvard University is editing "The Synoptical Flora of North America"

ROD Emile Rodigas, for some years connected with L'Illustration Horticole.

RODR. J. B Rodrigues, Brazilian botanist, writer on palms and Brazilian botany

ROEM. Johann Jacob Roemer, 1763–1819. Switzerland Also M J Roemer

ROSCOE William Roscoe, 1753–1831 England

ROSE J. N Rose, assistant curator, United States National Herbarium, Smithsonian Institution. Mexican plants.

ROTH. Albrecht Wilhelm Roth, 1757–1834. Physician at Vegesack, near Bremen.

ROXBG. William Roxburg, 1759–1815 India

ROYLE John Forbes Royle, born 1800, at Cawnpore, died 1858 London. Professor in London. Plants of India.

RUIZ & PAV Hipolito Ruiz Lopez, 1764–1815, and José Pavon, authors of a Flora of Peru and Chile. Spain

RUPR Franz J Ruprecht, 1814-1870 Russia

RYDB Per Axel Rydberg New York Botanical Garden.

S. & Z. See Sieb & Zucc

SABINE Joseph Sabine, 1770-1837 England

SAFFORD W. E Safford, United States Department of Agriculture, Washington

SALISB Richard Anthony Salisbury, 1761–1829 England.

SALM-DYCK Joseph, Prince and High Count Salm-Reifferscheidt-Dyck, born at Dyck, 1773, died 1861. Wrote on Aloe, Cactus, Mesembryanthemum

SARG Charles Sprague Sargent, Director Arnold Arboretum, author of "Silva of North America"

SAV L Savatier, writer on Japanese plants

SAVI Gaetano Savi, died 1844 Italy

SCHEIDW. Michael Joseph Scheidweiler, 1799–1861, professor of botany and horticulture at Horticultural Institute of Ghent

SCHK Christian Schkuhr, died 1811 Germany

SCHLECHT Diedrich Franz Leonhard von Schlechten dahl, 1794–1866. Professor at Halle, wrote several memoirs in Latin and German

SCHNEID Camillo Schneider, author of "Handbuch der Laubholzkunde" Vienna

SCHOTT Heinrich Wilhelm Schott, 1794–1865 Wrote much on aroids with Nyman and Kotschy

SCHRAD. Heinrich Adolph Schrader, 1767-1836 Germany.

SCHULT Joseph August Schultes, 1773-1831 Germany

SCHUM Christian Friedrich Schumacher, 1757–1830 Germany.

SCHUMANN Karl Moritz Schumann, 1851–1904, professor of botany, Berlin Wrote much on Cactaceæ

SCHUR Philipp Johann Ferdinand Schur, 1785–1848 Germany.

SCHW, SCHWEIN Lewis David von Schweinitz, 1780–1834 Pennsylvania

SCHWEINF. George Schweinfurth Germany Born 1836.

SCHWER. Graf Fritz von Schwerin, German authority on Acer.

SCOP Johann Anton Scopoli, 1723-1788 Italy

SEEM Berthold Seemann, Hanover, 1825–1872 Wrote on palms, and botany of the voyage of the *Herald*

SIBTH. John Sibthorp, 1758 1796, author of a Flora of Greece England

SIEB. & ZUCC Philipp Franz von Siebold, 1796–1866, and Joseph Gerhard Zuccarini, 1797–1848 Germany

SIMS John Sims, 1792–1838 England, for many years editor of Curtis' Botanical Magazine

SMALL. John Kunkel Small. New York Botanical Garden.

SMITH. James Edward Smith, 1759–1828 England.

SOLAND Daniel Solander, 1736-1782 England

SPACH. Eduard Spach, born 1801 Strassburg, died 1879. Author of "Histoire Naturelle des Vegetaux."

SPAETH. L Spaeth, Berlin, nurseryman, died 1913. H. L. Spaeth, the present head of the firm

SPRENG. Kurt Sprengel, 1766–1833 Germany.

STEUD. Ernst Gottlieb Steudel, 1783–1856. Germany.

STEV. Christian Steven, 1781–1863. Russia.

ST. HIL. Auguste de Saint Hilaire, 1779–1853. France.

SWARTZ. Olof Swartz, 1760–1818. Sweden.

SWEET. Robert Sweet, 1783–1835, author of many well-known works, as "Geraniaceæ," "British Flower Garden"

SWINGLE Walter T Swingle, United States Department of Agriculture, Washington

TAUSCH Ignaz Friedrich Tausch Died 1848. Austria.

TENORE. Michele Tenore, 1780–1861 Italy.

THORE Jean Thore, 1762–1823, physician at Dax.

THUNB. Carl Peter Thunberg, 1743–1822, wrote "Flora Japonica" (1784) Sweden.

TOD. Augustino Todaro, director of the botanic gardens at Palermo 1818–1892

TORR John Torrey, 1796–1873 New York

TRAUTV Ernst Rudolph von Trautvetter.

TREL William Trelease, professor of botany, University of Illinois

TUCKM Edward Tuckerman, 1817–1886 Massachusetts.

TURCZ Nicolaus Turczaninow Died 1864.

UNDERW Prof Lucien M Underwood, Columbia University, New York, N. Y., has written much on ferns, etc

URBAN Ignatius Urban, of the Kongl Bot. Garten, near Berlin, writer on Brazilian and West Indian plants.

VAHL. Martin Vahl, 1749–1804 Denmark

VAN HOUTTE. Louis Van Houtte, 1810–1876, founder and publisher of Flore des Serres.

VEITCH John Gould Veitch, 1839–1867, and successors, horticulturists at Chelsea, England.

VENT Etienne Pierre Ventenat, 1757–1808 France.

VERL B Verlot, contributor to Revue Horticole

VERSCH Ambroise Verschaffelt, 1825–1886, founder and publisher of L'Illustration Horticole at Ghent, Belgium.

VILL Dominique Villars, 1745–1814 France

VILM Several generations of the family of Vilmorin, Paris, seedsmen and authors of many books and memoirs on botany and horticulture Pierre Philippe André Leveque de Vilmorin, 1746–1804 Pierre Vilmorin, 1816–1860 Henry L de Vilmorin, died 1899

VOSS. A. Voss, author of botanical part of Vilmorin's Blumengärtnerei

WAHL Georg Wahlenberg, 1781–1851. Sweden.

WALDST. Franz Adam, Graf von Waldstein, 1759–1823. Austria.

WALL. Nathanael Wallich, born 1786, Copenhagen, died 1854 London Wrote on plants of India and Asia.

WALP Wilhelm Gerhard Walpers, 1816–1853.

WALT. Thomas Walter, about 1740–1788, author of "Flora Caroliniana" South Carolina

WANG. Friedrich Adam Julius von Wangenheim, 1747–1800. Germany

WANGN. Walter Wangerin, monographer of Cornaceæ. Germany

WARSCZ Joseph Warscewicz, 1812–1866

WATS. Sereno Watson, 1826–1892 Harvard University.

WEB Friedrich Weber, 1781–1823 Germany

WEDD H A Weddell, wrote for De Candolle's "Prodromus," vol 16, etc

WELW. Friedrich Welwitsch, 1806–1872.

WENDL. Hermann Wendland, Director Royal Botanic Garden at Herrenhausen, one of the chief writers on palms.

WIGHT. Robert Wight, writer on Indian plants. 1796–1872.

WILLD. Karl Ludwig Willdenow, 1765–1812 Germany

WILSON. Ernest H Wilson, collector of Chinese plants.

WITH, WITHER. William Withering, 1741–1799 England.

WITTM. Max Karl Ludwig Wittmack, editor of Gartenflora. Professor at Berlin.

WOOD. Alphonso Wood, 1810–1881 Of his "Class-Book of Botany," 100,000 copies have been sold in America.

ZABEL Hermann Zabel, writer on woody plants, 1832–1912. Germany

ZUCC Joseph Gerhard Zuccarini, 1797–1848, professor at Munich.

The Standard Cyclopedia of Horticulture

A SYNOPSIS OF THE PLANT KINGDOM

By KARL M. WIEGAND

Most modern botanists, as well as zoölogists, now think that organisms have descended, through the ages, from ancestors which differed in many ways and often markedly from the present organisms, but were in general of a less specialized type It is, indeed, thought that the original life was of an exceedingly simple nature, and that during the countless ages its descendents have gradually diverged from one another much as the branches of a tree diverge from its trunk, until we have the enormous wealth of species and extreme diversity, and great complexity of structure exhibited by the plants and animals existing today Just as through descent in the human race we have groups of individuals called families, the members of which are more closely related to each other by descent than to other individuals, so we have groups of related species and genera forming similar natural families The attempt of the so-called systematic botanist of the present day is to interpret the evolutionary history of plants, to discover these natural families, and to represent this knowledge of history and relationship in a synopsis of the plant kingdom Such a synopsis, therefore, attempts to show an actual "blood relationship,"—the real genealogy of the plant kingdom Before the theory of evolution became widely accepted as a result of Darwin's labors, systems of classification were either wholly arbitrary, and planned simply for convenience in dealing with the vast number of existing organisms (e g , the sexual system of Linnæus), or they were based on the morphological relation of the flower to a certain floral plan Since, however, the floral plan depends largely on descent, these last-named systems often accidentally approached in many respects very closely to the natural systems based on evolution Instead of placing the "highest" types of plants (the most recent) last in their classification, as is now done, the idealists placed them first,—hence the Ranunculaceæ, with parts separate and hypogynous, and therefore most ideal, is found first in such a classification The fusion of parts in the Compositæ, and the union of parts in the Gamopetalæ were thought to represent a less perfect condition Likewise, the Apetalæ, with parts lacking, were still less perfect, and therefore were placed later The Gymnosperms were somewhat arbitrarily placed next, followed by the Monocotyledons, in which the grasses were placed last. These in turn were followed by the ferns and the lower groups This was the system used in Bentham and Hooker's "Genera Plantarum," a great work which, notwithstanding the change in system, is still a standard authority in descriptive botany

In the system adopted for the present synopsis, that used by Engler and Prantl in the great German work, "Die Naturlichen Pflanzenfamilien," the sequence is from the most primitive and the most ancient toward the most specialized and most modern,—from the lower algæ to the fungi, mosses, liverworts, ferns,, gymnosperms, and flowering plants Here the Monocotyledonous line culminates in the highly specialized Orchidaceæ, and the Dicotyledonous line in the equally specialized Compositæ These two families, therefore, are now thought to represent the present culmination of nature's handiwork in the two great lines of development in flowering plants.

In the present synopsis of the Pteridophyta and Spermatophyta, the treatment of large groups, sequence of families and family limits, is, except in a few cases, that of our most recent great work edited by Engler and cited above Among the mosses and lower plants, an abridgment of the system used in Strasburger, Noll, Schenk and Karsten's "Text-Book of Botany," and other text-books, has been used The statistics as to genera and species are taken from Engler and Prantl, and are intended as general information, and may not in all cases conform to the limitations as worked out by the different authors in the Cyclopedia In some cases, particularly in Cactaceæ, other authorities have been followed

As no genera of the Thallophyta or Bryophyta are definitely treated in the body of the Cyclopedia, these two groups have been introduced into the synopsis largely as a background and as a proper perspective to the plant kingdom Therefore, in these groups no divisions smaller than classes have been considered In the Pteridophyta and Spermatophyta, the plan has been to include in the synopsis every family that has at least one genus represented in the body of the original Cyclopedia A few other families of minor horticultural value have found place in the present Cyclopedia and are not included in this synopsis Although the treatment in each case has been of necessity reduced to great brevity, it is hoped that the condensed account of important structural characteristics, size of family, range, and economic value will be of aid in forming a conception of what each family represents To render this conception more vivid, a list of the important cultivated genera and their common names has been appended to the treatment of each family

The number of species in the plant kingdom is not definitely known. It has been estimated that more than 120,000 species of Spermatophyta and more than 60,000 species of lower plants are described According to the treatment in Engler and Prantl, these legions are classified in 640 families, of which 278 are of the higher plants and 362 of plants below the Spermatophyta The number of known species, however, is being rapidly increased as research and exploration progress, so that the numbers given above are at best only approximate. The figures are also modified by disagreement as to what are species and what are varieties, some persons recognizing more or fewer species than others in a given genus or group

The names of the natural families are mostly derived from the names of a leading genus (as *Verbenaceæ*, *Ranunculaceæ*) or from some marked characteristic of the group as a whole (e g , *Compositæ*, composite or compound flowers, *Cruciferæ*, cross-like flowers). Commonly the family name terminates in the form *aceæ*, with the accent long on the antepenultimate syllable (e g , *Rosaceæ*, pronounced Ro-*say*-si-ee). The simple termination *æ* is used mostly for subfamilies and tribes, but there are marked exceptions, as in *Leguminosæ*

The illustrations accompanying this text are designed to show mainly such structural characteristics as are of importance in the separation of families For this reason, floral diagrams have been freely introduced These

diagrams are idealized cross-sections of the flower, and show particularly the number of parts in each floral set and their exact position, both of which are very frequently of diagnostic importance The illustrations have been prepared by F. Schuyler Mathews under the direction of the writer. They were in part drawn from life, and in part adapted from standard texts The most frequent sources are Baillon, "Natural History of Plants"; Engler and Prantl, "Die Naturlichen Pflanzenfamilien;" Strasburger, Noll, Schenk and Karsten, "Text-Book of Botany"; Warming, "Systematic Botany."

The following is an outline of the vegetable kingdom as treated in the succeeding pages:

Division I. Thallophyta.
- Class I Bacteria
- II. Cyanophyceæ.
- III. Flagellata.
- IV. Myxomycetes.
- V. Peridineæ.
- VI. Conjugatæ.
- VII Diatomeæ.
- VIII. Heterocontæ.
- IX Chlorophyceæ.
- X. Characeæ.
- XI. Phæophyceæ.
- XII Rhodophyceæ.
- XIII. Phycomycetes.
- XIV. Eumycetes.
- XV Lichenes

Division II. Bryophyta.
- Class I Hepaticæ.
- II Musci

Division III Pteridophyta.
- Class I Filicinæ
  - Sub-class I Eusporangiatæ.
    - Order 1 Ophioglossales.
      - Family Ophioglossaceæ, page 7.
    - Order 2 Marattiales,
      - Family Marattiaceæ, 7
  - Sub-class II Leptosporangiatæ.
    - Order 3 Filicales
      - Family Hymenophyllaceæ, 8.
      - Cyatheaceæ, 8
      - Polypodiaceæ, 8
      - Ceratopteridaceæ, 8.
      - Schizæaceæ, 9
      - Gleicheniaceæ, 9
      - Osmundaceæ, 9
    - Order 4 Hydropteridales.
      - Family Marsileaceæ, 9
      - Salviniaceæ, 10.
- Class II Equisetinæ
  - Order 5 Equisetales
    - Family Equisetaceæ, 10
- Class III. Lycopodinæ
  - Order 6 Lycopodiales
    - Family Lycopodiaceæ, 10.
  - Order 7 Selaginellales
    - Family Selaginellaceæ, 10

Division IV Spermatophyta or Siphonogamia (Phanerogamia).
- Sub-division I Gymnospermæ.
  - Order 8 Cycadales
    - Family Cycadaceæ, 11.
  - Order 9 Ginkgoales
    - Family Ginkgoaceæ, 11.
  - Order 10. Coniferales.
    - Family Taxaceæ, 11.
    - Pinaceæ, 12.
  - Order 11 Gnetales.
    - Family Gnetaceæ, 12.
- Sub-division II Angiospermæ.
  - Class I Monocotyledoneæ
    - Order 12 Pandanales
      - Family Typhaceæ, 13.
      - Pandanaceæ, 13.
    - Order 13. Helobiæ
      - Family Naiadaceæ, 13.
      - Aponogetonaceæ, 13.
      - Family Alismaceæ, page 13.
      - Butomaceæ, 14.
      - Hydrocharitaceæ, 14.
    - Order 14. Glumifloræ.
      - Family Gramineæ, 14
      - Cyperaceæ, 15.
    - Order 15 Principes
      - Family Palmaceæ, 16.
    - Order 16 Synanthæ.
      - Family Cyclanthaceæ, 17.
    - Order 17 Spathifloræ.
      - Family Araceæ, 17
      - Lemnaceæ, 18.
    - Order 18 Farinosæ
      - Family Bromeliaceæ, 18.
      - Commelinaceæ, 18.
      - Pontederiaceæ, 18.
    - Order 19 Lilifloræ
      - Family Juncaceæ, 19
      - Liliaceæ, 19
      - Amaryllidaceæ, 20.
      - Taccaceæ, 20
      - Dioscoriaceæ, 20.
      - Iridaceæ, 21
    - Order 20 Scitamineæ
      - Family Musaceæ, 21
      - Zingiberaceæ, 21.
      - Cannaceæ, 22
      - Marantaceæ, 22
    - Order 21 Microspermæ
      - Family Orchidaceæ, 22.
  - Class II Dicotyledoneæ
    - Sub-class I Archichlamydeæ (Choripetalæ and Apetalæ).
      - Order 22 Verticillales
        - Family Casuarinaceæ, 23
      - Order 23 Piperales
        - Family Saururaceæ, 23.
        - Piperaceæ, 23
        - Chloranthaceæ, 24.
      - Order 24 Salicales
        - Family Salicaceæ, 24
      - Order 25 Myricales
        - Family Myricaceæ, 24.
      - Order 26 Juglandales
        - Family Juglandaceæ, 25.
      - Order 27 Fagales
        - Family Betulaceæ, 25.
        - Fagaceæ, 25.
      - Order 28 Urticales
        - Family Ulmaceæ, 25.
        - Moraceæ, 26.
        - Urticaceæ, 26.
      - Order 29 Proteales.
        - Family Proteaceæ, 27.
      - Order 30 Santalales
        - Family Loranthaceæ, 27.
        - Santalaceæ, 27
        - Olacaceæ, 27.
      - Order 31 Aristolochiales
        - Family Aristolochiaceæ, 28
      - Order 32 Polygonales.
        - Family Polygonaceæ, 28
      - Order 33 Centrospermæ.
        - Family Chenopodiaceæ, 29
        - Amarantaceæ, 29
        - Nyctaginaceæ, 29
        - Phytolaccaceæ, 30

Family Aizoaceæ, page 30.
Portulacaceæ, 30.
Basellaceæ, 30.
Caryophyllaceæ, 31.
Order 34 Ranales.
Family Nymphæaceæ, 31.
Trochodendraceæ, 32.
Ranunculaceæ, 32.
Lardizabalaceæ, 33.
Berberidaceæ, 33
Menispermaceæ, 33.
Magnoliaceæ, 33
Calycanthaceæ, 34.
Annonaceæ, 34
Myristicaceæ, 35.
Monimiaceæ, 35.
Lauraceæ, 35
Order 35 Rhœadales
Family Papaveraceæ, 35.
Fumariaceæ, 36.
Cruciferæ, 36
Capparidaceæ, 36.
Resedaceæ, 37
Moringaceæ, 37.
Order 36 Sarraceniales.
Family Sarraceniaceæ, 37.
Nepenthaceæ, 38.
Droseraceæ, 38.
Order 37 Rosales
Family Crassulaceæ, 38.
Cephalotaceæ, 38.
Saxifragaceæ, 39.
Pittosporaceæ, 39.
Cunoniaceæ, 39
Bruniaceæ, 39
Hamamelidaceæ, 40.
Platanaceæ, 40.
Rosaceæ, 40.
Leguminosæ, 41.
Order 38 Geraniales.
Family Geraniaceæ, 42.
Oxalidaceæ, 43.
Tropæolaceæ, 43.
Linaceæ, 43
Erythroxylaceæ, 44.
Zygophyllaceæ., 44.
Rutaceæ, 44.
Simarubaceæ, 44.
Burseraceæ, 45.
Meliaceæ, 45
Malpighiaceæ, 45.
Tremandraceæ, 46.
Polygalaceæ, 46.
Euphorbiaceæ, 46.
Order 39 Sapindales
Family Buxaceæ, 47.
Empetraceæ, 47.
Coriariaceæ, 47.
Limnanthaceæ, 48.
Anacardiaceæ, 48.
Cyrillaceæ, 48
Aquifoliaceæ, 48.
Celastraceæ, 49.
Stackhousiaceæ, 49.
Staphyleaceæ, 49.
Aceraceæ, 49
Hippocastanaceæ, 50.
Sapindaceæ, 50
Melianthaceæ, 50.
Balsaminaceæ, 50.
Order 40 Rhamnales
Family Rhamnaceæ, 51.
Vitaceæ, 51.
Order 41 Malvales.
Family Elæocarpaceæ, 51.
Tiliaceæ, 52.
Family Malvaceæ, page 52
Bombaceæ, 53.
Sterculiaceæ, 53.
Order 42 Parietales
Family Dilleniaceæ, 53.
Ochnaceæ, 53.
Ternstrœmiaceæ, 54.
Guttiferæ, 54
Hypericaceæ, 54
Tamaricaceæ, 55
Fouquieriaceæ, 55.
Cistaceæ, 55.
Bixaceæ, 55
Violaceæ, 56
Flacourtiaceæ, 56.
Stachyuraceæ, 56.
Passifloraceæ, 56.
Caricaceæ, 57
Loasaceæ, 57
Begoniaceæ, 57.
Order 43 Opuntiales
Family Cactaceæ, 57.
Order 44 Myrtifloræ
Family Thymelæaceæ, 58.
Elæagnaceæ, 59.
Lythraceæ, 59
Punicaceæ, 59
Lecythidaceæ, 59
Rhizophoraceæ, 59.
Combretaceæ, 60.
Myrtaceæ, 60
Melastomaceæ, 60.
Onagraceæ, 61
Hydrocaryaceæ, 61.
Haloragidaceæ, 61.
Order 45 Umbellifloræ
Family Araliaceæ, 62
Umbelliferæ, 62.
Cornaceæ, 63
Sub-class II Metachlamydeæ or Sympetalæ.
Order 46 Ericales
Family Clethraceæ, 63.
Pyrolaceæ, 63
Monotropaceæ, 63.
Ericaceæ, 64
Epacridaceæ, 64
Diapensiaceæ, 64
Order 47 Primulales
Family Myrsinaceæ, 64
Primulaceæ, 64
Plumbaginaceæ, 65.
Order 48 Ebenales
Family Sapotaceæ, 65
Ebenaceæ, 65
Styracaceæ, 66
Symplocaceæ, 66.
Order 49 Contortæ
Family Oleaceæ, 66
Loganiaceæ, 67.
Gentianaceæ, 67.
Apocynaceæ, 67
Asclepiadaceæ, 67.
Order 50 Tubifloræ
Family Convolvulaceæ, 68.
Polemoniaceæ, 68
Hydrophyllaceæ, 68.
Boraginaceæ, 69.
Verbenaceæ, 69.
Labiatæ, 70
Nolanaceæ, 70.
Solanaceæ, 70
Scrophulariaceæ, 71.
Bignoniaceæ, 71
Pedaliaceæ, 72
Martyniaceæ, 72.
Gesneriaceæ. 72.

Family Lentibulariaceæ, page 73.
Globulariaceæ, 73.
Acanthaceæ, 73.
Myoporaceæ, 74.
Phrymaceæ, 74.
Order 51. Plantaginales.
Family Plantaginaceæ.
Order 52 Rubiales
Family Rubiaceæ, 74
Caprifoliaceæ, 74.
Valerianaceæ, 75
Dipsacaceæ, 75
Order 53. Campanulales
Family Cucurbitaceæ, 75
Campanulaceæ, 76
Compositæ, 76

DIVISION I THALLOPHYTA

Plants characterized rather indefinitely by the absence of an archegonium around the egg, and the absence of the type of antheridium found among the higher plants The plant body is rarely differentiated into organs simulating stem and leaves, and no true vascular tissue is found in the group Formerly the Thallophyta were divided into the Algæ, Fungi, and Lichens, but this, though a good classification on physiological grounds, does not indicate actual relationship so well as the modern division into fifteen classes founded on structure, as follows

CLASS I BACTERIA

Unicellular or filamentous organisms without green color, possibly "degenerated" from the Cyanophyceæ, with no true nucleus, the cell-wall often gelatinous reproduction wholly asexual by division into two equal portions and subsequent separation (fission), or by asexual spores, one of which may be produced in each cell Bacteria are probably the smallest known organisms, some being not over .00003 inch in diameter In form, the cells are either oblong, spherical or spiral, and may be separate or united in groups or chains, and may be either motile by means of cilia or non-motile Bacteria, while showing little structural diversity, have become highly specialized physiologically, and it is on this basis that the species are usually distinguished Many cause disease among animals and human beings, while others cause disease among plants. Nitrifying bacteria in the soil are of vital importance to higher plants Bacteria and fungi are the causes of decay

CLASS II CYANOPHYCEÆ (Blue-green Algæ)

Unicellular or filamentous algæ of blue-green color; true nuclei wanting cell-wall often gelatinous reproduction wholly asexual by fission or by asexual spores borne as in the bacteria The blue-green algæ inhabit water, damp soil, damp rocks, or damp tree trunks, where they often form filamentous or gelatinous, dark green patches The aquatic forms prefer water containing much organic matter and hence are abundant in sewers. Certain species inhabit flower-pots in greenhouses, and brick walls

CLASS III FLAGELLATA (Flagellates)

Simple unicellular aquatic organisms intermediate between the Thallophyta and Protozoa During a portion of their life they possess no cell-wall, and often show amœboid movements The cells contain a nucleus, pulsating vacuole, and chlorophyll; and one or more cilia are present Some reduced forms are colorless and saprophytic Reproduction is wholly asexual by fission and thick-walled resting spores Found in waters of ponds and streams.

CLASS IV MYXOMYCETES (Slime Molds)

A very distinct and independent group, formerly often classified in the animal kingdom. The plants consist of naked masses of protoplasm called plasmodia, which contain many nuclei but no chlorophyll These are found in forests and damp, shady places When ready to fruit, the plasmodia move toward the light and away from the water, hence ascend grass stems, stumps and logs, where they transform into elaborately constructed sporangia The asexual spores, each enclosed by a cell-wall, are distributed by the wind, germinate, produce a ciliated bit of naked protoplasm which swims in the soil moisture, multiply by division and at length fuse with neighboring protoplasts to form the plasmodium, which latter may be sometimes a foot in breadth During unfavorable weather, the plasmodia are often transformed into sclerotia *Plasmodiophora brassicæ*, which is the cause of the club-root of cabbage, is the only Myxomycete of great economic importance

CLASS V PERIDINEÆ

A small group mostly inhabiting the sea, more rarely fresh water They are unicellular, free-swimming organisms with nucleus, vacuole, chromatophores, and cilia The cell is usually surrounded by a cellulose, sculptured, or pitted and transversely furrowed, wall. Reproduction is by cell-division and swarm-spores Sexual reproduction has recently been discovered The Peridineæ often form an important part of the plankton in the sea

CLASS VI CONJUGATÆ

Green filamentous or unicellular fresh-water algæ: cell-wall and nuclei present. reproduction by division of the plant body, and by sexual spores, which latter result from the union of two body cells by means of a connecting tube (conjugation) Plants of the sub-group Desmidiaceæ are not filamentous, but often star-shaped, lunate, or geminate in outline The Zygnemaceæ are filamentous with star-shaped (Zygnema), spiral (Spirogyra), or plate-like chloroplastids The Conjugatæ are of little economic importance

CLASS VII DIATOMEÆ (Diatoms)

Unicellular algæ of very peculiar and interesting habit The wall consists of two silicious valves, one of which fits over the other like the lid of a box These valves are frequently very beautifully sculptured Through division, new cells and new walls are formed, which are always smaller than before, until finally as a limit a sexual spore is produced which reestablishes the size of the cell Diatoms inhabit stagnant water, wet rocks, and the sea They are either free-floating or pedicelled and attached The silicious walls will resist burning Diatoms contain little, if any, chlorophyll, and are mostly saprophytic A large part of the oceanic plankton is composed of Diatoms

CLASS VIII HETEROCONTÆ, or CONFERVÆ

A small group of green algæ, inhabiting wet soil or water, but of little, if any, economic importance The zoospores have unequal cilia, and the chloroplastids are yellowish green and oil-producing Asexual resting spores also occur Conjugating zoospore-like gametes are found in some genera Botrydium and Conferva are examples of this class

CLASS IX CHLOROPHYCEÆ

A large and important group of fresh-water, or rarely marine, algæ Plant body unicellular, filamentous, or even thalloid the cells contain chloroplastids and produce starch reproduction sometimes vegetative, but also by asexual zoöspores; sexual reproduction con-

sists of the the fusion of two zoöspore-like gametes, or the fusion of one such gamete and a specialized non-motile egg The latter condition is characteristic of the higher forms in nearly all the sub-groups of the Chlorophyceæ The plant body in the Order Siphonales is peculiar in that it consists of a continuous tube without cross-walls. Some common genera in this class are Volvox, Chlamydomonas, Pandorina, Protococcus, Pediastrum, Scenedesmus, Hydrodictyon (Water-net), Ulothrix, Ulva (Sea-lettuce), Œdogonium, Cladophora, Caulerpa, and Vaucheria

CLASS X. CHARACEÆ (Stoneworts)

Attached plants (1 inch to 1 yard in length) of fresh or brackish water, consisting of a slender stem, which bears at each node a whorl of branches, usually again bearing whorled branchlets The internodes consist of one immense multinucleated cell often as much as 3 inches long, which is naked or inclosed in a sheath of smaller cells The branches are similarly constructed though the cells are correspondingly smaller Asexual spore-reproduction is absent Sexual reproduction is by means of an egg-cell inclosed in a jacket of spiral wall-cells, and of sperm-cells inclosed in an antheridium which has a multicellular wall These sexual organs are borne at the nodes of the branchlets The fertilized egg and its investment becomes a thick-walled resting structure Many species of Chara and Nitella, the only two genera, have the power to deposit lime from solution, and thus become incrusted with that substance, hence the popular name In this way the Characeæ have played a part in the filling up of calcareous lakes and the production of new land They are mostly inhabitants of calcareous waters

CLASS XI PHÆOPHYCEÆ (Brown Seaweeds)

A large group of salt-water algæ, well known in all waters of the globe, but most abundant in the colder regions Plant body attached, usually thalloid and branched, but very diverse, in some cases filamentous, in others disk-shaped or globular The larger forms of Laminaria are sometimes 200 feet long The chromatophores of the Phæophyceæ contain a brown pigment which gives to these plants a brown or yellowish color instead of green The thallus is often very tough and cartilaginous, to resist the waves Zoöspores are often produced In sexual reproduction, the gametes are either similar and motile, rarely non-motile, or more often the sperm is motile while the egg is much larger and non-motile Details of structure in respect to reproduction, however, are very great

The thallus of various species of Phæophyceæ yields iodine and soda Some species (e g , *Laminaria saccharina*) yield mannite and are used in the Orient for food. The dried stalks of *L. digitata* and *L. Clouston* have been used in surgery. Fucus and other genera are used as manure.

One species, *Sargassum bacciferum*, has accumulated in great quantities in the Atlantic Ocean between the Bermuda Islands and the Spanish coast, in the so-called "Sargasso Sea"

CLASS XII RHODOPHYCEÆ (Red Seaweeds)

Mostly marine algæ, a few only inhabiting fresh water, widely distributed, but most abundant in the tropics and temperate region at lower depths. The thallus is very diverse, filamentous, branched, often thalloid, attached by holdfasts, and red, violet, or purple in color, rarely green. True starch is not found Asexual spore-reproduction is frequent These spores are non-motile and produced in fours (tetraspores). Sexual reproduction is by dissimilar gametes, the antheridium becoming without change a single non-motile sperm-cell. The egg-cell is prolonged upward into a slender tube (trichogyne). The fertilized egg by division gives rise to a globular mass of short filaments (cystocarp) which produce asexual spores. These spores in turn give rise to the mature plant The cystocarp and its spores, thus following fertilization, suggest the alternation of generations found in the mosses and liverworts and all higher plants. About 300 species of Rhodophyceæ have been described.

Carragheen, or Irish moss, used in jellies and puddings, is the dried thallus of *Chondrus crispus* and *Gigartina mamillosa* of northwestern Europe Agar-agar, used in the preparation of culture media in bacteriology and mycology, is obtained from various species of this group

CLASS XIII PHYCOMYCETES

A large group of parasitic or saprophytic organisms (fungi), without chlorophyll· thallus (mycelium) of much-branched filaments (hyphæ), usually without cross-walls (non-septate), as in the algal group Siphoneæ· asexual reproduction by motile or non-motile spores which are usually borne in sporangia, and by conidia which are cells abstricted from the tips of specialized hyphæ sexual reproduction diverse, either by the conjugation of similar gametes, or by the conjugation of a specialized antheridial branch (male) and an enlarged oogonial branch (female) which contains the egg, free sperm-cells are rare The order **Oömycetes,** with differentiated gametes, contains the following important fungi Saprolegnia (water-mold), a whitish, aquatic mold growing on decaying plants, insects, or living fishes, *Olpidium brassicæ*, parasitic in cells at the base of the stem of young cabbage plants causing their death, *Phytophthora infestans* (potato disease), *Plasmopara viticola*, downy or false mildew of the grape, *Albugo candida*, white rust of Cruciferæ, *Pythium de Baryanum*, causing damping off of seedlings Order **Zygomycetes,** with similar gametes, contains *Mucor mucedo*, white mold of bread, fruits, etc , *Rhizopus nigricans*, a mold on bread, fruit, etc , *Empusa muscæ*, parasitic on houseflies, causing their death and producing a white halo about them on the surface where they die.

CLASS XIV EUMYCETES

A very large and important group of saprophytic or parasitic organisms (fungi) without chlorophyll· thallus (mycelium) composed of fine tubular threads, which are septate sexual organs usually obscure or apparently wanting asexual reproduction by spores or by conidia, a modified form of which is termed basidia The conidia and basidia do not always represent homologous organs The group is divided into Ascomycetes and Basidiomycetes The Ascomycetes are characterized by a group of usually 8 spores inclosed in a unicellular sac (ascus), which is produced immediately after the imperfect sexual fertilization The asci are borne in spherical bodies (perithecia) or in open cups (apothecia) The Perisporiaceæ, Discomycetes, Pyrenomycetes, and Tuberaceæ are orders within this sub-class Among the many important economic fungi belonging here are the following Erysipheæ (Downy Mildews); Aspergillus and Penicillium (Fruit Mold, Blue Mold); Morchella (Morel), edible, Nectria (Currant Cane Rust and Tree Canker); *Claviceps purpurea* (Ergot), parasitic in the ovaries of grains, Taphrina (including Exoascus), causing witches' broom, leaf curl of peach, plum pockets, etc , Saccharomyces (Yeast), causing fermentation in saccharine solutions The Basidiomycetes are characterized by the production of four spores on a special hyphal tip or thread (basidium). Each spore is raised on a minute slender stalk (sterigma) These spores, in some cases, if not in all, follow immediately after a nuclear fusion, which probably represents a reduced sexual act. In this group are the Ustilagineæ (Smuts), infesting the ovaries of grains, etc , the Uredineæ (Rusts), which infest a wide variety of cultivated and wild plants, and among which may be men-

tioned the wheat rust; the Hymenomycetes (Mushrooms, Toadstools, and Bracket Fungi), which are saprophytic or inhabit timber, and the Gasteromycetes (Puff-balls), which are saprophytic. The rusts exhibit alternation of generations to a most remarkable degree, the different generations often inhabiting different host plants and possessing a wholly different appearance, as well as a wholly different method of spore-formation The Hymenomycetes are saprophytic, except the genus Exobasidium which inhabits the living foliage of various plants, the genus Armillaria which infests living tree-trunks, and many genera of the Polyporaceæ (Bracket Fungi) which also attack the wood of living trees The last-mentioned fungi, including Armillaria, inhabit the trunks and branches of forest trees, causing their death

CLASS XV. LICHENES (Lichens)

Green, gray or highly colored plants of very diverse habit and habitat, either thalloid, fruticose or crustaceous, and growing on the soil, bark of trees, rocks, or rarely on foliage. propagation by division of the thallus or by the separation of special minute powdery parts (soredia) spore-reproduction by ascospores borne in perithecia or apothecia, rarely by basidiospores. The lichen thallus is not a single organism, but is probably a symbiotic structure, comprised fundamentally of fungus hyphæ between which many unicellular green algæ are distributed, usually in a definite fashion The fungi belong to the Ascomycetes in the great majority of cases, rarely to the Basidiomycetes The algæ may belong to the Chlorophyceæ, in which case they are unicellular, or to the Cyanophyceæ, in which case they are either unicellular or in chains Because the symbiotic structure behaves as a unit, it has been decided to continue to treat the lichens as a class by themselves, rather than to consider the algal and fungal components independently in their respective groups. Except as soil-producers, lichens are of little economic importance· *Cetraria islandica* furnishes Iceland moss; *Sticta pulmonaria* was once used in medicine, *Cladonia rangiferina* furnishes the main food of the reindeer in Lapland, and, possibly, of other arctic animals; *Roccella tinctoria* of Africa and the East Indies is the source of the chemical indicator, litmus and of the dye orchil or orselle.

DIVISION II BRYOPHYTA
(Mosses and Liverworts)

Small green plants of simple structure, either thalloid or differentiated into stem and leaves true roots wanting vascular tissue absent alternation of generations well developed, the gamete-bearing generation dominant female gamete (egg) inclosed in a flask-shaped multicellular archegonium male gametes (sperm-cells) inclosed within a multicellular antheridial wall: fertilized egg producing the spore-bearing generation (sporogonium) which consists of a parasitic or semi-parasitic capsule usually borne upon a seta.

The Bryophytes are divided into two great classes, namely the Hepaticæ (Liverworts) and the Musci (Mosses) Each of these in turn is divided into several orders, which, as usual, contain one or more families. Mosses and liverworts are widely distributed over the earth, the latter seeming to prefer limestone regions

The Hepaticæ are characterized by a spore-bearing generation consisting of a stalked or sessile simple capsule, which contains spores and elongated sterile elaters, and splits into teeth or valves at maturity. The plant body (gamete-bearing generation) consists either of a thalloid, algal-like, dichotomously branching, ribbon-like structure, or of a slender axis bearing the very thin leaves, one cell in thickness, and destitute of a midrib. The leaves are usually arranged in two lateral rows, with often a third row of small dissimilar leaves on the under side, so that the shoot is strongly dorsi-ventral. The lateral leaves frequently bear at the base a curious lobe that is infolded or even flask-shaped, and probably aids in the conservation of water on the dry rocks and tree trunks which many of these plants frequent. The under side of the stem or thallus is usually provided with rhizoids that take the place of roots The thalloid liverworts are inhabitants of damp or wet situations, some being aquatic. in the North, they are found on damp soil, wet rocks, or among damp moss The majority of foliose liverworts inhabit similar places, only comparatively few genera and species being xerophytic Filaments of the alga, Nostoc, penetrate the cavities in the thallus of Anthoceros and there form endophytic colonies Vegetative reproduction is accomplished by the branching of the thallus, or by the production of special buds, called gemmæ, either on the edge of the leaf or thallus, or in special cup-like receptacles borne on the surface of the thallus

The Hepaticæ are divided into four principal orders as follows Order I —**Ricciales.** Thalloid, floating or amphibious sexual organs sunken in the thallus. capsule sessile, thin-walled, endophytic, irregularly dehiscent Order II —**Marchantiales.** Thalloid archegonia and antheridia usually borne on special branches of the thallus capsule often stalked, usually regularly dehiscent Marchantia was formerly used as a remedy in diseases of the liver, hence the name liverwort. Order III —**Anthocerotales.** Thalloid one chloroplast in each cell sexual organs superficial capsule very slender, chlorophyll- and stomate-bearing, continuing to elongate by basal growth Order IV —**Jungermanniales.** Thalloid or foliose capsule usually splitting to the base into four valves

The Musci (Mosses) differ from the Hepaticæ mainly in the more elaborate capsule, which in the young state commonly contains chlorophyll, is provided with stomates, and contains a central column of sterile tissue (columella) encircled by the spore-bearing chamber The dehiscence of the capsule is apical and transverse, and consists in the formation of a lid (operculum) which falls off exposing the mouth of the annular spore-chamber This mouth is surrounded by a single or double row of numerous hygroscopic teeth (peristome), which, by their bending, regulate the escape of spores in wet and dry weather No elaters are produced The sporogonium of the moss is, therefore, not only a more independent structure from the standpoint of nutrition than is that of most liverworts, but is constructed along wholly different lines On the summit of the capsule is usually found a delicate, diversely shaped, hood-like cap not organically connected with it and easily detached, called the calyptra This is the enlarged upper portion of the archegonium which, after rupture, is borne aloft on the summit of the growing sporogonium. The plant-body (gamete-bearing generation) is never thalloid; and the leaves, which are provided with a midrib, are frequently of several cells in thickness The germination of the spore does not result at once in a moss plant, but produces a creeping filamentous branched, algal-like growth (protonema) on which at length are borne the buds that give rise to the moss-stem proper

The Musci are subdivided as follows: Order I — **Sphagnales** (Bog or Peat Mosses). Structure of stem and leaf peculiar, consisting of dead, tracheid-like cells without protoplasm and provided with pits or thickening bands, regularly interspersed among slender, living cells containing protoplasm and chloroplastids. Under ordinary conditions, the tracheid-like cells are filled in part with air, and hence the plant has a grayish hue. In the presence of rain or abundant soil-water, the water is drawn into the cells by capillarity until the still apparently dry plant contains a surprisingly large quantity of water, which will flow out on squeezing

in the hand. The capsule possesses no peristome, and the spore-sac is continuous over the top of the columella Peat mosses are large, branched plants growing in extensive colonies in wet or damp situations in northern countries They are especially abundant on the floating moors which surround certain small ponds, and by their decay play an important part in the filling in of these ponds They continue to thrive in these "bogs" until the conditions at length become too dry. Peat mosses, therefore, form a large component of "peat," and in this way the Sphagnales have played a very interesting part in the evolution of the present surface of the earth Because of the power to retain water, sphagnum is of economic importance to nurserymen and florists, who use this moss extensively in packing stock for shipment, in germinating seeds, and for other purposes Some species of sphagnum are eaten in Lapland by the reindeer Mixed with the hair of the reindeer, they are used for stuffing mattresses Order II —**Andreales.** A small group of rock mosses. The spore-chamber is continuous over the summit of the columella, and the capsule dehisces by four longitudinal slits Order III —**Phascales.** A small group of minute terrestrial mosses with few leaves, but a persistent protonema capsule indehiscent, at length decaying. Order IV —**Bryales.** A large group containing the majority of the mosses capsule dehiscing by an operculum, peristome present, spore-sac interrupted at the summit by the columella Certain species were formerly used as astringents and diuretics *Leskea sericea* has been used to stop the flow of blood from wounds Species of Hypnum and Fontenalis are used in Norway and Sweden, by the peasants, to fill cracks in the walls of huts *Hypnum triquetrum* is sometimes used in place of sphagnum for packing plants

With the exception of sphagnum, the mosses and liverworts do not seem to be in the trade.

DIVISION III PTERIDOPHYTA

Eggs borne in archegonia sperm-cells in antheridia: alternation of generations clearly evident, the spore-bearing generation dominant true vascular tissue present, also true roots

CLASS I FILICINÆ (Ferns)

Sub-class I. Eusporangiatæ Sporangial wall several cells in thickness

Order 1 Ophioglossales

1 **Ophioglossaceæ** (from the genus *Ophioglossum, adder's tongue,* in reference to the fruiting spike). Adder's-Tongue Family Fig 1 Plants small or of medium size, often somewhat fleshy leaves various, entire or often much divided, not circinate in vernation; veins forking or netted, base of leaf cap-like, enclosing the succeeding leaf sporangia scattered, borne on the margin of the much modified fertile portion of the leaf, which is usually separated from the sterile by a stalk, globular in form, the walls several cells in thickness, annulus wanting, dehiscence by a straight horizontal or vertical fissure prothallium subterranean, tuber-like, chlorophylless, containing mycorrhizal fungi, saprophytic.

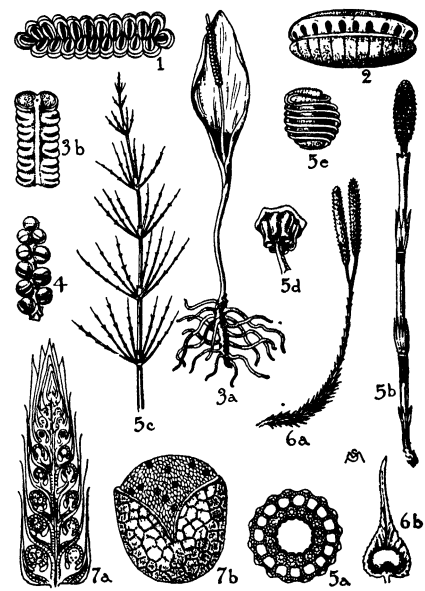
Three genera and about 50 species occur, of general distribution Several species of Botrychium and one of Ophioglossum are found in the eastern United States. The sheathing base of the leaf, the solitary, thick-walled sporangia without an annulus, and the subterranean saprophytic prothallia are important characteristics

Two genera are sometimes grown in North America. Botrychium (Moonwort Ferns, Grape Ferns) and Ophioglossum (Adder's Tongue)

Order 2. Marattiales

2 **Marattiaceæ** (from the genus *Marattia,* named in honor of Maratti, Italian botanist). Marattia Family Fig 1. Stately tropical ferns with thickened, often erect, stems leaves usually very large, from nearly entire to several times pinnate, circinate, inclosed when young by the prominent stipules indusium present or absent sporangia in sori on the under face of the leaf, either separate or united into a capsule-like body (synangium); the walls several cells in thickness, annulus wanting, or greatly reduced, dehiscence by clefts, pores, or, in case of the "synangia," first by valves and then by slits prothallium a green heart-shaped thallus on the surface of the soil, sometimes branched

Four genera and about 23 species are found in tropical regions, but extend into the south temperate



1. Marattiaceæ 1 Angiopteris, sorus 2 Marattia, synangium Ophioglossaceæ 3 Ophioglossum, *a*, whole plant, *b*, dehiscing sporangia 4 Botrychium, sporangia Equisetaceæ 5 Equisetum, *a*, cross-section stem, *b*, fruit stem, *c*, sterile stem, *d*, sporophyll and sporangia, *e*, spore and elater Lycopodiaceæ. 6 Lycopodium, *a*, fruit branch, *b*, sporophyll and sporangium Selaginellaceæ 7. Selaginella, *a*, fruit spike, *b*, spore showing prothallium and archegonia

zone. The fern-like habit, the prominent stipules, the thick-walled sporangia borne in sori or synangia, the absence of a well-developed annulus, and the green thalloid emersed prothallia, are important characteristics. The family is probably very old geologically

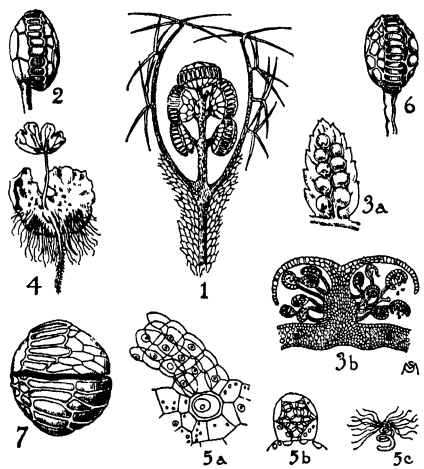
The thick, starchy stem of Angiopteris and some Marattias are locally used for food The fleshy stipules of *Marattia fraxinea* are eaten, the spicy leaves of some species are used to season food. The slime from the stipules of *M Douglasii* is used medicinally by the Hawaiians

Three genera are known to American horticulture and are occasionally grown as ornamental greenhouse plants Angiopteris, Danæa, and Marattia, representing less than a half-dozen cultivated species

Sub-class II. Leptosporangiatæ Sporangial wall one cell in thickness

Order 3. FILICALES

3. **Hymenophyllaceæ** (from the genus *Hymenophyllum*, signifying *membrane-leaved*). FILMY-FERN FAMILY. Fig 2 Very delicate ferns, small or minute in size, frequently epiphytic leaves entire, 1-3-pinnate, or dichotomously divided, rarely thalloid or orbicular, reduced in thickness to a single layer of cells between the veins, and thus often resembling the leaves of mosses, stomates absent; ultimate or all veins dichotomous. sori marginal, raised on a slender columnar pro-



2 HYMENOPHYLLACEÆ 1 Hymenophyllum, section of sorus CYATHEACEÆ 2 Alsophila, sporangium POLYPODIACEÆ 3 Adiantum, *a*, pinnule with sori, *b*, section of sorus 4 Adiantum, prothallium with young fern plant 5 Polypodium, *a*, archegonium, *b*, antheridium, *c*, sperm 6 Peranema, sporangium. GLEICHENIACEÆ 7 Gleichenia, sporangium.

jection of the veinlet. indusium cup-shaped: sporangium thin-walled; dehiscence vertical or oblique; annulus complete, horizontal: prothallium thalloid or filamentous, often much branched.

There are 2 genera and about 200 species growing upon rocks and trees in the damp, shady forests of the tropics, and in New Zealand. One species reaches central Europe and another reaches Kentucky. The family is readily distinguished by the delicate leaf, pedicelled sorus and equatorial annulus.

The Hymenophyllaceæ require a warm and very humid atmosphere, and, therefore, most species are difficult to cultivate

Several species of Hymenophyllum and Trichomanes are in cultivation in America.

4. **Cyatheaceæ** (from the genus *Cyathea*, signifying *cup+contain*, in reference to the cup-shaped indusium). CYATHEA FAMILY Fig. 2. Usually tree ferns with large, much-compounded, circinate leaves. sori globular, borne on the under side of the leaf: veins forking: indusium usually present, bi-valvular, cupular or unilateral: sporangia thin-walled, sessile or short-pedicelled, obovoid; annulus complete at the pedicel, oblique, dehiscence transverse: prothallium ordinary, green.

This family has 7 genera and about 300 species, of which 115 belong to Cyathea, 112 to Alsophila, and 44 to Hemitelia They are distributed in the tropics of both hemispheres The Cyatheaceæ is closely related to the Polypodiaceæ from which it differs only in the slightly oblique annulus which passes just at one side of the insertion of the pedicel, and is therefore uninterrupted at that point

The dense, woolly covering of the stem of many species is sometimes collected for stuffing pillows The starchy pith of some New Zealand Cyatheaceæ was formerly used for food In India, an intoxicating drink is prepared from the pith. Several species are important greenhouse ferns

Five genera at least are listed in the American trade. Alsophila, Cibotium (Scythian Lamb), Cyathea, Dicksonia, Hemitelia.

5 **Polypodiaceæ** (from the genus *Polypodium*, signifying *many feet*, in allusion to the branched rootstock of some species) POLYPODY FAMILY Fig 2 Ferns of very diverse habit, rarely arborescent leaves of normal texture, entire or pinnatifid or multisect, circinate; veins forking· sori mostly on the under side of the leaf, indusium peltate, fringed, capillary, cupular, elongated, unilateral or wanting sporangia thin-walled, long- or short-stalked; annulus vertical, interrupted by the pedicel; dehiscence transverse prothallium thalloid, green, growing upon the surface of the soil, mostly bisexual

Polypodiaceæ has more than 100 genera and about 4,000 species of wide distribution, especially abundant in humid regions and in forests The largest genera are. Dryopteris (or Aspidium), 450 species, Polypodium, 500 sp , Asplenium, 150–200 sp ; Elaphoglossum, 80–100 sp ; Adiantum, 80 sp , and Pteris, Blechnum, Polystichum and Aspidium about 50–70 species each The family is most closely related to the Cyatheaceæ The presence of sori, the thin-walled sporangium with vertical interrupted annulus and transverse dehiscence are distinctive This comprises the larger number of ferns, and is often called the Fern Family

Some of the most striking variants are the walking-leaf fern with undivided lanceolate leaves which take root at the apex and repeat the process several times, all the plantlets remaining for a time connected, the hart's-tongue fern with broadly lanceolate-oblong, entire frond; the epiphytic staghorn fern with erect, forked, fertile fronds and orbicular entire, sterile fronds closely imbricated over the short stem and support In many species the fertile and sterile fronds are dimorphic The stems of some species are slender and climbing, others long, slender and creeping, some are very stout and erect (tree ferns)

The ferns are of little economic importance except as ornamental plants The starchy rootstocks of some species are eaten locally, as are also the young shoots The rootstock of *Dryopteris* (*Aspidium*) *Filix-mas* is a reputed vermifuge.

About 60 species are in cultivation in America Among these are· Adiantum (Maidenhair Fern), Aspidium (Shield F.); Asplenium (Spleenwort); Camptosorus (Walking-leaf F.); Dennstædtia (Dicksonia) (Fragrant F.); Onoclea (Sensitive F , Ostrich F.); Pellæa (Cliff Brake); Phegopteris (Beech F); Platyceriun (Staghorn F); Polypodium (Polypody F.), Polystichum (Holly F , Christmas F.), Pteris (Common Brake); Scolopendrium (Hart's-tongue F.).

6. **Ceratopteridaceæ** (Parkeriaceæ) (from the genus *Ceratopteris*, meaning *horn-fern*). CERATOPTERIS FAMILY Aquatic ferns rooting in the mud· leaves of two sorts, the ones less divided with broader segments and veins more or less anastomosing; the more aerial fertile ones much divided, with narrow segments, and revolute margins which later almost completely inclose the scattered sporangia: indusium wanting. sporangia globular, thin-walled with a very diverse broad nearly complete or nearly wanting annulus; rarely the annulus wanting; dehiscence transverse: prothallia unisexual, thalloid, antheridia not superficial.

Only one genus and a few species of tropical distribution are known, the only aquatic species among the true ferns The habit, the absence of sori, the variable annulus, and the sunken antheridia are distinctive.

This fern is sometimes cooked and eaten as greens.

One or two species are frequently grown for aquaria and aquatic gardens.

7. **Schizæaceæ** (from the genus *Schizæa, cleft*, alluding to the leaves) CURLY-GRASS FAMILY. Fig 3. Ferns of very diverse habit, some extremely small, others climbing. stem mostly oblique or horizontal· leaves very diverse, usually pinnate or palmate; veins forking· sporangia thin-walled, usually scattered, at first marginal, later sometimes exceeded by the margin of the frond, often appearing spiked or panicled, sessile, no apparent indusium, annulus transverse, apical, complete, dehiscence vertical, fertile portion of the frond usually much modified prothallium of all genera except Schizæa ordinary, that of the latter genus filamentous and extremely branched, resembling that of the filmy ferns

In this family are 4 genera and about 70 species, mostly tropical, rare in the colder regions Two species reach the eastern United States, one of which extends to Newfoundland. The solitary sporangia and transverse apical annulus are important characteristics.

The curly grass (*Schizæa pusilla*) inhabits bogs, where it may form extended mats of dry, woolly "grass" 1–3 inches high The sterile leaves are without laminæ. *Lygodium palmatum* is the "climbing fern" of eastern America The leaf, not the stem, of this plant has unlimited growth, and twines.

Four genera are in the American trade. Anemia. Lygodium, Mohria, and Schizæa.

8 **Gleicheniaceæ** (from the genus *Gleichenia*, named in honor of W. F. Von Gleichen, 1717–1783) GLEICHENIA FAMILY. Fig 2. Terrestrial ferns with peculiar foliage leaves several times forking owing to the arrested growth of the main divisions which develop in succeeding seasons, only the ultimate branches pinnate (except in one genus) indusium none sporangia in sori on the under side of the leaf, thin-walled, sessile, pear-shaped, annulus complete, running obliquely around the back and over the top, line of dehiscence extending vertically down the ventral side from a constricted apical place in the annulus prothallium ordinary, green.

Two genera and about 26 species occur in tropical lands and the south temperate zone The family is related to the Schizæaceæ but the habit is very different. The peculiar forking of the leaves, as well as the unusual annulus and peculiar dehiscence, are characteristic.

A few species of Gleichenia are in cultivation in North America.

9. **Osmundaceæ** (from the genus *Osmunda*, derived from *Osmunder*, the Saxon name of the god Thor). OSMUNDA FAMILY Fig 3 Ferns of ordinary habit, rarely arborescent· rhizome mostly vertical, thick: leaves large, circinate, 1–3-pinnate, rarely thin and stomateless, petiole somewhat sheathing at the base, fibro-vascular bundle 1; veins forking· indusia wanting: sporangia scattered on the under side of the ordinary leaf, or on the margin or on both sides of modified fertile portions of the leaf, thin-walled, short-stout-pedicelled, globular; annulus imperfect, consisting of a group of cells on one side; line of dehiscence vertical, extending from this group up over the summit: prothallium ordinary, green.

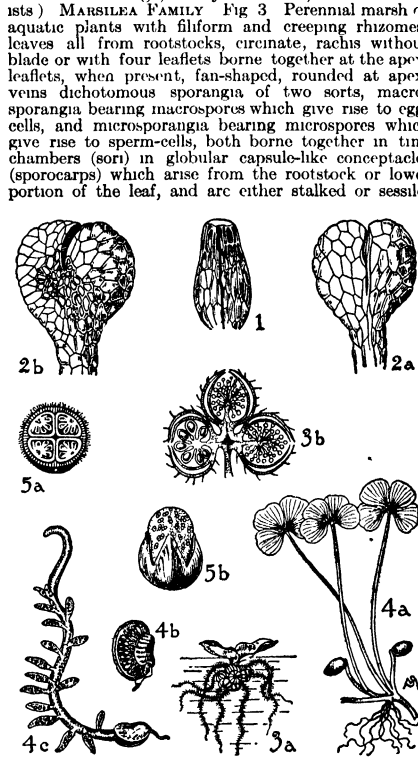
There are 3 genera and 10 or 12 species of general distribution, and others in the Australian region Three species occur in the eastern United States The family is related to the Gleicheniaceæ and Schizæaceæ. The peculiar dehiscence, and the scattered sporangia with the annulus consisting of a group of cells, instead of a ring, are distinctive

The family has practically no economic importance, except as ornamental plants, except that the root masses are used as matrix on which to grow orchids and other epiphytic plants (see *Osmundine*) Some have been used in medicine, although their virtues are questionable. The family contains some of our most stately native ferns.

All three genera are in American horticulture: Leptopteris (leaves thin and no stomates); Osmunda (Royal Fern, Cinnamon Fern), Todea (Grape Fern).

Order 4. HYDROPTERIDALES

10. **Marsileaceæ** (from the genus *Marsilea*, in honor of Giavanni Marsigli, or Aloysius Marsili, Italian naturalists) MARSILEA FAMILY Fig 3 Perennial marsh or aquatic plants with filiform and creeping rhizomes. leaves all from rootstocks, circinate, rachis without blade or with four leaflets borne together at the apex; leaflets, when present, fan-shaped, rounded at apex; veins dichotomous sporangia of two sorts, macrosporangia bearing macrospores which give rise to egg-cells, and microsporangia bearing microspores which give rise to sperm-cells, both borne together in tiny chambers (sori) in globular capsule-like conceptacles (sporocarps) which arise from the rootstock or lower portion of the leaf, and are either stalked or sessile:



3. SCHIZÆACEÆ 1 Anemia, sporangium OSMUNDACEÆ 2 Osmunda, sporangium, *a*, front view, *b*, back view SALVINIACEÆ 3 Salvinia, *a*, whole plant, *b*, section of sporocarps showing sporangia MARSILEACEÆ 4 Marsilea, *a*, whole plant, *b*, sporocarp germinating, *c*, sporocarp emitting gelatinous thread with sori 5 Pilularia, *a*, cross-section of sporocarp, *b*, sporocarp emitting sporangia

male and female prothallia very much reduced, remaining inclosed within the spore-wall, which in the case of the macrospores early becomes ruptured on one side to expose the archegonia

Two genera (Marsilea and Pilularia) and about 60 species occur, of which 52 or 54 belong to Marsilea. The distribution is general, though mainly tropical. Marsilea is represented in the United States by one native and one introduced species The family is closely related to the Salviniaceæ, but the peculiar habit and unusual sporocarps are distinctive.

At maturity, a gelatinous mass escapes from the sporocarp, and on this mass the sori are borne in somewhat characteristic fashion in different species. The leaflets of the clover-like leaves of Marsilea, in emersed forms, show sleep movement, as do those of clover. These leaflets float upon the water to the varying depths of which the petioles accommodate themselves; but the plant may grow emersed on mud, in which case the petioles are erect like clover The leaves of Pilularia are filiform, pointed, and destitute of blade.

In Australia, the sporocarps of *Marsilea Nardu* and *M Drummondii*, which contain much starch and other nutritious material, are used by the natives for food. They are ground into a powder, mixed with water and baked. Fish and marsilea "fruits" form almost the sole food of some tribes.

One species, *Marsilea quadrifolia*, is in cultivation in America for aquatic gardens.

11 **Salviniaceæ** (from the genus *Salvinia* in honor of A M. Salvini, Italian scientist) SALVINIA FAMILY. Fig. 3. Small, floating aquatic plants, resembling large Lemnas (Salvinia) or foliaceous liverworts (Azolla). stem reduced or wanting leaves few, orbicular or oval (Salvinia); or numerous, minute and imbricated (Azolla) sporangia and spores of two sorts as in Marsilea, but borne on basal columns in the single cavity of the sporocarp; at first both sorts of sporangia are present but only one kind matures so that the sporocarp becomes entirely "male" or entirely "female." prothallium partly endosporous, only a portion of either the male or female prothallium emerging from the spore wall.

The family has 2 genera and about 15 species, of which 11 belong to Salvinia; generally distributed but principally tropical Each genus is represented in the eastern United States by one native species The family is related to the Marsileaceæ, but the habit, the structure of the sporocarps, and the separation of macrosporangia and microsporangia in different sporocarps are distinctive

The "roots" of Salvinia represent a modified leaf Each leaf of Azolla is two-lobed, one lobe floating, the other submerged. A small cavity inclosed by the upper lobe is always inhabited by a nostoc-like alga, between which and the Azolla there is indication of a symbiotic relationship Azolla possesses true roots.

The family is of almost no economic importance

One species of Salvinia and two species of Azolla are occasionally grown in water-gardens.

CLASS II EQUISETINÆ

Order 5. EQUISETALES

12. **Equisetaceæ** (from the genus *Equisetum*, meaning *horse-bristle*). HORSE-TAIL FAMILY Fig 1 Plants of striking appearance, often with rhizomes and with a straight, aerial, striated axis bearing whorls of connate, scale-like leaves at the nodes· from the nodes also frequently arise slender branches of different structure which bear different but still scale-like leaves the stem is hollow, and besides the central canal often contains numerous additional large canals imbedded in the outer tissue. spores of one kind (not microspores and macrospores) sporangia 5–9, borne on the under surface of peltate, polygonal scales which form a terminal cone, dehiscence longitudinal; spores green, provided with several hygroscopic "elaters" which aid in dissemination prothallia green, unisexual, the female largest, branched.

A single genus and about 24 species are known, of which one section is tropical, the other of temperate distribution. Ten species are native in the eastern United States The family is very distinct and shows no definite relationship to any existing plants The habit, the undifferentiated spores, the peltate sporophylls. and the dioecious emergent prothallia are distinctive The arrangement of the canals and also of the stomates along the stem are important in the distinction of species.

The stems of *E. hemale*, rich in silica, were formerly much used for scouring and for polishing woods, and are still used to some extent. *E. arvense* and *E. sylvaticum* have been used for polishing tin vessels, hence the name "tinweed" Several species have been used in medicine, as diuretics. *E. giganteum* is employed as an astringent. *E arvense* and *E. palustre* are bad weeds in parts of Europe.

Several species have been advertised by American dealers in native plants.

CLASS III. LYCOPODINÆ

Order 6. LYCOPODIALES

13. **Lycopodiaceæ** (from the genus *Lycopodium*, *wolf-foot*, from a fancied resemblance) CLUB-MOSS FAMILY. Fig 1. Branched plants of moderate size, stems often erect when short, usually prostrate, pendent, or creeping leaves very numerous, small, subulate or oblong, moss-like, often imbricated, rarely the leaves all basal (Phylloglossum) sporophylls either similar to the leaves, or much modified and forming terminal "cones." sporangia and spores of one sort (not macrospores and microspores), the former reniform, borne at the base of a leaf on the upper side, dehiscence longitudinal prothallia more or less cylindrical or amorphous, in some species green, in others colorless, saprophytic, subterranean or subcortical

The club-moss family contains 2 genera and about 100 species, all but one of which belong to Lycopodium, distributed in all parts of the world except the very dry regions The majority of the epiphytic species are tropical, but several terrestrial species extend to the arctic circle Twelve of the species are native in the eastern United States The family is not closely related to any other The habit, the undifferentiated spores, and the prothallium are distinctive.

The branching of Lycopodium is of two types, the dichotomous, and the monopodial (a central axis from which lateral branches arise). On these types subgenera are based.

The spores of Lycopodium (principally of *L clavatum*), which are produced in great quantities, are used by apothecaries for coating pills, and by metal-workers These spores are highly inflammable and were formerly used in theaters to produce flashlights. *L. Selago* is emetic, drastic, vermifugal, and emmenagogue. *L. myrsinites* and *L. catharticum* are purgative Several other species have been used locally for various complaints The creeping stems of *L. clavatum* and *L. complanatum* are often used for Christmas and church decorations

Several species of Lycopodium (Club-moss, Ground Pine, Creeping Pine) are gathered or protected in America for decorative purposes or for the spores.

Order 7. SELAGINELLALES

14. **Selaginellaceæ** (from the genus *Selaginella*, diminutive of *Selago*, ancient name of Lycopodium). SELAGINELLA FAMILY. Fig 1. Moss-like or lycopodium-like plants, often of moderate size, usually profusely and dichotomously branched, more rarely monopodial; creeping, pendent or erect, sometimes climbing and several meters long, or minute and 1–3 cm. long: leaves moss-like, very small, usually densely placed, often imbricated, often of two sizes (the branches therefore strongly dorsiventral); ligule present, borne at the base of the leaf on the upper side roots borne on "rhizophores" which are probably modified branches: spores of two sorts (microspores and macrospores) in separate sporangia, borne in the leaf axils: sporophylls frequently modified, forming a cone or spike: prothallia

endosporous, the spore wall of the macrospores soon rupturing and exposing the archegonia

The one genus, Selaginella, and about 500 species are widely distributed, but mostly tropical The majority prefer damp forests, but some (e g , *S rupestris*) are xerophytic Three species are native in the eastern United States The family is related to the Lycopodiaceæ superficially, but not in the spores and in the prothallia, which are more closely allied to another family, the Isoetaceæ The habit, the foliar ligule, the undifferentiated spores, and the endosporous prothallia are distinctive

The spores of Selaginella have been used in the same manner as those of Lycopodium, but are less easily obtainable *S concinna* and *S obtusa* have been used for diarrhea and dysentery Several Mexican species are used locally for medicine. *S. convoluta* is employed in the East Indies as an aphrodisiac The rosette-like *S. lepidophylla* of Mexico is the best-known "resurrection plant" When dry, it rolls into a ball and becomes brown, when the air is humid, the branches spread out and the green upper surfaces are exposed

Many species of Selaginella are in choice American collections, but very few are commonly in the trade They are mostly grown for greenhouse and for table decoration under the name of "lycopodium."

SPERMATOPHYTA or SIPHONOGAMIA (PHANEROGAMIA)

SUB-DIVISION I GYMNOSPERMÆ

Order 8 CYCADALES

15 **Cycadaceæ** (from the genus *Cycas*, the Greek name of a certain palm) CYCAS FAMILY Fig 4 More or less woody plants, with thick, unbranched, columnar or tuberous stem leaves alternate, pinnate stamens and carpels borne in cones or in temporarily terminal clusters scales of the staminate cone bearing very many scattered anthers on the under side the carpels open, not forming a closed ovary, either leaf-like pinnatifid and bearing marginal ovules, or peltate with 2 or more suspended ovules, the latter very large, often 1 inch long, orthotropous, with 1 integument, becoming drupe-like

Cycadaceæ has 9 genera and about 85 species, distributed in tropical and subtropical regions Zamia is the largest genus, with 30 species The family stands isolated among the gymnosperms The palm-like habit, pinnate leaves, very numerous scattered stamens, and, in Cycas, the leaf-like carpel, are distinctive Differences more important to the morphologist are to be found in the embryology, especially in the fertilization by motile sperm-cells The leaves are circinate when unfolding, like those of a fern The Cycadaceæ represent an ancient family far more numerous in past geologic ages Many fossil species are known

Various species of Cycas in the Moluccas and Japan, especially *C revoluta*, yield a sago in the pithy part of the stem which the natives bake into bread The Hottentots eat the pith of Encephalartos, making from it "Kafir bread" The seeds of Cycas and Zamia are edible The leaves of Cycas are used at funerals and church festivals as "palm branches"

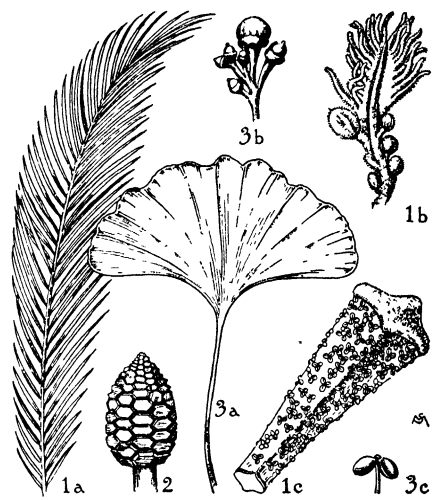
Several genera are in cultivation in America for greenhouse use and outdoors in the South These are Bowenia, Ceratozamia of Mexico, Cycas (Sago Palm) of the far East; Dioon of Mexico, Encephalartos of South Africa, Macrozamia of Australia, Stangeria of South Africa, Zamia (Coontie, Comptie) of tropical America

Order 9 GINKGOALES

16. **Ginkgoaceæ** (from the genus *Ginkgo*, the Japanese name). GINKGO FAMILY. Fig 4. Much-branched tree with deciduous leaves secondary wood without true vessels, resin-tubes present leaves alternate, fan-shaped like the pinnules of Adiantum, veins forking. anthers borne in pedicelled pairs on a slender axis, without bracts, the whole somewhat catkin-like no true pistillate cone, ovules borne in pairs at the summit of branched peduncles, each ovule surrounded at the base by a fleshy ring. fruit drupaceous Fertilization is by means of motile sperms

A single genus of one species occurs in China and Japan Fossil species are known. The family is distantly related to the Coniferæ, but the peculiar foliage, as well as the absence of cone structure and the great reduction of sporophylls, is distinctive

Ginkgo biloba (ginkgo, maidenhair tree, Kew tree), the only species, is grown as a park tree.



4 CYCADACEÆ 1 Cycas, *a*, leaf, *b*, carpel with ovules, *c*, male scale with anthers 2 Zamia, female cone GINKGOACEÆ 3 Ginkgo, *a*, leaf, *b*, ovules, *c*, stamen

Order 10 CONIFERALES

17 **Taxaceæ** (from the genus *Taxus*, the classical name, probably from the Greek meaning *bow*, for which the wood is used). YEW FAMILY Fig. 5 Much-branched trees or shrubs, with resin-tubes in the bark and no true vessels in the secondary wood leaves alternate, needle-like or scale-like, persistent stamens borne on the protected portion of more or less apically thickened or peltate scales (sporophylls) forming a small cone pistillate cones wanting, ovules borne singly or two together on a fleshy or rudimentary carpel (sporophyll), inverted or straight, the outer integument forming an arillus fruit a dry seed surrounded by the fleshy often highly colored arillus, the receptacle also often enlarged and forming a fleshy part of the fruit

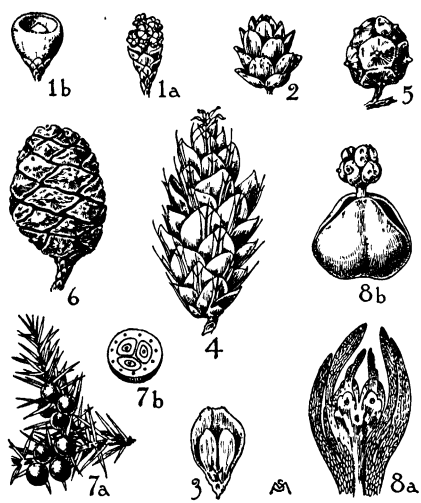
Taxaceæ has 8 genera and about 70 species widely distributed, of which 40 belong to the genus Podocarpus The family is related to the Coniferæ, but differs in the reduction of the pistillate cone to a single ovule, in the modification or suppression of the sporophyll, and in the aril or arillus The closely related Ginkgoaceæ has a different staminate inflorescence Fertilization is by means of pollen-tubes

The timber produced by the tropical eastern species of Podocarpus and of Dacrydium (heron pine and

damion pine) is highly valued. The yew wood is hard and susceptible of a high polish. It is used in cabinet work and for bows. The seed and shoots of yew are said to be poisonous, but the arillus is harmless.

In cultivation in America are a few genera for ornamental purposes· Cephalotaxus, East Asia, Podocarpus, Chile, Japan, Australia, grown in the South, Taxus (Yew), Europe, Asia, North America; Torreya (California Nutmeg), California to Florida

18. **Pinaceæ** (from the genus *Pinus*, the classical Latin name) PINE FAMILY Fig 5 Tree or shrub, with no true vessels in the secondary wood, but with resin-tubes. leaves linear, or needle-like, or scale-like, alternate or opposite, evergreen or deciduous anthers and ovules both in true cones plainly subtended by scales (sporophylls); the staminate scales usually bearing 2–6, rarely more, anthers on the under side; the pistillate bearing 1–2, rarely many, ovules on the upper side, or peltate and ovule-bearing under the crown or at its base; ovules with 1 integument: fruit



5 TAXACEÆ 1 TAXUS, *a*, male cone, *b*, fruit (seed and aril) PINACEÆ 2 Tsuga, female cone 3 Picea, female cone-scale with ovules. 4 Pseudotsuga, female cone 5 Chamæcyparis, female cone 6 Sequoia, female cone 7. Juniperus, *a*, female cones (berries), *b*, cross-section berry GNETACEÆ. 8 Ephedra, *a*, female inflorescence, *b*, male inflorescence

a dry woody cone with dry, often winged seeds between the scales; or berry-like through the union of the fleshy cone-scales

Sub-family 1 Cupressineæ —Cone-scales opposite; ovules erect leaves opposite or whorled.

Sub-family 2. Abietineæ —Cone-scales alternate; ovules inverted leaves alternate

There are 25 genera and about 240 species, widely distributed but most abundant in temperate regions The largest genus is Pinus with 70 species. The family is related to the Taxaceæ and Ginkgoaceæ, from which it differs in the presence of true staminate and pistillate cones It also differs from the latter in the absence of motile sperm-cells.

The Pinaceæ, like other Gymnosperms, is an old group, more abundant in former geologic ages Many fossil species are known The Sequoias of California were formerly more abundant, extending to Greenland. The young plants of many Cupressineæ possess foliage quite different in appearance from the mature foliage, the leaves being longer and more spreading These juvenile forms have been called Retinisporas, a name which has been applied also to all cultivated species of Chamæcyparis Juniper "berries" are fleshy cones with peltate, fused scales The leaves of Larix, Pseudolarix and Cedrus are deciduous. The branchlets and leaves are deciduous in Taxodium. The cone-scales of many Abietineæ are double, an outer thinner 3-toothed scale, and a thick inner scale that bears the ovules (see *Pseudotsuga*)

Among the Pinaceæ are some of our most valuable timber trees, e g, cedar, arborvitæ, spruce, fir, hemlock and redwood The resin from various pines when distilled yields spirits of turpentine and rosin, when dry-distilled, it yields tar Venice turpentine is the resinous exudation of European larches Canada balsam that of *Abies balsamea* Dammar resin is from the Malayan *Agathis Dammara* Kauri resin is the semi-fossilized resin of *Agathis australis* of Australia and New Zealand Sandarac resin is from *Callitris quadrivalvis* of Northwest Africa Amber is the fossilized resin of prehistoric conifers around the Baltic. Oil of savin is from the leaves and twigs of *Juniperus sabina*, and oil of cedar from *Thuya occidentalis* Juniper berries, from *J communis* of Europe and America, are diuretic and also used for flavoring gin. Edible seeds are produced by *Pinus Pinea* (stone pine) of the Mediterranean, *P Cembra* of Europe and Siberia, *P. Parryana* and *P edulis* of the southwestern United States, *Podocarpus nerifolia* of the East Indies, *Araucaria braziliana* of Brazil, and *A Bidwillii* of Australia Bread is made by the Laps and Eskimos from the inner bark of *Pinus sylvestris* and *Abies alba*, also from various Pinaceæ by our northwestern Indians Deodar (*Cedrus Deodara*) is sacred to the Hindoos *Cedrus Libani* is the cedar of Lebanon. Pine bark was formerly used for tanning.

Many genera are in cultivation in America Among these are Abies (Fir, Balsam); Araucaria (Norfolk Island Pine, Monkey Puzzle), Callitris (Cypress Pine), Cedrus (Cedar of Lebanon, Deodar), Chamæcyparis (White Cedar, Yellow Cedar, Hinoki Cypress, Sawara Cypress, Retinispora, Japanese Cedar), Cryptomeria; Cupressus (Cypress, Monterey Cypress), Juniperus (Red Cedar, Juniper, Savin); Larix (Larch, Tamarack, Hackmatack); Libocedrus (Incense Cedar, White Cedar), Picea (Spruce); Pinus (Pine, Pinnon, Soledad); Pseudolarix (Golden Larch), Pseudotsuga (Douglas Spruce, Red Fir); Sciadopitys (Umbrella Pine), Sequoia (Big Tree of California, Redwood), Taxodium (Bald Cypress, Deciduous Cypress); Thuya (Arborvitæ, White Cedar); Thuyopsis, Tsuga (Hemlock Spruce).

Order 11. GNETALES

19. **Gnetaceæ** (from the genus *Gnetum*, derived from *Gnemon*, said to be the old Malay name of the plant). GNETUM FAMILY. Fig 5 Very peculiar semi-woody plants of diverse habit leaves large and broad, or modified, or reduced, or opposite, or whorled no resin-tubes in the stem, secondary wood containing true vessels. true flowers present, with a 2–4-parted perianth, unisexual, rarely bisexual; stamens 2–8; pistillate perianth becoming juicy or wing-like in fruit and inclosing one naked orthotropous seed with 1 or 2 integuments

The family consists of 3 genera and about 35–40 species, widely distributed. It is distinguished from the Coniferæ by the presence of a perianth, the absence of resin-tubes, and the presence of vessels in the secondary wood The endosperm development, also, approaches that of the Angiosperms. The fertilization is by means of pollen-tubes. The three genera are very distinct. Ephedra, of the tropics of both hemispheres, is much branched, with slender jointed striate

equisetum-like stems, leaves scale-like at the distant nodes; Gnetum of South America, except one species, is a group of vines or shrubs with large broad leaves like those of an Angiosperm, Welwitschia of South Africa is a desert plant with a thick subterranean stem bearing two ribbon-like leaves 6 feet long, lying flat on the ground, and with a terminal cluster of cone-like flower-spikes

It is doubtful whether any of these are regularly in the American trade

SUB-DIVISION II. ANGIOSPERMÆ

CLASS I MONOCOTYLEDONEÆ

Order 12 PANDANALES

20 **Typhaceæ** (from the genus *Typha*, the old Greek name). CATTAIL FAMILY Fig. 6 Perennial marsh herbs, with creeping rootstocks, and long-linear, erect, mostly basal leaves flowers monœcious, naked, in a dense terminal spike, which is staminate above and pistillate below, each sex subtended by one bract-like spathe, perianth 0, stamens 2–5, filaments connate, bearing long, silky hairs, carpels 1, ovary 1-celled, raised on a stipe which also bears long, silky hairs; ovule 1, suspended; style slender. fruit a nutlet; seed albuminous

A single genus and about 12 species occur in the tropical and temperate zones Fossil species are known. The family is closely related to the Sparganiaceæ, with which it was formerly united These two families constitute a very distinct group of simple-flowered Monocotyledons The habit, the flowers borne in spikes without perianth, the hairy pedicels, the absence of bracts, and the simple pistil, are together distinctive.

The starchy rootstocks are sometimes used for food The leaves are woven into matting, and into chair-bottoms, and are used for calking barrels The pollen has been used as a substitute for the spores of Lycopodium The rootstock is used in East Asia for dysentery and urethritis, and the leaves in various localities for thatching cottages A vain attempt has been made to utilize the silky hairs of the fruit for making velvet

Two species of Typha (Cattail Flag, Reed Mace), both native, are in the American trade for water-gardens

21 **Pandanaceæ** (from the genus *Pandanus*, derived from a Malay name) SCREW-PINE FAMILY Fig 6 Shrubby or arborescent plants stems simple or branched, with prop-roots leaves spirally arranged, densely placed, sword-shaped, often canaliculate, clasping, stiff, edges and midrib often spiny-serrate flowers on simple or branched spadices, dioecious, naked, spathes caducous, stamens densely packed, separated or united in fascicles, scattered over the spadix, and not in definite flowers, pistillate spadix simple, ovaries numerous, coherent in bundles, or isolated, not in real flowers, stigma sessile, ovules solitary or several fruit drupaceous, cohering in multiple fruits, seed albuminous.

There are 3 genera and about 350 species, natives of the tropics of the Old World The family is unique. The floral structure, while much like that of Typha, suggests also the Palmaceæ As in Typha, actual flowers cannot here be distinguished.

The fleshy pericarps of some are eaten The strong odor of the staminate flowers is either agreeable or disagreeable, depending on the species, in the former case the flowers are used for perfumery. The leaves of *Pandanus utilis* are made into bags for shipping coffee, and the plant is now cultivated for that purpose in the West Indies

Ten to 15 species of Pandanus (Screw Pine, Candelabrum Tree, Chandelier Tree) are in greenhouse cultivation in America.

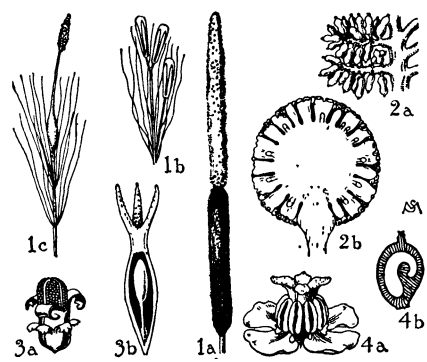
Order 13. HELOBIÆ

22. **Naiadaceæ** (from the genus *Naias*, derived from the Greek, meaning a *water nymph*) PONDWEED FAMILY Fig 6 Immersed aquatic herbs leaves mostly cauline, opposite or alternate, the floating often differing from the submerged in shape and texture: flowers axillary or spicate, bisexual or unisexual, perianth of 4 herbaceous segments, or wanting, stamens 1–4, rarely more, carpels 1–9, mostly distinct, 1-celled, 1-ovuled fruit a nutlet, endosperm none, embryo curved, rarely straight.

Naiadaceæ has 10 genera and about 100 species widely distributed, but most abundant in temperate regions. The largest genus is Potamogeton with 50 species The family is a very heterogeneous one which has been divided or united in many ways by different authors As here treated it is distinguished by the aquatic habit, greenish, often reduced perianth, few stamens, and few, separate, 1-seeded carpels A spathe-like bract usually incloses the inflorescence

The dried leaves of Zostera and Posidonia have been used since ancient times in Venice to pack glassware. They are now widely used for packing Plants of Potamogeton and Zostera are employed as manure.

Several species of Potamogeton (Pondweed) and one of Zannichellia are possibly in the American trade, for water-gardens



6 TYPHACEÆ 1 Typha *a*, inflorescence, *b*, male flower, *c*, female flower PANDANACEÆ 2 Pandanus, *a*, portion male inflorescence, *b*, female inflorescence, vertical section NAIADACEÆ 3 Naias, *a*, male flower, *b*, female flower. 4 Potamogeton, *a*, flower, *b*, vertical section nutlet

23 **Aponogetonaceæ** (from the genus *Aponogeton*, derivation obscure) APONOGETON FAMILY Aquatic herbs with tuberous rhizomes, and basal, submerged or floating leaves, blade linear to oval, palmately parallel-veined, with transverse veinlets, the general tissue between the veins often wanting, thus producing a remarkable openwork latticed effect. flowers spicate, bisexual, regular, hypogynous perianth of several petaloid parts; stamens usually 6, rarely more; carpels mostly 3, rarely 4–6, separate, ovules 2–6, mostly basal, anatropous· fruit pouch-like, endosperm none

The single genus, with its 15 species occurs in Africa, Madagascar, tropical Asia and Australia The family is related to the Naiadaceæ, with which it was formerly united, and from which it is distinguished by the petaloid perianth, several ovules, and straight embryo.

The roots are sometimes eaten by natives.

Aponogeton distachyus (Cape pondweed, water hawthorn) is cultivated in water-gardens

24 **Alismaceæ** (from the genus *Alisma*, the Greek name). WATER-PLANTAIN FAMILY. Fig. 7. Herbace-

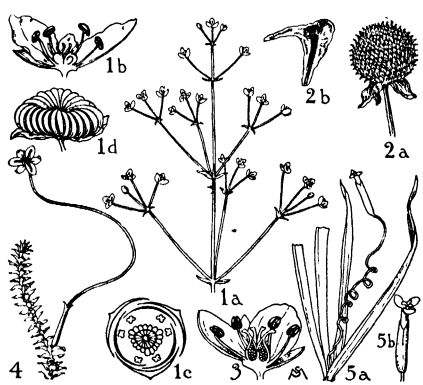
ous marsh plants with milky juice leaves mostly basal, sheathing, with a scale in the axil, blade various, floating or erect, often sagittate, varying in size and width with the depth of the water, palmately parallel-veined with cross veinlets flowers bisexual or unisexual, regular, hypogynous, in whorls of 3, sepals 3, more or less hyaline, petals 3, white and petaloid, stamens 6 to many, in several whorls, carpels very many, separate or rarely coherent, spirally arranged or in a whorl, 1-ovuled, rarely 2–5-ovuled fruit dry, rarely dehiscent, seed basal, anatropous, exalbuminous, embryo curved.

The family has 10 genera and about 50 species, distributed throughout the warmer and temperate zones The family is related to the Butomaceæ and Juncaginaceæ, which are all peculiar in having an axillary intravaginal scale The whorled flowers, differentiated perianth, numerous carpels, and mostly solitary, basal, exalbuminous seeds are distinctive

The acrid juice formerly led to the occasional use of these plants in medicine The tubers and rhizomes of Sagittaria were eaten by the American Indians as wappato, and are cultivated in China They are said to come into the Chinese market at San Francisco, preserved in liquid.

Two genera are in cultivation for water-gardens: Alisma (Water Plantain), native, and Sagittaria (Arrowhead), some native

25 **Butomaceæ** (from the genus *Butomus*, signifying *ox* + *to cut*, in reference to the rough leaves) Fig 7 Aquatic or marsh herbs leaves basal, with an axial scale, sometimes with milky juice blade linear or oval, veins palmately parallel with cross veinlets, or nearly veinless. flowers solitary or umbelled, bisexual, regular, hypogynous, sepals 3, subherbaceous, petals 3, colored, imbricated, stamens 9 or more, whorled, carpels 6 or more, separate, ovules numerous, borne



7 Alismaceæ 1 Alisma, *a*, inflorescence, *b*, flower, *c*, floral diagram, *d*, fruit 2 Sagittaria, *a*, fruit, *b*, achene Butomaceæ: 3 Butomus, flower Hydrocharitaceæ 4 Elodea, female flower branch 5 Vallisneria, *a*, habit and flower, *b*, female flower.

between the margins and midrib of the carpels fruit dry, dehiscent, seed anatropous, exalbuminous, embryo straight or curved

The family contains 4 genera and about 5 species, natives of the temperate and tropical zones of the Old World, and the tropics of the New World The family is related to the Alismaceæ and Juncaginaceæ, from the former of which it differs principally in the numerous ovules and their peculiar position

The roots and seeds of Butomus were once used as emollients The baked roots of Butomus are eaten in North Asia.

Two genera are in cultivation for water-gardens: Butomus (Flowering Rush), and Limnocharis (Water Poppy)

26 **Hydrocharitaceæ** (from the genus *Hydrocharis*, derived from the Greek meaning *water* and *rejoice*). Frog's-Bit Family. Fig 7 Submerged aquatic herbs, rarely floating, the flowers usually at first inclosed by a 2-bracted spathe. leaves alternate or opposite, very diverse, cordate, linear or ribbon-like flowers usually unisexual, regular, epigynous, perianth in 2 series, composed of 3 imbricated or valvate, calicoid parts, and 3 convolute petaloid parts, rarely of only 3 divisions, stamens in 1 to several series of 3, some often staminodia, carpels 2–15, ovary inferior, 1-celled with parietal placentæ, or imperfectly several-celled, stigmas 3–6 fruit not regularly dehiscent, submerged, somewhat fleshy; seeds many, exalbuminous

There are 14 genera and about 40 species widely distributed The family is related to the Alismaceæ and Naiadaceæ The differentiation into calyx and corolla, the usually numerous stamens, the inferior, 1-celled ovary with parietal placentæ, and the exalbuminous seeds are together characteristic The plants of this family are very diverse in appearance and often striking Fossil species are known The pollination of Vallisneria is very remarkable (See Kerner and Oliver, "Natural History of Plants")

Elodea canadensis, introduced into Europe from America, has there become so abundant as to impede navigation The plants of Hydrocharis, Stratiotes, and Elodea are used as fodder and as manure in Europe The starchy rootstocks of Ottelia and Boottia are eaten in India as pot-herbs, also the tubers and fruits of Enalus The fibers from the leaves of Enalus are used in India *Vallisneria alternifolia* is employed in India in the preparation of sugar.

Five genera are in cultivation in America, mostly for aquaria Elodea (Waterweed, Ditch-Moss, Water Thyme, Water Pest); Hydrocharis (Frog's-Bit), Limnobium (American Frog's-Bit), Stratiotes (Water Soldier, Water Aloe), Vallisneria (Eel-Grass, Tape-Grass)

Order 14 Glumifloræ

27. **Gramineæ** (from the Latin signifying *grass*) Grass Family Fig 8 Herbs, or sometimes almost tree-like stems hollow or solid leaves usually linear, in 2 ranks, composed of a sheath which is usually open down the front, a sessile blade, and a ligule at the juncture of blade and sheath flowers bisexual or unisexual, naked, or with the perianth reduced to 1–3 tiny scales, borne in specialized spikelets composed of 3 or more 2-ranked scales, the first 2 empty (called empty glumes), the others termed flowering glumes or lemmas, and 1 scale on each secondary flower-bearing axis, called a palet or palea, stamens 2–3, exserted for wind-pollination, carpel 1; ovary 1, 1-celled, 1-ovuled, stigmas feathery, usually 2 fruit a caryopsis, seed with endosperm, and embryo with an absorbing organ

Gramineæ is a family of 300–400 genera and perhaps 5,000 species distributed all over the earth The largest genera are Panicum with 300–400 species, Paspalum with 160 species, and Poa with 100 species The Gramineæ and Cyperaceæ form a very distinct group The usually hollow stem, the open sheaths, the ligule, the 2-ranked leaves, and the peculiar spikelet-structure are the best characters to separate Gramineæ from Cyperaceæ The Indian corn is one of the most modified of grasses It is monœcious The staminate spikelets are arranged on finger-like branches of the tassel at the summit of the plant, the pistillate spikelets are borne on the cob, which is supposed to be composed of similar finger-like portions grown together. Each spikelet is 2-flowered, but only 1 flower bears an ovary. The kernel is this ovary, and the chaff on the cob represent the glumes and palets. The grasses are divided into 13 tribes.

The grasses are among the most useful of plants. The following, among others, are, or have been, used as medicine Rhizome of *Agropyron repens* (quick- or quack-grass) is emollient, and aperient (several other grasses have the same properties) Root of *Arundo Donax* (reed) is diuretic and sudorific *Phragmites communis* was formerly considered depurative and anti-syphilitic. Calamagrostis was used by the French peasants as a diuretic *Perotis latifolia* is used in India for the same purpose, as are also the seeds of *Coix Lacryma-Jobi* in China. The roots of *Manisuris granularis* are used in India for intestinal troubles. The aromatic, fragrant roots of various Andropogons (or Cymbopogons) are used for medicine and for perfume in India and elsewhere, e g , *A. Nardus* (false spikenard, citronella), *A. citratus* (lemon-grass). *A lanuer* and *A Schœnanthus* (sweet rush, ginger-grass, geranium-grass) are used in Africa and Arabia as a stimulant, antispasmodic and diaphoretic, and for perfume.

The following are used for food. Seeds of wheat, barley, rye, oats, rice, Indian corn and millet, also seeds of *Andropogon arundinaceus* var *vulgare* (sorghum), and var *Durra* (durra) *Pennisetum americanum* (pearl millet) is an important food of the negro races, and *Poa abyssinica* and Eleusine are important in East Africa Sugar is obtained from the stems of several species, most important of which are *Saccharum officinarum* (sugar-cane), and *Andropogon arundinaceus* var *saccharatus* or *A Sorghum* (sugar sorghum)

Many grasses are used as fodder for cattle, as, for instance, our pasture and hay grasses *Poa pratensis* (June grass, Kentucky blue grass), *Phleum pratense* (timothy), *Festuca ovina*, etc (fescue), *Agrostis alba* (red-top), *Dactylis glomerata* (orchard-grass), *Cynodon Dactylon* (Bermuda-grass) Some grasses are poisonous to stock, e g , *Lolium temulentum* (darnel), and the Peruvian *Festuca quadridentata*

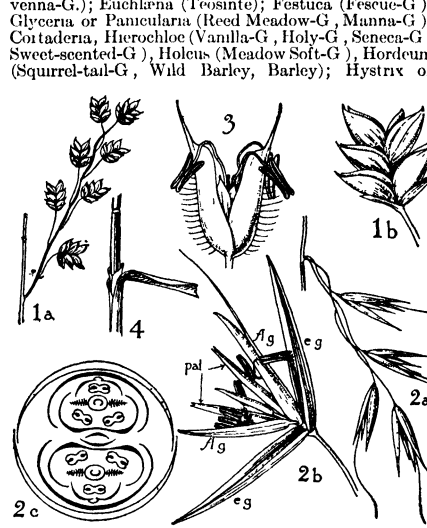
Straw from cereals is used for matting, upholstery, bedding, hats and for making paper

The bamboos yield very important building material in the East Like the palms, the bamboos are used for almost every conceivable purpose, and are among the most useful of plants

Several grasses, other than those above mentioned, contain a fragrant principle, e g , roots of *Vetiveria zizanioides* (vetiver or kus-kus of India) used to perfume rooms, and to keep insects out of clothing *Hierochloe odorata* (vanilla- or holy-grass) is used in Europe in religious ceremonies, and by the American Indians for making baskets *Anthoxanthum odoratum* is the European sweet-grass, now introduced into America.

The most important ornamental species are *Phalaris arundinacea*, *Stipa pennata*, *Cortaderia argentea*, *Lagurus ovatus*, *Hordeum jubatum*, *Miscanthus sinensis*, Briza, Arundo, Phragmites, Erianthus, Pennisetum, Thyssanolæna, and Bamboos

In America 70-80 genera are cultivated, or are important as natural fodder plants or weeds Among these are Agropyron (Quack-Grass, Couch-G , Quick-G), Agrostis (Bent-G , Red-Top, Cloud-G , Tickle-G , Fly-away-G), Aira (Hair-G), Andropogon (Silver-beard-G , Johnson-G , Lemon-G), Anthoxanthum (Sweet Vernal-G.), Ammophila (Beach-G , Marram-G), Arundinaria (Large Cane, Switch Cane, Scotch Cane), Arundo (Giant Reed); Avena (Oats); Bamboo, Briza (Quaking-G); Bromus (Brome-G , Rescue-G.), Calamagrostis (Reed Bent-G , Blue-joint-G., Pony-G.); Calamovilfa (Purple Bent-G), Cenchrus (Sand-bur, Bur-G); Chloris (Finger-G); Cinna, Coix (Job's Tears, Tear-G , Corn Beads); Cortaderia (Pampas-G), Cynodon (Bermuda-G); Cynosurus (Crested Dog's-tail, Silky-awned Dog's-tail); Dactylis (Cock's-foot, Orchard-G); Dactyloctenium (Crowfoot-G.); Desmazeria (Spike-G); Deschampsia (Hair-G , Hassock-G.); Digitaria (Crab-G , Finger-G); Distichlis (Salt-G., Marsh Spike-G.), Echinochloa (Barnyard-G); Eleusine (Crab-G , Yard-G , Dog's-tail, Wire-G., African Millet); Elymus (Lyme-G , Wild Rye, Terrel-G), Eragrostis, Erianthus (Woolly Beard-G , Plume-G , Wool-G , Ravenna-G.); Euchlæna (Teosinte); Festuca (Fescue-G), Glyceria or Panicularia (Reed Meadow-G , Manna-G); Cortaderia, Hierochloe (Vanilla-G , Holy-G , Seneca-G , Sweet-scented-G), Holcus (Meadow Soft-G), Hordeum (Squirrel-tail-G , Wild Barley, Barley); Hystrix or



8 Gramineæ 1 *a*, part of a grass panicle, *b*, spikelet 2 Avena, *a*, portion of panicle, *b*, spikelet, *e g* , empty glume, *fl g* , flowering glume or lemma, *pal* , palet or palea, *c*, ground-plan o spikelet. 3 Phleum, spikelet 4 Phalaris, sheath and ligule

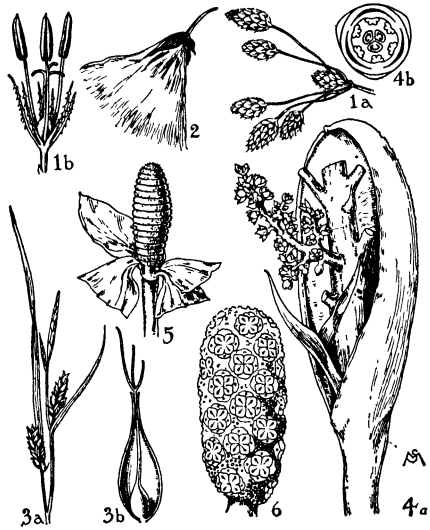
Asprella (Bottle-G.); Lolium (Darnel, Rye-G); Milium (Wild Millet-G), Miscanthus (Eulalia, Himalaya Fairy-G), Oplismenus; Oryza (Rice); Oryzopsis (Mountain Rice); Panicum (Panic-G , Old-Witch-G , Millet. Broom Corn Millet), Pennisetum (Pearl Millet); Phalaris (Canary-G , Gardener's Garters), Phleum (Timothy-G , Herd's-G), Phragmites (Common Reed); Phyllostachys (Bamboo, in part), Poa (Blue-G , Kentucky Blue-G , Meadow-G); Saccharum (Sugar-cane), Secale (Rye), Setaria (Millet, Hungarian-G , Foxtail-G , Pigeon-G), Spartina (Cord-G), Sphenopholis, Stenotaphrum (St Augustine-G); Stipa (Feathered-G , Esparto-G , Porcupine-G), Tripsacum (Gama-G., Sesame-G.); Triticum (Wheat, Spelt)

28 **Cyperaceæ** (from the genus *Cyperus*, the ancient Greek name) Sedge Family Fig 9 Herbaceous plants with grass-like habit and solid stems leaves alternate, in 3, rarely 2, vertical rows, linear, sheaths closed flowers bisexual or unisexual, regular, hypogynous, borne in variously disposed spikelets, subtended and hidden by overlapping scales none of which are regularly empty as in the grasses, no true palets, perianth reduced to bristles, scales, or 0, stamens 2-3; carpels 2-3; ovary 1-celled, 1-ovuled; style 1; stigmas 2-3 fruit an achene; seeds basal, anatropous, albuminous

There are 65 genera and about 3,000 species, inhabiting the whole earth More than 500 species belong to the genus Carex, 400 to Cyperus, and 200 to Scirpus They are abundant in swampy regions The family is closely related to the Gramineæ, from which it differs in the often 3-ranked leaves, solid stem, the absence of palets and of regular empty glumes, and the presence, in most cases, of a perianth and 3 carpels Most divergent from the ordinary is Carex, the flowers of which are monœcious, and the pistillate, though naked, are inclosed in a flask-shaped structure called a peri-

gynium, which probably corresponds to the modified palet of the grass spikelet The elongated perianth forms the wool of the wool-grass or cotton-grass The scales of the spikelet are in 2 ranks in Cyperus and Dulichium; in many ranks in the other genera

The Cyperaceæ are of far less economic importance than the Gramineæ The rhizomes of several species of Carex were formerly used as a remedy in syphilis. *Scirpus lacustris* is astringent and diuretic, but other



9 CYPERACEÆ, 1 Scirpus, *a*, portion of inflorescence, *b*, flower 2 Eriophorum, spikelet 3 Carex, *a*, inflorescence, *b*, vertical section perigynium PALMACEÆ 4 Chamærops, *a*, spathe and spadix, *b*, floral diagram CYCLANTHACEÆ. 5. Cyclanthus, inflorescence 6. Carludovica, inflorescence.

species also possess this property. The foliage of Eriophorum has been used for dysentery The spongy pith of the Eriophorum stem was used by German peasants for tapeworm. The tubers of *Cyperus esculentus*, now a weed in all countries, were cultivated by the Egyptians for food The leaves of many species of Cyperaceæ have been woven into mats, chair-bottoms, and the like The Egyptians made parchment from the pith of *Cyperus Papyrus* The rhizomes of *Eleocharis tuberosa* are used in the manufacture of starch, in China and India *Cyperus scariosus* and *C pertenuis*, of India, are fragrant and used in making perfumery Some canes are used in making rugs

Several genera are in cultivation in America, mostly for water-gardens, table decorations, and the conservatory Carex (Sedge); Cyperus (Umbrella Palm, Egyptian Paper Plant, Egyptian Papyrus, Chufa); Dulichium, Eleocharis, Eriophorum (Cotton-Grass, Wool-Grass); Mapania; Scirpus (Bulrush Sedge).

Order 15 PRINCIPES

29 **Palmaceæ** (from the Latin name *palma*) PALM FAMILY Fig 9 Woody plants of various habit, low, or arborescent, or climbing, usually unbranched, sometimes spinescent: leaves forming a crown at summit of stem except in Calamus, alternate, coriaceous, palmately or pinnately veined, entire or pinnatifid or palmatifid, often very large. inflorescence a simple or much-branched spadix, with or without a subtending spathe, the latter often woody, flowers unisexual, rarely bisexual, often sunk in the spadix, perianth of 6 parts in 2 series, greenish, often woody, valvate in the staminate, imbricated or convolute in the pistillate flower; stamens 6, rarely 3 or many, on or around a disk, separate or united, carpels 3, rarely fewer, separate or forming a 1–3-celled ovary, each cell 1-ovuled, but all except one seed in the ovary may abort, stigmas usually 3 fruit a berry or drupe, pericarp fleshy or fibrous; seeds albuminous.

Palmaceæ has 128 genera and about 1,000 species of tropical distribution, 10–15 species are found in the southern United States The largest genera are Calamus with about 200 species, Bactris with 90 species and Chamædorea with 60 species The family is very distinct, having no close relatives, but it evidently belongs to the spathe- and spadix-bearing group. The habit, coriaceous pleate leaves which are entire in the bud, the woody flowers and inflorescence, the 3 sepals and 3 petals, the usually 6 stamens, and the 3 carpels, each with 1 seed, are together distinctive

Palm leaves are always entire in the bud, and if later pinnatifid or palmatifid, become so on unfolding In this respect the palms are unique The leaves are plicate in the bud, and, on opening, the plates of the fan expand and either remain united or, more frequently, split down along the folds In the pinnate species the rachis between the folds elongates so that the divisions are separated, and the well-known palm leaf is produced The splitting may be at the top of the fold, or at the bottom, depending on the genus, and is an important characteristic in classification Some of the largest seeds in the plant kindgom belong to the Palmaceæ, as, for example, the coconut This fruit is produced from an originally 3-celled ovary, 2 cells of which abort

Next to the grasses, the palms are the most generally useful of all plants It is said that probably there is not a species but that is useful in some way Many yield textile fibers The wood is used to build houses and the leaves to thatch the roofs The leaves are also made into mats, baskets, hats, and the like The fibrous bud-sheaths are used as hats, or for fiber Some species contain starch or sugar in the trunk The fruits of many contain sugar, protein, starch, or oil Comparatively few are medicinal "The palm is called King of Plants and is said to supply all the wants of an inhabitant of the tropical zone It yields sugar, milk, solid cream, wine, vinegar, oil, cordage, cloth, cups, wood for building, thatch and other products" Coconuts, the fruit of *Cocos nucifera*, form one of the most important foods of the tropics The date fruit (*Phœnix dactylifera* of the Sahara) is also important *Metroxylon Rumphii*, and other species, yield sago A fermented liquor known as palm wine, laymi or arrack, is made from the juice of *Arenga saccharifera*, *Borassus flabelliformis*, *Metroxylon Rumphii*, *Mauritia vinifera*, and others The central bud of the cabbage palm and others is used for food Most palm oil is from the fruit of *Elæis guaneensis* of West Africa, which is now cultivated in America It is used like olive oil, or in the North for making soap Vegetable wax is obtained from the leaves and stems of *Ceroxylon andicolum* of Peru, also from *Copernicia cerifera* (carnauba wax). The famous giant double coconut is from *Lodoicea sechellarum* of the Seychelle Islands The fruit of *Areca Catechu* of the East Indies and India yields an astringent juice which, mixed with the leaves of the betel pepper and lime, is chewed by the inhabitants of tropical Asia Coconut fiber is important for making ship cables. The very slender stems of Calamus, often 300 feet or even 500 feet long (it is reported 1,200 or 1,800 feet, but not verified) and scarcely larger than a pipe-stem or a finger, are called rattan, and used for furniture. Much of the dragon's blood of the druggists

is the red juice of the fruit of *Calamus Draco* Palm-leaf fans are made from the palmately veined leaves of several species The saw palmetto (*Sabal serrulata*) of the southern states is medicinal The seeds of *Phytelephas macrocarpa* have a very hard endosperm known as vegetable ivory, used for carving as a substitute for ivory

Probably 100 genera are in the trade Except in the tropics, they are almost entirely ornamental greenhouse plants Among these are. Areca (Betel Nut), Attalea, Bactris, Calamus, Caryota (Fish-tail Palm, Wine Palm, Toddy Palm); Ceroxylon (Wax Palm), Chamædorea, Cocos (Coco Palm, Coconut, Pindo Tree), Corypha (Talipot Palm), Dæmonorops, Elæis (Oil Palm), Erythea (Blue Palm), Geonoma, Hedyscepe (Umbrella Palm), Howea (Flat Palm, Thatch Leaf Palm, Curly Palm), Livistona, Oreodoxa (Royal Palm, Cabbage Palm), Phœnix (Date Palm); Phytelephas (Ivory Palm); Rhapis, Rhapidophyllum (Blue Palmetto, Needle Palmetto); Sabal (Dwarf Palmetto, Blue Palm, Cabbage Palmetto), Serenæa (Saw Palmetto), Thrinax, Trachycarpus (Fortune's Palm); Washingtonia or Pritchardia (Weeping Palm).

Order 16 Synanthæ

30 **Cyclanthaceæ** (from the generic name *Cyclanthus*, which has reference to the spiral arrangement of the flowers) Cyclanthus Family Fig 9 Stemless or caulescent, palm-like, somewhat woody plants, often climbing leaves alternate, coriaceous, cleft or parted. flowers in a dense terminal unbranched spike (spadix), with several bract-like spathes beneath, staminate flowers grouped in 4 bundles accompanying the pistillate, or both in conspicuous alternating spirals, staminate perianth reduced and fimbriate, or 0, stamens 6 to many, borne in groups, perianth of the pistillate flower 0, or of 4 fleshy parts accompanied by 4 long, twisted, exerted staminodia, carpels 4, united below, sunken in the spadix, ovary 1-celled, many-ovuled, with parietal placentæ fruit multiple, a berry-like spike The tissue of the spadix splits into valves, coiling up from the base to apex and thus inclosing the fruitlets which dehiscence

This family has 5 genera and about 50 species, of which 35 belong to Carludovica They are confined to the tropics of America, and stand intermediate between the Palmaceæ and Araceæ The family is distinguished by the combination of palm-like foliage, numerous ovules, thick spadix, and closely associated staminate and pistillate flowers

The flowers of *Cyclanthus bipartitus* of Brazil are vanilla-scented, cultivated, and cooked with meat as an aphrodisiac The leaves of *Carludovica palmata* furnish the material for the panama hats

Several species of Carludovica are in the American trade as greenhouse plants

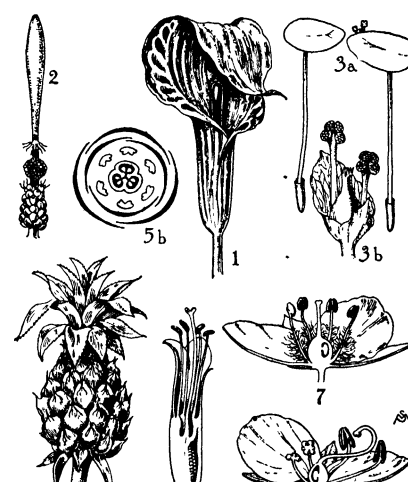
Order 17 Spathifloræ

31 **Araceæ** (from the genus *Arum*, the ancient name of these plants) Arum Family Fig 10 Herbs, shrubs, or trees, of the most diverse habit and appearance, often climbing, or epiphytic with aerial roots, rarely floating, usually subfleshy, juice sometimes milky leaves ensiform or broad, parallel- or netted-veined, entire or variously cut flowers bisexual or unisexual, rarely reduced to a single stamen and carpel, regular, hypogynous or epigynous, disposed on an unbranched fleshy axis (spadix), which is usually subtended by a special bract (spathe); perianth 0, or of 4–8 parts, stamens 1 to many, carpels 1 to several; ovary superior or inferior, 1 to several-celled, 1 to many-ovuled; style and stigmas various· fruit a berry; seeds albuminous, outer integument fleshy

Araceæ has over 100 genera and about 900 species, widely distributed, but most abundant in the tropics, especially as epiphytes in the deep, damp forests The majority in the temperate regions are swamp-plants. The largest genera are Philodendron with 100 species, and Arisæma with 50 species The family stands as the type of the spathe-bearing plants Its close relatives are the Lemnaceæ, Palmaceæ, and Cyclanthaceæ, from which it is distinguished more by general habit and texture than by structural details

The pollination of the Araceæ is often complicated and remarkable (see Kerner and Oliver) The transfer of the pollen is mostly accomplished by flies, which are frequently attracted by lurid color and carrion scent The leaves of Monstera are remarkable for their peculiar perforations, while the massive petioles of other Araceæ are sometimes mottled like snakeskin Pistia is a much-reduced floating aquatic, transitional to the Lemnaceæ The aerial roots of the epiphytic species are frequently covered with a special water-absorbing tissue The unfolding spathes of the Araceæ are noted for the heat evolved The tissues are usually very mucilaginous and filled with needle-like crystals of calcium oxalate These crystals are supposed to give the pungent flavor to Indian turnip simply by mechanically penetrating the tongue

Many species have been used locally for medicine. *Lagenandra toxicaria* of Ceylon is extremely poisonous.



10 Araceæ 1 Arisæma, spathe and spadix 2 Arum spadix with male and female flowers Lemnaceæ 3 Lemna, *a*, whole plants, *b*, male and female flowers, and spathe Bromeliaceæ 4 Bromelia, flower 5 Ananas, *a*, fruiting inflorescence, *b*, floral diagram. Commelinaceæ 6 Commelina, flower 7 Tradescantia, flower.

Dieffenbachia Seguine and *Arisæma triphyllum* are violent irritants when chewed, causing the mouth to swell *Arum maculatum* of Europe was used by the ancients as an excitant The roots of Symplocarpus have been used for asthma and colds The roots of *Acorus Calamus* (sweet flag) are aromatic and used for coughs, colds, and the like The thick rootstocks and roots of many have been used for food, e. g , *Orontium aquaticum* of North America, *Colocasia antiquorum* of India, *Alocasia macrorhiza* (taro) of the Pacific Islands, and *Pellandra virginica* (taro) of North America. The rhizomes of *Arisæma maculatum* and *Calla palus-*

tris, mixed with cereals, according to Linnæus, serve for food among the Laps and Finns. Portland arrow-root is derived from Arums The delicately flavored, juicy fruits of *Monstera deliciosa* are eaten in Mexico. The shoots of *Xanthosoma sagittifolium*, called caraibe cabbage, are eaten as a vegetable in the Antilles. The aerial roots of aroids are used to tie bundles of sarsaparilla sent to Europe and America.

Because of their odd habit and strange appearance, as well as, in some cases, for real beauty, many Araceæ are in cultivation, mostly as conservatory plants. Many genera are in the American trade Among these are: Acorus (Sweet Flag); Alocasia; Amorphophallus (Devil's Tongue, Snake Palm, Stanley's Wash-Tub), Anthurium, Arisæma (Indian Turnip, Jack-in-the-Pulpit, Dragon Root, Fringed Calla), Arum (Black Calla, Solomon's Lily, Lord and Ladies, Cuckoo Pint, Wake-Robin of England); Biarum, Caladium, Calla; Colocasia, Dieffenbachia; Helicodiceros (Hairy Arum), Monstera (Ceriman, Shingle Plant), Nephthytis; Orontium (Golden Club); Peltandra (Water Arum); Pistia (Water Lettuce, Tropical Duckweed); Pothos; Sauromatum; Schizmatoglottis, Spathiphyllum, Symplocarpus, or Spathyema (Skunk Cabbage), Xanthosma (Malanga), Zantedeschia, or Richardia (Calla Lily, Lily-of-the-Nile)

32 **Lemnaceæ** (from the genus *Lemna*, an old Greek name of uncertain origin) DUCKWEED FAMILY Fig 10. Tiny aquatic plants floating or submerged, the plant body reduced to an oval or oblong, flat or globular thallus, which multiplies rapidly by marginal buds, and may or may not bear 1 or more roots on the under side: flowers unisexual, naked, monœcious, the staminate consisting of 1 stamen; the pistillate of 1 flask-shaped, 1-celled pistil, with several ovules, the latter orthotropous or anatropous, the micropyle transformed into a cap. fruit a several-seeded utricle

There are 3 genera and about 25 species, distributed over the whole earth, except the arctics The family is related to the Araceæ, from which it is supposed to have degenerated. The flowers, which rarely occur, are borne in minute pits in the edge or upper surface of the thallus, either 1 staminate and 1 pistillate, or 2 staminate and 1 pistillate together; in some genera provided with a spathe corresponding to the spathe in the Araceæ. The roots, when present, are balancing organs to resist the upsetting of the plant by the waves Wolffia is the tiniest flowering plant, the whole plant sometimes in size only half the diameter of a pinhead.

By the very rapid vegetative multiplication of some species, ponds are often completely covered with a green coating, and these plants may then become of economic importance

Lemna and Spirodela are often grown in aquaria.

Order 18. FARINOSÆ

33. **Bromeliaceæ** (from the genus *Bromelia*, in honor of Olaus Bromel, a Swedish botanist). PINEAPPLE FAMILY. Fig 10. Herbs or subshrubs, mostly epiphytic: leaves usually basal, alternate, linear, trough-like, sheathing at the base, mostly stiff and spiny-serrate, usually covered in part or all over with peltate scale-like hairs or glands. flowers in spikes, racemes, panicles or heads, often in the axils of imbricated, highly colored, bracts, usually bisexual, regular, epigynous or hypogynous; perianth of 6 parts, definitely differentiated into calyx and corolla; parts free or united; stamens 6, often borne on the perianth; anthers introse; ovary inferior or superior, 3-celled; ovules many; style 1; stigmas 3. fruit a berry or capsule, more or less surrounded by the persistent perianth; seeds albuminous

The family has 40 genera and about 900 species, almost exclusively of tropical and subtropical America. *Tillandsia usneoides* reaches Florida and Texas. Tillandsia is the largest genus with 120 species. The family is closely related to the Liliaceæ and Amaryllidaceæ. The peculiar stiff leaves, the conspicuous bracts, the herbaceous calyx, the mealy endosperm, and, in general, the epiphytic habit, are distinctive. There are few families more easily recognized than this.

The most important economic species is the pineapple (*Ananas sativus*), the fruit of which is an important article of commerce. Its unripe juice is used as a vermifuge and diuretic. Florida or Spanish moss (*Tillandsia usneoides*) is used in the preparation of a styptic ointment It is also used to stuff mattresses, under the name of vegetable hair *Billbergia tinctoria* is the source of a dye The leaves of pineapple yield a beautiful fiber *Bromelia Pinguin* is a vermifuge employed in the West Indies.

There are several genera grown in America, all for ornamental purposes except the pineapple. Among these are: Æchmea, Ananas (Pineapple); Billbergia, Bromelia (Pinguin of Jamaica, Wild Pine), Cryptanthus, Dyckia; Guzmannia; Nidularium, Pitcairnia, Tillandsia (Spanish Moss, Florida Moss, Long Moss), Vriesia

34 **Commelinaceæ** (from the genus *Commelina* dedicated to J. and G Commelin, Dutch botanists of the early 18th century). SPIDERWORT FAMILY Fig 10 Herbs with knotty stems, and somewhat sheathing, alternate, flat or channeled, cauline leaves flowers usually bisexual, almost or quite regular, hypogynous, perianth of 6 parts, in 2 series, differentiated into a green calyx and colored corolla; the petals separate or united into a tube, mostly quickly disappearing, and dissolving into a viscid liquid; stamens 6, or reduced to 3, with or without staminodia; some anthers often sterile and altered, the filaments usually provided with characteristic long hairs, ovary superior, 2-3-celled, few-seeded, style 1, stigma usually captitate fruit a capsule.

Twenty-five genera and about 300 species occur, widely distributed in the tropics and subtropics Eleven species reach the northeastern United States. The largest genus is Commelina, with 88 species The family is not closely related to any other The general habit, the complete differentiation of the perianth into calyx and corolla, the slight irregularity of the flower, the peculiar stamen-hairs, and the transformed anthers, are together distinctive The peculiar deliquescent character of the petals in many genera is of interest

The rhizomes of several species of Commelina contain starch, besides the mucilage, and are eaten The rhizome of *C Rumphii* is an emmenagogue The tubers of *Aneilema medicum* are used in China for coughs and lung diseases A decoction of *Cyanotis axillaris* is used by the Indians for dropsy The family is most important from the point of view of ornamental use.

Several genera are grown in America, all for ornament Among these are· Aneilema, Cochliostema, Commelina (Day Flower); Dichorisandra, Tradescantia (Spiderwort, Wandering Jew); Zebrina (Wandering Jew)

35. **Pontederiaceæ** (from the genus *Pontederia*, named in honor of Pontedera, professor at Padua in the 18th century) PICKEREL-WEED FAMILY Fig 11. Upright or floating, fleshy, water- or swamp-plants· leaves alternate, petioles sheathing; blade cordate, oval, or orbicular, or reduced to the linear flattened petiole: flowers not bracted, bisexual, irregular, hypogynous; perianth of 6 similar parts, in 2 whorls, more or less connate, persistent; stamens 3 or 6, rarely 1, inserted unequally on the perianth-tube; anthers introse; ovary superior, 3-celled and ovules many, or 1-celled and 1-seeded, style 1; stigmas 3· fruit a capsule, or an achene enveloped by the fleshy persistent base of the perianth; embryo as long as the endosperm.

The family contains 6 genera and about 20 species, of which 9 belong to the genus Heteranthera, and about 5 to Eichhornia. They are distributed in the swamps of



II. Vegetation areas.—Aquatic, marsh and upland floras, and the relation of farm lands.

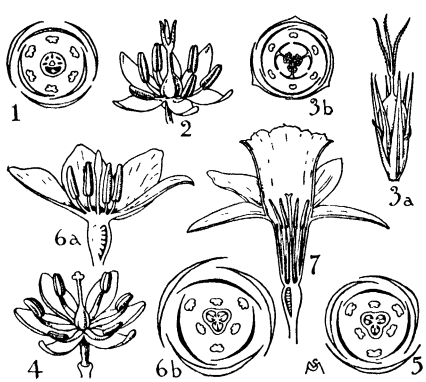
the warmer parts of the earth, except Europe The family is most closely related to the Liliaceæ, from which it differs in the irregular flowers, in the sympodial method of growth, in anatomical characters, and principally in the abundant mealy endosperm

A decoction of the root of *Monochoria vaginalis* of the Far East is used for liver and stomach complaints, the root is chewed for toothache; pulverized and mixed with sugar it is used for asthma; the leaves bruised and mixed with milk are used for cholera, and the shoots are edible. *Eichhornia crassipes* is a floating fleshy plant with beautiful flowers It has become so abundant in Florida as to interfere seriously with steamboat navigation in the rivers The large violet flowers of both Eichhornia and Pontederia are valued in cultivation for water-gardens

Two genera are frequent in cultivation· Eichhornia (Water Hyacinth), from South America; and Pontederia (Pickerel-weed), native

Order 19 Liliflorae

36 **Juncaceæ** (from the genus *Juncus*, classical name, derived from *jungere*, to join) Rush Family Fig 11 Rush-like or grass-like herbs or shrubs flowers numerous, very small, bisexual, regular, hypogynous, perianth of 6 similar, separate parts, greenish or brownish, chaffy; stamens 3 or 6 in 2 whorls, carpels 3, ovary 1-



11 Pontederiaceæ 1 Pontederia, floral diagram Juncaceæ 2 Luzula, flower 3 Juncus, *a*, flower, *b*, floral diagram Liliaceæ 4 Dracæna, flower 5 Fritillaria, floral diagram Amaryllidaceæ 6 Leucoium, *a*, flower, *b*, floral diagram 7 Narcissus, flower

or 3-celled, ovules 3 to many, stigmas 3· fruit a capsule; seeds mostly very small, albuminous, anatropous

Juncaceæ has 7 genera and about 175 species, of which 160 belong to the genus Juncus, widely distributed in temperate and cold regions, both north and south, but rare in the tropics The family is closely related to the Liliaceæ, from which it differs only in the rush- or grass-like habit and scarious perianth Fossil species are known The leaves are sheathing and the blades are either flat, or tubular and nodulose Distichia of the Andes is densely heath-like or moss-like

The stems and leaves of many species are used for binding, or for weaving into mats Light hats are made from the pith of certain species in India and China The pith is also used for candlewicks

In cultivation in America are 2 genera for water-gardens Juncus; Prionium, woody. Xanthorrhœa is transferred to the Liliaceæ

37. **Liliaceæ** (from the genus *Lilium*, classical Latin name). Lily Family Fig 11 Herbs, shrubs, or trees, usually with rootstocks or bulbs, sometimes climbing leaves alternate, rarely with petiole and blade flowers bisexual, rarely unisexual, regular, hypogynous, rarely epigynous, not subtended by spathes; perianth petaloid, of 6 similar parts, in 2 series, the parts separate or connate, rarely differentiated into a green calyx and colored corolla; stamens 6, rarely fewer, hypogynous, or borne upon the perianth; carpels 3, rarely more or fewer, united, rarely free, ovary usually 3-celled, ovules 1 to many in each cell, styles and stigmas 1–3 fruit a capsule or berry

There are about 200 genera and 2,000 species, distributed in all parts of the world The large genera are Smilax with 200 species, Allium with 250 species, Asparagus with 100 species, Aloe with 85 species and Scilla with 80 species The Liliaceæ, taken in the broader sense, as is done by Bentham & Hooker, and by Engler, is an easily recognized group except in unusual cases The regular, 6-parted perianth, 6 stamens, and 3-celled superior ovary are distinctive The family has been divided by Engler into 11 tribes The Liliaceæ furnishes a host of cultivated plants

The following plants, among others, have been or are used in medicine *Amianthium muscætoxicum* of North America as a narcotic and a fly poison, various species of Uvularia of North America as a gargle and for rattlesnake bites, the root of Polygonatum sp in Europe as a vulnery, and the berries as an emetic and purgative, the berries of *Smilacina racemosa* of North America as a tonic, the root of *Convallaria majalis* of Europe as a purgative, the leaves of *Streptopus amplexicaulis* of North America as a gargle, the roots of Ruscus of Europe as a diuretic and emmenagogue, the roots of Smilax sp of the tropics (the sarsaparillas of commerce) as a tonic and diuretic, the roots of *Asparagus officinalis* in Europe as an aperient, the berries as a diuretic and aphrodisiac, and the shoots as a sedative and cardiac, the roots of Cordyline of the southern tropics for dysentery, the flowers of *C deflexa* as an emmenagogue, the resin from *Xanthorhœa hastilis* (Botany Bay gum, with a fragrance like benzoin) in Australia for throat troubles, the resin of *X australis* (grass tree gum, earth shellac, or nut pitch) for various purposes, the tubers of *Ophiopogon japonicus* (serpent's beard) in China and Japan for abdominal troubles; the bulbs of Gagea of Europe as an emetic, the flowers of Hemerocallis of Europe as a cordial, the leaves of species of Aloes of the Old World as a tonic, purgative, and emmenagogue (*A Perryi* is Socotrine aloes, *A vera* is Barbadoes aloes, and *A spicata* is Cape aloes), the bulb of *Urginea maritima* (squills) of the Mediterranean as a diuretic, expectorant, and emetic; Allium sp as a vermifuge and carminative, the bulbs of Hyacinthus, Muscari, and Ornithogalum of Europe as purgatives and diuretics, *Ornithogalum altissimum* of the Cape as a remedy for asthma and catarrh; Antherieum and Asphodelus as diuretics and emmenagogues; Tulbaghia of the Cape as a vermifuge and for phthisis; the poisonous root of *Veratrum album* (white hellebore) of Europe as a violent purge and emetic, and to exterminate vermin, *V nigrum* (black h) of Europe, and *V viride* (green h) of the United States, occasionally, for the same purpose; *Schœnocaulon officinalis* (cavadilla or sabadilla) of Mexico for vermin and as a vermifuge, the narcotic, poisonous root and seeds of *Colchicum officinale* of Europe as a cathartic, emetic, and sedative, and *Helonias bullata* of North America as a vermifuge The roots of Gloriosa, also, are poisonous *Dracæna Draco*, the dragon tree of the Canaries and Teneriffe, famous for the extreme age and size of the trees, was superstitiously revered by the ancients The red resinous astringent exudation of these plants was called dragon's blood

The following have been used for food Bulbs of *Camassia esculenta*, western United States, bulbs and

leaves of Allium sp. (onion, leek, eschalot or shallot, rochambole); shoots of Polygonatum, Europe, United States; shoots of *Asparagus officinalis*, roots of Cordyline sp., in South Sea Islands, and there called ti. The seeds of Ruscus are a substitute for coffee.

A few have been used for other purposes: Roots of Yucca for soap; fibers of New Zealand flax (*Phormium tenax*) for fabrics; and the fragrant root of *Dianella nemorosa* for incense.

For ornament, great numbers of genera and species are in cultivation.

Very many genera are in cultivation, some common, for ornamental purposes unless otherwise stated Among these are Agapanthus (African Lily, Lily-of-the-Nile); Aletris (Colic Root), native, Allium (Onion, Chives, Cives, Garlic, Leek, Shallot), ornament and food; Asphodeline (True Asphodel, King's Spear); Asphodelus (Branching Asphodel), Bessera (Mexican Coral Drops); Brevoortia (Floral Fire-Cracker), Brodiæa, Calochortus (Star Tulip, Globe Flower, Mariposa Lily, Butterfly Tulip); Camassia (Camass); Chionodoxa (Glory-of-the-Snow); Chlorogalum (Soap Plant, Amole), Clintonia, native; Colchicum (Meadow Saffron, Autumn Crocus); Cordyline (Dracæna), Dasylirion; Dracæna (Dragon Tree); Erythronium (Dog's-tooth Violet, Adder's Tongue); Eucomis (Royal Crown, Pineapple Flower); Fritillaria (Crown Imperial, Black Lily, Checkered Lily); Funkia (Day Lily, Plantain Lily), Galtonia (Giant Summer Hyacinth), Gasteria; Gloriosa (Climbing Lily); Haworthia, Helonias (Swamp Pink, Stud Pink), Hemerocallis (Yellow Day Lily, Lemon Lily), Hyacinthus (Hyacinth); Kniphofia (Red-hot-poker Plant, Torch Lily, Flame Flower), Lachenalia (Cape Cowslip), Lapageria (Chilean Bellflower); Leucocrinum (Sand Lily); Lilium (Lily, Easter Lily, Madonna Lily, Tiger Lily, Japan Lily, Turk's-cap Lily); Littonia (Climbing Lily); Maianthemum (False Lily-of-the-Valley, Two-leaved False Solomon's Seal), native; Medeola (Indian Cucumber Root), native; Melanthium (Bunch Flower); Milla (Mexican Star, Mexican Star of Bethlehem, Frost Flower, Floating Star), Muscari (Grape Hyacinth, Musk Hyacinth, Feathered Hyacinth); Narthecium (Bog Asphodel), Nolina, Nothoscordum (Yellow False Garlic, Streaked-leaved Garlic); Oakesia (Wild Oats), native; Ornithogalum (Star of Bethlehem); Paradisea (St. Bruno's Lily, St Bernard's Lily), Paris (Herb Paris, Love Apple, True Love); Phormium (New Zealand Flax); Polygonatum (Solomon's Seal); Ruscus (Butcher's Broom); Sansevieria (Bow-string Hemp); Scilla (Squill, Wild Hyacinth, Bluebell, Harebell, Spanish Jacinth, Sea Onion, Starry Hyacinth, Cuban Lily, Hyacinth of Peru, Peruvian Jacinth); Semele (Climbing Butcher's Broom); Smilacina (False Solomon's Seal), native; Smilax; Streptopus (Twisted Stalk), native; Tricyrtis (Toad Lily), Trillium (Wake-Robin, Birthroot, Bethroot, White Wood Lily, Ground Lily), native; Triteleia (Spring Star-Flower); Tulipa (Tulip); Urginea (Sea Onion, Squills), Uvularia (Bellwort, Wild Oats), native; Veratrum (False Hellebore, White Hellebore, Green Hellebore, Black Hellebore, Indian Poke); Xanthorrhœa (Grass Tree, Grass Gum, Black Boy); Xerophyllum (Turkey's Beard); Yucca (Spanish Bayonet, Adam's Needle, Bear Grass, Silk Grass); Zygadenus (Fly-poison).

38 **Amaryllidaceæ** (from the genus *Amaryllis* named for a nymph celebrated by Virgil) Amaryllis Family. Fig. 11. Caulescent or acaulescent herbs, bulbous- or fibrous-rooted. leaves alternate, elongated, entire: flowers bisexual, regular or irregular, epigynous, usually borne singly or in clusters from a spathe-like bract; perianth of 6 similar parts in 2 series, usually connate below into a tube and sometimes with a tubular or cup-shaped crown in the throat; stamens 6, some occasionally staminodial, anthers introrse; ovary inferior, 3-celled; ovules numerous, anatropous; style 1; stigmas 1–3 fruit a capsule, rarely a berry; seeds albuminous.

There are 71 genera and about 800 species, widely distributed but most abundant in the steppe regions of the tropics and subtropics Five species are found in the northeastern United States The largest genera are Crinum with 60 species, and Hypoxis, and Hippeastrum with 50 species each The family is most closely related to the Liliaceæ; less closely to the Iridaceæ The 6-parted perianth, 6 stamens with introrse anthers, and inferior 3-celled ovary, are together distinctive.

The bulbs or rootstocks of some species have been used in medicine Those of *Narcissus Pseudo-Narcissus* and *Leucoium vernum* are vigorous emetics Those of *Crinum zeylanicum* of the Moluccas, *Amaryllis Belladonna*, of the Cape of Good Hope, and *Buphane toxicaria* of South Africa are violent poisons The latter is used by the Kafirs to poison their arrows In South America the farinaceous tubers of the Alstrœmeriæ are eaten. The most important plants are the Yuccas From the terminal bud of these, a sugary liquid is obtained which by the Mexicans is made into a fermented drink, called pulque, when distilled this drink is called mescal The juice of the leaves has been used for syphilis, scrofula, and cancers The leaf-fibers yield vegetable silk or sisal hemp, and are also made into paper Razor-strops and cork are made from the pith The flowers are sometimes boiled and eaten

Forty or more genera are in cultivation in America, as ornamental plants in greenhouse and garden Among these are. Agave (Century Plant, Sisal Hemp, Pulque Plant), Alstrœmeria, Amaryllis (Belladonna Lily), Beschorneria; Bomarea, Bravoa (Mexican Twin Flower), Cooperia (Evening Star, Giant Fairy Lily); Crinum (St John's Lily, Florida Swamp Lily), Eucharis (Amazon Lily, Star of Bethlehem), Eurycles (Brisbane Lily), Furcræa, Galanthus (Snowdrop), Griffinia (Blue Amaryllis), Hæmanthus (Blood Lily), Hippeastrum (Amaryllis, Lily-of-the-Palace, Barbadoes Lily), Hymenocallis (Spider Lily, Sea Daffodil); Hypoxis (Star Grass), native, Leucoium (Snowflake), Lycoris (Golden Spider Lily); Narcissus (Narcissus, Jonquil, Daffodil, Pheasant's Eye); Nerine (Guernsey Lily), Pancratium (Spider Lily, Spirit Lily); Polianthes (Tuberose); Sprekelia (Jacobæan Lily); Tecophilæa (Chilean Crocus), Vallota (Scarborough Lily), Zephyranthes (Zephyr Flower, Fairy Lily, Atamasco Lily)

39 **Taccaceæ** (from the genus *Tacca*, from the Malay name) Tacca Family Fig 12 Herbaceous plants leaves large, entire, or commonly pinnatifid or bipinnatifid, all basal· flowers saucer- or urn-shaped, bisexual, regular, epigynous, perianth of 6 nearly separate similar parts in 2 series, stamens 6, borne on the base of the perianth; filaments queerly broadened and cucullate, ovary inferior, 1-celled, or incompletely 3-celled, ovules numerous; placentæ parietal; style umbrella-like, the terminal disk variously lobed, and bearing the peculiar stigmatic pores beneath: fruit a capsule or berry; seed albuminous.

Taccaceæ has 2 genera and 10 species, inhabitants of the tropics of both hemispheres, mostly of the Malay archipelago. A very distinct family of doubtful relationship, even suggesting several Dicotyledonous families, but probably close to the Dioscoriaceæ and Amaryllidaceæ. The acaulescent habit, the epigynous bisexual flowers, the six queer stamens, and the 1-celled, many-ovuled ovary, are together distinctive.

Several species of Tacca, e. g., *T. pinnatifida*, possess tubers from which a starchy meal, called arrowroot, is made in the East Straw hats are made from the stems of Tacca by the Tahitians.

Tacca pinnatifida and *T. cristata* are cultivated sparingly in America

40 **Dioscoreaceæ** (from the genus *Dioscorea*, named in honor of Dioscorides). Yam Family. Fig. 12. Climbing or twining herbs or shrubs· leaves alternate, mostly arrowhead-shaped. flowers bisexual or unisex-

ual, regular, small, and inconspicuous; perianth of 6 similar parts, in 2 series; stamens usually 6, or the 3 inner staminodia, ovary inferior, 3-celled, rarely 1-celled, placentæ axile or parietal; ovules 2 in each cell, superposed, anatropous, stigmas 3, or each 2-parted. fruit a capsule or berry, seed albuminous

Nine genera and about 170 species, of which 150 belong to the genus Dioscorea, are distributed very generally in the tropics and in the subtropics, and extend sparingly into the north temperate zone They are most abundant in South America and the West Indies One species reaches north to southern New England The family is related to the Amaryllidaceæ and Liliaceæ The climbing habit, peculiar leaves, definite stamens, inferior 3-celled ovary, and 2 albuminous seeds are distinctive Most Dioscoriaceæ spring from a tuberous base, which is sometimes very large and conspicuous Odd tubers are borne in the leaf-axils of species of Dioscorea and Rajania.

The tuberous root of *Dioscorea Batatas* yields the yams of eastern commerce, a very important article of food in the Far East Those of several other species, including our own native *D villosa*, are also cultivated in various parts of the tropics. The leaves of some species are used in intermittent fevers The tubers of *Tamus communis* were formerly employed as a purgative, and were also applied to bruises, hence the name "beaten woman's herb." The shoots are eaten like asparagus

Two genera are in cultivation in the United States, mostly in the South Dioscorea (Yam, Chinese Potato, Cinnamon Vine, Air Potato), Testudinaria (Hottentot's Bread, Tortoise Plant, Elephant's Foot), rarely grown

41. **Iridaceæ** (from the genus *Iris*, the rainbow) IRIS FAMILY. Fig. 12 Herbs or sub-shrubs with fibrous roots or often tuberous rootstocks (corms) leaves mostly basal, equitant, linear flowers usually showy, bisexual, regular or irregular, epigynous, each with 2 spathe-like bracts, perianth of 6 petaloid parts in 2 series, usually unlike, generally connate into a tube; stamens 3, the inner whorl wanting, separate or connate, anthers extrorse, ovary inferior, 3-celled, rarely 1-celled, ovules few to many, anatropous, style 1, stigmas 3 fruit a capsule, seeds albuminous

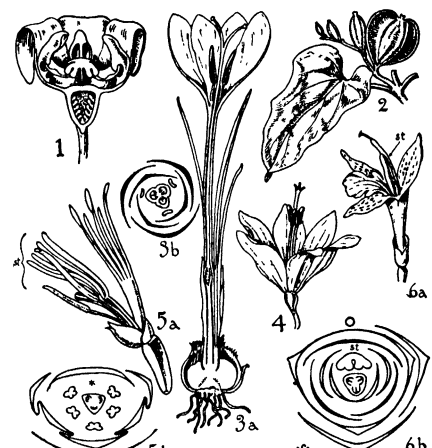
The iris family has 57 genera and about 1,000 species of wide distribution The two main centers are the Cape of Good Hope and subtropical America The family is not plainly related to any other, perhaps most closely to the Amaryllidaceæ The ensiform equitant leaves, the 6-parted showy perianth, the 3 extrorse stamens, and the inferior 3-celled ovary, are together characteristic

The rootstocks of many Iridaceæ are purgative and diuretic, e g , *Iris florentina*, *I germanica*, *I pallida*, and *I. versicolor*. The rootstock of *I. florentina* is fragrant and used for sachet perfume and tooth-powder (orris root). *I Pseudacorus* and *I versicolor* have been used for dropsy and diarrhea *I. fætidissima* was an ancient remedy for scrofula and hysteria. The stigmas of *Crocus sativus* have been renowned since earliest times as an emmenagogue, they are deep orange in color, and used also in dyeing and as a condiment. Iris-green of the painters was prepared by treating violet iris flowers with lime The seeds of *I. Pseudacorus* have been used as a substitute for coffee. The rootstocks of *Homeria collina* of South Africa are very poisonous The family contains many well-known ornamental plants.

In America, many genera are in cultivation, all for ornamental purposes Among these are: Belamcanda (Blackberry Lily, Leopold Flower); Crocus; Freesia; Gladiolus; Hermodactylus (Snake's-head Iris); Iris (Fleur-de-lis, Iris, Gladwin); Ixia; Moræa (Wedding Iris); Schizostylis (Crimson Flag); Sisyrinchium (Blue-eyed Grass, Satin Flower, Rush Lily); Sparaxis (Wand Flower), Tigridia (Tiger Flower, Shell Flower), Tritonia (Blazing Star).

Order 20. SCITAMINEÆ

42. **Musaceæ** (from the genus *Musa*, the Arabic name) BANANA FAMILY. Fig 12 Large, semi-ligneous herbs, the stout stem enveloped at base by the sheathing petioles, unbranched leaves alternate, entire, convolute, pinnately parallel-veined: flowers bisexual, or unisexual, irregular, epigynous, borne in the axil of a bract in spikes with subtending spathes, nectaries ovarian, perianth of 6 parts, in 2 series, the parts unequal in size and shape, separate or variously united, stamens 6, 5 fertile and 1 staminodium, ovary inferior, 3-celled; ovules solitary and basal, or numerous and axile, anatropous, style 1; stigmas usually 3 fruit



12. TACCACEÆ 1 Tacca, flower DIOSCOREACEÆ 2 Dioscorea, leaf and fruit IRIDACEÆ 3 Crocus, *a*, vertical section whole plant, *b*, floral diagram 4 Sisyrinchium, flower MUSACEÆ 5 Musa, *a*, flower, *st*, stamen, *b*, floral diagram ZINGIBERACEÆ 6 Zingiber, *a*, flower, *st*, stamen, *b*, floral diagram

fleshy and pulpy or drupaceous, indehiscent, dehiscent or separating into fruitlets, seeds with perisperm; embryo straight.

Six genera and about 60 species occur, 30 of which belong to the genus Heliconia and 20 to Musa, of general tropical distribution Fossil species are known. The family is related to the Marantaceæ, Zingiberaceæ and Cannaceæ; with the last it is often united These families all have irregular flowers of the same type, and inferior ovaries; but the Musaceæ differ in their slightly differentiated calyx and corolla, in the 5 fertile stamens, and in the absence of aromatic principles

The banana (*Musa paradisiaca*, *M sapientum*, etc) is the most important economic plant, the fruit of which is widely used for food. The pith of the stem, top of the floral spike, and also the shoots, are eaten as vegetables The fibers from the petioles of *Musa textilis* are made into thread and fabrics The leaves are used to thatch huts. The traveler's tree (*Ravenala madagascariensis*) holds sufficient water at the leaf bases to serve for drink The water is obtained by boring the sheath The seeds of this tree are eaten

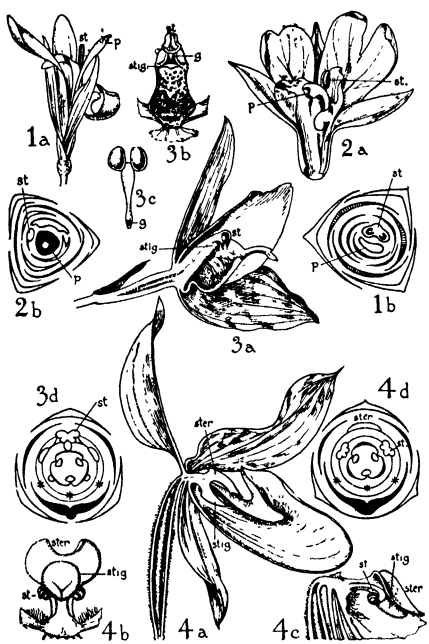
Four genera are in cultivation in the South and in conservatories, for ornament; and one also, Musa, for the fruit Heliconia (Balsier, Wild Plantain), Musa (Banana, Plantain Tree, Chumpa, Adam's Fig); Ravenala (Traveler's Tree); Strelitzia (Bird of Paradise Flower).

43. **Zingiberaceæ** (from the genus *Zingiber*, the Indian

name). GINGER FAMILY Fig 12. Herbs with creeping or tuberous rhizomes, rarely with fibrous roots leaves basal or cauline, alternate, sheathing, blade with ligule at top of petiole, linear or elliptic, the pinnately parallel veins strongly ascending flowers bisexual, irregular, epigynous, perianth of 6 parts, in 2 series, differentiated into a tubular 3-toothed or spathiform somewhat herbaceous calyx, and a tubular unequally 3-lobed corolla, 1 stamen only is fertile, opposite this is a large petaloid staminodium, and there are sometimes other smaller ones, ovary inferior, 3-celled, rarely 1-celled, ovules many in each cell, style 1, stigma usually 1 fruit a capsule, seed with large perisperm, small endosperm, and straight embryo

There are 24 genera and about 270 species, distributed in the tropical regions of the eastern hemisphere Only 2 genera are in America. The largest genera are Amomum, with 50 species, and Alpinia, with 40 species The family is related to the Musaceæ, Marantaceæ and Cannaceæ, but differs in the ligule, the aromatic oil, the sharp differentiation of the perianth, the single stamen, and the large single staminodium

To the spicy aromatic flavor of the rhizomes and fruits the family owes its useful qualities Ginger is from the rhizomes of *Zingiber officinale*, cultivated from India Cardamon fruits are from *Elettaria Cardamomum* of farther India Curcuma or turmeric is from the rhizomes of *Curcuma longa*, cultivated from southeast Asia This is used in medicine, and for flavoring pickles In it is a yellow dye The seeds of *Amomum Melegueta* of west Africa are the grains of paradise of commerce. Galangal, used in perfumery, is the rootstock of *Alpinia Galanga* of the East Indies.



13. CANNACEÆ 1 Canna, *a*, flower, *b*, floral diagram MARANTACEÆ 2 Maranta, *a*, flower, pistil removed, *b*, floral diagram ORCHIDACEÆ: 3 Lycaste, *a*, flower, *b*, column, front view, *c*, pollinia and gland, *d*, floral diagram 4 Cypripedium, *a*, flower, *b*, column, under side, *c*, column, side view, *d*, floral diagram (*st*, fertile stamen, *ster*, sterile stamen, *stig*, stigma, *g*, gland, *p*., pistil).

Several genera are in cultivation in America, mostly grown for ornamental purposes in greenhouses and principally in the South. Among these are Alpinia (Shell Flower); Amomum; Curcuma (Curcuma, Turmeric), Elettaria (commercial Cardamon seeds), Hedychium (Butterfly Lily, Ginger Lily, Garland Lily); Kæmpferia, Zingiber (Ginger)

44 **Cannaceæ** (from the genus *Canna*, the origin of the name not clear). CANNA FAMILY. Fig 13 Similar to the Marantaceæ in all but the following structural details no joint nor ligule at summit of petiole, ovules many in each cell of the ovary, embryo straight

This family contains a single genus and 25–50 species of tropical and subtropical America

The starchy rhizome of *C edulis* is grown and eaten in the West Indies and Australia The arrowroot starch of the English and French is derived from *C coccinea* of the West Indies and South America The cannas are popular ornamental garden plants

45 **Marantaceæ** (from the genus *Maranta*, named for Maranti, a Venetian botanist and physician of the 16th century) ARROWROOT FAMILY Fig 13 Herbs with rhizomes leaves mostly basal, with an articulation at the summit of the petiole, blade linear to oval, pinnately parallel-veined inflorescence usually surrounded by spathe-like bracts; flowers bisexual, irregular, epigynous, perianth of 6 parts, plainly differentiated into calyx and corolla, the latter somewhat irregular, one stamen of the inner set fertile, petaloid, with lateral anther, the two others of the inner whorl transformed into enlarged staminodia, usually 1 or 2 of the outer whorl also present as petaloid staminodia, ovary inferior, 3-celled, rarely 1–2-celled, ovule 1 in each cell; style flat and twisted or lobed fruit a capsule or berry, seeds with perisperm, and aril, embryo curved

Marantaceæ has 12 genera and about 160 species, of damp situations in the tropics, mostly American The largest genus is Calathea with 60 species The family is related to the Cannaceæ, Zingiberaceæ, and Musaceæ The joint at the summit of the petiole, the type of stamen-irregularity, the 1-seeded cells of the ovary, and the curved embryo are distinctive

The rhizome of *Maranta arundinacea* is cultivated in tropical America, and furnishes the maranta arrowroot of commerce, rhizomes of some other species are eaten Many species are ornamental, mostly for conservatory.

Five or 6 genera are in cultivation in America, as Calathea (Rattlesnake Plant), Maranta, Phrynium; Stromanthe; Thalia

Order 21. MICROSPERMÆ

46 **Orchidaceæ** (from the genus *Orchis*, an ancient name of these plants) ORCHID FAMILY Fig 13 Herbaceous plants of very diverse habit and structure; terrestrial, epiphytic or saprophytic, sometimes climbing; the terrestrial with fibrous roots or with thickened tuber-like roots, the epiphytic often with the base of the leaf and adjoining stem swollen, forming a pseudobulb; the saprophytic without chlorophyll, the epiphytic often with aerial hanging roots are provided with a water-absorbing layer (velamen) leaves alternate, succulent, coriaceous or membranous, linear to oval flowers bisexual, rarely unisexual, irregular, epigynous, perianth of 6 parts, in 2 series, usually all petaloid; one petal larger, forming the lip (labellum); stamens originally 6, but all except 1 or 2 wanting, or reduced to staminodia, united with the pistil, pollen-grains compound, granular, or aggregated into masses (pollinia) which are either free in the anther or attached by a stalk to a viscid apical or stigmatic gland; carpels 3; ovary inferior, 1- or 3-celled; ovules very numerous, style united with the stamens to form the column; stigma in the front of the column, or on a projecting lobe. fruit a capsule, seeds very minute.

This is an important family of more than 400 genera and between 6,000 and 10,000 species Orchids are very widely distributed, except in the arctics, but are most numerous in the tropics Those of temperate regions are mainly terrestrial, those in the tropics commonly epiphytic The large genera are Epidendrum, 500 species; Habenaria, Dendrobium, Bulbophyllum, and Oncidium, 200–600 species each; Masdevallia, Odontoglossum, and Maxillaria, each 100 or more species

From the standpoint of the intricate and very special mechanisms evolved in order to insure cross-pollination, the orchids are the most wonderful of our insect-pollinated plants For a detailed account see Darwin's "Fertilization of Orchids," or Kerner and Oliver's "Natural History of Plants" In general, the insect visiting the showy flower for the honey comes in contact with the sticky gland above the stigma, thereby pulling it out, along with the attached pollen masses While the insect is going to another flower, the pollen masses dry and bend down until they are in position to strike the viscid stigma, which tears away and retains some of the pollen. The method of pollination in Cypripedium is fundamentally different Some orchids (e g , Catasetum) possess a sensitive explosive mechanism that forcibly ejects the pollen mass, often to the distance of 2 or 3 feet The minute seeds of the orchids are well adapted to be disseminated by the wind and find lodgment in the crevices of the bark of trees and on other supports.

Orchids are divided into large groups as follows

Group I Diandræ The two lateral stamens of the inner whorl fertile, the dorsal of the outer whorl staminodial or fruitful, the others absent Cypripedium, Selenipedium, Paphiopedilum, and others

Group II Monandræ The dorsal stamen of the outer whorl fruitful, all the others wanting By far the majority of the species belong here Subgroup I. Pollinia connected by caudicles with a gland at base of anther near stigma Subgroup 2. Pollen without caudicles or with these attached to a gland at apex of anther

The family is very distinct and easily distinguished Its only near relatives are the Burmanniaceæ The peculiar structure of the stamens and pistil, together with the minute exalbuminous seeds are distinctive

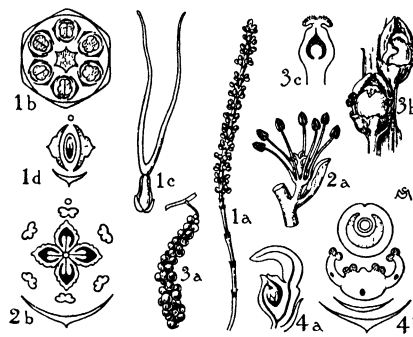
The Orchidaceæ is perhaps the most important family from the standpoint of ornamental gardening. To grow these singular, fantastic, showy, and often sweet-scented flowers has in recent years become almost a craze. It is estimated that, whereas Linnæus knew but a dozen exotic orchids, at the present day more than 2,500 are known to English horticulturists. Plants in the family useful for other purposes are few. The most important is vanilla, derived from the capsule of *Vanilla planifolia* of Mexico, and now widely cultivated in the tropics Faham (*Angræcum fragrans* of Bourbon) has a fragrant, bitter-almond-like taste, the leaves are used for indigestion and tuberculosis, and are known as Bourbon tea. Salep is derived from the roots of various terrestrial orchids of the Mediterranean region The roots of helleborine (*Epipactis latifolia*) are used for rheumatism. The root of *Spiranthes diuretica* of Chile is renowned as a diuretic. The flowers of *Habenaria conopsea* are used for dysentery. *Spiranthes autumnalis* and *Habenaria bifolia* are said to be aphrodisiac. The roots of *Cypripedium parviflorum* var. *pubescens* are frequently used in America as a substitute for valerian.

CLASS II DICOTYLEDONEÆ

Sub-class 1. Archichlamydeæ (Choripetalæ and Apetalæ)

Order 22. Verticillales

47 **Casuarinaceæ** (from the genus *Casuarina*, derived from the resemblance of the branches to the feathers of the bird cassowary). Casuarina Family. Fig 14. Shrubs, or much-branched trees, with the habit of the horse-tail (Equisetum) or Ephedra branches whorled, jointed, striate leaves replaced by striate, many-toothed sheaths flowers monœcious or dioecious, the staminate in spikes, the pistillate in heads, perianth of the staminate flower of 2, rarely 1, bract-like parts; stamen 1; perianth of the pistillate flower 0, ovary 1-celled, rarely 2-celled, 2–4-ovuled, stigmas 2. fruit



14 Casuarinaceæ 1 Casuarina, *a*, portion of male inflorescence, *b*, diagram of whorl of flowers, *c*, female flower, *d*, female flower, cross-section Saururaceæ 2 Saururus, *a*, flower, *b*, floral diagram Piperaceæ 3 Piper *a* inflorescence in fruit, *b*, portion of spike with flowers, *c*, female flower, vertical section Chloranthaceæ 4 Chloranthus, *a*, flower, vertical section, *b*, floral diagram

dry, often samaroid, inclosed by the woody valve-like bracts, seeds 2, or 3–4, orthotropous, ascending

A single genus containing about 20 species occurs in Australia and the neighboring islands, extending to Madagascar and to southeast Asia The family is very distinct and its relationships are in doubt It is placed here in the system because of the simple flowers The peculiar habit, reduced staminate flowers, and peculiar fruit are characteristic

The wood of *Casuarina equisetifolia* is very hard, and called ironwood It is used in ship-building, and by the Indians for war-clubs, the powdered bark is used to dress wounds, or for diarrhea A brown dye is obtained from the same plant

A few species of Casuarina (Beefwood, She Oak) are cultivated in the South for timber and ornament

Order 23 Piperales

48 **Saururaceæ** (from the genus *Saururus*, meaning *lizard's tail*, in allusion to the long slender spike). Lizard's-Tail Family Fig 14 Herbs leaves alternate, large and broad flowers bisexual, regular, in a long, dense spike, perianth 0, stamens 6 or fewer, hypogynous or united with the pistil; carpels 3–4, separate, or united in to a 3–4-celled ovary, ovules 2 to several, parietal; stigmas as many as the carpels: fruit of follicles, or a lobed berry

Three genera and about 4 species are found in temperate or subtropical Asia and North America The family is related to the Piperaceæ, with which it is frequently united From that family it differs in having several carpels in each flower and several parietal ovules for each carpel

Saururus cernuus (lizard's tail), a native herb, is in the trade as a garden plant for wet soil

49 **Piperaceæ** (from the genus *Piper*, an ancient name of pepper). Pepper Family Fig 14 Herbs, shrubs, or rarely trees. leaves alternate, rarely opposite or whorled· flowers in dense spikes, bisexual, or unisexual, regular, perianth 0, stamens 1–10, ovary

1-celled, ovule 1, basal; stigmas 1–4, rarely more, sessile: fruit a dry or fleshy berry

There are 9 genera and about 1,025 species, confined to the tropics The largest genera are Piper with 600 species and Peperomia with 400 species The family is related to the Saururaceæ, with which it is often united; otherwise it stands alone as a distinct type, the systematic position of which is uncertain The spicate inflorescence, naked flowers, and 1-celled, 1-seeded ovary are distinctive

The unripe fruit of *Piper nigrum* (Java, etc) yields black pepper The ripe fruit of the same plant yields white pepper Long pepper is the whole spike of *P longum* of India The drug cubebs is obtained from *P Cubeba* Betel consists of the leaves of *P Betle*, which in India are mixed with the areca nut and masticated (p 16) From an extraction of the roots of *P methysticum* (ava, or kava-kava), mixed with the milk of coconuts, an intoxicating drink is made in the Pacific Islands Some species of Peperomia are eaten as salads, others chewed as betel

Some genera are in cultivation in America as greenhouse foliage plants Peperomia, 10 or more species, Piper (Pepper, Black Pepper, Japanese Pepper)

50 **Chloranthaceæ** (from the genus *Chloranthus*, signifying *green flowers*) CHLORANTHUS FAMILY Fig 14 Herbs, shrubs or trees leaves opposite flowers bisexual or unisexual, regular, very small, subtended by bracts, and mostly borne in spikes; perianth 0, stamens in the bisexual flowers 1–3, united with each other and with the ovary, in the staminate inflorescence inserted on a common axis and forming a spike; carpels 1, with 1 pendent ovule, stigma sessile. fruit drupaceous

Three genera and about 35 species occur, in tropical America, East Asia, and the islands of the Pacific Ocean The family is related to the Piperaceæ and Saururaceæ The opposite leaves, the few stamens, which are often unilaterally united with the 1-celled ovary, and the suspended ovule, are peculiar

The roots of *Chloranthus officinalis* have a camphor-like odor, and are used in the East as a febrifuge

One species of Chloranthus is grown in greenhouses for foliage and berries

Order 24. SALICALES

51. **Salicaceæ** (from the genus *Salix*, the classical Latin name) WILLOW FAMILY Fig 15 Shrubs or trees, creeping in the arctics· leaves alternate, simple: flowers dioecious, both sexes in catkins, 1 flower to each scale; perianth 0; disk present, cup-shaped or finger-like, stamens 2–many, separate or united, ovary often pedicelled, 1-celled, placentæ 2, parietal, ovules numerous; stigmas 2, often each 2-lobed fruit a capsule; seeds with a basal tuft of long hairs

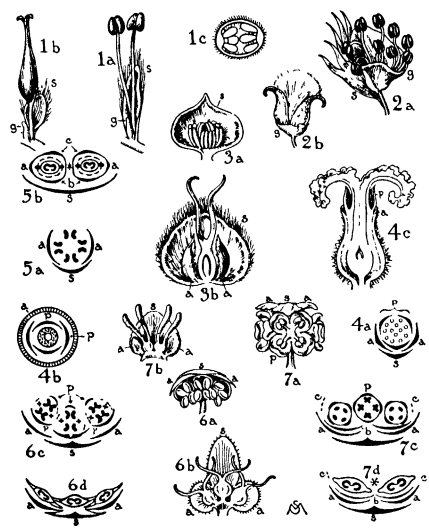
Salicaceæ has 2 genera and about 180 species, of which 160 belong to the genus Salix, inhabitants of the north temperate and arctic zones, a few in the tropics and in South Africa The family is not definitely related to any other family, though possibly to the Tamaricaceæ The flowers of both sexes in catkins, the glandular disk, and the dehiscent many-seeded capsule with comose seeds, are distinctive

The bark of many species has been used for intermittent fevers and for tanning leather A yellow dye occurs in the bark of *Populus alba* and *P tremula*, also in *Salix alba, S. daphnoides*, and others The resinous buds of *P balsamifera*, or tacamahac, furnish American balm of Gilead The staminate catkins of *S ægyptiaca* are odoriferous and are used in the East in medicinal waters, as a cordial, and as a sudorific Willow and poplar wood is soft and light The twigs of several species of Salix are universally used in basket-making

The two genera are in cultivation in America, as ornamental plants and for shelter-belts and basket-work and sometimes for timber Populus (Poplar, Aspen, Tacamahac, Balm of Gilead [not the original]. Cottonwood, Abele); and Salix (Willow, Osier).

Order 25. MYRICALES

52 **Myricaceæ** (from the genus *Myrica*, the ancient name of the Tamarisk). SWEET GALE FAMILY Fig 15 Shrubs or trees leaves alternate, usually simple, resinous· flowers monœcious or dioecious, in catkins or spikes, single for each bract, perianth 0, stamens 4–6, or 16, in the axil of the bract (scale), ovary 1-celled, 1-ovuled, stigmas 2 fruit a drupe, usually slightly horned by union with the bracteoles, seed solitary, orthotropous, basal



15. SALICACEÆ 1 Salix, *a*, male flower, *b*, female flower, *c*, cross-section ovary 2 Populus, *a*, male flower, *b*, dehiscing fruit, MYRICACEÆ 3 Myrica, *a*, male flower, *b*, female flower JUGLANDACEÆ 4 Juglans, *a*, diagram male flower, *b*, diagram female flower, *c*, vertical section female flower BETULACEÆ 5 Corylus, *a*, diagram male flower, *b*, diagram female flowers 6 Betula, *a*, male flowers, *b*, female flowers, *c*, diagram male flowers, *d*, diagram female flowers 7 Alnus, *a*, male flowers, *b*, female flowers, *c*, diagram male flowers, *d*, diagram female flowers (*s*, scale, *a*, *b*, and *c*, bracteoles of the first, second and third orders, *p*, perianth, *g*, gland)

One genus with about 35 species is generally distributed over the more temperate parts of the earth The Myricaceæ are related to the other amentiferous families, e g , Juglandaceæ, Fagaceæ and Betulaceæ The indehiscent, 1-seeded fruit, basal seeds, two carpels, absence of perianth, and simple leaves are characteristic of the family

Myrica Gale and other species are used for tanning leather. *M Gale* has also been used in the preparation of beer. The wax from the drupelets of *M cerifera* and *M. carolinensis* is used for making candles The fruit of *M sapida* and *M Nagi* is edible. *M* (*Comptonia*) *asplenifolia* has been used as a tonic A volatile oil is obtained from the fruits of *M Gale* The root of *M cerifera* is emetic and purgative

M. Nagi is cultivated in California for the edible fruit *M asplenifolia*, native in the United States, is grown for ornament. Other species are sometimes planted.

Order 26. JUGLANDALES

53. **Juglandaceæ** (from the genus *Juglans*, a contraction of the Latin *Jovis glans*, the nut of Jupiter). WALNUT FAMILY. Fig 15. Trees or shrubs, often resinous leaves alternate, exstipulate, pinnately compound: flowers monœcious, small; the staminate in drooping catkins with single perianth of 4 parts, or rarely 0, one flower for each bract, the pistillate 2–3 together, with perianth of 4 parts adherent to the ovary as are also the bract and bracteole; ovary inferior, 1-celled; ovule 1, basal, orthotropous; stigmas usually 2- or 4-branched: fruit a nut with a fleshy exocarp, or bursting irregularly, or 4-valved, or winged

In this family are 6 genera and about 35 species of the north temperate zone The largest genus is Carya with 10 species The family is related to other Amentiferæ, e g., Myricaceæ, Fagaceæ, and Betulaceæ. The indehiscent, 1-seeded fruit, basal seeds, 2 carpels, perianth and pinnate leaves are distinctive. Fossil species are known

The wood of English walnut is highly valued, but that of *Juglans nigra* (black walnut) is one of the most valuable of woods Hickory wood is prized for its hardness and toughness The fruits of the English walnut (*J regia*), butternut (*J. cinerea*), and of species of Carya (hickory) are among the most important food-nuts The leaves and bark of Carya and Juglans are purgative Green dyes are obtained from *Carya tomentosa*, and yellow from *C ovata*, *C sulcata*, and *C glabra*. Walnut oil and hickory oil are in the trade

The cultivated genera in America are Carya or Hicoria (Hickory, Pecan, Bitternut, Pignut, Mockernut, Shellbark, Kingnut), native and hardy; Juglans (Walnut, Butternut, English Walnut), ornamental, fruit, and timber, Platycarya, ornamental, Pterocarya, ornamental.

Order 27 FAGALES

54. **Betulaceæ** (from the genus *Betula*, the ancient Latin name of the birch) BIRCH FAMILY Fig 15 Trees or shrubs. leaves alternate, simple, mostly pinnately parallel-veined: flowers monœcious, regular, much reduced, the staminate in slender catkins; the pistillate in short spikes, rarely in flexuous catkins or geminate; 3 flowers, rarely by reduction 2 or 1 flower behind each bract; perianth of the staminate flower single, 2–4-lobed or 0; stamens 2–10; perianth of the pistillate flower absent in Betula and Alnus, in other genera an epigynous crown of several tiny scales; ovary inferior, originally 2-celled and each cell 1-ovuled, but only one cell and 1 seed maturing; stigmas 2: fruit an indehiscent nutlet, often winged; either separating from the bract and bracteoles (Alnus, Betula), or falling with them, in which case these organs form a protective involucre (Corylus), or a winged or bladdery organ concerned in seed-dissemination (Carpinus, Ostrya); seeds anatropous, exalbuminous.

Six genera and about 75 species inhabit the extratropical northern hemisphere; many are arctic, some of which are creeping. Fossil species are known The family is related to the Fagaceæ and other amentiferous families. The pistillate flowers in spikes, the presence of a perianth in one or the other sex, the cymose group of flowers for each bract, the 2 carpels, and the single integument of the seed are characteristic.

The wood of Alnus and Betula is prized by wagon-makers, cabinet-makers and turners; charcoal for gunpowder is made from this wood The twigs of Betula are made into brooms. The bark of *Betula papyrifera* strips off in thin plates and is used for making canoes and for writing-paper. The very thin bark-layers of *B Bhojpattra* of India also furnish writing-paper. Vinegar and beer are made from the sugary sap of Betula, which is also considered an efficient antiscorbutic. The bark of Alnus and Betula is used in tanning Russia leather, and other kinds Hazelnuts are the fruit of Corylus; filberts of *Corylus Avellana*. Oil of betula has a flavor like wintergreen. The wood of Ostrya is very hard and prized for beetles. The wood of all the Betulaceæ is good for firewood.

Several genera are in cultivation in America for ornament or for the fruit (Corylus) such as Alnus (Alder); Betula (Birch), Carpinus (Hornbeam Tree, Blue Beech, Water Beech), Corylus (Hazel, Filbert, Cobnut); and Ostrya (Hop Hornbeam, Ironwood, Leverwood).

55. **Fagaceæ** (from the genus *Fagus*, the classical name, in allusion to the esculent nuts). BEECH FAMILY. Fig 16. Trees or shrubs leaves simple, alternate flowers monœcious, the staminate in slender catkins, one flower with each bract and a perianth of 4–6 parts, the pistillate solitary or in groups of 3, epigynous, the perianth reduced, ovary mostly 3- or 6-celled; ovules 2 in each cell, suspended, all but one in the ovary aborting, integuments 2, stigmas 3 fruit a 1-seeded nut, which singly, or in a group of 2–3, is surrounded by a special involucre.

The family has 5 genera and about 600 species, all natives of the subtropical and temperate northern hemisphere, except the antarctic genus, Nothofagus The largest genera are Quercus with 200 species, and Pasania with 100 species The family is related to the Betulaceæ and other amentiferous families, but the staminate flowers alone in catkins, the indehiscent 1-seeded fruit, the 3 carpels, and the special involucre are distinctive There has been much debate as to the morphology of the involucre,—whether it is composed of the bracteoles of the little dichasium, or represents sterile scales of the condensed catkin, or is a wholly new outgrowth of the subfloral axis The latter is a recent view of Engler This involucre becomes the bur in beech and chestnut, and the cup in the oak.

The wood of white oak, red oak and many other species is very valuable, as is also that of beech and chestnut. The bark of *Quercus Suber* of Spain yields bottle-cork The bark of *Q velutina* of America is called quercitron, and is used to dye yellow The kermes insect, which furnishes a crimson dye, lives on *Q coccifera* of the Mediterranean The stings of gall insects produce the commercial oak-galls from which tannic and gallic acid are obtained, and from which ink was made Officinal creosote is distilled from the tar of species of Fagus. The nut-like fruits of Castanea, Fagus, *Quercus Ilex*, *Q Robur*, and *Q Ægilops* are eaten. The cups of *Q. Ægilops* are sold for dyeing black and for tanning The bark from many species of this family is used for tanbark

In America several genera are cultivated for ornament, food, and timber: Castanea inc (Chestnut, Chinquapin); Castanopsis Fagus (Beech); Nothofagus, little known; Quercus (Oak, Black Jack).

Order 28. URTICALES

56. **Ulmaceæ** (from the genus *Ulmus*, the classical name). ELM FAMILY. Fig 16. Trees or shrubs without milky juice· leaves alternate, usually oblique· flowers bisexual or unisexual, regular, small; perianth simple; parts 4–5, rarely 3–7; stamens of the same number opposite the sepals, rarely twice as many, not elastically incurved; ovary superior, 1-celled, 1-ovuled; the ovule suspended, anatropous; stigmas usually 2. fruit nut-like, drupaceous, or winged.

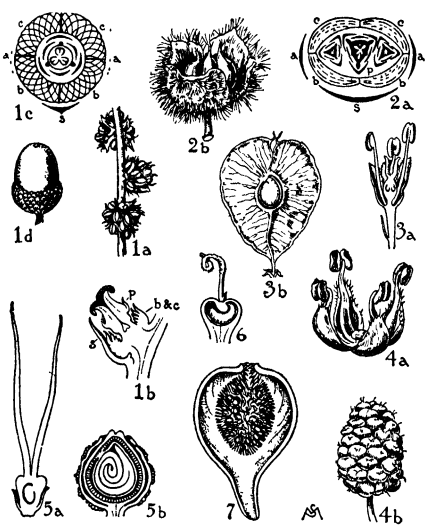
Thirteen genera and about 140 species are generally distributed in all but the polar regions. The largest genus is Celtis, with 60 species. The family is closely related to the Urticaceæ and Moraceæ. Its nonelastic stamens, and suspended anatropous seeds are important distinguishing characters

The seeds of some species of Celtis are edible. The wood is used to make wind instruments, and the like.

Elm wood is of use in the crafts. The mucilaginous bark of slippery elm (*Ulmus fulva*) is used for poultices and coughs The fragrant wood of *Planera Abelicea* of Crete is false sandalwood

There are several genera in cultivation in America. Among these are. Aphananthe, ornamental; Celtis (Nettle Tree, Hackberry, Sugarberry), hardy, ornamental; Planera (Water Elm), ornamental, Ulmus (Elm), ornamental, and for timber; Zelkova, ornamental.

57 **Moraceæ** (from the genus *Morus*, the classical name) MULBERRY FAMILY Fig 16. Herbs, shrubs, or trees, sometimes climbing· juice milky: leaves alternate: flowers dioecious or monoecious, regular, small, mostly in heads or spikes, or lining the hollow pyriform fleshy axis of the inflorescence (Ficus); perianth single, of 4, rarely 2–6, imbricated parts, more or less united and fleshy in the pistillate flower, stamens of the same number and opposite the sepals, usually inflexed in the bud and elastic; ovary superior, sessile or stipitate, 1-celled, 1-ovuled; the ovule suspended, amphitropous, rarely



16. FAGACEÆ 1 Quercus, *a*, male flowers, *b*, female flower, *c*, diagram female flower, *d*, fruit 2 Castanea, *a*, diagram female flower, *b*, involucre and 3 fruits ULMACEÆ 3 Ulmus, *a*, flower, *b*, fruit MORACEÆ 4 Morus, *a*, male flower, *b*, fruit 5 Humulus, *a*, female flower, *b*, vertical section fruit 6 Cudrania, pistil 7 Ficus, vertical section female inflorescence (for explanation of letters see Fig 15)

basal, stigmas 1–2 fruit an achene or drupe enveloped by the fleshy perianth, or on a fleshy gynophore, or composed of achenes in a fleshy hollow common receptacle

Moraceæ contains 55 genera and about 950 species, mostly of tropical distribution, 6 species of which are native in the eastern United States. The largest genus is Ficus with 600 species. The family is frequently united with the Urticaceæ and differs from that family only in the presence of milky juice, in the two stigmas, and in the usually suspended seed From the Ulmaceæ it differs in the inflexed elastic stamens

The fruit of the black mulberry (*Morus nigra*) has been eaten since earliest times Those of *M. rubra* (red mulberry), and *M alba* are also used for food The bread fruit (*Artocarpus incisa*) of the South Sea Islands is now cultivated for food everywhere in the tropics The leaves of *Morus indica* are eaten in India; those of *M. rubra* in America *M serrata* is cultivated for fodder The fig is the fleshy receptacle of the inflorescence of *Ficus Carica*. For the structure and pollination of this remarkable plant see Kerner and Oliver's "Natural History of Plants." The leaves of Morus are diuretic and anthelmintic The juice of *Antiaris toxicaria* is used by the Javanese to poison arrows Hops are used in medicine, also to flavor beer Hashish, bhang or Cannabis indica is obtained from *Cannabis sativa*, and is much used in the East as a narcotic to chew and smoke like opium The fibers of *C sativa* are hemp. The bark of Broussonetia furnishes clothing to the South Sea Islanders The wood of *Maclura aurantiaca* is flexible, the yellow juice of the fruit of this plant was used by the Indians to paint their faces. *Cudrania javanensis* yields a dye The milky juice of *Ficus elastica* and other species yield commercial rubber. *F. indica* is a banyan tree of India *F religiosa* is the sacred fig The leaves of various species of mulberry are used to feed silkworms Shellac is obtained from a small hemipterous insect which lives on *F. laccifera* and *F. religiosa* in India

Several genera are in cultivation in America, the majority in the far South Among these are Artocarpus (Bread Fruit, Jack Fruit), cultivated in the West Indies and in botanical gardens, Brosimum (Bread Nut), tropical, Broussonetia (Paper Mulberry), ornamental, semi-hardy; Cannabis (Hemp), grown for fiber or ornament, Cudrania, grown for hedges; Ficus (Fig, India Rubber Plant, Banyan Tree, Creeping Fig, Peepul Tree), grown in warm regions and in the greenhouses, Humulus (Hops), grown for the fruit, Maclura (Osage Orange), for hedges; Morus (Mulberry), for fruit, and leaves for silkworms

58. **Urticaceæ** (from the genus *Urtica*, the classical Latin name of the plant, signifying *to burn*) NETTLE FAMILY Fig 17 Herbs, shrubs or trees, rarely climbing leaves alternate or opposite flowers unisexual, regular, perianth single, rarely 0, usually green, consisting of 4–5, rarely 2 3, separate or united parts, imbricated or valvate, stamens as many, and opposite the segments, inflexed and uncoiling elastically, ovary sessile, or pedicelled, or rarely united with the perianth, 1-celled, 1-ovuled, style 1; stigma feathery fruit an achene or drupe; seeds basal, orthotropous; embryo straight

The 41 genera and about 475 species are mainly tropical, a few in North America and fewer in Europe. The largest genus is Pilea, with 100 species. The family is very closely related to the Moraceæ and Ulmaceæ, with which it was formerly united The apetalous anemophilous flowers, with elastic stamens opposite the sepals, and the 1-celled ovary, with a single basal, orthotropous seed, are distinctive Many of the Urticaceæ are covered with stinging hairs containing formic acid The common nettles are examples Cystoliths are common in the leaves

Parietaria diffusa and *P. erecta* contain niter, and have been used as diuretics Nettles were used by doctors to flog patients in order to produce a counter irritation of the skin, a practice called "urtication." Other species have been used locally as medicine. *Laportea stimulans* has been used as a fish-poison The bast fibers of many species are useful; e g , *Urtica dioica, U cannabina, Laportea canadensis*, and especially the China grass or ramie (*Bœhmeria nivea*). The fibers of this latter have long been used in the Netherlands The young foliage of many Urticaceæ is used as spinach. The tuberous root of *Pouzolzia tuberosa* is eaten

The following are in cultivation in America; three of them are ornamental: Pellionia, a greenhouse creeper; Pilea (Artillery Plant), a garden and greenhouse plant; and Urera, a greenhouse shrub The other genus, Urtica (Nettle), is grown for fiber, and Boehmeria occurs occasionally in cultivation

Order 29. Proteales

59. Proteaceæ (from the genus *Protea*, from Proteus, a self-transforming sea-god, in allusion to the great diversity of the genus). Protea Family Fig 17 Shrubs or trees, rarely herbs leaves alternate flowers bisexual, rarely unisexual, regular or irregular, perianth of one series, parts 4, separate or variously united, or labiate, valvate; stamens 4, opposite the perianth parts, hypogynous or inserted on the perianth; hypogynous stalk (gynophore) usually developed, often bearing a ring of scales, or swellings, or a cup, carpel 1, ovary superior, 1-celled, ovules 1 to several, style slender, stigma slender or enlarged fruit unsymmetrical, capsular, drupaceous, or nut-like, or a samara or follicle, seeds sometimes winged

There are 49 genera and about 1,000 species, mostly Australian, but many also in South Africa, and a few in South America The largest genera are Grevillea, with 160 species, and Hakea, with 100 species The family is perhaps distantly related to the Loranthaceæ, Santalaceæ, and Urticaceæ, but the relationship is little understood The 4 valvate sepals, 4 stamens, and the unsymmetrical, 1-celled ovary, raised on an appendaged gynophore are distinctive The small flowers are usually aggregated in heads or spikes surrounded by bracts The Proteaceæ, for the most part, inhabit countries in which a very dry windy season alternates with a rainy season, and many of them are white-hairy

Grevillea robusta, *Knightia excelsa*, *Embothrium coccineum*, *Leucospermum conocarpum* (redwood), and *Protea grandiflora* (wagen-boom) are useful for timber. The wood of the last species is used for wagon-wheels The seeds of several species are eaten A bitter principle is found in *Leucadendron argenteum* of Africa; a gum resin in *Grevillea robusta* of Australia A golden dye is obtained from the Australian *Persoonia saccata* *Gevuina avellana* (Chilean hazelnut) furnishes an edible fruit, as does also *Brabeium stellatifolium* (wild chestnut of South Africa), and *Macadamia ternifolia* (Queensland nut) Banksia and Protea furnish important bee-plants

The genera in cultivation in America are mostly the following Banksia, Gevuina (Chilean Nut, Chile Hazel), grown in California, Grevillea (Silk Oak), in greenhouse and California, Leucadendron (Silver Tree of the Cape), grown in California, Macadamia (Australian Nut), in southern California, Protea, in southern California; Telopea (Waratah, Warratau), in California

Order 30. Santalales

60 **Loranthaceæ** (from the genus *Loranthus*, meaning *thong flower*, significance not clear) Mistletoe Family Fig 17 Herbs or subshrubs, parasites or half-parasites, with or without chlorophyll, rarely rooted in the earth leaves usually opposite, rarely alternate, thick and green, or reduced to scales flowers bisexual or unisexual, usually regular, receptacle of the pistillate flower cup-shaped, united with the ovary, perianth undifferentiated, usually in 2 series of 2 or 3 parts each, of which the outer may be calyx and the inner corolla, stamens as many as the parts of the perianth and opposite them, free, or united with the perianth, ovary 1-celled, inferior; ovule 1, orthotropous; stigma 1, often sessile· fruit a 1-seeded berry.

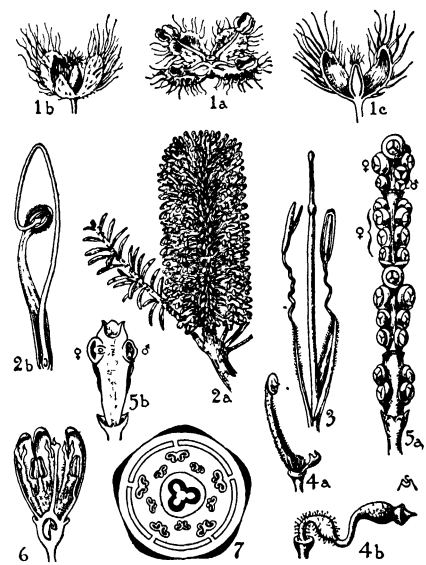
The 21 genera and about 600 species are mostly inhabitants of tropical countries, but extend into the temperate zone. One species reaches Newfoundland. Loranthus, the largest genus, contains 200 species, and Phoradendron contains 80 species The family is related to the Santalaceæ and Proteaceæ The habit, the cup-shaped receptacle, the position and number of the stamens, and the 1-celled, 1-seeded fruit are distinctive The fruits are often very viscid and easily become fastened to the branches of trees where they germinate and grow The inflorescence is often much reduced and inconspicuous.

The viscid substance of the fruit is called birdlime, and is used for catching small birds. Various species have been used locally as medicine The mistletoe (*Viscum album*) of Europe was worshipped by the Gauls When gathered from the oak it was considered sacred by the Druids.

Phoradendron flavescens (American mistletoe) is gathered and sold in the market

61 **Santalaceæ** (from the genus *Santalum*, the Latin name for sandalwood) Sandalwood Family. A family closely related to the Loranthaceæ, from which it differs only in the more numerous ovules and the general habit The Santalaceæ are commonly independent plants or root parasites, while the Loranthaceæ are usually aerial parasites

The Santalaceæ consists of 26 genera and about 250 species, in the temperate and tropical regions



17. Urticaceæ 1 Urtica, *a*, male flower, *b*, female flower, *c*, female flower, vertical section Proteaceæ 2. Banksia, *a*, inflorescence, *b*, flower 3 Protea, flower 4. *a* and *b*, pistils of Proteaceæ Loranthaceæ 5 Phoradendron, *a*, inflorescence, *b*, vertical section inflorescence. Olacaceæ 6 Lirıosma, flower 7. Lirıosma, floral diagram.

The aromatic and sweet-scented wood of the tree, *Santalum album*, has been used medicinally, and is used in perfumery and cabinet-making Other species of Santalum, also of Fusanus, Acanthosyris, Colpoon, and Exocarpus are also used in cabinet work The sweet flesh of the fruit of some species, the thickened pedicels or oily seeds of others, are edible

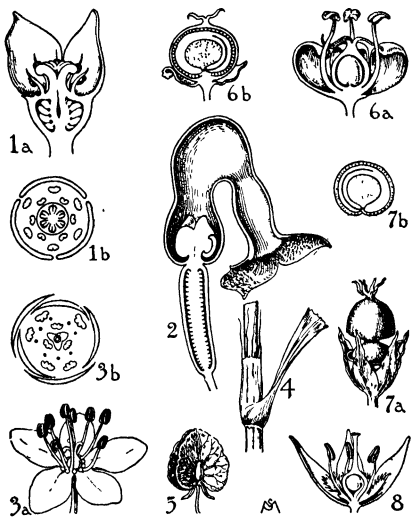
Queer tendril-like brushes on the fruits of the reduced aerial genus Myzodendron of South America serve as flying organs and later twine about the support

Buckleya of the southeastern United States is sometimes cultivated, also Pyrularia

62 **Olacaceæ** (from the genus *Olax*, signifying a furrow, application unknown) Olax Family Fig. 17. Trees or shrubs, sometimes twining or climbing, with alternate, entire leaves flowers mostly bisexual, regular, perianth single, the divisions (sepals?) 4–5, rarely 6

valvate; stamens 4–10, often adnate to the perianth or connate, disk present, diverse, carpels 3, rarely 2–5; ovary superior, 1-celled, rarely falsely 3–5-celled, ovule 1; style 1: fruit usually a drupe inclosed in the accrescent and persistent perianth, seed albuminous

Olacaceæ has 25 genera and about 140 species of tropical distribution, two of which reach southern Florida Olax is the largest genus The Olacaceæ are related to the Loranthaceæ and Santalaceæ



18. ARISTOLOCHIACEÆ 1 Asarum, *a*, flower, *b*, floral diagram. 2 Aristolochia, flower POLYGONACEÆ 3 Fagopyrum, *a*, flower, *b*, floral diagram 4 Polygonum, sheathing stipule 5 Rumex, fruiting calyx CHENOPODIACEÆ 6 Chenopodium, *a*, flower, *b*, fruit AMARANTACEÆ 7 Amarantus, *a*, fruit, *b*, vertical section seed. 8 Achyranthes, flower

The family is of little economic importance Some species are valuable for their hard timber The drupes of Ximenia are eaten in Senegal. *Olax zeylanica* has a fetid wood, used locally for fevers.

One species, *Ximenia americana* (hog plum) is native in Florida and the tropics, and is of moderate value for the fruit

Order 31. ARISTOLOCHIALES

63 **Aristolochiaceæ** (from the genus *Aristolochia*, in reference to its supposed medicinal properties in connection with child-birth) BIRTHWORT or DUTCHMAN'S PIPE FAMILY Fig 18 Herbs or woody plants, the latter mostly twining leaves alternate, usually broad and entire flowers bisexual, epigynous, regular or irregular, perianth of one series, the parts mostly 3, connate, often petaloid, very diverse, sometimes regular with the parts nearly separate, sometimes with a long tube which is swollen below, abruptly curved above, and with an abruptly spreading entire border, stamens 6–36, separate and inserted on the ovary, or united with the style, ovary inferior, rarely superior, 4- or 6-, rarely 5-, celled, ovules many, style 1; stigmas 4 or 6. fruit a capsule

Five genera and about 210 species are known, 180 species of which belong to Aristolochia They are distributed in the warm parts of the earth, but are most numerous in South America Seven or 8 species are native in northeastern North America. The family is not definitely related to any other, but is placed provisionally near the Polygonaceæ, not however because related to that family, but because equally simple in structure Three scale-like organs between the perianth and stamens in Asarum are probably true petals The flowers of most Aristolochiaceæ are lurid in color and pollinated by flies Many are carrion-scented and afford an additional attraction for these insects The perianth in Aristolochia assumes remarkable shapes, some of which have led to the name "Dutchman's pipe"

The rootstock of *Asarum canadense* (Canada snakeroot or wild ginger) is aromatically peppery, and used to flavor wines, the breath, and the like *Aristolochia reticulata*, of Arkansas, and *Aristolochia Serpentaria*, of the eastern United States, furnish the serpentaria of medicine, used as a tonic and as a febrifuge The latter plant is Virginia snakeroot The common name arises from the reputed efficacy of these plants and other species of the family as remedies for snake-bites

The genera in cultivation in America are Aristolochia (Birthwort, Virginia Snakeroot, Dutchman's Pipe, Pelican Flower, Goose Flower), hardy or greenhouse twiners, Asarum (Wild Ginger, Canada Snakeroot), low hardy border herbs.

Order 32. POLYGONALES

64. **Polygonaceæ** (from the genus *Polygonum*, derived from the Greek meaning *many knees* in reference to the swollen joints of some species) BUCKWHEAT FAMILY Fig 18 Herbs, shrubs, or trees, sometimes twining stem often knotty leaves alternate, rarely opposite, simple, usually with a sheathing stipular growth (ochrea) at the base flowers bisexual or unisexual, regular, perianth apparently of one set, though sometimes in 2 whorls, the parts usually 3, 5, or 6, distinct or connate at base, the inner set sometimes much enlarged and modified with hooks, spines, wings, or tubercles, stamens 1–15, usually 6, 8, or 9, usually opposite the perianth parts, mostly separate and hypogynous, ovary superior or nearly so, compressed or 3-angled, of 2–4-carpels, but 1-celled or falsely 3-celled, ovule solitary, styles and stigmas 2–4 fruit a flat, angled, or winged achene, seeds usually not inverted (orthotropous)

Thirty genera and about 700 species occur, mostly in the north temperate zone of both continents The largest genera are Polygonum, 150 species, Coccoloba, 125 species, Eriogonum, 120 species, and Rumex with 100 species The family is not closely related to any other, but is usually placed near the Chenopodiaceæ because of its simple floral structure and for want of a better place The stipular sheaths or, when absent, the involucrate heads (Eriogonum), and 1-celled fruit with a single orthotropous seed, are distinctive.

The foliage of the Polygonaceæ contains an acid, for which reason it is frequently eaten as salads or pot-herbs. Among plants used for this purpose are several species of Rumex, petioles of *Rheum Rhaponticum*, and Oxyria. The seeds of buckwheat (*Fagopyrum esculentum*) contain much starch and are made into flour In medicine, rhubarb (*Rheum officinale*), employed as a purge and tonic, has been in use since earliest times, and its origin is lost in antiquity, though probably it is a native of China Yellow dock (*Rumex crispus*) is a tonic. Smartweed (*Polygonum Hydropiper*) has an acrid juice that will produce a blister. A blue dye is obtained from *P. tinctorium* of China. The roots of *Calligonum Pallasia* are used in Siberia to stay hunger, and the fruits to quench thirst The astringent drug, bistorta, is from *P Bistorta* The leaves of *P. orientale* are smoked like tobacco in China

Several genera are in cultivation in America for ornament and food. Among these are Antigonon (Mountain Rose, San Miguelito), very showy climbers, Coccoloba (Sea Grape, Shore Grape, Pigeon Plum),

trees both of greenhouse and the South, used for timber and edible fruit, Eriogonum, garden plants, Fagopyrum (Buckwheat), grain, Muehlenbeckia (cultivated as Coccoloba or Tapeworm Plant), greenhouse, Polygonum (Smartweed, Jointweed, Knotweed, Prince's Feather, Kiss-me-over-the-garden-gate, Lady's Thumb, Mountain Fleece, Seealine), hardy ornamental herbs, Rheum (Rhubarb, Pie-plant, Wine Plant), food, medicine, and ornament, Rumex (Dock, Sorrel, Sheep Sorrel, Canaigre, Rais Colorada, Herb Patience, Spinage Dock, Curly Dock), ornamental plants, food-plants and weeds.

Order 33 CENTROSPERMÆ

65 **Chenopodiaceæ** (from the genus *Chenopodium*, which means *goose foot*, from the shape of the leaves). GOOSEFOOT FAMILY Fig 18. Herbs, shrubs, or rarely small trees, often very fleshy with reduced branching and foliage, and very diverse and remarkable in form leaves alternate, rarely opposite, often fleshy or reduced to scales flowers bisexual or unisexual, regular, very small, perianth of one series, the parts 1–5, separate or united, greenish, imbricated, persistent, stamens as many as the perianth parts, or fewer, opposite them, hypogynous or borne on the perianth, often connate, hypogynous disk usually present, ovary superior, 1-celled, 1-ovuled, style and stigmas 1–4 fruit dry, rarely fleshy, usually indehiscent, inclosed in the very diverse perianth which is often hard, or fleshy, or thorny, or hooked, embryo coiled

This family contains 73 genera and about 550 species, distributed all over the world, but principally confined to saline or alkaline habitats A few have become weeds in good garden soil The family is closely related to the Amarantaceæ, Phytolaccaceæ, Caryophyllaceæ and Portulacaceæ, all of which have an annular embryo The fleshy habit, absence of scarious bracts, 1-celled, 1-seeded ovary, and coiled embryo are distinctive A remarkable family of littoral plants, often with water-storing tissue, spines, queer fruits, and the like

The most important economic species is the beet (*Beta vulgaris*), the enlarged root of which is used for food and for sugar, the foliage as a pot-herb Species of Chenopodium, Atriplex, Spinacia and others are eaten as greens Of these spinach is the most famous The young shoots of Salicornia (glasswort, marsh samphire) are eaten as a pot-herb and are pickled. These shoots are also used for making glass and soaps because of the soda contained The seeds of *Chenopodium Quinoa* are made into flour in Peru The foliage of *Chenopodium Botrys* and *Chenopodium ambrosioides* is fragrant-scented The seeds of *Chenopodium anthelminticum* (wormseed) are a well-known vermifuge *Chenopodium mexicanum* yields saponin *Atriplex hortensis* (orach) of Europe and Asia, yields an indigo dye, and the leaves are edible Soda is obtained by burning many species *Salsola Kali* var *tenuifolia* (Russian thistle) is a bad weed

Several genera are in cultivation in America, largely for food, but some for ornament Among these are: Atriplex (Orach, Sea Purslane), food and ornament; Beta (Beet, Mangel-wurzel, Mangel, Chard, Swiss Chard, Spinach Beet), food and ornament, Chenopodium (Good King Henry, Mercury, Markery, Feather Geranium, Jerusalem Oak, Wormseed, Mexican Tea), ornament, food, medicine; Cycloloma (Cyclone Plant), ornament, Kochia (Mock Cypress), ornament; Spinacia (Spinach, Spinage), food

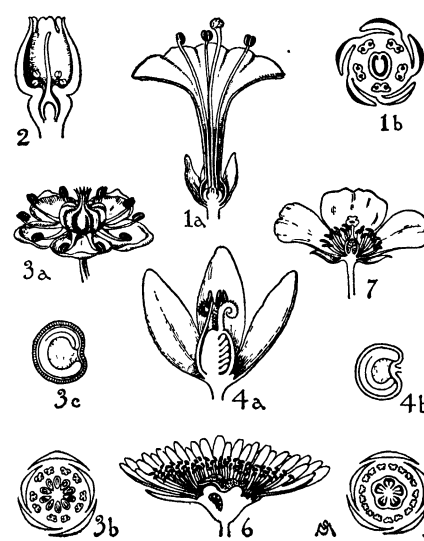
66 **Amarantaceæ** (from the genus *Amarantus*, derived from the Greek, signifying *unfading*, the bracts are scarious and unchanging) AMARANTH FAMILY. Fig. 18 Herbs, shrubs, or rarely trees leaves opposite or alternate, rarely fleshy: flowers bisexual or unisexual, small, regular, usually surrounded by scarious bracts; perianth simple, in one series of 5, rarely 1, 2, 3, or 4, separate or united parts, stamens opposite the perianth parts, of the same number or fewer, rarely more numerous, hypogynous or perigynous, separate or united, the stamen-tube often with fringed appendages at the top, hypogynous disk usually present; ovary superior, free or slightly united with the perianth, 1-celled, 1 to many-seeded, style 0, or 1, or several, stigmas various fruit a berry, an achene, or dehiscent by a lid; usually surrounded by the perianth, embryo coiled

The 40 genera and about 450 species are distributed everywhere except in the arctics; most abundant within the tropics The family is very closely related to the Chenopodiaceæ and Phytolaccaceæ, also to the Caryophyllaceæ and Portulacaceæ. The single perianth, scarious persistent bracts, and 1-seeded fruit are distinctive

Many species of Amarantus are eaten as greens. *Gomphrena arborescens* is a tonic Many Amarantaceæ are weeds in cultivated grounds Some are important ornamental plants The garden forms of *Celosia cristata* are remarkable for their fasciated inflorescence

In cultivation in America are Amarantus (Loves-lies-bleeding, Prince's Feather, Joseph's Coat), garden annuals, Bosca, ornamental, Celosia (Cockscomb), garden annuals; Gomphrena (Globe Amaranth, Bachelor's Button), garden annual; Iresine or Achyranthes, bedding plants; Telanthera (Alternanthera), bedding plants, Trichinium or Ptilotus, greenhouse.

67 **Nyctaginaceæ** (from the generic name *Nyctago*, a synonym of Mirabilis, meaning *night*, in reference to the crepuscular or nocturnal flowering of the Four-O'clock). FOUR-O'CLOCK FAMILY Fig 19 Herbs, shrubs, or trees leaves usually opposite, entire· flowers bisexual, rarely unisexual surrounded by an involucre of separate or united bracts which incloses 1 or several flowers, corolla absent; perianth parts united, very diverse in consistency, form and color, often petaloid,



19 NYCTAGINACEÆ 1 Mirabilis, *a*, flower; *b*, floral diagram, 2 Neea, flower PHYTOLACCACEÆ 3 Phytolacca, *a*, flower, *b*, floral diagram, *c*, vertical section of seed AIZOACEÆ 4 Mollugo, *a*, flower, *b*, vertical section of seed 5 Aizoon, floral diagram 6. Mesembryanthemum, flower. PORTULACACEÆ 7. Calandrinia, flower

valvate or plicate persistent after flowering, and often woody or leathery, enveloping the fruit, stamens 1–30, united at the base, unequal, hypogynous, ovary of 1 carpel, 1-celled, 1-ovuled; style 1, stigma 1. fruit an achene.

The family has 18 genera and about 150 species, principally natives of America from Colorado to Chile. A few are scattered in other parts of the world The largest genus is Pisonia with 40 species, Neea has 30 species The family is related to the Phytolaccaceæ. The floral bracts, absence of corolla, persistent perianth enveloping the very thin-walled fruit, and the 1-seeded, 1-celled ovary, are distinctive

The roots of Boerhavia and of *Mirabilis Jalapa* are purgative, and are sold as a substitute for jalap The foliage of several species of Boerhavia is used as vegetables The natives of the Hawaiian Islands catch birds with the very sticky fruits of the native species The leaves of *Neea theifera* are used as tea in Brazil, also as a black dye

In America 3 genera are in common cultivation Abronia, garden annuals; Bougainvillæa, greenhouse shrubs, Mirabilis (Four-o'clock, Marvel of Peru).

68 **Phytolaccaceæ** (from the genus *Phytolacca*, derived from the Greek meaning *plant* and *lac*, in reference to the red juice of the fruit) Pokeweed Family. Fig 19 Herbs, shrubs, or trees leaves mostly alternate, simple flowers bisexual, rarely unisexual, regular; perianth of one series, divisions 4–5, separate, persistent, not modified in fruit; stamens of the same number as the parts of the perianth and alternate with them, or more numerous, often connate at base, hypogynous, disk obscure or annular, ovary usually superior, rarely inferior, carpels 1 to many, free, or united into a several-celled ovary, ovules 1 for each carpel, styles as many as the carpels fruit a berry, utricle, nut, or samara; embryo curved.

The pokeweed family contains 22 genera and about 100 species, mostly of tropical and subtropical America and South Africa One species reaches the eastern United States All the genera are small The family is related to the Aizoaceæ, also to the Caryophyllaceæ, Chenopodiaceæ, Nyctaginaceæ, and other families with curved embryos. The several 1-seeded carpels and non-accrescent perianth are usually distinctive

The red juice of the fruit of *Phytolacca decandra* was used by the American Indians for staining baskets, and the like The roots of this plant are medicinal (emetic, cathartic), and the young shoots are eaten

A few genera are in cultivation in America Among these are Phytolacca (Pokeberry, Pokeweed, Scoke, Garget, Pigeonberry, Inkberry), native, hardy, rarely cultivated as a pot-herb, and Rivina (Rough Plant), ornamental garden and greenhouse plants

69 **Aizoaceæ** (from the genus *Aizoon*, derived from the Greek meaning *always alive*, in reference to the persistence of life in desert habitats) Carpet-weed or Ice-Plant Family Fig 19 Erect or prostrate, often fleshy herbs or sub-shrubs, either the stem or the leaves, or both, curiously modified to reduce surface and store water; rarely ordinary herbaceous plants: leaves opposite, alternate or whorled, simple and mostly entire· flowers bisexual, regular, hypogynous or epigynous, perianth of one set of 4–5 separate or united parts, stamens 5, alternating with the perianth parts, or by the splitting up of each becoming very numerous, in which case many of the outer are changed into long, showy, petaloid staminodia, the whole then somewhat resembling the head of an aster; ovary 2-20-celled, superior or inferior; placentæ axial, basal, or parietal, ovules mostly numerous, stigmas 2-20: fruit capsular or nut-like; embryo curved or annular.

Eighteen genera and about 500 species are known, of which 300 belong to the genus Mesembryanthemum; mostly inhabitants of the desert or, at least, dry portions of tropical and south-tropical regions The large genus, Mesembryanthemum, is almost exclusively South African, but reaches the Mediterranean One species of Aizoaceæ (Sesuvium) is native in the eastern United States The family is related through some genera to the Phytolaccaceæ, through others to the Caryophyllaceæ and Portulacaceæ The annular embryo places the Aizoaceæ in this group The apetalous, often falsely polypetalous, flowers, with several-celled ovary, and curved embryo, are characteristic

The fruits of *Mesembryanthemum edule* (Hottentot fig) are edible The leaves of Mesembryanthemum are used as a vegetable on the borders of the African desert *Tetragonia expansa* (New Zealand spinach) is cultivated as a pot-herb *Mesembryanthemum crystallinum* (ice-plant) of the Mediterranean region, with leaves covered with peculiar vesicular hairs filled with a viscid liquid, which sparkles in the sunlight like frost, is cultivated as a curiosity Other species are cultivated for their strange appearance

Many species of Mesembryanthemum (Fig Marigold, and Ice-plant) are more or less cultivated in America, also one species of Tetragonia (New Zealand Spinach, New Zealand Ice-plant)

70 **Portulacaceæ** (from the genus *Portulaca*, an old Latin name of unknown origin) Purslane Family Fig 19 Herbaceous or suffruticose leaves often fleshy, sometimes connate flowers bisexual, usually regular, sepals 2, petals 4–5, rarely more, sometimes connate at the base, fugaceous, stamens in 1 or 2 whorls, hypogynous (except in Portulaca), equal in number to the petals and opposite them, or double the number and alternating with them, or fewer, or, by multiplication, very many, ovary 1-celled, with a free-central or basal placenta; ovules 2 to many, style 2–3-parted fruit a capsule, opening by a valve or lid, rarely indehiscent, embryo curved or annular

Most of the 17 genera and about 150 species are inhabitants of the warmer, dry or arid regions, for which their fleshy structure and frequently prostrate or cæspitose habit are an adaptation They are most abundant in South America and the Cape of Good Hope, also common in western North America The Portulacaceæ are most closely related to the Caryophyllaceæ and Aizoaceæ The 2 sepals, 1-celled ovary with central placenta, several styles, and curved or coiled embryo are distinctive In the common purslane and a few other species, the capsule opens by a terminal lid, which, separating along a transverse line, falls off and thus allows the seeds to escape In Portulaca the ovary is partly inferior

Most of the Portulacaceæ are mucilaginous, some are slightly bitter and have been used as a mild tonic The herbage of *Portulaca oleracea* is eaten as a salad or as greens, and is also said to be sedative and an antidote for scurvy Several species of Calandrinia, Talinum and Claytonia, are used as pot-herbs The roots of *Claytonia tuberosa* of Siberia are edible, as are also the roots of the western Lewisia

About one-third of the genera are in cultivation in America. *Portulaca grandiflora* (Rose Moss) is ornamental, *P. oleracea* (Purslane or Pusley) is a pot-herb, the Montias are also pot-herbs Lewisia, Talinum, Spraguea and Claytonia are mostly ornamental

71 **Basellaceæ** (from the genus *Basella*, the Malabar name of the plant) Basella Family Fig 20. Climbing, perennial herbs, rarely slightly woody leaves alternate, broad, often fleshy. flowers bisexual, regular, 2 bracteolate, sepals 2, petals 5, separate or connate, imbricated, persistent, stamens 5, opposite the petals and attached to their base; ovary superior, 1-celled, ovule 1, basal, curved; style and stigma 1–3· fruit indehiscent, inclosed in the corolla; embryo spiral.

There are 5 genera and about 15 species, all except one species being confined to tropical America, mostly in the Andes Boussingaultia, the largest genus, contains 10 species. The family is related to the Cheno-

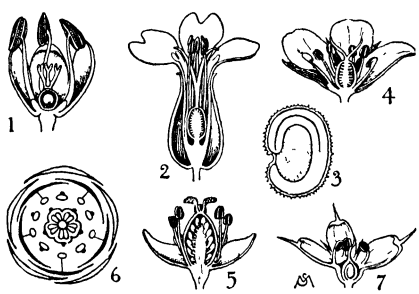
podiaceæ with which it has been united; also to the Polygonaceæ and Portulacaceæ. The twining stem, and the two sets of floral envelopes, together with the 1-celled ovary and single seed, are distinctive.

Basella alba (red and white spinach) is eaten as a pot-herb. The starchy root of *Ullucus tuberosus* is eaten in Peru It is used as a substitute for the potato, which it resembles

The genera apparently in cultivation in America are. Anredera; Basella (Malabar Nightshade), grown as ornamental greenhouse plants, or eaten as spinach, and Boussingaultia (Madeira Vine, Mignonette Vine), ornamental garden or greenhouse plants

72 **Caryophyllaceæ** (from the genus *Caryophyllus*, an old botanical name for the clove pink [Dianthus], the application of the name obscure) PINK FAMILY Fig 20 Herbs, rarely suffruticose, with opposite entire leaves· flowers bisexual, rarely unisexual, regular; sepals 5, separate or united, petals 5, rarely wanting, stamens twice as many as the petals, rarely fewer, hypogynous or perigynous, carpels 3–5; ovary superior, 1-celled with a free-central or basal placenta, ovules 1 to many, styles 3–5· fruit a capsule, rarely a berry, opening by valves or indehiscent; seed albuminous, embryo strongly curved or coiled

The pink family consists of 70 genera and from 1,200–1,500 species, distributed over all parts of the earth, though most abundant in the temperate and sub-



20 CARYOPHYLLACEÆ 1 Boussingaultia, flower calyx removed 2 Silene, flower 3 Agrostemma (Lychnis), seed 4 Arenaria, flower 5 Sagina, flower 6 Spergula, floral diagram 7 Paronychia, flower

arctic zone Many have become weeds in cultivated ground and are now very widely dispersed. The Caryophyllaceæ are related to the Chenopodiaceæ, Amarantaceæ, Phytolaccaceæ, Portulacaceæ, Nyctaginaceæ and Aizoaceæ, all of which have a coiled, curved or annular embryo Of these, the Phytolaccaceæ probably represent more nearly the ancestral type By most recent authors (see PAX) the Illecebraceæ (Paronychia, Anychia, Scleranthus and Herniaria) are included in the Caryophyllaceæ The curved embryo, the 1-celled ovary with several styles and central placenta, the 10 stamens, the 5 separate petals and the opposite entire leaves are together distinctive

The family is very naturally divided into two distinct tribes. *Tribe I Silenoideæ*—Sepals united forming a tubular calyx; stamens hypogynous This includes Silene, Lychnis, Dianthus, Tunica, Saponaria and Gypsophila.

Tribe II. Alsinoideæ—Sepals separate; stamens mostly perigynous Includes Spergula, Cerastium, Stellaria, Arenaria, Sagina, Paronychia, Anychia, Herniaria and Scleranthus

In the Silenoideæ, the long-clawed petals often have a scale at the top, the five together forming a tiny crown Some species of Silene and Lychnis flower only at night or in cloudy weather, and are pollinated by night-flying moths The bracts at the base of the flower in Dianthus are distinctive. The petals of chickweed are curiously 2-parted, simulating 10 petals.

The Caryophyllaceæ are of little economic importance. Some were formerly used in medicine, but have fallen into disrepute The roots of *Saponaria officinalis* contain a saponaceous substance, saponin, and have been used for washing, whence the common name "soapwort" Saponin is a powerful local irritant, and, if applied strong, is said to kill either muscular or nervous tissue *Spergula arvensis* has been used as a fodder plant. Many members of the family are well-known ornamental plants, of which the most famous is *Dianthus Caryophyllus*, the carnation pink.

Perhaps 20 genera (including Illecebraceæ) are grown, mostly for ornament Among these are· Arenaria (Sandwort), Cerastium (Mouse-ear Chickweed), Dianthus (Carnation, Clove Pink, China Pink, Plumed Pink, Sweet William, Picotee, Grenadine), Gypsophila (Baby's Breath), Lychnis (Ragged Robin, Maltese Cross, Dusty Miller); Paronychia (Whitlow-wort), Sagina (Pearl-wort), Saponaria (Bouncing Bet, Soapwort, Cow Herb); Silene (Catchfly, Campion, Wild Pink), Spergula (Spurry), Stellaria (Chickweed, Starwort); Tunica.

Order 34 RANALES

73 **Nymphæaceæ** (from the genus *Nymphæa*, a name intended for the white water-lilies; dedicated by the Greeks to the water nymphs) WATER-LILY FAMILY Fig 21 Aquatic herbs leaves alternate flowers usually bisexual, regular, the organs, in part at least, spirally arranged; sepals mostly 4, rarely 3, 5, 6, or 12, petals 3-many, usually very numerous, hypogynous, or more or less epigynous, often a distinct transition to the stamens, stamens very numerous (rarely 6), inserted with the petals, carpels rarely 3–4, usually many, rarely distinct, usually coherent in a whorl or sunken in the enlarged receptacle; stigmas radially arranged on a sessile disk (as in poppy) or single fruit indehiscent or irregularly dehiscent, usually fleshy, seeds several.

Nymphæaceæ has 8 genera and about 60 species, distributed in all parts of the world, but more especially in tropical South America The family is closely related to the other families with spiral structure of the flower, as the Ranunculaceæ, Magnoliaceæ and Dilleniaceæ There is also a relation to Podophyllum of the Berberidaceæ, and to the Papaveraceæ The habit, spiral arrangement of floral parts, when present, the numerous stamens, the usually coherent carpels, and the type of fruit, are characteristic

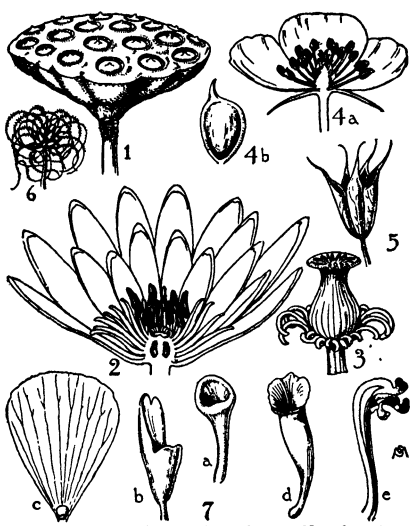
The leaves of Nelumbo are raised on long petioles, those of Nymphæa usually float, those of Brasenia are covered with a thick layer of slime, those of *Victoria regia* are 5–8 feet in diameter and floating. The receptacle of Nelumbo in fruit is like an inverted top with the ripe 1-seeded carpels loosely rattling in small cavities on the flat surface. The Nymphæaceæ in stem structure and character of the embryo shows a transition to the monocotyledons

Because of their unique appearance among plants, some species were venerated by the ancients. The lotus of the Egyptians, represented on their monuments and statues of their gods 5,000 years ago, was *Nymphæa cærulea* or *N. Lotus*, though *Nelumbo nucifera* has long passed under that name. (See article on Nymphæa.) The rootstocks of the Nymphæaceæ contain abundant starch, mucilage and sugar, which render them nutritive The seeds are edible and the negroes of the Nile used them as millet. The Egyptians still eat the seeds and rootstocks The seeds and rootstocks of *Euryale ferox* are cultivated and eaten in China.

In the American trade a few genera appear. Cabomba (Fish-Grass), with dissected submerged leaves and

white flowers, is grown in aquaria; Brasenia (Water Shield) is grown in aquatic gardens, as are also various species of Nuphar (Yellow Water-Lily, Spatterdock, Cow Lily); Nymphæa (White Pond-Lily); Nelumbo (Indian Lotus, so-called Egyptian Lotus, and Water Chinquapin); *Victoria regia*, and the similar *Euryale fercx*. The white water-lilies have latterly been called Castalia, but the name Nymphæa as applied to them has good historical standing and is retained in this work, Nuphar is still held for the yellow pond-lilies.

74. **Trochodendraceæ** (from the genus *Trochodendron*, from the Greek *wheel*, plus *tree*) TROCHODENDRON FAMILY Trees or shrubs leaves alternate or opposite, with oil-glands: flowers bisexual or unisexual,



21. NYMPHÆACEÆ: 1. Nelumbum, fruit 2. Nymphæa, flower 3 Nuphar, fruit RANUNCULACEÆ 4 Ranunculus, *a*, flower, *b*, fruit 5 Aquilegia, fruit 6 Clematis, fruit 7 Petals of various genera, *a*, Coptis, *b*, Eranthis, *c*, Ranunculus, *d*, Aquilegia, *e*, Aconitum

regular, hypogynous or perigynous; sepals and petals wanting; stamens numerous, spirally arranged, carpels separate, sometimes half immersed in the receptacle, 2 to many in one whorl; ovules 1 to many. fruit a follicle, or indehiscent.

Only 3 genera and 6 species are known, all of Eastern Asia. The family is closely related to the Magnoliaceæ, in which it has been included by many authors. It has the same spiral structure of the flower, and separate carpels, but the perianth is wanting

Trochodendron is one of the very few angiosperms in which the secondary wood is made up entirely of tracheids with bordered pits, without true vessels, as in the Coniferæ.

The family is of little economic value The wood of some species is used locally. In America, *Cercidiphyllum japonicum* and *Euptelea polyandra* are in cultivation as hardy, ornamental woody plants

75. **Ranunculaceæ** (from the genus *Ranunculus*, from the Latin signifying a little frog, because many of these plants are aquatic or marsh plants) BUTTERCUP FAMILY. Fig. 21. Herbs or shrubs of diverse habit· flowers bisexual rarely unisexual, spirally constructed except often the perianth, regular or irregular; sepals 3 to many, usually 5, separate, often petaloid; petals 3 to many, or 0, often in the form of honeyglands; stamens usually very numerous, hypogynous, carpels 1 to many, usually separate fruit an achene or follicle, rarely a capsule or a berry, seeds with endosperm

The 27 genera and about 680 species are distributed mainly in the north temperate and subarctic regions. Clematis, Anemone and Delphinium cross the equator southward The largest genus is Ranunculus The family is related to the Magnoliaceæ, Annonaceæ, Dilleniaceæ, Nymphæaceæ, and other families with acyclic flowers and numerous carpels The spiral floral structure, the numerous hypogynous stamens, and the usually separate carpels are the most distinctive characteristics The Ranunculaceæ is probably a very old family, and by some authors is thought to represent more closely than others the stock from which the dicotyledons have sprung

The floral structure is very interesting and very variable The petals, when not wanting, are rarely normal In one series a transition is shown from the staminode-like nectary of Coptis to the petal-like nectary of Ranunculus, in another series the nectar-bearing petals are spurred or variously irregular, as in Aconitum, Delphinium and Aquilegia In the last two genera, the flowers also have become extremely irregular. The fruits show an equally great diversity. From the primitive follicular type, they have become modified into achenes with a suspended or erect ovule, into a berry, or, in Nigella, even into a several-celled capsule by the fusion of the carpels The wind-pollinated Thalictrum shows great reduction and modification on that account The stalked carpels of Coptis simulate an umbel of separate fruits Finally the foliage of several species of Ranunculus has become very much dissected on account of the aquatic habit, and the plants, therefore, simulate a Myriophyllum

The Ranunculaceæ is divided by Prantl into three tribes as follows·

Tribe I. Fruit follicular, carpels fleshy, outer seed-coat long, e g Pæonia and Hydrastis

Tribe II Fruit usually follicular, carpels rarely fleshy, outer seed-coat not longer than the inner, e g , Caltha, Helleborus, Coptis, Actæa, Aquilegia, Delphinium, etc

Tribe III Fruit an achene, e g , Anemone, Clematis, Ranunculus, Thalictrum, etc.

The family contains many plants useful to mankind. Many are cultivated for their ornamental flowers The seeds, leaves and roots contain a bitter acid principle which is very irritating and in many cases poisonous. Because of this, many species of Anemone, Clematis, and so on, have been used to produce blisters, and beggars are said to have made use of *C Vitalba* to produce artificial sores and thus excite pity The roots of Coptis (gold-thread) are bright yellow, and have been used both as bitters and for the dye-stuffs contained Hydrastis (golden seal) is a well-known tonic and stomach corrective Aconite is a powerful narcotic drug much used to allay fever Slow cooking usually dissipates the poisonous properties of the Ranunculaceæ, thus enabling the vegetative portion in many cases to be eaten as greens. *Ranunculus Thora* and *R sceleratus* were named by the Romans "sardonia" because they are said to excite convulsive sardonic laughter.

Two dozen or more genera are in cultivation in America, almost entirely for ornamental purposes. Among these are Aconitum (Aconite, Monkshood, Wolfsbane); Actæa (Baneberry, Red and White Cohosh); Adonis (Pheasant's Eye, Adonis); Anemone (Anemone, Windflower, Patens, Pasque Flower); Aquilegia (Columbine), Caltha (Marsh Marigold, American Cowslip); Clematis (Virgin's Bower); Coptis (Goldthread); Delphinium (Larkspur); Eranthis (Winter Aconite); Helleborus (Christmas Rose), Hydrastis (Golden Seal, Orange Root); Nigella (Love-in-a-Mist, Devil-in-a-Bush, Fennel Flower); Pæonia (Peony, Piney);

Ranunculus (Buttercup, Crowfoot), Thalictrum (Meadow Rue); Trautvetteria (False Bugbane); Trollius (Globe Flower), Xanthorrhiza (Shrub Yellow Root).

A considerable industry has recently sprung into existence in which Hydrastis is grown for the medicinal value of the roots

76 **Lardizabalaceæ** (from the genus *Lardizabala*, named in honor of a Spanish naturalist, Lardizabala y Uribe) LARDIZABALA FAMILY Mostly twining plants with palmately compound leaves flowers polygamous or unisexual, rudiments of the other sex organs present, regular, hypogynous, sepals 6, petaloid, in two whorls, petals none, stamens 6, hypogynous; usually with nectaries between stamens and petals, carpels 3, rarely 6–9 or numerous, separate, ovules many rarely one, parietal; fruiting carpels baccate, indehiscent or dehiscent

This family has 8 genera and 18 species, inhabitants of the Himalayas, China, Japan, and Chile The family is related to the Berberidaceæ, with which it was formerly united, and to the Menispermaceæ, from both of which it is distinguished by the several-seeded fruit and by other characters

The fruits of most species are edible. The stems of Boquila and Lardizabala are used as cordage

Lardizabala, Stauntonia, Akebia and Sargentodoxa are in the American trade

77 **Berberidaceæ** (from the genus *Berberis*, derived from Berberys which is the Arabic name of the fruit) BARBERRY FAMILY Fig. 22 Herbs or shrubs with large, compound leaves, or small and simple, or spine-like leaves flowers bisexual, regular, hypogynous, sepals 3–9 in 1–3 series, petals 4–9 or more, in several whorls, often changed to nectaries, stamens as many as the petals and opposite them, rarely twice as many, anthers peculiar, opening by valves which roll upward, ovary 1-celled with several ovules, style almost 0, stigma mostly peltate fruit a berry or capsule

The family Berberidaceæ has 8 genera and about 200 species, distributed through north temperate Europe, Asia and America Berberis extends along the Andes to the Straits of Magellan Fossil species in the Tertiary are known The family is related to the Ranunculaceæ, Papaveraceæ and Fumariaceæ There is also an evident relation to the Magnoliaceæ and Annonaceæ The cyclic flowers, definite stamens opposite the petals, the solitary carpel, and usually the dehiscence of the anthers are distinctive In Podophyllum, the anthers open longitudinally in the ordinary way, and the stamens are twice the number of the petals The stamens of Berberis are irritable, flying toward the stigma when touched, and then scattering the pollen

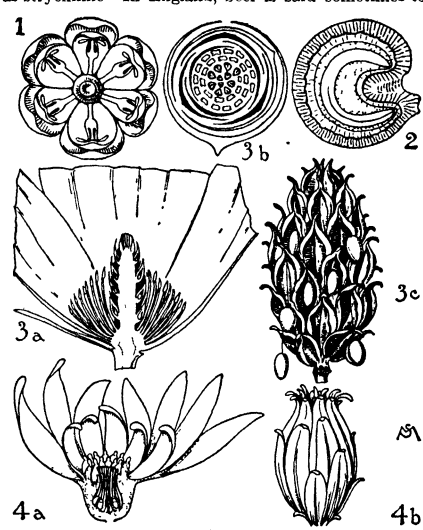
The fruit of the common barberry (*Berberis vulgaris*) contains oxalic acid and is used as a preserve, the yellow inner bark and stems are astringent and yield the yellow "berberine," which is also a purgative This yellow color formerly induced doctors to administer Berberis for jaundice The fruits of the mahonias of California are also eaten as a preserve The wood of the Indian and South American species of Berberis is used as a dye The root of Podophyllum (mandrake or May apple) is purgative and poisonous, the ripe fruit of this plant is fleshy and edible Many other species have been used for medicine in various parts of the world *Berberis vulgaris* is the famous host-plant of the æcidial stage of the wheat rust

The genera that are in the American trade are mostly grown as unusual herbaceous plants in gardens and are not widely known Many species of the shrubby and spiny Berberis, and also of Mahonia, are grown for ornamental purposes Akebia, a well-known woody twiner with palmate leaves and curious purple flowers, is now placed in the Lardizibalaceæ.

78 **Menispermaceæ** (from the genus *Menispermum*, derived from the Greek meaning *moonseed*). MOONSEED FAMILY. Fig 22. Woody climbers. leaves alternate: flowers dioecious, regular, sepals usually 6, in 2 series; petals 6, in 2 series, stamens 6, hypogynous, opposite the petals, sometimes monadelphous; carpels usually 3, rarely more, separate, 1-ovuled, much curved in fruit, seed half-inverted, embryo usually curved: fruit compound of sessile or stipitate drupelets

There are 56 genera and 150 species, distributed mostly in the tropical and subtropical portions of both hemispheres None are found in Europe Three species are native in the northeastern United States The Menispermaceæ are related to the Berberidaceæ, the Annonaceæ and the Magnoliaceæ The numerical plan of 3, the 2 whorls of sepals and petals, the curved seed, the drupelets, and the absence of oil-glands, are distinctive. Cross-sections of the twining stems often present peculiar patterns due to the unequal growth of the cambium

Several species are used in medicine *Jateorhiza palmatus* of tropical Africa has a turnip-shaped root which was much used as a tonic The roots of species of Cissampelos are administered in Brazil in cases of snake-bites The bark of several species yields a yellow dye *Anamirta Cocculus* of tropical Asia has extremely poisonous fruits (fish-berries or cocculus) used to intoxicate and poison fish which are thus obtained in abundance, but are sometimes dangerous to eat The narcotic principle, picrotoxine, is almost as poisonous as strychnine In England, beer is said sometimes to



22 BERBERIDACEÆ 1 Berberis, flower MENISPERMACEÆ: 2 Menispermum, fruit MAGNOLIACEÆ 3 Magnolia, *a*, flower; *b*, floral diagram, *c*, fruit CALYCANTHACEÆ 4 Calycanthus, *a* flower, *b*, fruit

be adulterated with the fruit (called cocculus indicus) of this plant.

Few genera are in cultivation in America for ornamental purposes, mostly in the southern states, and especially Florida. Cissampelos (Velvet Leaf or Pareira Brava), tonic and diuretic, in Florida, Menispermum (Moonseed Vine, from the curved fruit), hardy, native; *Cocculus carolinus* of the southeastern United States, semi-hardy; *C. triloba*, E. Asia, hardy

79 **Magnoliaceæ** (from the genus *Magnolia*, which was dedicated to P. Magnol, a professor of Botany at

Montpellier in the 17th century.) MAGNOLIA FAMILY. Fig 22 Woody plants with alternate, entire or lobed leaves, and usually large stipules, each pair of which forms a hood over the young growth above, the outer pair of stipules serving as bud-scales, and each pair leaving a scar which completely encircles the stem flowers usually bisexual, regular, hypogynous, the parts spirally arranged except sometimes the sepals and petals; sepals 3, petals 6 to many, separate, stamens very numerous, carpels usually many and usually separate; ovary 1-celled, 1- to several-seeded, arranged spirally or in a whorl (Illicium) at the top of the receptacle fruit a follicle, or samara, or indehiscent and fleshy

Ten genera and about 80 species are distributed principally in the subtropical and temperate portions of Asia and America, but are absent in Africa, Europe and the arctic regions The Magnoliaceæ are most closely related to the Annonaceæ and Calycanthaceæ The peculiar stipules, the spiral structure of the hypogynous flower, and the separate carpels are distinctive In Magnolia, the outer seed-coat is fleshy and red, when ripe the seeds fall out but remain suspended by the uncoiled spiral vessels of the raphe and funiculus

The wood is generally valuable for timber, while all parts, such as leaves and bark, contain a bitter resin, which in some species is fragrantly aromatic *Michelia Champaca* is cultivated in tropical Asia for its sweet flowers which are carried about as a perfumery Its aromatic and acrid bark and buds are used in rheumatism. The bark of *Talauma elegans* is used in Java as a stomachic. The seeds of *Magnolia Yulan* have been used from prehistoric times in China as a febrifuge It is said that the aromatic bark of the tulip tree is a substitute for cascarilla and quinine *Drimys Winteri* has long been used as a stimulant in Central and South America, and, by importation, in Europe The fruit of *Illicium verum*, a Chinese shrub, is very pleasantly aromatic, resembling anise, from which, and its remarkable star-like whorled carpels, it is called "star anise" It is much used as a condiment in oriental countries. The bark of *Illicium anisatum* (*I religiosum*) was formerly burned as incense in the temples of Japan For a long period the name *Illicium anisatum* was thought to apply to the star anise, but this mistake was rectified in the B M. 7005 *Liriodendron Tulipifera* furnishes the valuable "whitewood" or "yellow poplar" of commerce. The wood of various species of Magnolia is used in cabinet-work

Several genera are in cultivation in America, all except Illicium as ornamental trees and shrubs. Among these are Illicium (Star Anise); Liriodendron (Tulip Tree); Magnolia (Magnolia, White Bay, Beam Tree, Cucumber Tree); and Schizandra, a procumbent warty shrub

80 **Calycanthaceæ** (from the genus *Calycanthus*, derived from the Greek, which means a *cup* and *flower*, referring to the peculiar receptacle) CALYCANTHUS FAMILY. Fig 22 Shrubs with opposite leaves and aromatic bark flowers bisexual, regular, perigynous, spirally constructed, parts of the perianth numerous, petaloid, not clearly differentiated into calyx and corolla, stamens 10–30 (5 in Meratia); carpels numerous, separate, inserted on the inner face of the hollow receptacle, each 1–2-ovuled, in fruit forming 1-seeded achenes, which are completely inclosed by the fleshy receptacle; seeds, exalbuminous, cotyledons spirally rolled.

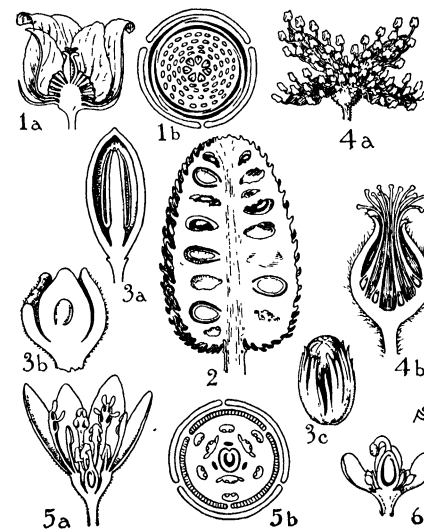
Calycanthus, with 4–6 species, is confined to the southern United States and California, Meratia has two species in China and Japan The family is related to the Magnoliaceæ and the Annonaceæ in the spiral structure of the flowers, but differs in the exalbuminous seed, the perigynous flowers and the opposite leaves. By some authors the family has been placed near the Rosaceæ because of the perigynous flowers, but the spiral arrangement is not that of this latter family. The aromatic bark, the magnolia-like flowers, and the peculiar rose-like fruits are distinctive.

The bark of *Calycanthus floridus* is used in America as a tonic under the name Carolina allspice.

All the species are in cultivation in the northern United States as ornamental shrubs

81. **Annonaceæ** (from the genus *Annona*, which is from Menona, its Banda name) CUSTARD-APPLE FAMILY Fig 23 Trees or shrubs, with simple and entire alternate leaves flowers usually bisexual, regular, hypogynous; sepals 3; petals usually 6, commonly valvate, rarely imbricated; stamens spirally arranged; numerous, carpels usually numerous and separate (united in Monodora), 1- to several-ovuled fruit berry-like, rarely capsular, often constricted between the seeds.

From 500–600 species in 46 genera are found mostly in the tropical regions of Asia, Africa and America, the majority occurring in the Old World. Only



23. ANNONACEÆ 1 Asimina, *a*, flower; *b*, floral diagram 2 Annona, fruit MYRISTICACEÆ 3 Myristica, *a*, male flower, *b*, female flower, *c*, seed with arillus MONIMIACEÆ 4 Monimia, *a*, male flower, *b*, female flower LAURACEÆ 5 Cinnamomum, *a*, flower, *b*, floral diagram 6 Benzoin, female flower

the genus Asimina is extra-tropical in Atlantic North America and in Australia The family is most closely related to the Magnoliaceæ, but also to the Myristicaceæ, Menispermaceæ, Calycanthaceæ and Dilleniaceæ The plan of 3 in calyx and corolla, the numerous spiral stamens, the usually separate carpels, the berry-like fruit and ruminate endosperm are distinctive There is great structural diversity in the family

The Annonaceæ is rich in useful plants. The Malayans use the bark of several species for rheumatic pains, and the fruit of others as a stomachic With the flowers of Uvaria they prepare an ointment to ward off fevers European women in India formerly used the scented flowers of this plant in hair-oil Many species of Annona and Asimina produce edible fruit, as for example, the sweet-sop (*Annona squamosa*), the sour-sop (*Annona muricata*), the custard-apple (*Annona reticulata*), and the northern papaw (*Asimina triloba*).

A few genera are in cultivation in America, mostly in Florida and southern California. Annona, cultivated

for the fruit; Asimina, ornamental, in the North; Artabotrys, climbing, ornamental, sweet-scented, used for perfume; Duguetia, cultivated for the fruit in Florida

82 **Myristicaceæ** (from the genus *Myristica*, meaning an *anointing medium*, in reference to the fragrant fruit). NUTMEG FAMILY. Fig 23. Trees or shrubs leaves alternate, coriaceous, entire flowers dioecious, regular, small, perianth of one series, the 3 parts connate, 3-lobed, stamens 3–18, monadelphous, carpel 1, superior, ovary 1-celled, ovule 1, stigma sessile, entire or lobed. fruit a fleshy capsule, seed with a fleshy, laciniate aril

The family contains 1 genus and about 80 species, of tropical distribution, principally in tropical Asia The family is most closely related to the Annonaceæ The dioecious flowers with only one set of floral envelopes, and that consisting of 3 parts, the monadelphous stamens, the 1-celled, 1-ovuled ovary and the aril are distinctive

All parts of Myristicaceæ contain a fragrant oil, which, however, is most abundant in the fruit The seeds of *Myristica fragrans*, of the Moluccas, furnish the well-known nutmeg, used as a condiment The aril of the same fruit is mace The fruits of other species are also sparingly used as condiments

Myristica fragrans is cultivated and naturalized in the West Indies

83 **Monimiaceæ** (from the genus *Monimia*, named for the wife of Mythridates) MONIMIA FAMILY Fig 23 Trees or shrubs with aromatic glands leaves opposite or whorled, rarely alternate flowers usually bisexual, regular, perigynous, the more or less cup-shaped receptacle conspicuous, variously formed; perianth of 1 or 2 whorls, inconspicuous, stamens numerous, rarely few, scattered over the inner face of the receptacle, anthers often opening by uplifting valves, carpels numerous, all separate, also scattered over the receptacular cup, ovaries 1-ovuled, style and stigma 1 for each carpel fruit an achene or drupe, borne on the receptacle and sessile or pedicelled, or immersed in the fleshy often urn-shaped receptacle which becomes part of an aggregate accessory fruit and frequently completely incloses the achenes

Contained in this family are 31 genera and about 150 species, of tropical and subtropical distribution, principally of the South Sea Islands and Australia; some, however, reach South America, Africa, and other countries The largest genus is Siparuna, containing 60 species The family is related to the Calycanthaceæ, as is plainly evident in the fruit The usually enlarged receptacle, the peculiar fruit, and the 1-seeded carpels are distinctive

The Monimiaceæ have stimulating properties Peumus leaves are used to promote digestion, like tea and coffee The fruits of this plant are edible, as are also those of *Laurelia sempervirens* The wood of *Atherosperma moschatum* is much sought for shipbuilding, the bark is a substitute for tea

Peumus (Chilean Boldo) is advertised in California; valuable for its timber, edible fruits, and ornamental qualities

84 **Lauraceæ** (from the genus *Laurus*, the old Latin name). LAUREL FAMILY Fig. 23 Trees or shrubs with fetid or aromatic bark leaves alternate, rarely otherwise, simple, punctate flowers bisexual or unisexual, regular, parts of the perianth similar, usually 6, in 2 whorls; stamens in 3–4 whorls of 3 each, perigynous or epigynous, some often staminodial and glandular; anthers opening by uplifting valves, ovary superior or very rarely inferior, 1-celled, 1-ovuled, style 1, stigma 2–3-lobed fruit a berry, drupe, or dry, often seated on a thickened pedicel or inclosed in a hollow receptacle

The 39 genera and about 900 species inhabit mostly tropical regions, but extend into the temperate regions Six species are found in the northeastern United States The largest genera are Ocotea with 200 species, and Litsea with 100 species The family is related to the Monimiaceæ, and stands between that family and the Thymelæaceæ The undifferentiated perianth, numerous stamens with uplifting valves, and 1-celled, 1-seeded ovary are distinctive

The Lauraceæ are useful on account of the aromatic oil The leaves of laurel (*Laurus nobilis*) are used for flavoring and for packing figs Cinnamon is from the bark of *Cinnamomum zeylanicum*. *Cinnamomum Cassia* yields cassia cinnamon The bark of the root of *Sassafras variifolium* is the sassafras of commerce Camphor is obtained by distillation from *Cinnamomum Camphora* The fruit of *Persea gratissima* is the avocado of South America, eaten by both men and animals Many fragrant woods are obtained from this family, as, for example anise wood (*Ocotea cymbarum*), bebeeru wood, greenheart (*Nectandra Rodiæi*), or clove-cassia pepper wood (*Dicypellium caryophyllatum*) so named because of the pungency of the dust, Madeira mahogany (*Persea indica*), fetid till (*Ocotea fœtens*), sweetwood (*Nectandra exaltata*), and stinkwood (*Ocotea bullata*)

Among the genera in cultivation in this country are Benzoin (Spice Bush, Benjamin Bush, Wild Allspice, Fever Bush), native, ornamental, Cinnamomum or Camphora (Camphor Tree), introduced in Florida and California, Cinnamomum (Cinnamon, Cassia Buds), cultivated under glass, Laurus (Sweet Bay), ornamental, conservatory, Persea (Red Bay, Bull Bay, Avocado), greenhouse and South, Sassafras, native ornamental, and Umbellularia (California Laurel), ornamental, in the South and California.

Order 35. RHŒADALES

85 **Papaveraceæ** (from the genus *Papaver*, derivation obscure) POPPY FAMILY Fig 24 Annual or perennial herbs, or rarely shrubs, with yellow (Chelidonium), white (Papaver), or red (Sanguinaria), or rarely watery (Eschscholtzia) juice leaves usually alternate, often crenately toothed or lobed or divided flowers bisexual, regular, sepals 2, rarely 3, petals 4, rarely 6 or more, rarely wanting, stamens numerous in many whorls, hypogynous, carpels 1 to many, connate into a 1-celled ovary, with the parietal placentæ as many as the stigmas, ovules 1 to many, styles as many as the carpels, usually wanting, stigmas distinct, or in a radiate disk, or lobed fruit capsular or siliquose, seed albuminous

The 23 genera and about 80 species are widely distributed in the north temperate zone, but are especially numerous in central and eastern Asia, the Mediterranean region and western North America One species of poppy is found in the south temperate region in South Africa and Australia The family is closely related to the Fumariaceæ (which see), with which it is united by many European authors It is also related to Capparidaceæ and Cruciferæ There is, on the other hand, an affinity with the Berberidaceæ The milky juice, numerical plan of 2 or 3 in the perianth, numerous stamens, and 1-celled ovary with parietal placentæ are characteristic.

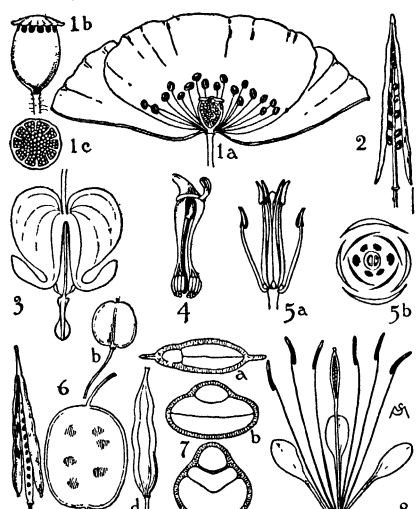
In Papaver, an orbicular disk crowns the ovary on the top of which radiate the numerous stigmatic lines The capsules open by means of small valves between the placentæ and underneath the disk The capsule of Chelidonium is like a mustard fruit (silique), in being long and slender and the lateral walls springing upward as valves, leaving the placentæ exposed

Many of the Papaveraceæ are cultivated as ornamental plants Some poppies are bad weeds in cultivated ground in Europe *Papaver somniferum*, a native of Asia, furnishes the opium of commerce, which is obtained by incisions made in the capsules Poppy oil is derived in France from the seeds of *Papaver somniferum* Sanguinaria root is used in medicine as a sedative

A score of genera are in cultivation in America, all as garden plants Some of these are Bocconia (Plume Poppy of eastern Asia), Chelidonium (Celandine), a weed from Europe; Dendromecon, shrubby, Eschscholtzia (California Poppy), Mecanopsis (Welsh Poppy of western Europe), Papaver (Poppy); Platystemon (Cream Cups), Platystigma, Sanguinaria (Bloodroot), native, Stylophorum (Celandine Poppy), native

86. **Fumariaceæ** (from the genus *Fumaria*, which is from the Latin *fumus*, smoke, presumably referring to the nitrous odor of the roots when pulled from the ground). FUMITORY FAMILY. Fig 24. Herbaceous plants with alternate, dissected leaves flowers bisexual, regular or irregular, hypogynous; sepals 2, petals 4, free or connate, in 2 unlike pairs, outer pair larger, either one or both petals of which are spurred or gibbous, the two inner crested and united over the anthers and stamens; anthers 6, borne on 2 filaments, carpels 2, united; ovary 1-celled, 1- to many-seeded. fruit a silique, vesicular or indehiscent, or transversely jointed, seeds albuminous.

There are 5 genera and 130 species, mostly from the north temperate regions The family is closely related to the Papaveraceæ with which it is often united The



24 PAPAVERACEÆ 1. Papaver, *a*, flower, *b* and *c*, fruit 2 Chelidonium fruit FUMARIACEÆ 3 Dicentra, flower 4 Fumaria flower 1, corolla removed CRUCIFERÆ 5 Flower, *a*, perianth removed, *b*, floral diagram 6 Fruit, *a*, Brassica, *b*, Lepidium, *c*, Lunaria, *d*, Raphanus 7 Cross-section seeds of Cruciferæ, showing types of embryos, *a*, accumbent, *b*, incumbent, *c*, conduplicate. CAPPARIDACEÆ 8 Cleome, flower

bleeding-heart-like flower, the plan of 2, the 6 anthers on 2 filaments, the 1-celled ovary, and the absence of milky juice are distinctive

Fumaria officinalis and some species of Corydalis have been used as medicine, but the family is of little economic importance, except for the few ornamental species

Following are the genera best known in cultivation: Adlumia (Allegheny Vine, Climbing Fumitory), a graceful native garden climber; Corydalis, with 1-spurred corolla; Dicentra (Bleeding Heart, Squirrel Corn, Dutchman's Breeches), with 2-spurred corolla, and Fumaria (Fumitory), with 1-spurred corolla.

87 **Cruciferæ** (from the Latin signifying *cross-bearers*, in reference to the cross-like appearance produced by the four petals) MUSTARD FAMILY Fig 24 Herbs, rarely shrubby leaves usually alternate, simple, often varying from entire to palmate or pinnatifid within the same genus flowers bisexual, regular, sepals 4; petals 4, rarely wanting, stamens 6, 4 long and 2 shorter (tetradynamous), rarely fewer, very rarely more, hypogynous, carpels 2, united, ovary superior, 2-, rarely 1-, celled with 2 parietal placentæ at the edges of the septum fruit a silique (long), or a silicle (short), rarely indehiscent, seeds exalbuminous; the embryo variously curved and folded

In the family are 208 genera and 1,600 species, distributed throughout the cold and temperate parts of both hemispheres, but especially abundant around the Mediterranean Sea, a few are tropical The Cruciferæ are closely related to the Capparidaceæ, Papaveraceæ, and Fumariaceæ The 4 sepals, 4 petals, 6 stamens (4 long and 2 short), and the peculiar fruit are distinctive

The 6 stamens probably represent a reduction from 2 sets of 4 each In Lepidium and other genera, there may be only 2 stamens The septum of the fruit remains upon the plant when the seeds and valves fall The silicles are often flattened, either perpendicular or parallel to the partition (in different genera) The embryos in the seed are folded so that the hypocotyl (radicle) and cotyledons lie side by side Distinct patterns are thus produced which are so constant as to be of great value in the classification within the family Three principal types are recognized cotyledons accumbent, when the edges of the cotyledons are applied to the hypocotyl, incumbent, when the back of one cotyledon is applied to the hypocotyl; and conduplicate, when the cotyledons themselves are also folded and enwrap the hypocotyl. In Leavenworthia, alone, the embryo is straight

The flower of Cruciferæ is of little value in classification within the family; the important characters are in connection with the fruit and seeds.

Many have become well-known weeds as, for example, charlock (*Brassica arvensis*), shepherd's purse (*Capsella Bursa-pastoris*), pepper grass (Lepidium), spring mustard (Barbarea), wild radish (*Raphanus Raphanistrum*). Many others are among the well-known old-fashioned ornamental plants of the garden, e g, rocket (*Hesperis matronalis*), stock or gilliflower (Matthiola), wallflower (Cheiranthus), honesty (Lunaria) with large orbicular flat pods, candytuft (Iberis), sweet alyssum (Alyssum) Others are used as food, of which *Brassica oleracea*, a very variable species, is the most important, furnishing cabbage, cauliflower, kohlrabi and kale. *Brassica campestris* furnishes the various forms of rutabaga *Brassica alba* furnishes white mustard, and *Brassica nigra*, black mustard *Radicula Nasturtium-aquaticum* is water-cress; *Radicula Armoracia* is horse-radish The rootstocks of Dentaria are eaten in America under the name "crinkle root" *Raphanus sativus* is the garden radish; *Lepidium sativum* is garden cress The various organs of most Cruciferæ contain an oily substance which is very pungent to the taste and which gives the peculiar flavor to the various cresses This oil is abundant in the seeds from which it is extracted (oil of mustard). The foliage of the various maritime Cruciferæ have been found a useful article of diet in counteracting scurvy, for which reason the arctic Cochlearia is called "scurvy-grass" The leaves of the woad of western Europe (*Isatis tinctoria*) yield a blue dye *Anastatica Hierochuntica* is the original "rose of Jericho," the branches of which close and open when alternately dried and wetted. (See article on Resurrection Plants)

88. **Capparidaceæ** (from the genus *Capparis*, the Greek name, from the Arabic *kapar*, capers). CAPER FAMILY. Fig 24. Herbs or rarely shrubs. flowers bisex-

ual, more or less irregular, sepals 3–8, usually 4; petals 4–8, rarely 0, hypogynous or perigynous, disk ring-like or scale-like or tubular at the base of the petals, stamens 6, rarely 4 or many, carpels 2 or more, ovary 1- to several-celled, usually raised on an outgrowth (gynophore) of the pedicel-like axis, which may become much elongated in fruit, ovules numerous, style 1 or 0; stigmas 1 to several fruit a capsule, silique, berry or drupe, embryo usually coiled.

Thirty-four genera and about 350 species occur, mostly of tropical and subtropical distribution They extend to Australia, the African deserts and into the western and eastern United States The family is very closely related to the Cruciferæ and certain forms are difficult to distinguish from that family The non-tetradynamous stamens, and commonly 1-celled ovary are distinctive The gynophore is often very long, slender and conspicuous, and sometimes (Gynandropsis) carries up the stamens along with the pistil The detailed variation in the flower is very intricate

Several genera are cultivated as ornamental plants The acrid oil in the fruit is stimulating, as in the Cruciferæ, and for this reason several genera have been used in medicine (Cleome, Polanisia, Capparis, etc) *Capparis spinosa* of the Mediterranean region furnishes the capers of commerce, which are flower-buds preserved in salt and vinegar

As garden plants, a few genera are in the American trade Cleome (Bee or Spider Plant), ornamental, Gynandropsis, ornamental, Capparis (Caper Plant), shrubby, grown in this country for ornament as well as for food, and Crataeva, shrubby, grown in southern California

89. **Resedaceæ** (from the genus *Reseda* which is from the Latin, *to calm*, in allusion to supposed quieting properties) Mignonette Family Herbs or shrubs: leaves usually alternate flowers mostly bisexual, more or less irregular, calyx persistent, 4–8-parted, irregular, petals 0–8, alternating with the sepals, stamens 3–40, inserted within an irregular fleshy disk, carpels 2–6, free, or united into a 1-celled ovary which is often imperfectly closed at the top, placentæ 2–6, parietal; ovules many, styles or sessile stigmas 3–6 fruit usually a dehiscent capsule, rarely a berry, or composed of separate follicles; seeds reniform, without endosperm; embryo curved

About 45 species and 6 genera occur, mainly distributed about the Mediterranean Sea This family is allied to the Cruciferæ and Capparidaceæ, from which it differs principally in general character The extra-staminal disk, the numerous stamens, the 1-celled ovary or ovaries with parietal placentæ, and the usually gaping summit of the ovary are distinctive

Reseda Lutcola (Dyer's weed) yields a yellow dye which was formerly much used *R odorata* (mignonette), a plant cultivated since early times, and whose origin was long considered unknown, although probably Egyptian, is extensively cultivated for the fragrance of its flowers

90 **Moringaceæ** (from the genus *Moringa*, derived from the Malabar name of the plant) Moringa Family Trees, with 2-3-pinnate alternate leaves: flowers bisexual, irregular, perigynous, sepals 5, imbricated, petals 5, imbricated, unequal, lower reflexed, stamens 8–10, separate or united at the base, alternate ones shorter or reduced to staminodia; subovarian disk present, lining the cup; ovary borne on a gynophore, 1-celled, placentæ 3, ovules numerous, style 1. fruit a silique-like capsule

There is but one genus, containing 3 species, natives of northeastern Africa and India The family is distinct, not related closely to any other, perhaps distantly related to the Bignoniaceæ, the Capparidaceæ, the Violaceæ, or the Leguminoseæ Provisionally placed by Engler and Prantl between the Poppy group of families and the Rose group.

Moringa arabica of Arabia (ben-nut) yields a useful oil which does not become rancid The root of one species is used in intermittent fevers. A tragacanth-like gum exudes from the bark of *M oleifera.*

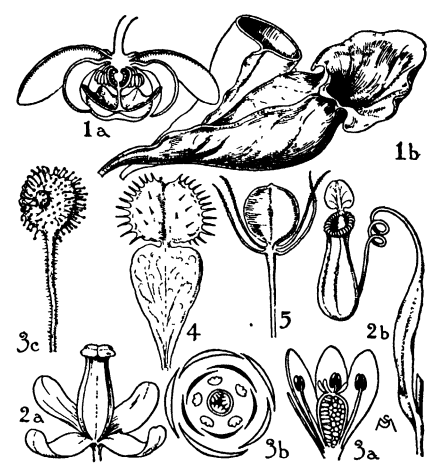
M oleifera (horse-radish tree) is grown sparingly in the southern United States. The fruits and the roots are edible.

Order 36 Sarraceniales

91 **Sarraceniaceæ** (from the genus *Sarracenia*, in honor of Dr Sarracin, an early physician of Quebec, who sent the northern species to Europe). Pitcher-plant Family Fig 25 Perennial herbs inhabiting bogs leaves all basal, tubular scapes 1-flowered, flowers bisexual, regular, sepals 4–5, imbricated, petals 5, hypogynous, or 0, stamens many but not apparently either cyclic or spiral, ovary superior, 3–5-, rarely 6-, celled, ovules numerous, style 1, stigmas 1–5 fruit a capsule

The Sarraceniaceæ has 3 genera and 8 species, of which 6 belong to the genus Sarracenia, all American. Heliamphora is in British Guiana, Darlingtonia in California, and Sarracenia in Atlantic North America from Newfoundland to Florida The family is most closely related to the Droseraceæ and Nepenthaceæ, but also to the Papaveraceæ and Nymphæaceæ

The Sarraceniaceæ are far-famed as insectivorous plants The pitchers are partly filled with a liquid containing a digestive enzyme Small insects which fall into the liquid, or are attracted by a sugary secretion, and are unable to escape because of various devices, are at length digested and absorbed Like the sun-



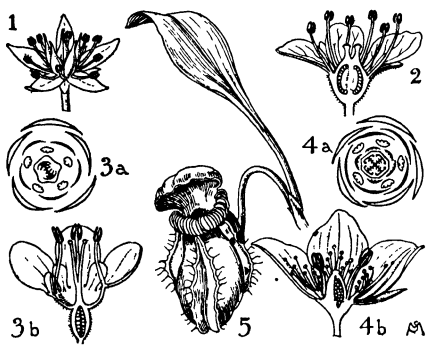
25 Sarraceniaceæ 1 Sarracenia, *a*, flower, *b*, leaves Nepenthaceæ 2 Nepenthes, *a*, female flower, *b*, leaf Droseraceæ 3 Drosera, *a*, flower, *b*, floral diagram , *c*, leaf 4 Dionæa, leaf 5 Aldrovanda, leaf

dews, these plants can inhabit soils poor in nitrates. The remarkable umbrella-shaped style, and fiddle-shaped petals of Sarracenia are part of a very interesting mechanism for cross-pollination

The family is of little economic importance. The rhizome of *Sarracenia purpurea* was used in Canada as a specific against smallpox, but did not prove of value. *Darlingtonia californica* and species of Sarracenia are in the trade because of their peculiar habits and structure, and their botanical interest. They are grown mainly in the greenhouse.

92. **Nepenthaceæ** (from the genus *Nepenthes*, derived from the Greek signifying a *magic potion*, probably in reference to the pitchers) NEPENTHES FAMILY. Fig. 25 Slightly woody or herbaceous plants. leaves alternate, consisting of a winged basal portion, a slender stalk-like intermediate portion, and a terminal urn-shaped pitcher with a rolling fluted border and a lid, the pitcher containing a watery fluid flowers dioecious, paniculate, regular, perianth of 4 parts, possibly 2 sepals and 2 petals, imbricated, stamens 4–16, monadelphous, ovary superior, 3–4-celled, ovules numerous in each cell, stigma sessile, discoid fruit a capsule

A single genus with about 40 species occurs in the East Indies, Madagascar, the Seychelle Islands, and New Caledonia. Borneo has the greatest number of species The family is related to the Sarraceniaceæ and Droseraceæ, although formerly considered related to the Aristolochiaceæ The habit, the undifferentiated perianth, the monadelphous stamens, and the 3–4-celled ovary, are distinctive A remarkable family of insectivorous plants. Along with the water secreted in the cavity of the pitcher is a pepsin-like substance, by the aid of which insects are digested, the dissolved material being later absorbed The slender part of the leaf in some species coils and serves as a tendril by means of which the plant climbs.



26 CRASSULACEÆ 1 Sedum, flower SAXIFRAGACEÆ 2 Saxifraga, flower 3 Ribes, *a*, floral diagram, *b*, flower 4 Parnassia, *a*, floral diagram, *b*, flower CEPHALOTACEÆ. 5 Cephalotus, leaves

In American greenhouses, many kinds of Nepenthes (Pitcher Plants), some of hybrid origin, are cultivated because of their curious habit

93 **Droseraceæ** (from the genus *Drosera*, derived from the Greek, meaning *dewy*) SUNDEW FAMILY. Fig. 25 Very glandular herbs or sub-shrubs with alternate leaves flowers bisexual, regular, hypogynous, rarely perigynous, sepals 4–5, imbricated, petals 5, imbricated; stamens in 1 or more whorls of 5; carpels 2–5; ovary superior, 1–3-celled. fruit a capsule with numerous seeds

The 6 genera and about 100 species, 90 species of which belong to the genus Drosera, are widely scattered over the earth. The family is related in floral structure to the Cistaceæ and Violaceæ, and to the Saxifragaceæ.

The Droseraceæ are noted as insectivorous plants. Drosera has a rosette of small basal leaves covered with sensitive motile tentacles that secrete a terminal drop of clear sticky fluid, the so-called dew, in which small insects are caught as on sticky fly-paper A digestive substance is then secreted and the organic matter absorbed. The leaves of Dionæa (the famous Venus' fly-trap of Carolina) have a conduplicate terminal lobe which closes violently when a fly alights upon the upper (inner) surface A marginal fringe prevents the escape of the insect; and it is in time digested Aldrovanda of South Europe has tiny traps similar to those of Dionæa, but the whole plant is aquatic, and resembles Utricularia

Drosophyllum and Roridula are said to be used in Portugal and the Cape for the practical capture of flies in the house The leaves of some Droseras yield a purple dye. The liquids known as aqua-auri and rosoglio (Italian) contain *Drosera rotundifolia* as an essential ingredient.

Drosera and Dionæa are in the American trade, mostly grown as greenhouse curiosities.

Order 37. ROSALES

94 **Crassulaceæ** (from the genus *Crassula*, diminutive of *crassus*, meaning thick) ORPINE FAMILY Fig. 26 Herbs or sub-shrubs leaves mostly alternate, commonly fleshy flowers mostly bisexual, regular, sepals 5, rarely 3–30, imbricated, petals as many, rarely connate, stamens as many or twice as many as the petals, epipetalous or hypogynous, rarely perigynous, separate, carpels as many as the petals, separate with a scale at the base of each, ovules numerous, rarely few or one fruit a group of follicles, rarely the carpels somewhat united and ovary half-inferior

Thirteen genera and about 500 species inhabit the drier parts of the earth, but principally South Africa and South Europe The genus Sedum contains 140 species, and Crassula 120 species This is a very definite family, but closely related to the Saxifragaceæ, from which it differs in the regular numerical plan, almost constantly separate ovaries, and predominatingly fleshy habit

The Crassulaceæ are well adapted to a dry climate The fleshy leaves are provided with water-storage tissue and a thick cuticle, and are often odd in shape and appearance These leaves lose water very slowly when separated from the plant, and will often remain fresh for weeks When pinned to the wall, the leaf of Bryophyllum sends forth plantlets from the margin, and the stem of live-forever may grow and flower, so efficient is the protection against loss of water afforded by the cuticle These plants, likewise, will grow for weeks or months in the collector's press

The herbage contains much tannin and sometimes acid A refreshing drink has been made from *Sempervivum tectorum* (houseleek) The fleshy leaves of the Crassulaceæ are cooling to wounds and burns *Sedum Telephium* was formerly cultivated as a pot-herb Other species have been used for nearly similar purposes

Several genera are in cultivation in America Of these, Sempervivum is the well-known Houseleek or Old-hen-and-chickens, Cotyledon is somewhat similar in growth, *Sedum acre* is Moss Stonecrop, and *Sedum triphyllum* (*S Telephium*) is Live-forever, or Orpine.

95 **Cephalotaceæ** (from the genus *Celphalotus*, derived from the Greek meaning *headed*, said to refer to the capitate hairs at the base of the flower) CEPHALOTUS FAMILY Fig 26 Perennial scapose herbs leaves of 2 kinds in a basal rosette, one lanceolate and ordinary, the other a petioled pitcher with winged sides, fluted mouth and a lid. flowers bisexual, regular, perigynous, perianth of 6 parts, apparently in one series, valvate, stamens 12, in 2 whorls, carpels 6, separate, arranged around the woody apex of the axis; 1–2 basal ovules in each: fruit dry, somewhat inflated.

The family consists of but 1 genus and 1 species (*Cephalotus follicularis*), found in the swamps of King George's Sound, West Australia This family is related to the Saxifragaceæ, and was formerly united with that family, but differs in the peculiar habit, the wholly separate carpels arranged around the apex of the axis,

and the basal seeds, related also to the Crassulaceæ, but lacks the hypogynous scales and has basal seeds

This remarkable little insectivorous plant is cultivated in greenhouses as a curiosity.

96 **Saxifragaceæ** (from the genus *Saxifraga*, derived from the Latin signifying to *break rocks*, in allusion to the habit of growing in the clefts of rocks). SAXIFRAGE FAMILY Fig 26. Herbs, shrubs, or small trees leaves alternate, rarely opposite flowers bisexual, usually regular, hypogynous or perigynous, rarely epigynous, sepals 4–5, rarely more or fewer; petals usually of the same number, valvate or imbricated, inserted with the stamens at the edge of a receptacular nectariferous disk, stamens of the same number as the petals and alternate with them, or twice as many and the outer opposite the petals, carpels 2, rarely 5, partly united, rarely separate, superior or half inferior, ovules numerous, styles and stigmas as many as the carpels fruit a capsule or berry

There are about 70 genera and some 700 species, widely distributed but more abundant in temperate regions Many reach the arctics Some are fossil Saxifraga is the largest genus, with 200 species in the north temperate, arctic and Andean regions. Ribes has 50 species The family is closely related to the Rosaceæ, differing in the more abundant endosperm and constantly few carpels and few stamens, related also to the Crassulaceæ, which has a regular numerical plan and hypogynous scales; and to the Cunoniaceæ and Hamamelidaceæ

The ovaries of Ribes, Philadelphus, Chrysosplenium, Deutzia, Hydrangea, and some Saxifragas, and a few other genera are almost wholly inferior Parnassia has staminodia in clusters at the base of each petal The fruit of Ribes is a berry Some Heucheras have irregular flowers, also some Saxifragas, some Hydrangeas and Tolmieas The peripheral flowers of Hydrangea often have enlarged corollas and are sterile Waterglands in the axils of the foliar teeth of some Saxifragas secrete a deposit of lime.

The rough leaves of *Deutzia scabra* are used in Japan to polish wood The fruits of several species of Ribes are edible, *R vulgare* yields the red currant, *R. Grossularia*, the English gooseberry, and also native gooseberries, *R nigrum*, the black currant Otherwise the family is of economic importance only for its ornamental species, which are numerous and largely hardy

Many genera are in cultivation in this country. Among these the following well-known names may be noted Deutzia, Decumaria, climbing shrub, Golden Saxifrage (Chrysosplenium), Astilbe; Hydrangea; Mock-orange or Syringa (Philadelphus), Currants and Gooseberries (Ribes), False Mitrewort or False Bishop's-cap or Foam-flower (Tiarella), Grass of Parnassus (Parnassia); Mitrewort or Bishop's-cap (Mitella); Alum Root or Coral Bells (Heuchera); Saxifrage and Strawberry Geranium (Saxifraga)

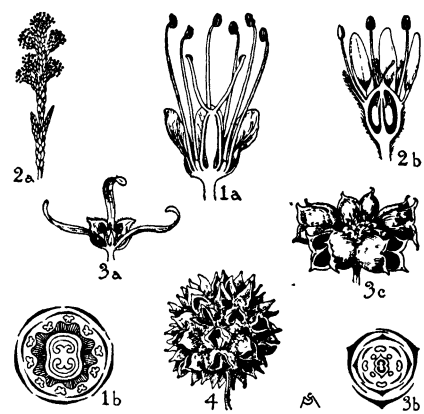
97 **Pittosporaceæ** (from the genus *Pittosporum*, the name referring to the viscid coating of the seeds) PITTOSPORUM FAMILY Trees or shrubs, often climbing· leaves alternate, mostly leathery· flowers bisexual, regular; sepals or divisions of the calyx 5, imbricated; petals 5, imbricated in the bud, claws often connivent or coherent, stamens 5, alternating with the petals, hypogynous, no disk at the base; carpels 2, rarely 3–5; ovary 1- to several-celled, placentæ parietal or axial; style 1; stigmas 1 to several fruit a capsule or berry; seeds numerous or few, immersed in a pulp or viscid juice.

All the 9 genera and about 90 species are natives of Australia, except the genus Pittosporum, which, however, is of the Old World. The largest genus is Pittosporum containing 70 species The relationship of the family is doubtful. Though in the past supposed by different authors to be related to the Celastraceæ, Polygalaceæ, Caryophyllaceæ, Rutaceæ, Saxifragaceæ, Ericaceæ. and so on, it is, according to Pax, most closely related to the Saxifragaceæ.

The Pittosporaceæ all contain resinous aromatic bitter material in organized resin-canals or chambers. These give the fruit a disagreeable flavor. In spite of this disagreeable taste, it is said (Lemaout and Decaine) that, "The natives of Australia, who to appease their hunger are reduced to filling their stomachs with clay mixed with organic detritus, eagerly devour the fleshy fruits of this family."

Most of the genera are in cultivation· Bellardiera; Bursaria, a spiny shrub; Hymenosporum, a shrub with yellow flowers, Pittosporum (Pittosporum, Karo, Tawhiwhi, Tarata, Tobira), evergreen, fragrant shrubs; Sollya (Australian Bluebell Creeper).

98 **Cunoniaceæ** (from the genus *Cunonia*, named after John Christian Cuno, an Amsterdam botanist of the 18th century) CUNONIA FAMILY. Fig 27 Trees or shrubs: leaves opposite or whorled, simple, ternate or pinnate: flowers small, densely crowded, usually bisexual, hypogynous, sepals 4–5, rarely 6, usually valvate, petals 4–5, small, usually wanting; stamens twice as many as the sepals, rarely just as many or more numerous, exserted, attached near the edge of an intrastaminal disk, ovary mostly 2-celled, superior; ovules numerous, rarely few, styles 1–2; stigmas 2. fruit usually a capsule, rarely a drupe or nut.



27. CUNONIACEÆ 1 Cunonia, *a*, flower, *b*, floral diagram BRUNIACEÆ 2 Brunia, *a*, flower branch, *b*, flower HAMAMELIDACEÆ 3 Hamamelis, *a*, flower, *b*, floral diagram, *c*, fruit 4 Liquidambar, fruit

Nineteen genera and 120 species are known, 70 species of which belong to Weinmannia; all of South America or the Australian region, except one in South Africa.

The family is closely related to the Saxifragaceæ, with which it was formerly united, but because of the uniform floral structure and the position of the leaves, as well as the geographical distribution, it is now treated as distinct.

The wood of some species is useful; otherwise the Cunoniaceæ are of little economic importance *Acrophyllum venosum*, an Australian evergreen shrub, is cultivated in greenhouses

99. **Bruniaceæ** (from the genus *Brunia*, named in honor of Cornelius Brun, a traveler in the East). BRUNIA FAMILY Fig 27. Heath-like shrubs· leaves alternate· flowers bisexual, regular, epigynous; sepals 4–5, imbricated, petals 4–5, imbricated, stamens 4–5,

alternating with the petals, free or united with the petals, or with each other, rarely an intrastaminal disk present; ovary inferior, 1–3-celled; ovules 1–2 in each cell: fruit dry, indehiscent, or capsular.

Twelve genera and about 50 species occur, all natives of South Africa. The family is related to various families of the Saxifrage group, as for instance, the Hamamelidaceæ, but is distinct because of its heath-like habit The flowers are mostly in dense heads

The family is of no economic importance. One species of Audouinia (*A capitata*) is said to be sometimes in cultivation as *Diosma capitata*

100 **Hamamelidaceæ** (from the genus *Hamamelis*, an ancient Greek name applied to some tree). WITCH-HAZEL FAMILY Fig 27 Trees or shrubs leaves simple, alternate. flowers unisexual or bisexual, hypogynous, perigynous or epigynous; sepals 4–5; petals 4–5, or 0; stamens 4–5, rarely more, sub-ovarian disk rare, ovary 2-celled; ovules 1 or several in each cell. fruit a woody, 2-valved capsule, with a separating inner layer of different texture, seeds often winged

Twenty genera and 50 species are known, widely distributed in subtropical or warm temperate regions of both hemispheres It is an ancient family more abundant in former ages, related to the Saxifragaceæ, and by some considered related to the Cornaceæ or Araliaceæ. Many fossil species are known The peculiar fruit is distinctive

In some genera, as in Hamamelis, the seeds are forcibly expelled when the fruit opens, often to a distance of 10 feet or more, much as wet apple seeds may be shot from between the thumb and finger.

The family is of little economic importance Extract of the bark of Hamamelis is used as a liniment (witch-hazel) The twigs are supposed to have supernormal properties, especially in the detection of water in the earth They are frequently used in rural districts in the attempt to detect underground springs. *Liquidambar Styraciflua* (sweet gum), of the southern United States, yields a balsam The oriental balsam, Styrax, is obtained from the eastern *L. orientalis*. This was formerly used in medicine.

Perhaps half the genera are in cultivation, all for ornamental purposes Of these, Fothergilla, Corylopsis Hamamelis, and Liquidambar are the best known. Most of the species are hardy

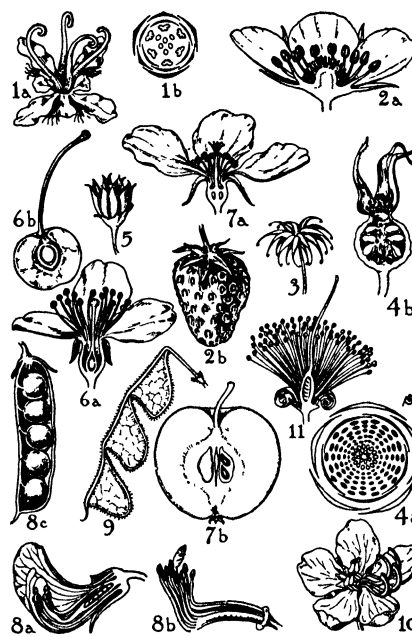
101 **Platanaceæ** (from the genus *Platanus*, the ancient name of the tree, signifying *broad*) PLANE-TREE FAMILY Fig 28 Trees with alternate, broad, palmately veined leaves. flowers in dense heads, monœcious, regular, perigynous, sepals usually 3–8, separate, thick, often with bracts at the base, petals of the same number, glabrous, stamens of like number alternating with the petals, connective peltate at the top; extra staminodia often present; carpels several, distinct, 1-seeded. fruit a caryopsis, angled from pressure, and truncate at top, surrounded by long hairs at the base; seed orthotropous.

A single genus and about 6 species are distributed in southern Europe, southern Asia, and in North America. The family is related to the Saxifragaceæ and Hamamelidaceæ The polypetalous perigynous flower, with as many stamens as petals, the separate carpels, and especially the peculiar inflorescence and leaf, are distinctive Fossil species are known

The wood of Platanus is similar to maple and of value, but the most important use is for ornament Two species of Platanus (Plane-Tree, Buttonwood, Button Ball, Oriental Plane, Sycamore) are in cultivation in America.

102 **Rosaceæ** (from the genus *Rosa*, the ancient name of the rose) ROSE FAMILY. Fig 28. Herbs, shrubs, or trees, often thorny, sometimes climbing leaves alternate, rarely opposite flowers bisexual, rarely unisexual, usually regular, perigynous; calyx of 4–5 imbricated or valvate sepals; corolla of as many imbricated petals, or 0; stamens 5 to many, in whorls of 5, borne on the cup of the receptacle at some distance from the carpels; cup lined with a glandular disk; carpels 1 to many, separate and superior or united and inferior, ovaries 1 to several-ovuled; styles as many as the carpels. fruit a follicle, achene, drupe, pome, or hip: seeds usually exalbuminous

There are about 90 genera and 1,500 species, widely distributed in all parts of the world, most abundant, perhaps, in the temperate regions The largest genera are Rubus, 180–200 species, Potentilla, 200 species; and Rosa, 100 species. The family is related to the Saxifragaceæ and the Leguminosæ, also to the Calycanthaceæ The perigynous flower with cup lined by the glandular disk, the numerous cyclic stamens, and



28 PLATANACEÆ· 1 Platanus, *a*, flower, *b*, floral diagram ROSACEÆ 2 Fragaria, *a*, flower, *b*, fruit 3 Geum, fruit 4 Rosa, *a*, floral diagram, *b*, fruit 5 Spiræa, fruit 6 Prunus, *a*, flower, *b*, fruit. 7. Pyrus, *a*, flower, *b*, fruit LEGUMINOSÆ 8. Pisum, *a*, flower, *b*, flower, petals removed, *c*, fruit 9 Desmodium, fruit 10. Cassia, flower. 11. Acacia, flower

the separate, usually cyclic, carpels, are distinctive. The Ranunculaceæ is similar, but acyclic and hypogynous.

The family is divided into 6 very distinct subfamilies, some of which, by certain authors, are considered of family rank, as follows: I Fruit follicular, e g, Spiræa, Physocarpus, Aruncus, Sorbaria, and so on II Ovary compound, inferior: fruit fleshy, e g., Pyrus, Cratægus, Cotoneaster, Cydonia, Amelanchier, Mespilus, and the like III Fruit of achenes or separate drupelets, e g, Rubus, Fragaria, Potentilla, Geum, Cercocarpus, Ulmaria, Alchemilla, Agrimonia, Sanguisorba, and Rosa. IV Carpels connate, and adnate to the hollow, but dry, receptacle, e g, Neurada and Grielum. V. Carpel 1, superior: fruit a drupe: style terminal, e g., Prunus. VI. Same as the last, but

tyle basal and flowers often irregular, e.g, Chrysobalanus.

The fruitlets of Rubus have a fleshy ovarian wall and are drupelets The strawberry has a fleshy receptacle with dry achenes scattered upon it. The rose fruit consists of a hollow, fleshy receptacle bearing achenes on its inner face, that of Pyrus is similar, but the receptacle and carpels have grown together into one structure. The peach, cherry, and plum are each the product of one superior carpel.

The following plants are cultivated for their fruits. Apple, pear, quince, cherry, plum, apricot, peach, almond, raspberry, blackberry, strawberry, and medlar These fruits are eaten fresh, preserved in sugar, or fermented into vinegar or cider Rose fruits are also preserved, and the fruits of mountain ash are used for making a spirituous drink The petals of *Rosa damascena* and *R. gallica* are macerated with oil of sesame to form attar of roses The petals themselves yield oil of rose, from which rose-water is made. Many species have been used in medicine, e g, rose, the seeds of which are vermifugal Quince seeds contain mucilage and are emollient The conserve of rose is astringent Agrimony is nephritic, and is also used for pulmonary catarrh and angina Alchemilla is astringent and vulnerary. The root of Fragaria is diuretic and astringent Flowers of *Hagenia abyssinica* are a famous remedy or tapeworm Flowers of Ulmaria are used to give a bouquet to wine, also as a sudorific and cordial The bark of *Prunus serotina* (wild cherry bark) is tonic and pectoral. The bark of *Quillaja Saponaria* (soap-bark tree) of Chile, is a stimulant, diuretic and irritant, contains saponin, and is used for washing delicate fabrics Gummy exudations from the bark of cherry are sometimes used in medicine Sanguisorba has been used for forage, and as a condiment The seeds of many species of Prunus and others yield oil in quantity

Fifty or sixty genera are cultivated in America. Among these are Agrimonia (Agrimony), Alchemilla (Lady's Mantle), Amelanchier (Shadbush, Juneberry, Service-berry), Aronia (Choke-berry), Aruncus, Cercocarpus; Chrysobalanus (Cocoa Plum), Comarum (Marsh Cinquefoil); Cotoneaster, Crataegus (Hawthorn, Scarlet Thorn, Washington Thorn); Eriobotrya (Loquat, Japan Plum), Exochorda (Pearl Bush), Fragaria (Strawberry), Geum (Avens), Gillenia or Porteranthus (American Ipecac, Bowman's Root), Holodiscus or Schizonotus, Kerria (Globe-flower, Japanese Rose); Margyricarpus (Pearl Fruit), Mespilus (Medlar, Mespil); Neviusia (Snow Wreath), Photinia (Toyon, Tollon); Physocarpus (Ninebark), Potentilla (Cinquefoil, Five-finger, Silver-weed), Pyracantha, Pyrus (Pear, Apple, Crab), Quillaja (Soap-bark Tree); Raphiolepis (Indian Hawthorn), Rosa (Rose, Eglantine, Sweetbrier); Rubus (Bramble, Blackberry, Raspberry, Cloudberry, Baked-apple Berry, Yellow Berry, Salmonberry, Wineberry, Blackcap, Thimbleberry, Dewberry); Sanguisorba (Burret); Sorbaria; Sorbus, (Mountain Ash, Rowan Tree, Dogberry, Service Tree, White Beamtree); Spiraea (Queen of the Meadows, Meadowsweet, Hardhack, Steeple-bush, Bridal Wreath); Ulmaria (Meadowsweet, Queen-of-the-Prairie, Queen-of-the-Meadows); Waldsteinia (Barren Strawberry, Yellow Strawberry).

103. **Leguminosæ** (from *legume*, the name of the type of fruit characteristic of this family) PEA FAMILY. Fig 28. Herbs, shrubs, or trees, often twining leaves alternate, compound, rarely simple· flowers regular or irregular, usually bisexual, hypogynous or perigynous, fundamentally polypetalous; sepals 5, more or less connate, often unequal; petals 5, rarely fewer, nearly equal, or unequal, or more commonly papilionaceous (i. e, 1 dorsal standard, 2 lateral cleaver-shaped wings, and 2 ventral, more or less connate, petals forming the keel); stamens 10 or very numerous, rarely 5, included or exserted, often inserted around a glandular disk, monadelphous, 9 united and 1 separate, or all separate; carpel 1, rarely 2–15, superior; ovary 1-celled, inequilateral, the single parietal placenta ventral but turned dorsally, ovules 1 to many fruit a legume, or, by reduction, indehiscent, or follicular, or fleshy, often jointed between the seeds, and sometimes filled with pulp, seeds exalbuminous

Leguminosæ contains 429 genera and about 7,000 species, distributed over the whole earth, but most abundant in the tropics. This family and the Orchidaceæ are, next to the Compositæ, the largest families of flowering plants The large genera which contain 100 or more species are Astragalus, 1,200 species, Acacia, 450 sp , Cassia, 380 sp , Mimosa, 300 sp , Crotolaria, 250 sp , Indigofera, 250 sp.; Trifolium, 250 sp , Bauhinia, 150 sp ; Aspalanthus, 150 sp ; Oxytropus, 150 sp ; Desmodium, 150 sp , Inga, 140 sp ; Tephrosia, 120 sp , Vicia, 120 sp , Pithecolobium, 110 sp , Lupinus, 100 sp , Psoralea, 100 sp , Dalea, 100 sp , Lathyrus, 100 sp , Rhynchosia, 100 sp ; and Phaseolus, 100 sp Taken in the broad sense, the family is a very natural one, the nearest relatives being the Chrysobalanus section of the Rosaceæ The most constant distinguishing character is the leguminous type of fruit When this occasionally varies, the papilionaceous corolla, or the general Mimosa type of flower, is distinctive Except in the fruit, the family is very diverse, and the following sub-families have often been treated as distinct families

Sub-family I Mimosæ —Flowers regular; corolla valvate, stamens 5–10, or very numerous, exserted. e g, Pithecolobium, Albizzia, Mimosa, and Acacia

Sub-family II Cæsalpineæ —Flowers irregular, not papilionaceous, stamens 10 or fewer, not conspicuously exserted, corolla imbricated e g, Copaiba, Tamarindus, Cercis, Bauhinia, Cassia, Gleditsia, Gymnocladus, Cæsalpinia, and the like

Sub-family III Papilionateæ —Corolla papilionaceous, imbricated; stamens 5–10, included e g, Pisum, Lathyrus, Robinia, Vicia, Phaseolus, and so forth

The leaves of many Leguminosæ are motile *Mimosa pudica*, *Cassia nictitans*, and others, are sensitive to touch, the leaflets, and often the leaves, quickly drooping when disturbed A great number show sleep movement, the leaflets drooping at nightfall The motile organ is the pulvinus at the base of the leaflet or leaf The lateral leaflets of *Desmodium gyrans* are rhythmically and spontaneously motile The pollination of the papilionaceous flowers is complicated and interesting (See Kerner and Oliver's "Natural History of Plants") The legumes of Desmodium separate into 1-seeded joints which are covered with hooked hairs, and, therefore, bur-like The roots of the Leguminosæ commonly bear tubercles containing nitrogen-fixing organisms, the product of which is used by the plant

The economic plants are almost innumerable. The following are the most important.

Plants used for food· *Detarium senegalense* of Senegambia, edible drupe, *Castanospermum australe* (Australian chestnut), *Dolichos Lablab* (black bean), *Phaseolus vulgaris* (bean), *Cicer arietinum* (chick pea), *Pisum sativum* (pea), *Ervum Lens* (lentil) and Lupinus sps, all have edible seeds, *Apios tuberosa*, *Psoralea hypogæa*, and *P. esculenta*, edible tubers; *Arachis hypogæa* (peanut), and *Voandzeia subterranea*, subterranean seeds; *Lathyrus tuberosa*, sugary tubers, much used before potatoes were known; and *Cytisus scoparius*, buds used as capers.

Plants used as forage: *Ceratonia Siliqua* (St. John's bread), *Onobrychis sativa* (sainfoin), *Vicia sativa* (vetch), *Medicago sativa* (alfalfa), *Medicago lupulina* (medick), *Trifolium* species (clover), *Glycine hispida* (soy bean), *Vigna Catjang* (cowpea), *Lotus corniculatus*, Lupinus sps, *Anthyllis Vulneraria*, *Hedysarum coronarium*, *Ornithopus sativus*, *Pisum sativum*, *Ulex europæus*

Plants used for medicine: *Acacia Senegal* (gum acacia); *A Catechu* (catechu), astringent, tonic; *Swartzia tomentosa*, sudorific; *Copaiba Langdorfii* (balsam of Copaiba), of Brazil, for catarrh, Cassia sps, Orient, India, etc., leaves purgative; *Tamarindus indica* (tamarind), pulpy pods used; *Sophora tomentosa*, India, seeds arrest choleric vomiting, *Toluifera Balsamum* (balsam of Tolu), South America, bronchial; Andira sps, tropical America, emetic, purge, narcotic, vermifuge; *Pterocarpus Draco* (dragon's blood), West Indies, astringent; *P. Marsupium* (gum kino), *Butea frondosa* (eastern kino), Asia, *Mucuna pruriens* (cowitch or cowage), India, stinging hairs on pod, anthelmintic, *Astragalus gummifer* (gum tragacanth), of the Orient; *Colutea arborescens* (bladder senna), purgative, emetic; *Glycyrrhiza glabra*, (licorice), Europe, emollient, *Genista tinctoria*, purgative; *Cytisus scoparius*, diuretic, *Trigonella Fœnum-græcum* (fenugreek), Old World, food, condiment, horse-remedy, and so on; *Anagyris fœtida* (stinking wood), purgative and poisonous, *Physostigma venosum* (calabar bean), sedative, contracts the pupil, poisonous; Astragalus sps, and Crotalaria sps are loco-weeds, and poisonous to cattle; arrow-poisons are furnished by Erythrophlœum, Afzelia, and Pithecolobium Fifteen genera furnish fish-poison

Dye-stuffs *Cæsalpinia echinata* yields braziline; *Sophora japonica* yields yellow dye, *Indigofera tinctoria* yields indigo, *Genista tinctoria*, yields a dye; *Hæmatoxylon campechianum* yields logwood and hæmatoxylin *Pterocarpus santalinum* yields red sandalwood, a brown dye

Other purposes Copal varnish from Hymenæa sps, Trachylobium sps, and Copaiba sps Many species are valuable timber trees A snuff-perfume is obtained from seeds of Coumarouna (tonka bean) Rosewood is from *Dalbergia nigra*, and other species African rosewood is from *Pterocarpus erinaceus* Red seeds of *Abrus precatorius* (jequirity) are used for necklaces, as are also those of *Adenanthera Pavonina* (Circassian seeds). Branches of *Cytisus scoparius* (broom) are used for basket-work. *Ulex europæus* (furze) is used as firewood in France Many species furnish fibers for spinning Oil is obtained from seeds of peanut and others. Many are ornamental

About 150 genera are cultivated in America, or are important to American agriculture Many of the species are among our most valuable ornamental and food-plants Some of these genera are Abrus (Crab's-eye Vine, Weather Plant); Acacia (Wattle, Kangaroo Thorn, Weeping Myall, Australian Blackwood, Mulga, Popinac, Opopanax, Cassie, Huisache, Espino, Cavan, Gum Arabic Tree); Adenanthera (Red Sandalwood); Albizzia; Alhagi (Camel's Thorn), Amphicarpæa (Hog Peanut); Amorpha (Lead Plant, Bastard Indigo), Anthyllis (Kidney Vetch, Sand Clover, Woundwort, Jupiter's Beard); Apios (Groundnut, Wild Bean); Arachis (Peanut, Goober); Astragalus (Milk Vetch); Baptisia (Wild Indigo), Bauhinia (Mountain Ebony), Cæsalpinia (Brasilleto, Barbadoes Pride, Barbadoes Flower-fence, Dwarf Poinciana); Canavalia (Jack Bean, Chickasaw Lima); Caragana (Pea Tree); Cassia (Wild Senna, Partridge Pea, Pudding Pipe Tree); Centrosema (Butterfly Pea); Cercis (Judas Tree, Red Bud), Chorizema; Cicer (Chick Pea), Cladrastis (Yellow-wood); Chanthus (Glory Pea, Glory Vine, Parrot's Bill); Clitoria (Butterfly Pea); Colutea (Bladder Senna), Coronilla (Crown Vetch, Scorpion Senna), Crotalaria (Rattle-Box), Cytisus (Broom, Genista); Desmodium (Tick Trefoil, Telegraph Plant); Dolichos (Hyacinth Bean, Taukok, Black Bean), the species still much confused; Erythrina (Coral Tree); Galega (Goat's Rue); Genista (Dyer's Greenwood); Gleditsia (Honey Locust, Sweet Locust, Three-thorned Acacia); Glycine (Soy Bean); Glycyrrhiza (Licorice); Gymnocladus (Kentucky Coffee Tree); Halimodendron (Salt Tree); Hedysarum (French Honeysuckle); Hosackia, Indigofera (Indigo); Kennedya, Laburnum (Golden Chain, Bean Tree, Scotch Laburnum), Lathyrus (Sweet Pea, Tangier Scarlet P, Pride of California, Everlasting P, Two-flowered P., Flat P, Perennial P, Lord Anson's P, Marsh P, Sea P, Beach P, Prairie Vetchling, Black P., Black Bitter Vetch, Spring Bitter Vetch), Lens (Lentil); Lespedeza (Bush Clover, Japan Clover, Hoopkoop), Leucæna (White Popinac); Lotus (Bird's-foot Trefoil, Babies' Slippers, Winged Pea), Lupinus (Lupine, Sundial, Deer Cabbage), Millettia (Ironwood); Medicago (Alfalfa, Lucerne, Black or Hop Medick, Nonesuch, Snails, Tree Alfalfa, Moon Trefoil), Melilotus (Sweet Clover), Mimosa (Sensitive Plant, Humble Plant), Mucuna (Cowitch, Cowage, Velvet Bean, Banana Bean), Onobrychis (Sainfoin, Holy Clover); Ononis (Rest-Harrow, Goat Root), Parkinsonia (Jerusalem Thorn); Parochetus (Shamrock Pea, Blue Oxalis), Petalostemon (Prairie Clover), Phaseolus (Bean, Caracol, Snail-flower, Corkscrew Flower, Scarlet-runner, Dutch Caseknife B, Metcalfe B, Moth B, Gram, Silva B., Civet B, Lima B, Kidney B, Bush B); Piscidia (Fish-poison Tree, Jamaica Dogwood), Pisum (Garden Pea, Field P), Pithecolobium, Prosopis (Mesquite, Screw Bean, Tornillo), Poinciana (Royal Poinciana, Peacock Flower, Flomboyant), Psoralea (Scurfy Pea, Pomme Blanche), Pueraria (Kudzu Vine), Robinia (Locust, False Acacia, Black Locust, Rose Acacia, Clammy Locust), Schrankia (Sensitive Brier); Sophora (Japan Pagoda Tree); Spartium (Spanish Broom); Sutherlandia (Bladder Senna), Swainsona (Winter Sweet Pea); Tamarindus (Tamarind); Templetonia (Coral Bush); Tephrosia (Goat's Rue, Catgut, Wild Sweet Pea, Hoary P.); Thermopsis, Trifolium (Clover, Alsike, Cowgrass); Trigonella (Fenugreek), Ulex (Gorse, Whin, Furze), Vicia (Vetch, Tare, Broad Bean, Windsor B, English Dwarf B); Vigna (Cowpea, Black Pea, China Bean), Wistaria (Chinese Wistaria, Kidney-bean Tree).

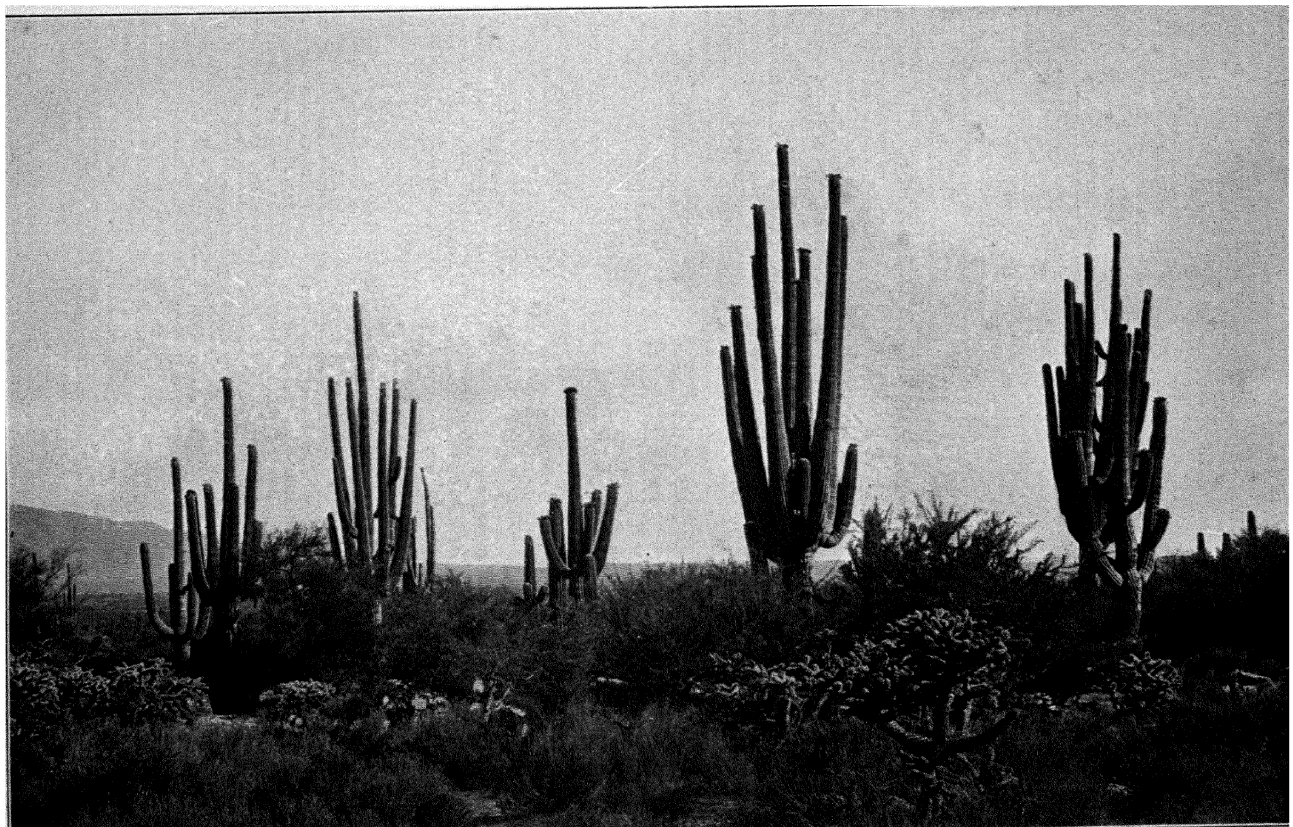
Order 38. Geraniales

104 **Geraniaceæ** (from the genus *Geranium*, Crane's-bill, from *geranos*, a crane, in allusion to the cranelike beak of the fruit) Geranium Family. Fig 29 Herbs and shrubs, sometimes fleshy· leaves opposite or alternate, very diverse flowers bisexual, regular or slightly irregular, sepals 5, imbricated, persistent; petals 5, rarely fewer, imbricated or convolute; stamens usually 10, rarely more, hypogynous or perigynous, the outer set opposite the petals, some frequently antherless, somewhat monadelphous below, often glandular at the base, carpels 5, ovary 5-celled, rarely 2–3-celled, 5-lobed, prolonged into a beak terminatd by the 5 styles; ovules 1 to many in each cell fruit rarely a capsule, more commonly splitting into 5 beaked sections, seeds with endosperm, straight or curved

The family has 10 genera and 360 species, widely distributed over the whole globe The largest genera are Pelargonium (South Africa) with 175 species, and Geranium with 160 species. Some fossil fruits of Geraniaceæ are known. The Geraniaceæ are related to the Oxalidaceæ, Tropæolaceæ and Balsaminaceæ, also to the Linaceæ and Rutaceæ The 5 sepals and petals, the 10 stamens, the 5 carpels, and the more or less beaked or lobed fruit with its peculiar dehiscence, are together distinctive

The flower of Pelargonium is slightly irregular, with a dorsal receptacular spur at the base of the calyx The fruits of all but 40 Geraniaceæ dehisce elastically, throwing the seeds to a distance. The 5 carpels split away at base, coil up violently, and remain attached to the summit of a column which projects from the receptacle This method of dehiscence, when present, is characteristic of the Geraniaceæ.

The Geraniaceæ are astringent, several contain resin, and others contain free acids Several species of



III. Desert vegetation.—The giant cactus (Carnegiea gigantea); also bushes of Opuntia fulgida, and in the foreground the low fine growths of Bigelovia Hartwegii.

Geranium have been used as remedies for wounds, others for dysentery, and the like, some have been used as stimulants. *Erodium moschatum* is valued because of a very strong odor of musk The resinous stems of Monsonia (South Africa) burn readily, and have been used for torches The most important economic genus is Pelargonium, cultivated for ornament The foliage of some Pelargoniums is glandular and very fragrant ("rose geraniums") Some species of Geranium also are ornamental The awn-like beak of Erodium fruits have been used as hygrometers

Few genera are in cultivation in America as ornamental plants Erodium (Stork's-bill), Geranium, (Crane's-bill), Pelargonium (so-called "Geraniums") Several cultivated genera, formerly included in the Geraniaceæ, are now placed in separate families, which see, e g , Impatiens (Balsaminaceæ), Tropæolum (Tropæolaceæ), Oxalis and Averrhoa (Oxalidaceæ)

105 **Oxalidaceæ** (from the genus *Oxalis*, signifying *acid*, from the sour taste of the foliage) OXALIS FAMILY Herbs, rarely shrubby leaves usually compound. flowers bisexual, regular, sepals 5, persistent, imbricated, petals 5, convolute or imbricated, rarely united at the base, stamens 10 in 2 whorls, the outer set opposite the petals, filaments coherent below, those of the outer set shorter, one or both sets with external glandular appendages at the base, hypogynous, ovary superior, 5-celled, with a persistent central column (as in Geraniaceæ), styles separate fruit an ordinary capsule with each cell dorsally dehiscent, or a berry

The Oxalis family contains 7 genera and about 230 species, of which 220 belong to the genus Oxalis They are mostly of tropical and subtropical distribution. Oxalis occurs chiefly in South Africa and South America The Oxalidaceæ were formerly united with the Geraniaceæ, but differ in the fruit, which is a dehiscent capsule or a berry and does not break up into separate carpels

The species of Oxalis are often bulbous or tuberous, or the roots are enlarged as water-storage tissue The leaflets usually have a sensitive cushion at the base (pulvinus) and show sleep-movements The flowers of many are dimorphic or trimorphic, i e , have stamens or styles of 2 or 3 lengths in the same species The seeds are forcibly ejected through the dorsal suture of the capsule by the elastic separation of the outer layer of the testa

Oxalis contains much oxalic acid, which may be extracted for economic purposes It is somewhat sedative, and the sour taste has made some species useful as salads The starchy roots of some South American species are used for cattle-fodder The fruits of Averrhoa are used in the tropics as a substitute for gooseberries, which they resemble in flavor

Two genera are grown in America Averrhoa (Carambola), 1 species grown for shade and fruit, and Oxalis.

106 **Tropæolaceæ** (from the genus *Tropæolum*, from *tropaion*, a trophy, the leaves are shield-like, and the flowers resemble a helmet) NASTURTIUM FAMILY Fig 29 Diffuse or climbing succulent herbs with alternate, peltate or lobed leaves flowers bisexual, irregular, spurred; sepals 5, imbricated, petals 5, imbricated, the upper two differing in shape from the lower three; stamens 8, separate, somewhat perigynous, ovary superior, 3-celled, 3-lobed, each cell 1-seeded, style 1; stigmas 3 fruit splitting into 1-seeded, indehiscent nutlets or drupelets.

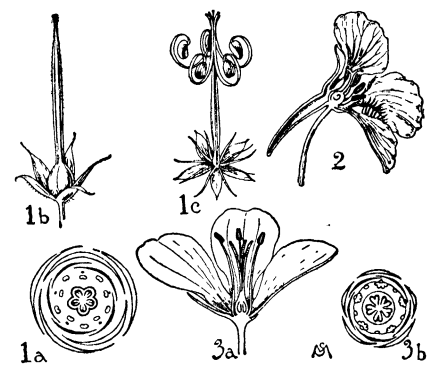
A single genus of about 35 species is found in the mountainous regions from Mexico to Chile The family was formerly included in the Geraniaceæ, but is distinguished by its separate stamens, its indehiscent fruitlets, and a very peculiar method of embryo development, in which the suspensor divides into three parts, one part growing into the placenta, another out into the ovarian cavity, and the third producing the embryo on its apex. The spur of the flower is an outgrowth of the obliquely cup-shaped receptacle at the base of the calyx, as in Pelargonium

The herbage of Tropæolum has an acrid taste like cress, and is often used for salad, hence the common name "nasturtium" or "Indian cress."

In America, several species are grown for their showy flowers *Tropæolum majus* is the most widely known species *T peregrinum* is the "canary-bird flower"

107 **Linaceæ** (from the genus *Linum*, the Latin name for flax, from the old Celtic *llin*, a thread) FLAX FAMILY Fig 29 Woody or herbaceous plants leaves alternate or opposite, rarely whorled, simple, entire flowers bisexual, regular, calyx of 5, persistent, imbricated sepals, rarely 4-parted, with 3-fid lobes, petals 5, rarely 4, convolute, clawed, the claw sometimes crested, stamens 5, alternate with the petals, with sometimes 5 additional staminodia, or 10, 15, or 20, hypogynous, usually united at the often glandular base, ovary 5-, rarely 3- or 4-, celled or falsely 10-celled by the intrusion of the midrib, ovules few, styles as many as the cells of the ovary fruit a capsule or drupe

There are 9 genera and about 120 species, of which 90 species belong to Linum The Linaceæ are related to



29 GERANIACEÆ 1 Geranium, *a*, floral diagram, *b*, fruit, *c*, fruit dehiscing TROPÆOLACEÆ 2 Tropæolum, flower LINACEÆ 3 Linum, *a*, flower, *b*, floral diagram

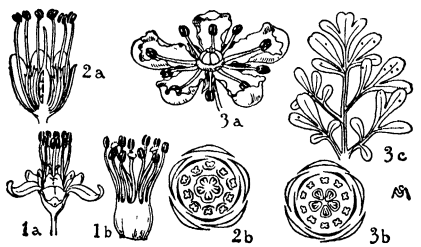
the Geraniaceæ and Oxalidaceæ, but also show a relation to the Silenes in the Caryophyllaceæ The many-stamened genera suggest the Ternstrœmiaceæ The family is most easily recognized by the simple, regular pattern of the flower, and the numerical plan of 5 (or 4) which is carried through all the floral parts For this reason, the flax was taken by the older botanists as a pattern flower.

Linum catharticum (Europe) was formerly used as a purgative A fixed oil is extracted from the seeds of the common flax (*Linum usitatissimum*), which is used in medicine as an emollient The most extensive use of this oil is in painting, its value being due to the property of drying into a hard, waterproof coating Flaxseed meal, from which the oil has been expressed, is used for fodder and for poulticing The seed-coats of flax become very mucilaginous when soaked, on which account flaxseed has also been used as an emollient in the treatment of coughs and colds The cortical bast-fibers of the flax have been used since earliest times in textile industries As the basis of linen cloth, flax is one of the most useful of cultivated plants Flax was probably Asiatic in its origin Many species of Linum are ornamental, but are little grown.

Two genera are cultivated in America· Linum, with species of annual garden plants; and Reinwardtia, with species of conservatory sub-shrubs from India.

108 **Erythroxylaceæ** (from the genus *Erythroxylon*, the name signifying *red wood*, the wood of some species being red). COCA FAMILY Fig 30 Shrubs and small trees. leaves alternate flowers bisexual, regular, inconspicuous, sepals 5, persistent, imbricated or valvate; petals 5, convolute or imbricated, with appendages on the inner face, or with projecting callosities, stamens 10, in 2 whorls, more or less connate into a tube, and externally glandular, ovary 3–4-celled, usually but 1 cell developing in fruit, 1–2 ovules in each cell; styles 3–4. fruit drupaceous, 1–2-seeded.

Two genera and about 90 species are known; all tropical, and reaching their greatest development in



30. ERYTHROXYLACEÆ 1 Erythroxylon, *a*, flower of *E pulchrum*, *b*, flower, perianth removed, of *E Coca* ZYGOPHYLLACEÆ 2 Zygophyllum, *a*, flower, *b*, floral diagram RUTACEÆ 3 Ruta, *a*, flower, *b*, floral diagram, *c*, leaf.

tropical South America, but extending northward to Mexico and southward in the Old World to Natal The family is closely related to the Linaceæ with which it was formerly united, but differs in the more prominent stamen-tube, the appendages on the petals, and the drupaceous non-capsular fruit

The only important economic plant is the coca plant (*Erythroxylon Coca*), a shrub famous as the source of cocaine Its origin is unknown, but it was early used by the Peruvians as a stimulant Coca is now grown to a limited extent in southern Florida and southern California, as well as in most tropical countries

109. **Zygophyllaceæ** (from the genus *Zygophyllum*, derived from the Greek signifying a *yoke* and *leaf*, the leaflets are in pairs) CALTROP FAMILY Fig 30 Herbs, shrubs, or trees leaves opposite, rarely alternate, mostly pinnately compound. flowers bisexual, regular, rarely irregular, sepals 4–5, persistent, imbricated or rarely valvate; petals 4–5, rarely 0, imbricated, rarely valvate; disk present, diverse, rarely wanting, stamens usually 8 or 10, hypogynous, the outer opposite the petals, usually scales at the base of the filaments, ovary superior, 4–5-celled, rarely falsely many-celled, ovules 2 to several in each cell, style and stigma 1 fruit a capsule or separating into fruitlets

Twenty-one genera and about 150 species occur as natives of the warmer parts of the world, especially the drier desert regions They are especially abundant in North Africa and the Mediterranean region This family is very closely related to the Rutaceæ, from which it differs in the absence of glandular dots and oil, and in the presence of stipules The fruits are usually more or less lobed and sometimes winged or covered with prickles

The hard, faintly aromatic wood (lignumvitæ) of *Guaiacum officinale* is used for cabinet work and for pulleys The wood of this plant yields a resin used as a diaphoretic and purge The flower-buds of one species of Zygophyllum are used in place of capers.

The Arabs use *Z simplex* to remove freckles. The fetid smell of this plant is so strong that even camels are said to reject it. Soda is obtained from species of Nitraria, which inhabit alkaline soil.

Guaiacum officinale is sometimes grown in southern Florida and southern California for ornament. Zygophyllum may be in cultivation

110 **Rutaceæ** (from the genus *Ruta*, the ancient name) RUE FAMILY. Fig 30 Herbs, shrubs, trees: leaves usually alternate, simple or variously cut or compound, usually with pellucid dots flowers bisexual, usually regular, sepals 4–5, often coherent, imbricated, petals 4–5, imbricated or valvate, usually separate; stamens 8–10, rarely 15, inserted at the base of a thick disk, usually distinct; ovary superior, 2–5-lobed, 2–5-celled, each cell 1 to many-ovuled, raised on a prolongation of the receptacle, a glandular disk at its base, styles usually connate. fruit a capsule opening by valves, or fleshy and indehiscent, or separating into fruitlets, rarely winged.

Rutaceæ contains over 100 genera and about 900 species, mostly of tropical countries but extending into temperate parts of Europe and America Fagara, with more than 130 species, is the largest genus The Rutaceæ are related to many of the Geranium group, especially to Simarubaceæ, Zygophyllaceæ, and Meliaceæ The transparent dots in the leaves, the numerical plan, and especially the lobed ovary raised on the disk or stalk, are together distinctive The disk is often much developed and very diversely constructed The outer stamens are usually opposite the petals, not alternate with them as might be expected In some cases the carpels are entirely free below and united only by the styles or stigmas The seeds, except in the berry fruits, are only 1 or 2 The great development of oil-glands containing a fragrant oil is one of the most characteristic features of the family These glands are produced on all parts of the plant, even on the floral parts and surface of the fruits The orange and lemon are examples of Rutaceæ with berry fruits, and they are widely cultivated and perplexingly variable

The volatile oil of the Rutaceæ has been used to some extent for medicine and also for perfumery Extract of rue has been used as a vermifuge The Romans used rue as a condiment Some species of rue are so pungent as to produce a poisoning of the skin similar to that produced by poison ivy The volatile oil is so copious in Dictamnus as to ignite readily Several species of Barosma (buchu) are tonic and diuretic The genus Citrus is the most useful It includes the orange, the bitter orange, the citron, the lemon, the lime, the grape-fruit, the kid-glove orange or tangerine, and the bergamot from the rind of which bergamot oil is manufactured, used in perfumery The bark of the prickly shrub, Zanthoxylum, is sometimes used as a tonic The seeds of some species of Zanthoxylum are used to poison fish

In cultivation in America or worthy of trial are 20 to 30 genera, used mostly for ornament and fruit. Among these are· Adenandra (Breath of Heaven); Ægle (Bael Fruit, Bengal Quince); Atalantia, Balsamocitrus (African Bael-Fruit); Calodendron (Cape Chestnut); Casimiroa (White Sapota), Citrus (Orange, Lemon), Dictamnus (Dittany, Gas Plant, Burning Bush), Fagara (Prickly Ash), Feronia (Wood Apple); Murraya (Orange Jessamine, Satinwood), Phellodendron (Chinese Cork Tree), Poncirus (Trifoliate Orange), Ptelea (Hop Tree), Ruta (Rue), Triphasia (Bergamot Lime, Lime Berry), Zanthoxylum (Prickly Ash, Chinese or Japanese Pepperwood, Toothache Tree)

111 **Simarubaceæ** (from the genus *Simaruba*, which is the Caribbean name of *Simaruba officinalis*) QUASSIA FAMILY. Fig. 31 Shrubs or trees leaves alternate or rarely opposite, pinnate, rarely simple, dotless flowers unisexual, regular; sepals 3–5, more or less connate, imbricated or valvate; petals 3–5, rarely 0, free or connate, variously arranged in the bud, disk prominent, very diverse, rarely 0, stamens usually twice the petals, filaments naked or with a scale; carpels 2–5, free, or

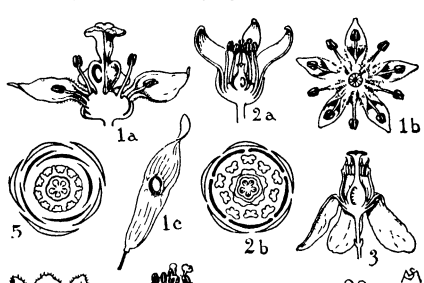
connate at the base or by the styles, or completely united into a 2-5-celled, superior ovary; each cell 1-, rarely several-, ovuled; carpels in fruit drupe-like, rarely forming a berry or samaras

About 28 genera and 140 species are generally distributed in the tropics, but extend into the temperate regions. The center of distribution is in tropical America Some fossil species are known. The family is closely related to the Rutaceæ, but differs in the absence of foliage-glands and in the presence of scales on the filaments It is also closely related to the Zygophyllaceæ

Most of the Simarubaceæ contain a bitter principle, also, sometimes, a resinous matter and an oil which is of value as a tonic *Quassia amara* of tropical America furnishes the quassia wood, famous as a bitter tonic *Picrasma excelsa*, of Jamaica, also furnishes quassia of equal quality Branches of quassia and the pulverized bitter wood of species of Simaruba are used in tropical America to drive away insects The seeds of *Simaruba Cedron* are used for the same purpose Various species are used for snake-bites The leaves and sap of species of Picramnia furnish a beautiful violet dye

Very few are in cultivation in America: Picrasma, a semi-hardy shrub, and Ailanthus (Tree of Heaven), a well-known tree

112 **Burseraceæ** (from the genus *Bursera*, named in memory of Joachim Burser, a botanist in Naples). BURSERA FAMILY Fig 31 Trees or shrubs, often very large, with usually alternate compound leaves flowers bisexual, regular, usually small and very numerous; sepals 3-5, more or less connate, imbricated or often valvate, petals 3-5, usually separate, imbricated or valvate; stamens usually twice as many as the petals, hypogynous, sometimes unequal, separate, the outer opposite the petals, disk present, annular or cup-shaped, rarely 0, sometimes adnate to the calyx, ovary superior, 2-5-celled, ovules usually 2 in each cell, style 1 or 0. fruit drupe-like with 2-5 stones or with a bony endocarp or a capsule with the epicarp opening and exposing the connate bony pits, seeds exalbuminous



31 SIMARUBACEÆ 1 Ailanthus, *a*, flower, section *b*, flower, looking in, *c*, fruit BURSERACEÆ 2 Bursera, *a*, flower, *b*, floral diagram MELIACEÆ 3 Swietenia, flower 4 Cedrela, flower 5 Melia, floral diagram MALPIGHIACEÆ 6 Camarea, flower, 7 Malpighia, floral diagram

The 16 genera and about 270 species are widely distributed in tropical regions One species of Bursera reaches Florida The family is related to the Rutaceæ and Simarubaceæ, from which it differs in the presence of resin-chambers in the bark. It is also very closely related to the Anacardiaceæ.

The family is very rich in resin and, therefore, is of considerable economic importance These resins are frequently aromatic or fragrant, hence many have been used as incense The resin myrrh is obtained from species of Commiphora of Arabia and Africa Mecca balsam is from the same genus Olibanum incense is derived from trees of the genus Boswellia, of India Frankincense is either this olibanum or the resin from *Boswellia Carteri* A substitute for dammar and copal has been obtained from the Burseraceæ.

Few species of the Burseraceæ are in cultivation in America: *Bursera Simaruba*, as an ornamental greenhouse tree, and *Garuga pinnata*, which is grown in Florida and California for the gooseberry-like fruit

113 **Meliaceæ** (from the genus *Melia*, the Greek name of the somewhat similar manna-ash). MAHOGANY FAMILY. Fig 31 Trees or shrubs leaves usually alternate, pinnate or rarely simple flowers bisexual, rarely unisexual, panicled, sepals 4-5, usually partly connate, imbricated, petals 4–5, rarely 3–8, separate, or connate or adnate to the stamens, stamens 8–10, rarely 5, or numerous, hypogynous, filaments usually connate into a tube which is entire or lacerate, rarely free, disk present; ovary superior, 2–5-celled, rarely 1- or many-celled, each cell 2-, rarely several-, ovuled, style and stigma 1 fruit a drupe, berry, or capsule

There are 42 genera and about 600 species, all confined to the tropics They enter the United States only in southern Florida Some fossil species are known The family is related to the Rutaceæ, but lacks the resin and oil-glands It is closely related to all of the disk-bearing families, but is distinguished by the peculiar stamen-tube with teeth and fringe

There is the greatest diversity in the arrangement of the anthers on the staminal tube and the dentation or fringing of the latter Very commonly there are 2 stipule-like teeth just below the anthers The seeds are sometimes winged (in mahogany) The leaves are rarely transparent-dotted (Flindersia).

Melia Azedarach, an Asiatic tree, is bitter, and has been used in medicine as a purgative and vermifuge. Other species of Meliaceæ are purgative and emetic, or are used for heartburn, and the like Some have the odor of garlic The bark of the Asiatic *Walsura piscidia* is used to stupefy fish The pulp of the fruit of *Aglaia edulis* is said to be delicious The bitter bark of mahogany has been used in place of quinine. The most celebrated member of the family is *Swietenia Mahogani* of the West Indies and Peru, which furnishes the mahogany timber of commerce The wood of the West Indian *Cedrela odorata* is fragrant, and is the so-called cigar-box cedar, from which these boxes are made The sawdust of the South African sneezewood (*Ptæroxylon obliquum*) causes sneezing, hence the popular name

Five or more genera are in cultivation in America, all confined to southern California and southern Florida, except Melia, which is common throughout the southern states, and *Cedrela sinensis*, hardy in Mass Among these are Cedrela (West Indian Cedar), Melia (Pride of India, China-berry Tree, Texas Umbrella Tree), Ptæroxylon (Sneezewood), Swietenia (Mahogany)

114 **Malpighiaceæ** (from the genus *Malpighia*, in honor of Marcello Malpighi, once professor of medicine at Pisa) MALPIGHIA FAMILY Fig 31 Trees or shrubs, most often climbing leaves usually opposite, often with petiolar glands and jointed petioles flowers commonly bisexual, usually obliquely irregular, sepals 5 mostly separate, some or all with large glands, petals 5, fringed or toothed, slender-clawed, stamens 10, in part staminodial, rarely fewer, the outer opposite the petals, hypogynous or nearly so, usually connate below, anthers very diverse and odd; ovary superior, 2–3-celled and lobed, rarely 5-celled, the cells 1-ovuled, styles 2–3, rarely connate fruit commonly separating into 2–3 nut-like portions which are entire, or pectinately winged, or naked, rarely a single nut or drupe, seeds

exalbuminous; embryo variously curved or spiral, rarely straight.

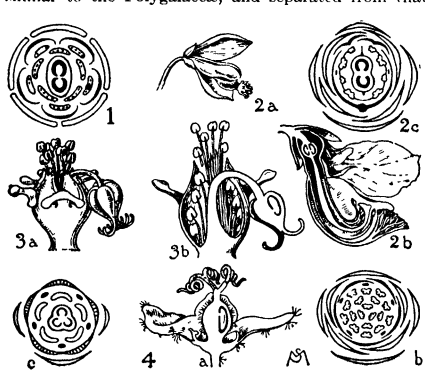
This family has 55 genera and about 650 species, generally distributed in the tropics, but reaching to Texas and California in North America, and Port Natal in Africa They are most abundant in the tropical forests of South America The family is closely related to the Zygophyllaceæ, Sapindaceæ, and Erythroxylaceæ, as shown by the lobed and winged fruit, or clawed petals. The glandular calyx, clawed petals, the outer stamens opposite the petals, peculiar anthers, queer fruit, and curved embryo are together distinctive.

The family is of little economic importance Various coloring matters and astringent tannins are contained in the bark, for which reason some of the Malpighiaceæ have been used for dysentery and intermittent fever. Some are used as a remedy for snake-bites The fruits of certain Malpighiaceæ are sour, juicy and refreshing.

Few species are in cultivation in North America, all in California, Florida or the West Indies. Galphimia and Stigmaphyllon are ornamental, *Malpighia glabra* is the Barbadoes cherry, cultivated in the West Indies for the cherry-like fruit

115 **Tremandraceæ** (from the genus *Tremandra*, which is from the Latin *tremble* and the Greek *male*, probably in allusion to the anthers) TREMANDRA FAMILY Fig 32 Shrubs or sub-shrubs, with opposite, whorled or alternate leaves. flowers bisexual, regular; sepals 4–5, rarely 3, valvate, petals of the same number as the sepals and alternating with them, colored, entire, separate induplicate-valvate, stamens 8 or 10, rarely 6, hypogynous, in 1 or 2 whorls, anthers opening by a transverse terminal valve, or more or less prolonged into a beak with terminal pores, ovary superior, 2-celled, style 1, stigma 1. fruit a capsule; seeds 1 or 2 in each cavity

In this family are 3 genera and about 23 species, of which 20 belong to the genus Tetratheca All are native of south and west Australia. The family is very similar to the Polygalaceæ, and separated from that



32 TREMANDRACEÆ 1 Platytheca, floral diagram POLYGALACEÆ 2 Polygala, *a*, flower, *b*, flower, vertical section; *c*, floral diagram EUPHORBIACEÆ 3 Euphorbia, *a*, involucre and flowers, *b*, involucre, vertical section 4 Croton, *a*, flower, *b*, floral diagram, male flower, *c*, floral diagram, female flower

family only by the regular flowers. Platytheca is remarkable in having the four anther cells all in one plane

Two genera are in the American trade, both tender heath-like plants Platytheca, and Tetratheca.

116 **Polygalaceæ** (from the genus *Polygala*, an old Greek name applied later to this genus by botanists because of the supposed stimulative action of the plant on the lactation of cattle). MILKWORT FAMILY. Fig. 32

Herbs, shrubs, or small trees, sometimes climbing or twining leaves mostly alternate. flowers bisexual, irregular, sepals 5, imbricated, separate or somewhat coherent, the 2 inner largest and often winged or petaloid; petals rarely 5, commonly 3, at least the 2 upper, and sometimes all more or less coherent with each other and with the stamen-tube, inner petal concave and often with a fringed crest (keel), stamens 8, rarely fewer, in 2 whorls, hypogynous, usually adherent to the keel petal and coherent into a tube which is slit down and open behind; anthers usually opening by terminal pores or slits, ovary superior usually 2-celled, ovule usually 1 in each cell; style 1, dilated above; stigmas 1–4: fruit usually a capsule, rarely a drupe or samara, seeds pendulous, albuminous.

Polygalaceæ has 10 genera and about 500 species, 450 of which belong to the genus Polygala, widely distributed over the earth but absent in New Zealand, Polynesia, arctic North America and arctic Asia The family is not closely related to any other. The peculiar perianth and stamens, and the 2-celled ovary, are together very distinctive The floral parts, though simulating those of the Leguminosæ, are not homologous

A bitter principle gives the Polygalaceæ tonic and astringent properties Some species are emetic The root of *Polygala Senega* (North America), so-called "Senega or Seneca snakeroot," is used as an emetic and cathartic, but more especially as an expectorant This and many other species of Polygala are reputed antidotes for snake-bites, hence the name "snakeroot"

Only the genus Polygala is in cultivation in N America, of which 9 or 10 species are grown for ornamental purposes. Some are shrubs and 1 is an evergreen trailer

117. **Euphorbiaceæ** (from the genus *Euphorbia*, named in honor of Euphorbus, physician to King Juba) SPURGE FAMILY Fig 32 Herbs, shrubs or trees, of greatly varying habit, sometimes fleshy and cactus-like, often with milky juice: leaves mostly alternate flowers monœcious or diœcious, regular or irregular, both calyx and corolla present, or the latter absent, or both absent, or both much reduced, valvate or imbricated, the parts free, rarely united, intrastaminal disk usually present in the staminate flowers, often changed to glands; stamens as many as the sepals, or twice as many, or reduced to 1, separate or monadelphous; hypogynous disk in the pistillate flowers annular or cup-shaped or in the form of glands, ovary superior, usually 3-celled, rarely 1-, 2-, or 4-celled, style and stigma various, ovules 1–2 in each cavity, side by side, suspended, anatropous; micropyle external, covered with a caruncle fruit splitting into three portions, leaving a central column, rarely indehiscent and berry-like, or drupaceous, seeds albuminous

The 208 genera and about 4,000 species are widely distributed, mainly in the tropics, but extend into temperate regions The largest genera are Euphorbia with about 700 species, Croton with 500–600 species, and Phyllanthus with 400 species. The family is related to the Geraniales, as shown by the fruit. The only constant characters of this great polymorphic family are the collateral anatropous ovules with micropyle external, the caruncle, the usually persistent axis of the fruit, and the albuminous seeds In Euphorbia, some sessile staminate flowers and a pedicelled pistillate flower are inclosed in a common involucre which bears various horn-like, or gland-like, or petaloid appendages. The variation in the inflorescence and floral structure throughout the family is very intricate

The family is of great economic importance. Only the most important plants can be mentioned here The following are used in medicine The juice of *Euphorbia Esula*, *E Cyparissias*, *E. Lathyris*, *E helioscopia*, and others, is purgative, as is also that of Mercurialis *Croton Tiglium* yields the purgative croton oil. *Ricinus communis* yields castor oil *Jatropha Curcas* (physic nut) is purgative. *Euphorbia Hyberna*, *Jatropha*

officinalis, Croton, and *Stillingia sylvatica* (queen's root) are used for syphilis *Euphorbia corollata* and *E. Ipecacuanhæ* are emetic *E. thymifolia* is used as a vermifuge in India. *Croton Eluteria* yields cascarilla bark, a tonic The hairs of the capsule of *Mallotus philippinensis* are in the trade as kamala The juice of *E cotinifolia* is used by the Caribbeans to poison arrows; that of *Excæcaria Agallocha* (blinding tree) is so acrid as to blind the eye into which it may chance to fall The juice of *E balsamifera*, of the Canaries, is cooked and eaten as jelly. The seeds of *Aleurites triloba* are called "almonds," and eaten, as are also those of *Conceveiba guyanensis*. The fruit of *E disticha* is edible *E. Emblica* has fleshy, sweet fruit The most useful as food are the tuberous roots of the sweet manioc (*Manihot palmata* var *Aipi*), eaten cooked or raw, and of the bitter manioc (*M utilissima*), which is poisonous when raw, but when cooked is very widely used for food in the tropics This root is the source of cassava bread, and tapioca. Phosphorescent juice is obtained from *E phosphorea* of Brazil The fruit of *Hura crepitans* (sand-box) opens with a report like a pistol. It is cooked in oil to prevent dehiscence, and used as a sand-box India rubber is obtained from the juice of *Hevea guyanensis*, and other species *Omphalea triandra* yields a blackening juice used as ink Soap is made from the seminal oil of *Jatropha Curcas* Oil from the seeds of *Aleurites cordata* (Japanese oil tree) is used for lighting. Turnsole (*Crozophora tinctoria*), of the Mediterranean, yields a dye used to color Dutch cheese Other Euphorbiaceæ yield dyes *Sapium sebiferum* (Chinese tallow tree) yields a fat used for burning, and other purposes.

Twenty to 30 genera are in cultivation in N. America for various purposes. Among these are: Acalypha, ornamental; Aleurites (Candlenut, Candleberry Tree), California, Codiæum (Croton), ornamental; Euphorbia (Spurge, Snow-on-the-Mountain, Scarlet Plume, Poinsettia, Mexican Fire Plant, Hypocrite Plant, Painted Leaf, Fire-on-the-Mountain, Crown of Thorns, Medusa's Head, Caper Spurge, Mole Plant), greenhouse, garden, ornamental, Hevea (South American Rubber Tree), botanical gardens and Florida, Jatropha (French Physic Nut), South; Manihot (Ceara Rubber Tree, Cassava, Manioc Plant), South, food and ornamental, Pedilanthus (Bird Cactus, Jew Bush), greenhouse, Phyllanthus (Snow-bush, Emblic Myrobolan, Otaheite Gooseberry), greenhouse, garden, Putranjiva, (Indian Amulet Plant), South; Ricinus (Castor-Oil Plant, Palma Christi), garden, ornamental; Stillingia (Queen's Root, Queen's Delight); Sapium (Tallow Tree), South.

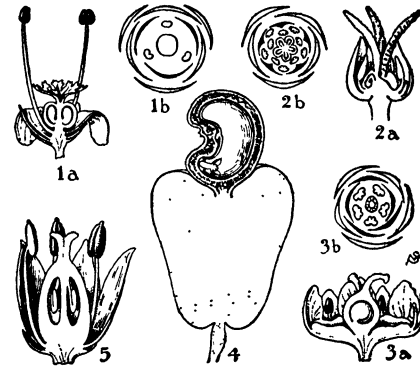
Order 39 Sapindales

118. **Buxaceæ** (from the genus *Buxus*, the ancient name of the box). Buxus Family. Herbs, shrubs or trees leaves opposite or alternate flowers monœcious, inconspicuous, hypogynous disk wanting; corolla absent, calyx 4-parted, or in the pistillate flower 4–12-parted or 0, imbricated; stamens 4, opposite the lobes of the calyx, or numerous, ovary superior, 3-celled, rarely 2–4-celled, ovules 2, collateral, rarely 1, suspended, micropyle turned toward the axis; styles 2–3 fruit capsular and opening elastically, or fleshy; seeds with endosperm, with or without a caruncle.

About 6 genera and 30 species inhabit the tropics and subtropics One species is native in the southeastern United States. The largest genus is Buxus with 19 species Fossil species are known. The family is related to the Euphorbiaceæ, with which it is united by some authors, and to the Celastraceæ and Empetraceæ. The absence of milky juice, the calycoid perianth, the 3-celled ovary with collateral suspended albuminous seeds, and the axially directed micropyle are together characteristic.

The wood of the box (*Buxus sempervirens*) of Europe is close-grained and homogeneous; used for engraving and for the manufacture of musical instruments. A decoction of the wood was formerly used in medicine for fevers. Its leaves and seeds are purgative. Oil from the seeds of Simmondsia is used as a hair-tonic.

Four or more genera are in cultivation in America. These are· Buxus (Box) ornamental; Pachysandra



33 Empetraceæ. 1 Empetrum, *a*, flower, *b*, floral diagram. Coriariaceæ. 2 Coriaria, *a*, flower, *b*, floral diagram Anacardiaceæ 3 Rhus, *a*, flower, *b*, floral diagram 4 Anacardium, fruit Cyrillaceæ 5 Cyrilla, flower

(Mountain Spurge), garden, ornamental; Sarcococca, greenhouse, ornamental; and Simmondsia, California, for oil.

119. **Empetraceæ** (from the genus *Empetrum*, an ancient name signifying *upon a rock*) Crowberry Family. Fig 33 Small ericoid shrubs. leaves alternate, deeply furrowed beneath flowers polygamous or dicœcious, small, regular, hypogynous; disk wanting, sepals 2–3, imbricated, petals 2–3, or 0, stamens of the same number as the petals and alternate with them; ovary superior, 2–9-celled, each cell 1-ovuled, style-branches 2–9, often fringed or toothed. fruit drupaceous, seed ascending, anatropous, albuminous, micropyle turned toward the outside.

In the north temperate and arctic regions, and in the Andes, are found 3 genera and about 5 species. The family is related to the Buxaceæ, and more distantly to the Euphorbiaceæ and Celastraceæ. The habit, the reduced or absent corolla, the few stamens, the 1-seeded ovary, the external micropyle, and the absence of the disk and aril are together distinctive

The acid berries of Empetrum are eaten in north Europe and Kamtschatka, and also used to prepare a drink The fruit of *Corema album* has been used as a fever remedy. An acid drink is prepared from it in Portugal

In North America, 2 genera are in cultivation· Ceratiola, not hardy; and Empetrum (Crowberry), grown in rock-gardens

120. **Coriariaceæ** (from the genus *Coriaria*, derived from the Latin meaning *a hide*, used for tanning). Coriaria Family. Fig 33. Shrubs with opposite or whorled, entire leaves. flowers bisexual, or unisexual, regular, sepals 5, imbricated; petals 5, smaller, but enlarging in fruit, fleshy, keeled within and pressed between the carpels; stamens 10, hypogynous; carpels 5–10, superior, separate: fruitlets indehiscent, 1-seeded, dry.

This family consists of a single genus containing 8 species, widely distributed in warm-temperate zones. Coriariaceæ is not closely related to any other family;

perhaps most closely to the Empetraceæ. Some authors place it near the Sapindaceæ or Phytolaccaceæ, or Rutaceæ It represents an ancient group. Fossil species are known.

Coriaria myrtifolia (myrtle-leaved sumach) of the West Mediterranean region, contains much tannin and is used by curriers; its leaves and fruits are poisonous The fruit of *C. ruscifolia* of New Zealand contains a vinous juice, which is drunk as a beverage, but its seeds are poisonous. *C ruscifolia* also yields a black color used by shoemakers

Two species are grown for ornamental purposes in eastern North America They are semi-hardy

121. **Limnanthaceæ** (from the genus *Limnanthus*, the name signifying marsh flower) Limnanthus Family. Herbs with alternate leaves. flowers bisexual, regular; sepals 3 or 5, valvate, petals 3 or 5, convolute, separate; stamens twice as many as the petals, the outer opposite the petals, often glandular at base; ovary superior, 3- or 5-lobed, 3- or 5-celled, ovules 1 in each cell, ascending, micropyle directed downward and outward, stigmas 3 or 5: fruit dry, separating into segments

This is a small family of 2 genera and 5 species, all of North America. The family was formerly united with the Geraniaceæ, to which the floral structure bears a superficial resemblance It is also related to the Anacardiaceæ and Sapindaceæ It may be said to possess the general floral structure and lobed ovary of the Geraniaceæ, but the seed position of the two families last named

Limnanthus Douglasii, of California, is grown for ornamental purposes.

122. **Anacardiaceæ** (from the genus *Anacardium*, the name meaning *heart-like*, in reference to the shape of the nut) Cashew Family Fig 33 Trees or shrubs with resinous bark, and alternate, simple or compound leaves· flowers bisexual or unisexual, regular, small, and numerous, epigynous, perigynous or hypogynous; sepals 3–5; petals 3–5, mostly imbricated, or 0, stamens 5 or 10, rarely many, inserted with the petals at the edge or base of an annular, intra-staminal disk; ovary 1-, rarely 2–6-, celled, with 1 ovule in each cell; styles 1–6 fruit a drupe or nut, rarely dehiscent; seeds usually exalbuminous

There are 58 genera and about 400 species, most abundant in the tropical zone of both hemispheres, but represented by the genus Rhus as far north as Europe and the United States. Rhus is the largest genus, containing 120 species. The family is related to the Sapindaceæ, but contains resin, and has an intra-staminal disk. It is also related to the Burseraceæ and Simarubaceæ

The disk in some genera becomes elongated into a stalk on which the ovary is raised. The drupe is sometimes edible (Mangifera). In Anacardium, the nut-like fruit is situated on top of a fleshy edible receptacle. Sometimes the nut is surrounded by the edible receptacle In Cotinus, the pedicles become plumose and the whole much-branched inflorescence breaks off, and blows about, distributing the seeds. In Swintonia, the calyx or the corolla becomes enlarged and persistent and serves as a parachute in seed-dissemination. *Rhus Toxicodendron* (poison ivy) and *R Vernix* (poison sumach, poison elder, poison dogwood) contain in all their parts an oily, extremely irritating substance, which often produces a very painful vesicular eruption that may last for several days.

The Anacardiaceæ is a family of considerable economic importance Because of the resinous juice, it yields medicinal substances and varnishes. It also yields important edible fruits. *Pistacia vera* of Syria furnishes the pistachio nut; *Pistacia Terebinthus* of the Mediterranean yields Cyprus turpentine, formerly medicinal. The leaves of *Rhus Coriaria* of the Mediterranean are used for tanning fine leather. *Rhus succedanea* of Japan yields vegetable wax, which coats the seed within the capsule *Melanorrhœa usitata* yields a celebrated black varnish of Burmah *Mangifera indica* of the East Indies is the mango tree, the fruit of which is large, juicy, sugary-acid and agreeable. *Anacardium occidentale* of tropical America is the cashew. This plant yields edible nuts and an edible receptacle. From it vinegar is made, also a peppery oil used as a condiment; and the trunk yields a valuable acacia-like gum. The seeds of Semecarpus (marking-nut tree) give an indelible black dye used in marking linen. *Spondias purpurea* is the so-called Spanish plum of the West Indies The fruit of *Spondias dulcis* of the Pacific Islands is also frequently eaten Other species furnish the hog plum of the West Indies The mastic, a fragrant gum-resin of the pharmacist, is obtained from *Pistacia Lentiscus* of the Orient

Eight to 12 genera are in cultivation in N. America, but with the exception of Rhus and Cotinus, mostly in the southern states, especially in southern Florida and southern California Among these are: Anacardium (Cashew Tree), Cotinus (Smoke-bush); Cyrtocarpa, fruit edible; Mangifera (Mango); Pistacia (Pistachio Nut); Rhus (Sumach, Poison Ivy, Poison Oak, Poison Elder, Poison Dogwood), 15 species; Schinus (California Pepper Tree, Peruvian Mastic), Semecarpus (Marking-nut Tree).

123 **Cyrillaceæ** (from the genus *Cyrilla*, named in honor of Dominico Cyrillo, a professor of medicine at Naples). Cyrilla Family. Fig 33. Shrubs with alternate, entire leaves flowers bisexual, regular, small, sepals 5, often enlarged in fruit, imbricated; petals 5, imbricated, slightly connate at base or separate; stamens 5 or 10, hypogynous, the inner sometimes wanting, filaments dilated; ovary superior, 2–4-celled, ovules 1, rarely, 2–4 in each cell; style short; stigmas 2· fruit a fleshy or dry capsule, or nearly dry drupe with wings, seeds albuminous.

The 3 genera and only 5 species are all American, ranging from Virginia to Brazil The relationship of the Cyrillaceæ is doubtfully understood. It is probably closely related to the Aquifoliaceæ, although some have placed it with the Ericaceæ. The small polypetalous flowers, the few stamens, the several-celled, few-seeded ovary, the dry fruit and the non-arillate seeds are important characteristics.

Cyrilla racemiflora (leatherwood, black ti-ti) of the southeastern United States is occasionally cultivated for ornamental purposes.

124. **Aquifoliaceæ** (from *Aquifolium*, Tournefort's name for the genus Ilex, application obscure) Holly Family. Fig 34 Trees or shrubs, with alternate or opposite, simple, often evergreen leaves flowers bisexual, rarely unisexual, very small, axillary, solitary or fascicled, rarely cymose, sepals 3–6, more or less connate; petals 4–5, nearly separate, imbricated, stamens 4–5, alternating with the petals, and sometimes adhering to them, hypogynous disk wanting; ovary superior, 3 to many-celled, each cell 1–2-ovuled, stigma subsessile, lobed. fruit berry-like, seeds albuminous

Three genera are known and about 280 species, of which 275 belong to the genus Ilex. These are widely distributed, but rare in Europe, the center of distribution being in Central and South America. Ten species are found wild in the northeastern United States. The Aquifoliaceæ are related to the Celastraceæ and the Anacardiaceæ, from which they are distinguished by the absence of the hypogynous disk and by the general appearance.

Ilex Aquifolium of Europe is used there for hedges and for indoor decoration. *I. opaca* is used for indoor decoration in this country. The leaves of both are thick, glossy, evergreen and spiny-toothed. *I. paraguariensis* furnishes maté, which is the tea of South America It was early cultivated by the Jesuits (1609–1768), and is even yet one of the most important cultivated plants of South America. Other species of Ilex

have been used in various parts of the world for medicine because of their astringent qualities and bitter principle.

Many species of Ilex (Holly, Dahoon, Cassena, Yaupon, Winterberry, Black Alder), and one of Nemopanthus (Mountain Holly) are grown as cultivated plants in America, all for ornamental purposes.

125 **Celastraceæ** (from the genus *Celastrus*, an ancient Greek name). STAFF-TREE FAMILY. Fig. 34. Shrubs or trees, often climbing: leaves alternate or rarely opposite, simple, not lobed. flowers bisexual or unisexual, small and greenish, regular; sepals 4–5, imbricated; petals 4–5, imbricated; stamens 4–5, alternate with the petals, rarely 10; disk present, lining the bottom of the calyx, sometimes adnate to the ovary, ovary superior, 2–5-celled, buried in the disk, or distinct and disk small; 1–2 ovules in each cell; style 1, short; stigmas 2–5-lobed: fruit a drupe, or samara, or a capsule; seeds albuminous, usually with a pulpy aril.

Thirty-eight genera and about 375 species are distributed in all parts of the world except the arctic zone. They are especially numerous in the tropics. Euonymus, Maytenus, and Celastrus are the largest genera The Celastraceæ are in some respects related to the Cyrillaceæ, in others to the Aquifoliaceæ and Rhamnaceæ. The small greenish flowers, the stamens alternating with the petals, the ovary sunken in the disk, and the aril are in general distinctive. There are exceptions to all these characters

The capsule of Celastrus and Euonymus frequently remains on the plant through late fall and early winter. It splits into from 3–5 valves, which become reflexed and expose the aril of the seeds The contrast in color between aril and pericarp is often very striking and ornamental The Celastraceæ are mostly pollinated by ants and flies which run over the disk for the honey.

The Celastraceæ are of but slight economic importance Some have been used for their emetic and purgative properties. *Catha edulis* of East Africa has been long cultivated by the Arabs under the name *khat*; the leaves produce an agreeable excitement and it is considered a very valuable remedy for plague The drupes of an Elæodendron are said to be eaten in South Africa. The wood of some Celastraceæ is much valued for carving.

In North America 6 or more genera of Celastraceæ are grown for ornamental purposes Elæodendron in warmhouses and in southern parts, Euonymus, hardy North; Gymnosporia and Maytenus grown in southern regions; Pachistima, hardy, and Celastrus, a hardy vine

126 **Stackhousiaceæ** (from the genus *Stackhousia*, named in honor of John Stackhouse, a British botanist) STACKHOUSIA FAMILY Fig 34 Herbs with rather thick, alternate leaves flowers bisexual, regular, in spikes, racemes or fascicles, sepals 5, imbricated; petals 5, more or less, perigynous, long-clawed, the claws separate below, connate above; disk thin, clothing the inside of the cup-shaped receptacle, stamens 5, perigynous, alternating with the petals, often unequal; ovary superior, 2–5-lobed, 2–5-celled, each cell 1-ovuled, styles 2–5, free or connate fruit of 2–5 separate, globose, angular, reticulated or winged, indehiscent portions which separate from a central persistent column, seeds albuminous

This is a very small family of 2 genera and 14 species; natives of Australia and adjacent islands It is probably related to the Celastraceæ more closely than to any other family.

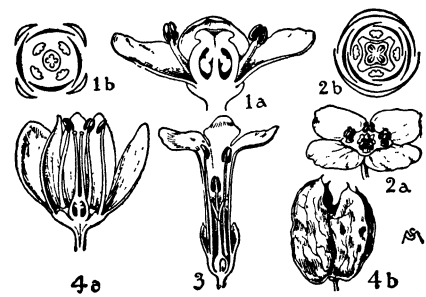
One species of Stackhousia is grown for ornamental purposes in California.

127 **Staphyleaceæ** (from the genus *Staphylea*, derived from the Greek meaning *a cluster*, probably in reference to the flower-cluster) BLADDERNUT FAMILY. Fig. 34. Trees or shrubs: leaves opposite or alternate, pinnately compound, stipulate: flowers bisexual, regular; sepals 5, imbricated, petals 5, imbricated; stamens 5, alternating with the petals, inserted outside the large, cup-shaped disk; ovary usually 3-celled; styles 3, separate or connate: fruit a capsule, often deeply lobed, sometimes indehiscent and berry-like; seeds usually many in each cell, albuminous, sometimes with an aril.

This family contains 5 or 6 genera and about 22 species, in the north temperate zone, extending rarely to northern South America and to the Malay region. Fossil species are known The family is closely related to the Sapindaceæ, in which it was formerly included, and from which it is separated by the abundant endosperm, the intra-staminal disk, the more numerous seeds, the straight embryo, and various anatomical differences. The fruits of the bladdernut are an inch long, membranous and bladdery; the seeds become loosened and the fruit then is interesting to children as rattle-boxes.

The family is of little economic importance. Three genera are cultivated in North America for ornamental purposes. These are: Euscaphis, Staphylea (Bladdernut), and Turpinia.

128. **Aceraceæ** (from the genus *Acer*, the classical name of the maples, from the Celtic meaning *hard*).



34. AQUIFOLIACEÆ: 1. Ilex, *a*, flower; *b*, floral diagram CELASTRACEÆ 2 Euonymus, *a* flower, *b*, floral diagram STACKHOUSIACEÆ 3 Stackhousia, flower. STAPHYLEACEÆ 4 Staphylea, *a*, flower, *b*, fruit.

MAPLE FAMILY. Fig. 35. Trees or shrubs: leaves opposite, exstipulate, simple or compound. flowers mostly unisexual, often bisexual ones intermixed, regular; sepals 4–5, separate or somewhat connate, imbricated; petals 4–5, or 0, imbricated, disk either extra-staminal or intrastaminal, usually flat, and sometimes lobed or divided, stamens 4–10, mostly 8, separate, inserted at the edge of the disk, ovary superior 2-celled, 2-lobed, much flattened contrary to the partition, style 1, stigmas 2 fruit splitting into two portions, each a samara; seeds 2 in each cell, exalbuminous.

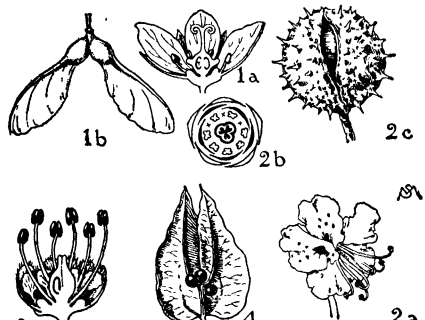
There are 2 genera and about 110 species; all but 1 belong to the genus Acer They are mostly natives of mountainous or upland countries of the northern hemisphere Some fossil species have been discovered. The Aceraceæ are closely related to the Sapindaceæ, with which they were formerly united, and from which they differ in the opposite, usually palmate leaves, the peculiar fruit, and regular flowers In position, the disk shows a transition between the Sapindaceæ and other families. The family is easily recognized by the opposite, exstipulate leaves, and peculiar fruit

The wood of *Acer saccharum* (sugar maple, hard maple) is of great value for timber Bird's-eye maple and curly maple are forms of this species in which the growth of the cambium is irregular The manufacture of sugar from the sap of the sugar maple is an important industry in the northern states in early spring The sycamore of England is *Acer pseudoplatanus*; that of America is a species of Platanus The juice of *Acer platanoides* (Norway maple), and probably of others, is milky.

Forty or more species of Acer (maple) are in cultivation in N. America for ornamental purposes. *Acer Negundo* (box elder) is exceptional in having compound leaves.

129. **Hippocastanaceæ** (from the genus *Hippocastanum*, the old generic name of the genus Æsculus, derived from the Greek meaning *horse* and *chestnut*). HORSE-CHESTNUT FAMILY. Fig. 35. Trees or shrubs: leaves opposite, exstipulate, palmately 3–9-foliate: flowers, some bisexual, some staminate, irregular, sepals 5, separate or connate, imbricated, petals 4–5, unequal, clawed; stamens 5–8, separate; disk present, extrastaminal, often inequilateral; ovary 3-celled; ovules 2 in each cell; style and stigma 1: fruit usually 1-celled and 1-seeded, capsular, 3-valved; seeds very large, exalbuminous.

There are 2 genera and 22 species of general distribution in the north temperate zone. The family is closely related to the Sapindaceæ, with which it is often united, and from which it differs only in its larger flowers, palmately compound leaves and large seeds. The Hippocastanaceæ, Sapindaceæ, Melianthaceæ,



35. ACERACEÆ: 1 Acer, *a*, flower, *b*, fruit. HIPPOCASTANACEÆ: 2 Æsculus, *a*, flower, *b*, floral diagram, *c*, fruit. SAPINDACEÆ 3 Sapindus, flower. 4. Kœlreuteria, vertical section fruit

and some Aceraceæ are almost the only plants with extra-staminal disks.

The horse-chestnut (*Æsculus Hippocastanum*) is a well-known shade tree, said to have been introduced into Europe by Clusius in 1575. The seeds, rich in starch, have been used for fodder. They have also been used to form the principal part of a certain kind of snuff, and the oil contained has been used to a slight extent in medicine. The roots of Æsculus contain saponin and have been used, like soapberry, for washing.

Several species of Æsculus are in cultivation in N. America. *Æ glabra* and *Æ octandra*, natives of the central United States, are called buckeyes.

130 **Sapindaceæ** (from the genus *Sapindus*, a contraction of the Latin *sapo-indicus*, Indian soap). SOAPBERRY FAMILY. Fig. 35. Trees or shrubs, rarely herbs, often climbing: leaves usually alternate, mostly compound, sometimes ternately, sometimes pinnately decompound: flowers unisexual or polygamous, regular or irregular (i.e. obliquely unsymmetrical), small; sepals 4–5, imbricated or rarely valvate; petals 4–5, small or wanting, usually with scales or hairs at the base inside; disk well developed, situated between the petals and the stamens (extrastaminal); stamens usually 10 in 2 whorls, more or less united at the base; ovary superior, mostly 3-celled and deeply 3-lobed; ovules typically 1 in each cell; style 1: fruit very diverse, a firm or bladdery capsule, a berry, nut, or winged fruit; seeds without endosperm.

The 118 genera and about 1,000 species are of tropical distribution. Only one species reaches northward as far as Kansas. The family is closely related to the Staphyleaceæ, Hippocastanaceæ, and Aceraceæ, which see for differences; and more distantly to the Celastraceæ. The small flowers, usually appendaged petals, 10 stamens, extra-staminal disk, and 3-celled, few-seeded fruit are usually distinctive.

The climbing Sapindaceæ often have very peculiar stems in which many separate cambium rings have taken part. This renders the cross-section very peculiar, making it appear sometimes as a bundle of woody ropes tied together, with bark between them.

The Sapindaceæ are of considerable economic importance. The fruits of many are used locally for food, sometimes the flesh of the fruit, sometimes the aril being of importance. The seeds of Sapindus and other genera are often roasted and eaten as food. Oil is obtained from the seeds of others. Some are used locally for medicine. The seeds and other parts of many species are very poisonous, the fruits of species of Sapindus being used to poison fish. The juice of *Paullinia pinnata* (cururu) is used by savages in Guiana to poison their arrows. The Lechecuquana bee collects honey from *Serjania lethalis* which, when eaten even in small quantities, produces raving madness or even death. The bark and berries of many species (e.g., the soap tree, Sapindus) contain saponin which reacts like soap, on which account they are used for washing. Yellow and black dyes, used as cosmetics, are obtained from certain species. The very hard wood of certain Sapindaceæ is much prized for timber. The hard, spherical, black seeds of *Sapindus Saponaria* are strung as beads.

There are 15 or more genera of true Sapindaceæ grown in America. Kœlreuteria (Varnish Tree) is hardy and ornamental. Cardiospermum (Balloon Vine) is a tender annual with queer fruit. Xanthoceras is a hardy ornamental tree. Paullinia is a greenhouse climbing shrub. The following are grown only in the southern states or California: Greyia, Melicocca (Spanish Lime); Blighia (Akee Tree), Dodonæa, Ungnadia (Mexican or Spanish Buckeye), Sapindus (Soapberry).

The following cultivated genera are now referred to other families. Melianthus (Melianthaceæ), Æsculus (Hippocastanaceæ); Acer (Aceraceæ), Ptæroxylon (Meliaceæ); Staphylea (Staphyleaceæ); Euscaphis (Staphyleaceæ), Turpinia (Staphyleaceæ).

131 **Melianthaceæ** (from the genus *Melianthus*, derived from the Greek meaning *honey* and *flower*). MELIANTHUS FAMILY. Shrubs or trees: leaves alternate, entire or pinnate: flowers bisexual, irregular, soon inverted, sepals 5, imbricated, petals 4–5, stamens 4–5, or 10, free or slightly connate at the base, alternating with the petals, disk present, extrastaminal, crescent-shaped, or annular with 10 projections, carpels 4–5, ovary 4–5-celled, ovules 1 to many in each cell, style 1, stigma 4–5-lobed: fruit a capsule, seeds albuminous, sometimes arillate.

All the 3 genera and 17 species are natives of Africa. The Melianthaceæ were formerly united with the Sapindaceæ, with which they agree in the extrastaminal disk, but they differ in the vertically bisymmetrical, not obliquely bisymmetrical, flowers, and more abundant endosperm.

In southern California, species of Melianthus are grown for ornament.

132. **Balsaminaceæ** (from *Balsamina*, the old name of the genus Impatiens, probably derived from *balassan*, the Arabic name of these plants). BALSAM FAMILY. Fig. 36. Herbs, very rarely epiphytic: leaves various: flowers bisexual, irregular, spurred, nodding; sepals 3–5, irregular, imbricated often petaloid, the posterior very large and sack-like, and gradually prolonged backward into a honey-spur; petals 5, alternate with the sepals, separate, or united so as to appear as 3, lower petals much the larger, stamens 5, hypogynous, closely

covering the ovary like a hood; anthers coherent; ovary superior, 5-celled; ovules 3 to many in each cell, stigmas sessile. fruit a 5-valved capsule, the valves of which coil up elastically and forcibly distribute the seeds, or sometimes a 5-celled drupe-like structure

Contained in this family are 2 genera and about 220 species, of which all but 1 belong to the genus Impatiens, widely distributed, but most abundant in the tropics of the Old World, wanting in South America The family is closely related to the Geraniaceæ, with which it was formerly united, but is distinguished by the 5 peculiar hypogynous stamens The honey-spur in this family is an outgrowth of the sepals, and not of the receptacle as in Pelargonium and Tropæolum. There are extra-floral nectaries on the foliage of some species, which attract protective ants

The sap of several species of Impatiens has been used as a dye to color red or yellow that of *I. biflora* (North America) staining yellow, that of *I. Balsamina* (India) staining red, and used to color the skin and fingernails The tubers of *I. tinctoria* of Abyssinia are used for dyeing the feet and hands red or black Some species have been used as medicine Many are ornamental.

There are several species of Impatiens in the North American trade *I. aurea* and *I. biflora* are the east American touch-me-nots or jewel-weeds; *I. Balsamina* is the garden balsam; the other species are greenhouse plants

Order 40. Rhamnales

133 **Rhamnaceæ** from the genus *Rhamnus*, the old Greek name) Buckthorn Family. Fig 36 Trees or shrubs, rarely herbs, sometimes spiny or climbing: leaves simple, mostly alternate flowers bisexual or unisexual, regular, perigynous, small, greenish, mostly axillary, sepals 5, rarely 4, valvate, petals 5, or 4, alternate with the sepals, stamens of the same number as the petals and opposite them; an intrastaminal disk lining the cup-shaped receptacle; ovary 2–4-celled, superior or inferior, cells 1-, rarely 2-, ovuled, styles 2–4, more or less connate fruit drupaceous, or winged, or capsular

Rhamnaceæ has 46 genera and about 550 species very generally distributed over the earth Rhamnus is the largest genus (70 species), and the most widely distributed The family is represented by 6 native species in northeastern North America It is most closely related to the Vitaceæ and Celastraceæ, differing from the former in the simple entire leaves and strongly perigynous flowers, and from the latter in the stamens being opposite the petals

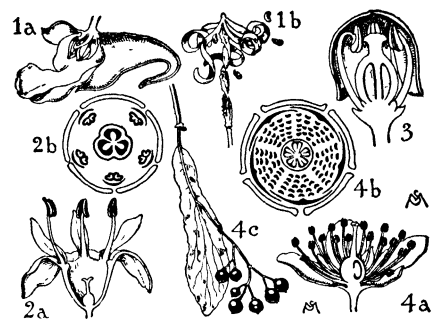
The family is not of great economic importance The berries and bark of *Rhamnus cathartica* (buckthorn) contain a bitter principle which is purgative. The fruits of some species of Rhamnus yield yellow or green dyes of some importance *R. dahurica* and *R. tinctoria* give Chinese green The bark of *R. cathartica* and *R. Frangula* (Europe) is used to dye yellow *R. Purshiana* (California) is the cascara segrada of medicine, a strong purgative The fruits of *Zizyphus Lotus* are pulpy and agreeable, and were much prized by the ancients The fruits of several species of Zizyphus are eaten in various parts of the Old World The spiny branches of *Paliurus Spina-Christi* or *Zizyphus Spina-Christi* are thought to have been those from which the crown of thorns was made.

Nine or more genera are in cultivation in N America for ornamental purposes These are. Ceanothus (New Jersey Tea); Berchemia (Supple Jack); Gouania; Hovenia, Paliurus, Pomaderris, Reynosia; Rhamnus (Buckthorn), Zizyphus (Jujube)

134 **Vitaceæ** (from the genus *Vitis*, the classical name) Grape Family Fig 36 Mostly climbing shrubs with tendrils, seldom upright shrubs or small trees. leaves alternate or opposite, very diverse. flowers bisexual, or unisexual small, numerous, regular; sepals 4–5, rarely 3–7, minute or obsolete; petals 4–5, rarely 3–7, valvate, separate (gamopetalous in Leea), stamens 4–5, rarely 3–7, opposite the petals, somewhat perigynous; disk evident annular or of separate lobes; ovary superior, 2-, rarely 3–6-, celled, with 2, or rarely 1, ovule in each cell; style 1 or 0, stigma capitate or peltate fruit a berry; seeds albuminous.

The 11 genera and about 450 species are mostly of tropical and subtropical distribution. Fourteen species reach the northeastern United States The largest genus is Cissus with 250 species. Some fossil forms are known The Vitaceæ are closely related to the Rhamnaceæ. The climbing habit, the few stamens opposite the petals, the 2-carpelled berry, and the capitate stigma are distinctive

The petals in Vitis remain connate at the tip as in the bud, but separate from each other at the base, and fall off as a cap The tendrils of the Vitaceæ are borne at the nodes and opposite the leaves There has been much discussion as to whether the tendrils are apical or



36 Balsaminaceæ 1 Impatiens, *a*, flower, *b*, fruit Rhamnaceæ 2 Rhamnus, *a*, flower, *b*, floral diagram Vitaceæ: 3 Vitis, flower Tiliaceæ 4 Tilia, *a*, flower, *b*, floral diagram *c*, fruit.

lateral, i e , whether the plant is sympodial or monopodial The tips of the tendrils are in some species expanded into disk-like holdfasts The species of Cissus are mainly desert plants They are often cactus-like, with fleshy, angled, jointed, or terete stems, or have tubers or tuberous bases.

The most important economic plant in the family is the grape (Vitis), which has been cultivated since early times *V. vinifera* is the wine grape of Europe and southern California, and has given rise to our greenhouse grapes; not hardy. *V. Labrusca* is one of the parents of most of our hardy grapes *V. vulpina* and *V. cordifolia* are frost or fox grapes Several species of Vitis are grown for ornamental purposes only. Raisins are the dried fruit of certain species of Vitis, mostly *V. vinifera* Virginia creeper or woodbine (*Parthenocissus* [*Ampelopsis*] *quinquefolia*) and Boston ivy or Japanese ivy (*P. tricuspidata*) are ornamental.

A few genera are in cultivation in America: Ampelopsis, Parthenocissus or Psedera; Cissus (Kangaroo Vine), and Vitis.

Order 41. Malvales

135. **Elæocarpaceæ** (from the genus *Elæocarpus*, derived from the Greek meaning *olive-fruit*). Elæocarpus Family. Trees or shrubs, with entire alternate or opposite leaves without slime-cells flowers usually bisexual, regular, hypogynous, involucre 0; sepals 4–5, separate or connate, valvate, petals 4–5, or 0, separate, rarely connate, usually valvate, often incised; stamens many, anthers opening by terminal pores; hypogy-

nous intra-staminal disk present; ovary superior, 2- to many-celled, rarely 1-celled, ovules many in each cell; style 1, stigmas 1 to several fruit capsular or drupaceous.

Seven genera and about 120 species are distributed in the tropics of both hemispheres. Elæocarpus contains 60 species and Sloanea 44 species. The family is closely related to the Tiliaceæ, with which it is often united and from which it is distinguished by anatomical characteristics, and usually also by the often hairy and firm, or incised, petals, or by the absence of petals.

A vegetable ivory used in carving is obtained from the large stone of the drupe of *Elæocarpus sphæricus* of India. Those of *E. tuberculatus* (India and Java) are worn as amulets. The seeds of *Sloanea dentata* of Guiana are eaten like chestnuts The bark of *Crinodendron Patagua* of Chile is used for tanning The wood of *Aristotelia Maqui* of Chile is variously used Its leaves are medicinal and its berries are edible

Two genera are cultivated in North America: Aristotelia, California; Elæocarpus, not hardy

136. **Tiliaceæ** (from the genus Tilia, the ancient Latin name of the Linden) LINDEN or BASSWOOD FAMILY. Fig 36. Trees, shrubs, or herbs. leaves mostly alternate, entire or variously lobed· flowers bisexual, regular; sepals 5, rarely 3 or 4, free or connate, usually valvate; petals as many as the sepals, convolute or imbricated, or valvate, rarely wanting or modified, stamens 10 or more, hypogynous, usually very numerous, filaments separate, or connate only at the base, or in 5–10 fascicles, some may be staminodia; anthers 4-celled, opening by slits or pores; ovary superior, 2–10-celled; ovules 1 to several in each cell; style 1; stigma rayed: fruit a capsule, or indehiscent and nut-like, or a drupe, rarely a berry, or separating into drupelets; seeds usually albuminous

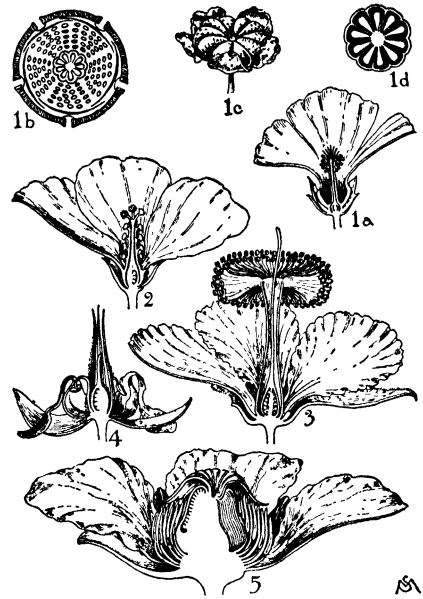
Most of the 35 genera and 270 species are tropical. The most important extra-tropical genus is Tilia (linden, basswood), which is widely distributed. Fossil species are known The Tiliaceæ are related to the Malvaceæ and Sterculiaceæ, from which they are distinguished by the nearly distinct stamens, and 4-celled anthers The stamens are sometimes borne, along with the ovary, on a long stipe-like projection of the receptacle, sometimes cover the whole surface of a discoid receptacle, and sometimes are enveloped by the petals

The Tiliaceæ, like the Malvaceæ, are mucilaginous. For this reason, many have been used more or less in medicine The genus Tilia and other arborescent genera furnish very valuable timber; that of *Grewia asiatica* is flexible and used for bow-making In the tropics the foliage of *Corchorus olitorius* is used as a pot-herb. The fruits of species of Grewia are used in India as a sherbet because of their agreeable juice Some members of the family yield cordage The beautiful seeds of many species are made into necklaces by the Indians.

In North America 6 or more genera are in cultivation. They are all warmhouse plants, or are grown in southern California, except the Tilias (Basswood, Lime, Linden), of which many species are grown in America The Tilias furnish some of our best-known hardy, ornamental trees. Other genera are Entelea, Luehea, Grewia (with some half-hardy species), and Sparmannia

137. **Malvaceæ** (from the genus *Mallow*, altered from the Greek, in allusion to the mucilaginous emolhent qualities). MALLOW FAMILY Fig 37 Herbs, shrubs or trees, with alternate, simple, usually palmately veined leaves flowers bisexual, regular, sepals 5, often united, valvate, frequently bracteolate at the base; petals 5, convolute, often adnate to the stamens, stamens very numerous, hypogynous, the filaments united into a tube (monadelphous), anthers 1-celled, pollen spiny; ovary superior, 2 to many-celled, rarely 1-celled, ovules in each cell 1 to many; styles and stigmas usually as many as the carpels· fruit a capsule or separating into drupelets, very rarely fleshy.

The Mallows include 39 genera and from 800 to 900 species, distributed over the whole earth, except in the arctic zone, but most abundant in tropical America. The Malvaceæ are closely related to the



37. MALVACEÆ 1 Malva, *a*, flower, *b*, floral diagram, *c*, fruit; *d*, cross-section fruit 2 Hibiscus, flower BOMBACACEÆ 3 Adansonia, flower STERCULIACEÆ 4. Theobroma, flower DILLENIACEÆ 5 Dillenia, flower

Sterculiaceæ and Tiliaceæ From the former they are distinguished by their 1-celled anthers and rough pollen, and from the latter by their monadelphous stamens as well as the 1-celled anthers The hollyhock-like flower is characteristic

The foliage, stems, and seeds of most Malvaceæ contain abundant mucilage for which, in some countries, they have been used as medicine Pungent and poisonous properties are apparently wanting *Althæa officinalis* (marsh mallow of Europe), *Malva sylvestris* and *M. rotundifolia*, both of Europe, have been used as emollients *Hibiscus Sabdariffa* and *H digitatus* (white and red kotmies of tropical Africa) have acid juice and are used in the preparation of refreshing drinks The capsule of *H.* (*Abelmoschus*) *esculentus* (okra or gumbo) of the tropics is eaten in soup, or cooked and seasoned The seeds of *H. Abelmoschus* of India, now widely cultivated in the tropics, are used for perfumery *H Rosa-sinensis* (Chinese hibiscus or shoeblack plant) contains a coloring matter in the flower with which the Chinese blacken shoes and eyebrows *Althæa cannabina* of southern Europe has fibers which may be used in place of hemp. The fibers of *Urena lobata*, *Abutilon indicum*, Sida, *Hibiscus cannabinus*, *H tiliaceus*, and others, are also used. The most useful genus is Gossypium (cotton) of Egypt, India, and tropical America, the abundant, long, woolly hairs on the seeds of which furnish the cotton of commerce. Cotton seed yields an oil which is used for fuel, cattle-food, soap, artificial butter, and many other purposes. Several mallows are weedy plants.

Many of the genera in cultivation in N America are among the most important old-fashioned cultivated garden plants Among these are· Abutilon (Indian Mallow, Velvet Leaf); Althæa (Marsh Mallow, Hollyhock), Callirhoe (Poppy Mallow), Gossypium (Cotton); Hibiscus (Bladder Ketmia, Roselle, Jamaica Sorrel, Okra, Gumbo, Rose of Sharon, Mountain Mahoe, Shoeblack Plant), Malope, Malvastrum; Pavonia, Sida; Sphæralcea

138 **Bombacaceæ** (from the genus *Bombax*, from the Latin meaning *silk* or *cotton*) BOMBAX FAMILY Fig 37 Trees leaves mostly alternate, entire or digitate, often with slime-cells and stellate hairs flowers bisexual, regular or slightly irregular, involucre often present, sepals 5, separate or connate, valvate, petals 5, twisted in the bud, stamens 5 to many, separate or monadelphous, anther cells 1-2 or more, pollen smooth; staminodia often present, ovary superior, 2–5-celled, ovules 2 to many; style 1, stigmas 1–5. fruit dry or fleshy, dehiscent or indehiscent

There are 20 genera and about 100 species, of tropical distribution, mostly in America The family is closely related to the Malvaceæ and often united with that family It is distinguished most easily by the smooth pollen and the often several-celled anthers

Many Bombacaceæ are very large trees The trunk of the baobab tree, or monkey's bread tree (*Adansonia digitata*) of tropical Africa is often 100 feet in circumference The wool produced in the fruit is of little value. The fruit of *Durio zibethinus* contains a cream-like substance and is eaten The seeds of the green fruit of *Maïssia cordata* of the Andes is edible The sour cucumber tree or cream of tartar tree is *Adansonia Gregorii* The fruit contains tartaric acid

Five or 6 genera are in cultivation in this country in the South and in greenhouses Adansonia (Boabab Tree, Monkey's Bread), Bombax (Silk Cotton Tree); Chorisia (Floss-silk Tree), Friodendron; Pachira

139 **Sterculiaceæ** (from the genus *Sterculia*, derivation obscure) STERCULIA FAMILY Fig 37. Trees, shrubs, or herbs, sometimes vines leaves alternate, simple or digitate flowers bisexual or unisexual, usually regular, sepals 3–5, somewhat united, valvate; petals wanting or reduced, stamens very remarkable and wonderfully diverse, in 2 whorls, those opposite the sepals reduced to staminodia or wanting, the 1 to many others united into a tube, the anthers frequently alternating with sterile teeth, or variously arranged on the back of the tube, ovary superior, 4–5-celled; ovules several, styles 4–5, distinct or connate fruit dry, rarely fleshy, or splitting into separate berries

The 48 genera and about 750 species are almost entirely confined to the tropics The family is related to the Malvaceæ in the monadelphous stamens, but differs in the 2-celled anthers, also related to the Bombacaceæ and Tiliaceæ The valvate sepals, reduced petals, 4–5-celled ovary, and especially the peculiar stamens, are distinctive

The Sterculiaceæ, like the Malvaceæ, contain abundant mucilage They also contain a bitter principle which renders them emetic and stimulant. The seeds of *Theobroma Cacao*, native of central and northern South America, furnishes cocoa, chocolate, and cocoa-butter *Cola acuminata* of Africa furnishes the cola nut, now very popular as an ingredient in a mildly stimulating drink It is said to form the main constituent of the drink called "coco-cola"

There are about 12 genera in cultivation in America, all either in tropical agriculture or in greenhouse culture Ruhngia, Reevesia, and Pterospermum in southern California; Sterculia (Japanese Varnish Tree, Chinese Parasol Tree, Flame Tree), Fremontia and Guazuma in the South; Theobroma and Cola in the West Indies; Abroma, Dombeya, and Mahernia (Honey Bell) mostly in the greenhouse. All are grown for ornamental purposes except Theobroma and Cola.

Order 42. PARIETALES

140 **Dilleniaceæ** (from the genus *Dillenia*, in honor of John James Dillenius, a professor of botany at Oxford). DILLENIA FAMILY Fig 37 Trees or shrubs, often climbing. leaves alternate, very rarely opposite· flowers bisexual, regular, hypogynous, sepals 5, rarely more or fewer, imbricated, persistent, petals 5 or fewer, imbricated, deciduous, stamens numerous, often very numerous, free or united in groups, anthers opening by slits or pores, carpels several, usually distinct, but often united, ovules numerous fruit a follicle, or a berry or a capsule, or inclosed in a fleshy calyx, which simulates a berry, seed albuminous, usually with an aril

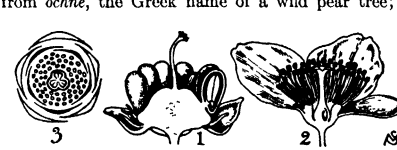
Nearly all the 11 genera and about 200 species are tropical, distributed chiefly in Australia, India, and tropical America, rarely in Africa Of these Dillenia, Hibbertia and Tetracera are the largest genera The family is related to the Ranunculaceæ and Magnoliaceæ on the one hand, and to the Theaceæ on the other. Its closest affinity is with the latter family. The woody habit, polypetalous flowers, very numerous stamens, usually separate carpels, albuminous seeds with arils, and straight embryo, are characteristic

The Dilleniaceæ are astringent, for which reason some are used medicinally, the fruits of some are eaten because acid, others are used as tonics Davilla of Brazil has been used for wounds; Curatella for ulcers; *Tetracera aspera* of Guiana as a sudorific and diuretic, also for syphilis, intermittent fevers and scurvy The astringent bark of a species of Dillenia is said to have been used in Asia for ulcerated sores The acid and inedible fruit of *Dillenia speciosa* serves to season dishes, and a syrup of the juice of the unripe fruit allays coughs, assists expectoration and is said to cure angina, the bark is also used for tanning Many species of Dillenia furnish timber in the Indo region The rough, silicious leaves of many of the tribe Tetraceræ, especially *Curatella americana*, have been used in Brazil to polish wood in place of sandpaper Some of the climbing species furnish drinking-water by incisions in the stem

The flowers of many species are very beautiful, but few forms are in cultivation In this country the only one apparently is *Dillenia indica*, a large magnolia-like tree with flowers 9 inches in diameter, grown in southern California and in Florida

By recent authors (Gilg, in Engler and Prantl), Actinidia, a genus of vines from eastern Asia, has been placed in this family, although formerly included in the Theaceæ A few species of Actinidia are in the American trade

141. **Ochnaceæ** (from the genus *Ochna*, which is from *ochne*, the Greek name of a wild pear tree; the



38. OCHNACEÆ: 1 Ochna, fruit TERNSTRŒMIACEÆ 2. Gordonia, flower 3 Thea, floral diagram

resemblance is probably in the foliage). OCHNA FAMILY. Fig 38. Shrubs or trees, with alternate, simple or pinnate, coriaceous leaves· flowers bisexual, regular, sepals 4–5, imbricated, rarely 10; petals 5, rarely 3–4, or 10, usually convolute; stamens 1–3 times the number of the petals, sometimes with 1–3 series of staminodia, hypogynous, separate; anthers usually opening by terminal pores; an hypogynous stipe usually present (gynophore); ovary 4–5-celled, often deeply lobed, ovules 1 to many in each cell; style and stigmas 1–5:

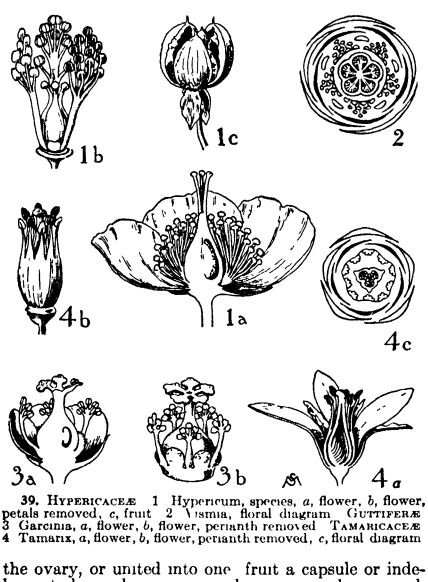
fruit coriaceous and indehiscent, or fleshy, or a capsule, or composed of the 1-seeded drupe-like lobes of the ovary which are whorled on the enlarged fleshy receptacle (Ochna).

The family has 17 genera and 100 or more species, distributed in the tropical regions of both hemispheres, most abundant perhaps in Brazil, but also abundant in Africa The family is not closely related to any other but seems to stand between the Ranunculus group and the Hypericum group of families The many sepals, petals and stamens, the gynophore, and usually the lobed ovary, are distinctive

The wood of some species of Ochnaceæ has been used locally for timber, and, because of the pronounced astringent properties of some species, they have been used locally for fly-bites, ulcers, and so on

Ochna multiflora, of Upper Guiana, is cultivated in America This is grown occasionally in greenhouses because of the peculiar fruit, for an account of which see the article on Ochna

142 **Ternstrœmiaceæ** (or **Theaceæ**) (from the genus *Ternstrœmia*, in honor of Ternstroem, a Swedish naturalist and traveler who died in 1745). Tea Family Fig 38 Large or small trees, with alternate, entire, leathery leaves flowers solitary or scattered, usually bisexual, regular, sepals 5–7, imbricated, persistent, petals 5, rarely 4 or more, nearly or quite separate; stamens very many, rarely 15 or fewer, usually hypogynous, separate or united at the base, or in 5 fascicles, usually adnate to the corolla below; ovary superior, 2–10-celled, ovules 1 to many in each cavity; styles as many as the cells of



39. Hypericaceæ 1 Hypericum, species, *a*, flower, *b*, flower, petals removed, *c*, fruit 2 Vismia, floral diagram Guttiferæ 3 Garcinia, *a*, flower, *b*, flower, perianth removed Tamaricaceæ 4 Tamarix, *a*, flower, *b*, flower, perianth removed, *c*, floral diagram

the ovary, or united into one fruit a capsule or indehiscent, dry or drupaceous; embryo more or less curved.

In this family are 16 genera and 174 species of tropical and subtropical distribution. Stuartia reaches Virginia and Kentucky, and Gordonia reaches Virginia This family is related to the Hypericaceæ and Guttiferæ, also to the Dilleniaceæ From it are now usually excluded several genera which were formerly included. Of importance to us in this connection are Actinidia (transferred to the Dilleniaceæ), and Stachyurus (transferred to the Stachyuraceæ). The very numerous stamens, the type of ovary and the curved embryo are distinctive The numerous stamens have probably been produced by the splitting up of one set of 5, as in the Hypericaceæ

Various glucosides and alkaloids are found in the foliage, on account of which Gordonia has been used for tanning leather, and other species have been used in medicine The most important species is *Thea chinensis* (tea) The bitter taste of tea is largely due to a glucoside, and the stimulating properties to an alkaloid, theine

Exclusive of Actinidia and Stachyurus, 8 or 10 genera are in cultivation in N America Stuartia and Gordonia (Loblolly Bay) are hardy Visnea, Ternstrœmia and Cleyera are grown in Florida Eurya and Schima are Camellia-like warmhouse shrubs Camellia (Thea) is a famous genus of old-fashioned greenhouse shrubs

143 **Guttiferæ** (from the Latin signifying *drop-bearing*, in allusion to the resinous exudation) Garcinia Family Fig 39 Trees or shrubs, with opposite or whorled, rarely alternate leaves flowers regular, usually some bisexual and others unisexual on the same plant, rarely all bisexual, styles usually united and stigmas sometimes shield-shaped,—otherwise as in the Hypericaceæ, to which family it is closely related, and with which the Guttiferæ is united by many authors

Thirty-five genera and about 370 species inhabit the tropical regions of both hemispheres Clusia (America), with 80 species, and Garcinia (Old World), with 150 species, are the largest genera Many species are tropical trees of majestic size and handsome form, useful for timber The Clusias are mostly epiphytic shrubs with aerial roots and evergreen leaves

The Guttiferæ yield a yellow or greenish resinous juice when incisions are made Gamboge is an intensely yellow resinous pigment extracted from *Garcinia Morella* (Ceylon) It is also a powerful purgative. The blackish bitter juice of *Clusia rosea* (West Indies) is also a purgative The juice of species of Clusia (West Indies) may be used as a varnish The resin of *C flava* (hog-gum) is a wound remedy Wounded swine smear themselves with the gum by rubbing against the plant, hence the name The pulpy fruit of *Garcinia Mangostana* ("mangosteen" of the Moluccas), and *Mammea americana* (West Indies) are delicious to many people.

There are 3 or 4 genera in cultivation in warm America Garcinia including the Mangosteen, cultivated in the West Indies, and the Gamboge Tree cultivated in the West Indies and Florida, Calophyllum, cultivated in southern Florida and southern California, *Mammea americana* (Mammee Apple or St Domingo Apricot), cultivated in southern Florida and southern California

144 **Hypericaceæ** (from the genus *Hypericum*, an ancient Greek name of unknown origin) St John's-wort Family Fig 39 Herbaceous or woody plants leaves opposite or whorled, often pellucid punctate or black-punctate flowers bisexual, regular, cymose, sepals 4–5, more or less connate, the outer smaller, rarely 4, with the 2 outer much larger, petals as many as the sepals, sessile or clawed, claw naked or with a honey-furrow or -pit; stamens many, hypogynous, usually in 3–5 bundles the members of which are often more or less united, rarely monadelphous; ovary superior 3–5-, rarely 1-, celled, placentæ usually parietal, ovules numerous, styles 1–5, usually 3–5. fruit a capsule, rarely fleshy.

About 8 genera and 260 species are known, of which 200 are in the genus Hypericum, of the tropical and temperate regions throughout the world, but especially abundant in the north temperate zone The family is very closely related to the Guttiferæ, with which it is united by Engler and Prantl under the latter name, also related to the Ternstrœmiaceæ (Theaceæ) The fascicles of stamens probably represent individual stamens, each of which has become divided into many.

The opposite pellucid-dotted leaves, fascicled stamens, and 3–5-celled ovary with separate styles are characteristic.

The balsamic exudations from the bark and wood, especially of the shrubby species, were formerly used to some extent in medicine as an astringent.

The genera in cultivation in America for ornamental purposes are. Ascyrum (St Andrew's Cross, St. Peter's-wort), and Hypericum (St John's-wort) Some of the species are herbaceous and some are shrubby. Some of the Hypericums are very showy

145. **Tamaricaceæ** (from the genus *Tamarix*, said to have been named from the river Tamaris, now Tambro, on the border of the Pyrenees). Tamarisk Family. Fig 39 Shrubs or small trees, with alternate, mostly needle-like or scale-like, ericoid leaves flowers bisexual, regular, sepals 4–5, petals 5, imbricated, withering and drying persistent, stamens equal to and alternate with the petals or double the number, inserted on a more or less evident disk, ovary superior, 1-celled, with 3–4 parietal placentæ, or placenta basal, ovules 2 to many, styles 3–4, or stigmas sessile, seeds densely bearded at distal end, rarely winged fruit a capsule, sometimes becoming falsely and incompletely several-celled.

The 5 genera and about 90–100 species are mainly distributed in the Mediterranean region and in central Asia The family is related to the Frankeniaceæ and Elatinaceæ, possibly also to the Saliacaceæ The ericoid habit, withering-persistent petals, definite stamens, 1-celled ovary and bearded seeds are distinctive. By means of small leaves, sunken stomata, water-storing tissue, and other contrivances, the Tamaricaceæ are adapted for life in the dry saline regions in which they live Foliage-glands excrete an excess of absorbed mineral matter, and this very hygroscopic excretion accumulates on the surface of the plant

The Tamaricaceæ contain much tannin, resin and oils, which render them bitter and astringent The bark of *Myricaria germanica* has been used for jaundice; the galls of some species are used because astringent *Tamarix mannifera*, "which grows on Mount Sinai and elsewhere in Arabia, secretes, as the result of the puncture of a cynips, a saccharine matter, supposed by some to be the manna which fed the Hebrews in the desert" (See also *Fraxinus Ornus*)

None of the genera in cultivation in N America is very hardy Tamarix (Tamarisk), Myricaria, all grown for the queer, fluffy foliage, and small, abundant flowers

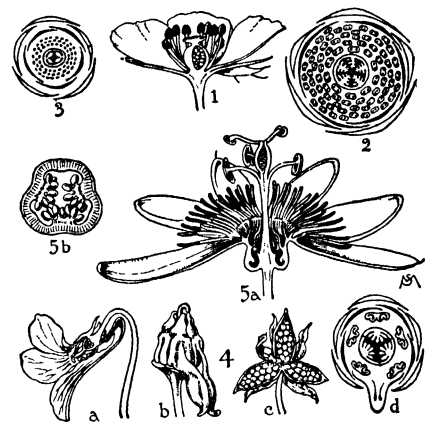
146 **Fouquieriaceæ** (from the genus *Fouquieria*, named in honor of Pierre E Fouquier, professor of medicine at Paris). Candlewood Family Similar to the Tamaricaceæ and formerly united with that family, but differing in the gamopetalous corolla, the ligule-bearing, hairy stamens, partially united styles, median ovules instead of basal, and leaves without crystal glands or epidermal glands.

The single genus and about 4 species are natives of Mexico and the southwestern United States.

F splendens is the ocotilla, coach-whip cactus, vine cactus, or Jacob's staff of the Southwest, a spiny cactus-like shrub used by the Mexicans to make impenetrable hedges A useful wax is obtained from the cortex of this species. The cortex is also used medicinally This species is in cultivation in the larger rockeries of California

147 **Cistaceæ** (from the genus *Cistus*, derived from the Greek, meaning a *box* or *capsule*, on account of the shape of the capsule) Rock-Rose Family. Fig. 40. Herbs or shrubs leaves mostly opposite· flowers bisexual, regular; sepals 3 or more, in $\frac{2}{5}$ phyllotaxy; petals 5, rarely 3 or 0, quickly falling; convolutions of corolla and calyx in opposite directions; stamens numerous, hypogynous; ovary superior, 1-celled, with 3–10 parietal placentæ, or falsely 5–10-celled by ingrowing partitions; ovules 2 to many, orthotropous, style 1; stigmas 1–3: fruit a capsule.

In North America and around the Mediterranean Sea, 4 genera and about 70 species are distributed, also a few species in eastern Asia and in South America. The family is most closely related to the Violaceæ and the Bixaceæ, and more distantly to the Hypericaceæ. The quickly falling convolute petals, many



40. Cistaceæ 1 Helianthemum, flower 2. Cistus, floral diagram Bixaceæ 3 Bixa, floral diagram Violaceæ 4. Viola, *a*, flower, *b*, flower, perianth removed, *c*, fruit, *d*, floral diagram Passifloraceæ. 5. *a*, flower, *b*, cross-section of ovary.

hypogynous stamens, 1-celled, many-seeded ovary, parietal placentæ and copious endosperm are distinctive features.

In the dry region about the Mediterranean, the shrubby forms, especially *Cistus ladaniferus* and *C monspeliensis* take part in forming extensive "maquis," or impenetrable evergreen thickets, where they alone form great stretches of vegetation. The Cistaceæ prefer dry, sunny, sandy or alkaline soil. In America, Hudsonia forms carpets on the sand-dunes which are often strikingly beautiful when in flower. The family includes also Lechea (pinweed), and Helianthemum (rock-rose)

In North America several species of Cistus, all shrubs, and of Helianthemum, are grown for ornamental purposes, although they have no marked importance in this country.

148 **Bixaceæ** (from the genus *Bixa*, a name of South American origin) Bixa Family. Fig 40. Trees or shrubs leaves alternate, simple or compound. flowers unisexual or bisexual, regular, sepals 4–5, imbricated; petals 4–5, large and colored, imbricated and twisted in the bud, stamens numerous, anthers opening by slits, or rarely by pores (Bixa), hypogynous; carpels 1 to several, united, ovary 1-celled, with 1 to several parietal placentæ, or falsely 3-celled; seeds many, with endosperm fruit fleshy or dry, indehiscent or valvular, in Bixa large and bristly-prickly all over

All the 4 genera and 19 species (excluding the Flacourtiaceæ and other small families often here included) are tropical, from Mexico to Brazil and in Africa, Madagascar and Australia Bixa is now widely distributed through the tropics. The Bixaceæ are related to the Violaceæ and Cistaceæ, as well as to the Tiliaceæ. The numerous stamens, compound but 1-celled ovary with many placentæ are all important distinguishing characters

Bixa Orellana furnishes the coloring matter known as "anatto," extracted from the pulp around the seeds,

which is much used to give butter a rich yellow color and is also used in dyeing silks. The Caribbeans formerly tatooed themselves with this dye in order, it is said, to prevent mosquito-bites. The wood is very soft and serves only for tinder; the roots are aromatic and have been used to color and flavor soups. *Maximiliana Gossypium* furnishes a substitute for gum tragacanth in farther India.

Bixa Orellana is in cultivation in the West Indies, where it is grown for the fruit. Several other genera in the American trade, which were formerly included in the Bixaceæ, are now placed by Warburg in the Flacourtiaceæ.

149. **Violaceæ** (from the genus *Viola*, the ancient Latin name). VIOLET FAMILY. Fig. 40 Herbs, shrubs or small trees, rarely climbing leaves usually alternate: flowers bisexual, regular or irregular, sepals 5, separate or nearly so; petals 5, 1 often spurred, stamens 5, hypogynous or slightly perigynous, closely connivent around the style, similar or dissimilar (2 spurred); ovary 1-celled; placentæ 2–5, usually 3, parietal; ovules many; style 1: fruit a firm capsule with placentæ on the middle of the valves, rarely a berry and indehiscent.

Violaceæ has 15 genera and about 300 species, of which about 200 belong to the genus Viola These genera are grouped in three tribes the Violeæ, with irregular flowers, found chiefly in Europe, Siberia and North America, although the woody species are mainly natives of tropical America; the Paypayroleæ and Rinoreeæ, with regular flowers, are principally found in South America, Africa and Australia The family is closely related to the Cistaceæ. The tendency to irregular flowers, the peculiar stamens, the 1-celled ovary with usually 3 parietal placentæ, and the anatropous ovules, are distinctive

In the genus Viola and some other genera, a finger-like curved nectar-secreting horn projects backward from the connective of each of the two lower anthers into the spur of the lower petal In many species of Viola, almost all the seeds are produced by small apetalous cleistogamous flowers on short pedicels near the ground in midsummer, after the normal flowering period is over These are very fertile, and quite diverse in structure, and, therefore, useful in classification Cleistogamous flowers are also produced in the genus Hybanthus. The capsules of most Violaceæ open elastically when ripe, the valves springing back and at the same time folding on the midrib so that the seeds are forcibly ejected as one would shoot a wet apple seed from between the fingers.

The Violaceæ have been used to a certain extent in medicine, their virtues being due to an alkaloid having emetic and laxative properties *Hybanthus ipecacuanha* ("white ipecacuanha" of commerce) furnishes a substitute for ipecac. Various species of Viola and other genera have been used in many countries for skin diseases, as emetics, laxatives, and the like. Several species are ornamental

Three genera are in the American trade: Corniostylis or Calyptrion, a species of greenhouse woody climbers; Hybanthus or Solea, of the garden; and Viola (Common Pansy, Horned Pansy, Sweet English Violets, Wild Violets)

150 **Flacourtiaceæ** (from the genus *Flacourtia*, named in honor of E de Flacourt, a governor of Madagascar). FLACOURTIA FAMILY. Trees or shrubs, rarely climbing: leaves usually alternate and in 2 ranks: flowers bisexual, rarely unisexual, regular; sepals 2–6, commonly 4–5, imbricated, rarely otherwise, petals 0, or equal to the sepals, or many, imbricated or convolute; stamens numerous, hypogynous or perigynous; receptacle enlarged and variously modified, often surmounted by a diversely formed disk; ovary superior or nearly so, 1-celled; placentæ parietal; ovules numerous; styles and stigmas 1 to several: fruit dry or fleshy, dehiscent or indehiscent.

There are 70 genera and more than 500 species of tropical distribution. The family is related to the Violaceæ, Passifloraceæ, and other families with similar parietal placentation, but is most closely related to the Bixaceæ with which it has often been united, and from which it differs mainly in the absence of slime-cells. In general, the peculiar ovary, the numerous stamens, the regular flower, and the enlarged receptacle are characteristic.

The sour fruit of several species is eaten, or preserved, in the tropics The seeds of *Pangium edule* are roasted and used for baking. The leaves of *Casearia esculenta* are eaten in India. The wood is little used. The bark of *Neumannia theiformis* is used like ipecac in Madagascar. Chaulmugra oil is obtained probably from *Gynocardia odorata* of farther India. A peculiar resin is secured from species of Lætia of Cuba. Coccos oil, used in perfumery, is obtained from the Polynesian genus Myroxylon. The fixed oil of species of Pangium is used in cooking.

Probably 5 or 6 genera are in cultivation in the warmer parts of North America· Aberia (Kei Apple); Azara; Carrierıa; Flacourtia (Rambustan, Governor's Plum); Idesia, hardy in Mass., Oncoba; Xylosma.

151. **Stachyuraceæ** (from the genus *Stachyurus*, signifying *spike-tail*, in reference to the form of inflorescence). STACHYURUS FAMILY. Shrubs or small trees with alternate leaves· flowers bisexual or polygamous, regular; sepals 4, imbricated, petals 4, imbricated, stamens 8, separate; carpels 4, ovary superior, 1-celled, or falsely 4-celled by the intrusion of the large parietal placentæ; style and stigma 1, ovules many: fruit berry-like, pericarp leathery

Only one genus and 4 species occur in Japan, China, and the Himalayas The family is closely related to the Ternstrœmiaceæ with which it was formerly united and from which it differs in the fewer stamens, 1-celled ovary and entire stigma Useful apparently only as ornamental plants

Two species are occasionally cultivated in America.

152. **Passifloraceæ** (from the genus *Passiflora*, early travelers thought they had found emblems of the crucifixion in the flower, for a detailed account of which see article on Passiflora) PASSION-FLOWER FAMILY Fig 40. Herbaceous or woody plants, usually climbing by axillary tendrils leaves alternate, simple or compound: flowers bisexual, or unisexual, usually involucrate, perigynous, calyx and corolla sometimes similar, sepals 4–5, imbricated, often petaloid, petals 4–5, rarely 0, imbricated, often smaller than the sepals, sometimes fringed; a crown (outgrowth of receptacle) of many filaments between the petals and stamens, sometimes tubular or scale-like; stamens 4–5, usually opposite the petals, inserted on the edge of the cup-shaped receptacle, or at the base of the corona, or at the base of the pistil at the summit of a long gynophore, separate or connate; ovary superior, raised on a more or less distinct stalk (gynophore), 1-celled with 3–5 parietal placentæ, ovules numerous; styles 3–5: fruit a berry or capsule.

This family contains 18 genera and about 350 species, inhabitants principally of the tropical regions, especially of the New World Two hundred and fifty species belong to the genus Passiflora, which extends as far north as southern Pennsylvania. The family is not closely related to other families, but finds its nearest affinities in the Loasaceæ, Turneraceæ and Begoniaceæ. The remarkable floral structure is distinctive.

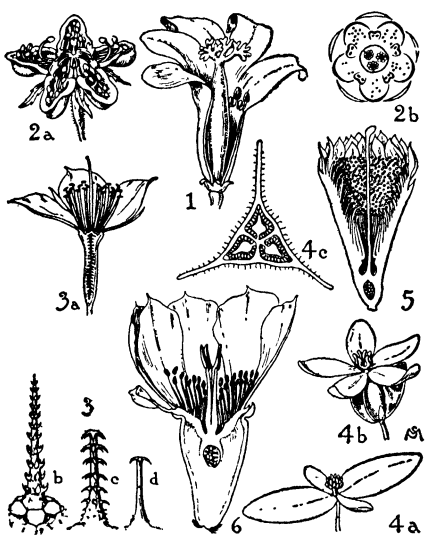
The pulpy aril of the seeds of Passiflora is used in tropical America in the preparation of cooling drinks. The flowers and fruit of *P. rubra* are narcotic. The roots of *P. quadrangularis* are very poisonous and sometimes used in small doses as a vermifuge. Many Passifloras are cultivated in the tropics as fruit plants.

Many are in cultivation in America, namely Passiflora and Tacsonia (Granadilla, Jamaica Honeysuckle,

Water Lemon, May-Pop), some for the beautiful and odd flowers, some, especially in the South, for the fruit.

153. **Caricaceæ** (from the genus *Carica*, erroneously supposed to be a native of Caria; or from the Latin meaning a kind of dry fig). PAWPAW FAMILY. Fig. 41. Peculiar trees with straight, rarely branched, palm-like trunks, very abundant milky juice, and a terminal crown of very large, alternate, palmately-lobed, rarely entire, leaves. flowers unisexual, small, nearly regular, sepals 5; petals 5, in the staminate flowers connate, in the pistillate nearly separate; stamens about 10, inserted on the corolla; ovary superior, 1- or 5-celled, many-seeded; styles 5: fruit a large melon-like berry.

This is a small family of 2 genera and 27 species, confined to tropical and subtropical America; most abundant in the Andes. The Caricaceæ is united with the Passifloraceæ by some authors, but is similar only in



41 CARICACEÆ 1. Carica, one form of flower opened LOASACEÆ 2. Loasa, *a*, flower, *b*, floral diagram 3 Mentzelia, *a*, flower, *b*, *c*, and *d*, types of foliage hairs BEGONIACEÆ 4 Begonia, *a*, male flower, *b*, female flower, *c*, cross-section ovary CACTACEÆ 5. Pilocereus, flower. 6. Opuntia, flower

the fruit. It is also related to the Cucurbitaceæ by the fruit. The peculiar habit and abundant milky juice are very distinctive.

The large melon-like fruits of *Carica Papaya* are now cultivated and eaten throughout the tropics; those of other species are also eaten. The milky juice of *C. Papaya* contains a pepsin-like substance which will curdle milk. This substance will separate the fibers of meat, and hence the leaves and fruit are cooked with too fresh tough meat to make it tender. The juice has also been used as a remedy for dyspepsia

Carica Papaya (South American pawpaw) is commonly grown in greenhouses; and it, as well as two other species, are grown in southern California and Florida in the open.

154. **Loasaceæ** (from the genus *Loasa*, the meaning unknown). LOASA FAMILY. Fig. 41. Erect or climbing herbs, rarely shrubby, with very peculiar and characteristic hairs, some hooked, some stinging: leaves opposite or alternate, very diverse: flowers bisexual, regular, mostly perigynous (i e, receptacle usually extended beyond the ovary); sepals 4–5, imbricated, petals 4–5, flat or cucullate; stamens 4–5, alternating with the petals, or more commonly very numerous through doubling, the outer often converted into staminodia which resemble the petals; ovary usually inferior, and 1-celled, with 3 parietal placentæ; ovules numerous. fruit a capsule, rarely indehiscent, often spirally constructed.

There are 13 genera and about 120 species confined to America from the Great Plains to Chile; most abundant in South America. This is a distinct family distantly related to the Passifloraceæ and the Begoniaceæ The very peculiar hairs constitute a good recognition character On Mentzelia there are three types of hairs: (1) Chinese pagoda-like, broad at the base, (2) tuberculate stem and harpoon-like top; (3) smooth stem and harpoon top The flowers with many staminodia are often large and cactus-like Very queer, grotesque, complex scales are produced in the flowers of certain genera (e g, Loasa) through the union of several staminodia

Mentzelia hispida is a strong purgative, and is used by the Mexicans for syphilis.

A few genera are in cultivation in North America Of these, Loasa is like a nettle, and the sting is very painful, but the flowers are queer and interesting. Mentzelia comprises a number of garden annuals or biennials often with large showy flowers

155. **Begoniaceæ** (from the genus *Begonia*, named in honor of Michael Begon, a French promoter of botany). BEGONIA FAMILY. Fig 41. Herbs, rarely shrubby, hairs usually scale-like or branched leaves alternate, usually oblique· flowers monœcious, regular, epigynous, cymose, the staminate opening first, perianth of the staminate flowers of 2 valvate sepals and 2 petals, all petaloid; perianth of the pistillate flowers of 2 to many similar petaloid parts, stamens numerous, separate or nearly so; ovary inferior, 2–3-celled, usually sharply angled and winged, ovules numerous; styles 3, more or less branched and bearing very peculiar crescent-shaped, kidney-shaped, or, more often, spiral, velvety stigmas, rarely straight fruit a capsule, rarely a berry

The Begonia family has 4 genera and about 500 species, most of which belong to the genus Begonia They are widely distributed throughout the tropics, but perhaps most abundant in South America along the Andes to Mexico, and in the eastern Himalayas southeastward to the Malay Peninsula The Begoniaceæ constitute a distinct group remotely related to the Cactaceæ, Loasaceæ, Passifloraceæ and Cucurbitaceæ

The family is of little economic importance except for ornamental purposes Many species contain oxalic acid and are eaten as salad, and as a remedy for scurvy. The roots of some are astringent; others have a purgative root, used in certain tropics for syphilis and scrofula. The Begoniaceæ is one of the most important ornamental families

Very many species and hybrids of Begonia are grown for greenhouse and bedding purposes, both for the flowers and the foliage.

Order 43. OPUNTIALES

156. **Cactaceæ** (from the old Linnæan genus *Cactus*, a name used by the ancients to denote any spiny plant). CACTUS FAMILY. Fig. 41. Fleshy plants with watery or milky juice, a great reduction or complete absence of foliage, and very thick, rather sparingly branched, rarely unbranched stems, which are cylindrical, globular, flattened, or fluted, and often constricted or jointed leaves alternate, flat and leaf-like in Pereskia, scale-like or absent in other genera, usually bearing bundles of spines in the axils, which are trichomes, and which are of two kinds, long and stout, or minute and needle-like· flowers bisexual, mostly regular, perigynous or epigynous, sepals and petals rarely 8–10, usually very many, similar, stamens many, inserted spirally or in groups

on inside of the receptacle; ovary inferior, 1-celled, with 3 to many parietal placentæ; ovules numerous; style 1; stigmas as many as the placentæ fruit a berry; embryo straight or curved.

The Cacti are almost entirely confined to the dry regions of tropical and subtropical America Mexico is the center of this distribution, but the Cactaceæ extend from New York to Patagonia. A species of Rhipsalis has lately been found indigenous in West Africa. The family is related to the Begoniaceæ, Loasaceæ, and Passifloraceæ. The peculiar habit, perianth of many similar parts, many stamens, and inferior 1-celled ovary are distinctive. The Cactaceæ is divided into three groups: (1) Cereus group, with receptacle extended in a tube beyond the ovary (perigynous), and no hooked spines, (2) Opuntia group, tube of the receptacle wanting, hooked spines usually present; (3) Pereskia group, with foliaceous leaves, panicled flowers, and no hooked spines.

The seeds of Rhipsalis, an epiphytic genus, are often viscid so as to adhere to tree trunks and the like. The ovaries of some Cactaceæ are imbedded in the tissue of the stem In this family, the thick stem is a water-storing organ. The flattened or fluted condition of the stem of most species is probably an adaptation which allows these stems to swell when water is abundant and contract when it is scarce without danger of rupturing the cuticle The variation in size and form among cacti is very great. The largest species is *Carnegiea giganteus* of Mexico, candelabra-like, 60 feet high.

The fruit of *Opuntia Ficus-indica*, now naturalized in the Mediterranean region, is there eaten under the name of Indian fig. *Opuntia Tuna* of tropical America is the prickly pear, an edible fruit *Opuntia vulgaris* of the eastern United States is also eaten under the name of prickly pear or Indian fig Fruits of *Cereus triangularis*, *C giganteus*, and *C Thurberi* are much prized. The stem and flowers of *C. grandiflorus* are used in medicine, producing an action on the heart Vermifugal properties are found in many Cactaceæ An alcoholic drink is made by the Mexicans from the sap of species of Cereus The cochineal insect, a scale insect yielding the well-known dye, cochineal, lives upon species of Opuntia, Pereskia, and Nopalea, in tropical America.

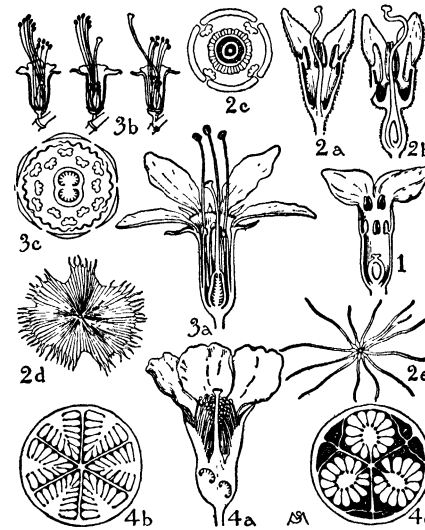
The total number of genera of Cactaceæ which have been described up to the present time is about 70, although Dr. Karl Schumann, who monographed the family in 1899, recognized but 21. Of the many genera described, most are good and will probably stand A rational and uniform treatment of the family will doubtless show that there are no less than 75 tenable genera The total number of names published is something over 3,800 This includes many species that have been transferred from one genus to another. The number of species recognized by Schumann is something less than 700 Many of these species of Schumann, however, are known to be aggregates, and it is not unlikely that there are about 1,200 species in the family

The number of genera treated in this work is 35. They are in cultivation in America as odd plants for desert gardens, and as greenhouse curiosities Many have beautiful showy flowers, those of *Cereus grandiflorus* (night-blooming cereus) being nearly one foot across, and opening only in the night.

The reader will find the cacti described in this Cyclopedia under the following names: Acanthocereus; Anhalonium = Ariocarpus; Aporocactus; Ariocarpus; Bergerocactus, Cactus; Carnegiea; Cephalocereus; Cereus, Disocactus; Echinocactus; Echinocereus; Echinopsis; Epiphyllum = Zygocactus; Escontria, Hariota; Harrisia, Heliocereus; Hylocereus; Lemaireocereus; Leptocereus; Leuchtenbergia; Lophophora; Mamillaria; Melocactus = Cactus, Myrtillocactus: Nopalea; Opuntia; Pachycereus; Pelecyphora; Pereskia; Pereskiopsis; Phyllocactus = Epiphyllum; Pilocereus = Cephalocereus, Rathbunia; Selenicereus; Schlumbergera; Wilcoxia, Wittia; Zygocactus.

Order 44. Myrtifloræ

157. **Thymelæaceæ** (from the generic name *Thymelæa*, a Greek name meaning *thyme* + *olive* or *oil*). Mezereum Family. Fig 42 Shrubs or trees, rarely herbs leaves alternate or opposite, simple, entire: flowers bisexual or unisexual, regular, receptacle developed into a long tube which bears appendages in the throat, perianth undifferentiated, often petaloid, parts 4–5, imbricated, perigynous, stamens as many as the sepals and alternate with them, or twice as many, or



42 Thymelæaceæ 1 Daphne, flower. Elæagnaceæ. 2, Elæagnus, *a*, male flower, *b*, bisexual flower, *c*, floral diagram, *d* and *e*, hairs from surface of leaf. Lythraceæ 3 Lythrum, *a*, flower, *b*, trimorphic flowers of *L Salicaria*, *c*, floral diagram. Punicaceæ. 4. Punica, *a*, flower, *b*, fruit, upper story, *c*, fruit, lower story.

reduced to 2, perigynous; ovary superior, 1-celled, rarely 2-celled; ovule solitary, pendulous; style 1 or 0, stigma 1: fruit indehiscent, a nut, drupe, or berry; rarely a capsule.

About 37 genera and 425 species are widely distributed over the earth. One species is native in northwestern North America. The largest genera are Gnidia with 80–90 species, and Pimelea with 75 species The family stands between the Myrtifloræ and the Cactales, and also somewhat suggests the Passifloraceæ The single perianth, the tubular receptacle, perigynous, definite stamens, the appendages in the tube of the receptacle, and the superior 1-celled, 1-ovuled ovary are distinctive

Gnidia carinata of South Africa and *Daphne Mezereum* (mezereon) of Europe have been used as a purge; as has also the spurge flax (*Daphne Gnidium*) of South Europe, the caustic juice of which is used in a blistering ointment A blistering principle is obtained from the bark of *Funifera utilis* of Brazil; also from *Dirca palustris* The roots of *Thymelæa tinctoria* yield a yellow dye. Paper is made from the cauline fibers of

several species, e.g, *Daphne cannabina* of India, *Dirca palustris* of the United States, Gnidia of Madagascar, and Lagetta of Jamaica. Cord is made from *Lagetta funifera* and *L. linteana* of South America The wood of *Aquilaria Agallocha* of India is aromatic, called aloewood One Pimelea yields a balsam. Lace-bark is the product of *Lagetta linteana*.

Six or more genera are in cultivation in this country for ornament Among these are Daphne (Mezereon), greenhouse and garden, Dirca (Leatherwood, Moosewood), native, hardy; and Pimelea (Rice Flower), greenhouse.

158 **Elæagnaceæ** (from the genus *Elæagnus*, derived from the Greek name of the olive combined with that of the Chaste tree). OLEASTER FAMILY. Fig 42 Trees and shrubs, covered with silvery and brown, peltate or stellate scales leaves alternate or opposite, simple, entire flowers bisexual or unisexual, regular, perigynous, receptacle developed into a long tube beyond the ovary, more or less persistent, and inclosing the fruit, perianth of 1 series, parts 4, rarely 2 or 6, valvate, stamens of the same number or double the number, inserted in the tube; perigynous disk prominent, lobed; ovary superior, 1-celled, 1-ovuled, style 1; stigma 1 real fruit dry, indehiscent, but appearing drupe-like because of the fleshy investing receptacle.

Three genera and about 30 species are found, of which about 25 belong to Elæagnus, mostly steppe or rock plants, chiefly of south Asia, Europe and North America The family is closely related to the Thymelæaceæ, which see for further relationship. The peculiar scales, the perigynous flowers, the 1-celled, 1-seeded ovary, and the fleshy but free receptacle are distinctive.

The acid fruits of *Elæagnus angustifolia* of Persia are eaten, also those of *E. latifolia* of India, and the seeds of *Shepherdia argentea* of North America

There are 3 genera in cultivation in America, principally as hardy ornamental plants with silvery foliage: Elæagnus (Oleaster, Goumi), Hippophae (Sea Buckthorn, Swallow Thorn), Shepherdia (Buffalo Berry)

159 **Lythraceæ** (from the genus *Lythrum*, derived from the Greek meaning *blood*, in reference to the purple flowers) LOOSESTRIFE FAMILY Fig 42 Herbs, shrubs, or trees leaves usually opposite or whorled flowers bisexual, usually regular, perigynous, receptacle ("calyx-tube") tubular, ribbed, free from the ovary, bearing the 4 or 8 valvate sepals on its margin; petals of the same number as the sepals, or 0, and inserted with them, imbricated, stamens usually twice as many as the petals, rarely more (up to 200), or fewer (to 1), outer set alternate with the petals, and inserted some distance below them; ovary superior, 2–6-celled, many-ovuled fruit a capsule, rarely indehiscent.

There are 22 genera and about 450 species known; generally distributed, but more abundant in the tropics, especially in America. The largest genus is Cuphea with about 160 species The family is closely related to the Onagraceæ, but differs in the superior ovary; it is also related to the Melastomaceæ, but the stamens are normal

Lythrum Salicaria has been used as an astringent; Heimia and Cuphea have been used as purgatives and emetics *Lawsonia inermis* of Egypt is the famous henna, the perfume of the flower of which is renowned throughout the East, with an orange-red dye obtained from the leaves of this plant, women of the orient dye hair and nails *Pemphis acidula* is used as a pot-herb in Asia The flowers of *Woodfordia floribunda* yield the red dye of India called dhak. Lagerstrœmia furnishes very valuable timber

In cultivation in N America are several genera: Cuphea, species of garden annuals, Decodon (Swamp Loosestrife), native, but used for water-gardens; Lythrum (Loosestrife); Lawsonia (Henna), cultivated in southern Florida and southern California; *Lagerstrœmia indica* (Crape Myrtle) cultivated in the South.

160. **Punicaceæ** (from the genus *Punica*, derived from the Latin in reference to Carthage, near which city the plant is said to have grown, or from the Latin meaning *scarlet*, in reference to the flowers) POMEGRANATE FAMILY. Fig 42 Shrubs or commonly small trees. leaves mostly opposite. flowers bisexual, usually perigynous; receptacle campanulate or tubular, thickened above the ovary; sepals 5–8, fleshy, valvate; petals 5–7, imbricated, inserted with the sepals on the edge of the receptacle, stamens very numerous, clothing the tube of the receptacle; carpels in 1–2 (rarely 3) superimposed series, 3 in the lower and usually 5–7 in the upper, ovary more or less inferior, with as many cells as carpels; placentæ of the lower series axile, of the upper parietal, the cells many-ovuled; style and stigma 1 fruit a berry, the pulpy central mass of which is formed from the fleshy outer seed-coats.

This is a family of only 1 genus and 2 species, natives of the Mediterranean region and eastward to the Himalayas It was formerly united with the Lythraceæ, but the peculiar ovary is unique. *Punica Granatum* is the famous pomegranate, cultivated for its fruit since the earliest times, and now widely spread over the tropics. This species is cultivated in the southern states and in greenhouses It has escaped in Florida

161 **Lecythidaceæ** (from the genus *Lecythis*, derived from the Greek meaning an *oil-jar*, in reference to the fruit) LECYTHIS FAMILY Fig 43. Trees. leaves alternate, large and striking flowers bisexual, regular, perigynous or epigynous, sepals 4–6, rarely fewer, valvate; petals 4–6, imbricated, rarely more or fewer, stamens very numerous, somewhat monadelphous, many antherless; intra-staminal disk often present, ovary inferior, 2–6-celled, several ovules in each cell· fruit a hard-shelled berry or a capsule dehiscing by a lid

The family has 18 genera and about 225 species, with a somewhat isolated distribution in various parts of the tropics, e g, North Brazil, west coast of Africa, Malay Peninsula, Mozambique, and Samoa. The family was formerly united with the Myrtaceæ but is dissimilar in some important details of vascular structure, and in the absence of volatile oils

The most important economic plant is the Brazil-nut or para-nut (*Bertholletia excelsa*) of northern South America, the oily seeds of which are an important article of food. The seeds are in a box-like capsule, the lid of which falls off. The oily seeds of several other species are eaten, e g, the monkey-pot tree (Lecythis). The fruits and roots of a number of species of Barringtonia are used in Java and China to stupefy fish. The flowers of *Grias cauliflora* of the West Indies are used for tea. A cooling drink is made from the fruit of *Couroupita guianensis* of the West Indies.

The Brazil-nut or nigger-toe is sparingly planted in southern California, Florida and the West Indies.

162. **Rhizophoraceæ** (from the genus *Rhizophora*, *root-bearing*, because of the numerous aerial roots). MANGROVE FAMILY. Fig 43. Trees or shrubs· leaves usually opposite, coriaceous flowers bisexual, epigynous or perigynous; sepals 3–14, more or less connate, valvate; petals of the same number, small, often lacerate; stamens 2–4 times as many, often in pairs opposite the petals; ovary inferior, usually 2–5-celled: fruit somewhat juicy, crowned with the calyx, rarely dehiscent, usually a berry, rarely a drupe

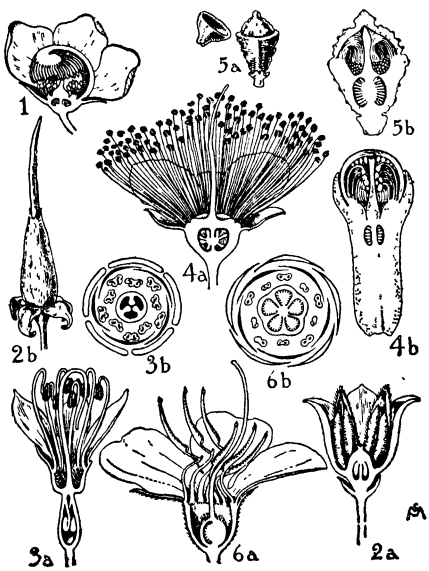
The 15 genera and about 50 species are distributed throughout the tropics The family is related to the Combretaceæ and Lythraceæ; more distantly to the other families of the myrtaceous group.

This is a small family of remarkable plants, mostly inhabiting mud-flats along the coast in the tropics. The stem soon perishes at the base and then the plant is supported by its numerous prop-roots alone The mud is so soft that otherwise the plants could probably not remain erect. The genus Rhizophora is almost unique in the vegetable kingdom because the seeds germi-

nate on the plant. The hypocotyl may reach the length of 3 feet, although usually less; it is club-shaped and heaviest at the apex, so that when the seedling eventually falls from the tree, it sticks in the mud vertically, with the hypocotyl down, ready to grow.

The Rhizophoraceæ are of little economic importance Land is held in place and protected from the waves by the mangrove The fruits of Anisophyllum are plum-like but poor. The mangrove grows wild on the Florida, Texas, and Mississippi coast, and has been offered for sale in California

163 **Combretaceæ** (from the genus *Combretum*, a name given to this plant by Pliny). COMBRETUM FAMILY. Fig 43 Trees or shrubs, erect or climbing leaves



43 LECYTHIDACEÆ· 1 Lecythis, flower RHIZOPHORACEÆ: 2 Rhizophora, *a*, flower, *b*, germinating fruit COMBRETACEÆ 3 Combretum, *a*, flower, *b*, floral diagram MYRTACEÆ 4. Jambosa, *a*, flower, *b*, vertical section flower-bud 5 Eucalyptus, *a*, flower-bud and lid, *b*, vertical section flower-bud. MELASTOMACEÆ 6 Melastoma, *a*, flower, *b*, floral diagram.

alternate or opposite, simple or coriaceous· flowers bisexual or unisexual, regular, usually perigynous, receptacle enveloping the ovary and often projecting into a slender tube; sepals 4–5, valvate, connate, petals 4–5, or 0, stamens 4–5, alternating with the petals, or twice or thrice as many; ovary 1-celled, inferior, 2–4-ovuled· fruit a drupe, or dry and winged, rarely dehiscent

In this family are 15 genera and about 280 species, mostly confined to the tropics of both hemispheres. The family is related to the Cornaceæ and the Rhizophoraceæ, as well as more distantly to the Onagraceæ.

The trees are valuable for their hard, close wood; the tannin-containing bark and galls are used locally for tanning leather The seeds known as myrobalans (*Terminalia Chebula* and *T. Catappa*) are much eaten in India A useful oil is obtained from these seeds. Black and yellow dyes are furnished by several species.

Four to 6 genera are in cultivation in the Southern States and the West Indies *Terminalia Catappa* (tropical almond, myrobalan) is grown for nuts and shade Poivrea is a red-flowered shrub grown in southern Florida. One species of Combretum is a warmhouse climbing shrub Quisqualis, or rangoon creeper, is a peculiar climbing shrub grown in the warmhouse. It is at first erect, later climbing

164 **Myrtaceæ** (from the genus *Myrtus* derived from the classical name myrtle, which probably meant *perfume*) MYRTLE FAMILY Fig 43. Usually shrubby or arborescent aromatically fragrant plants leaves usually opposite, thick, entire and pellucid-dotted flowers bisexual, regular, rarely perigynous; sepals mostly 4–5, imbricated, petals 4–5, imbricated, stamens very numerous by splitting, often in fascicles which are opposite the petals, ovary inferior, 1- to many-celled fruit usually a berry, rarely a drupe or nut, seeds 1- to many

The 72 genera and 2,750 species are confined almost entirely to the tropics, but with two great centers of distribution, one in tropical America and the other in Australia Eugenia contains 625 species, and Eucalyptus more than 130 species This is a large family related to the Melastomaceæ, Onagraceæ, and Lythraceæ The very numerous stamens, derived by the splitting of the few original stamens, and the oil-glands are distinctive The petals of Eucalyptus remain firmly grown together, and, when the flower opens, they separate along a transverse line and are thrown off as a lid

The Myrtaceæ are rich in volatile oils, also in tannin, acids, sugars, mucilage, and fixed oils. Cloves are the flower-buds of *Jambosa caryophyllus* The fruit of *Pimenta officinalis* is thought to combine the flavors of the nutmeg, cinnamon, and clove, and is therefore termed allspice *Psidium Guajava* is a tree cultivated in the tropics for the much-prized fruits Oil of myrica is obtained from the leaves of *Pimenta acris* of the West Indies, and is used in making bay rum Oil of cajeput, a fragrant oil used in medicine, is secured from the leaves and twigs of the East Indian *Melaleuca Leucadendron* The leaves of the European myrtle (*Myrtus communis*) yield a distilled preparation known as eau-d'ange, used as a toilet article Other edible fruits are rose apples (*Jambosa malaccensis* and *J vulgaris*) of the East Indies and Pacific Ocean Jambos berries are obtained from *Jambosa vulgaris*, which is extensively cultivated in the tropics Oil of eucalyptus is an important aromatic oil obtained from the foliage of various species of that genus The wood of Eucalyptus is hard, firm and elastic, and is much prized in wood-carving Many other species of this family are in use locally for food, condiments, medicine, timber, and so on

About 20 genera are in cultivation in North America, mostly in the South or Southwest Among these are the Bottle-brush (Callistemon), Cajaput Tree (Melaleuca), Eucalyptus or Australian Blue-gum, Rose Apple or Jambos (Jambosa), Cayenne Cherry (Eugenia), Myrtle (Myrtus), Guava (Psidium), Allspice, Pimento (Pimenta), Brisbane Box (Tristania), Turpentine Tree (Syncarpia), and Downy Myrtle (Rhodomyrtus)

165 **Melastomaceæ** (from the genus *Melastoma*, derived from the Greek *black-mouth*, because the berries of some of the species when eaten stain the mouth black) MELASTOMA FAMILY. Fig 43 Herbs, shrubs or trees, erect, climbing or epiphytic branches often 4-sided leaves opposite or whorled, simple, mostly entire, usually palmately nerved throughout with transverse nervelets. flowers bisexual, regular or slightly irregular, often perigynous, sepals 3–6, mostly 5, valvate, imbricated or united into a calyptra-like hood, petals commonly 5, convolute; stamens usually twice as many as the petals, rarely just as many; anthers mostly opening by terminal pores, inflexed in the bud, often curved, connective very peculiar and diverse, with various appendages; often one anther cell wanting, the other mounted on the end of the lever-like, versatile, curved connective, ovary usually 4–5-celled, more or

less inferior; ovules numerous in each cell; style and stigma 1; fruit a berry, drupe or capsule, or dry and indehiscent, usually inclosed in the calyx

Most of the 148 genera and about 2,800 species, are found in tropical America, where the species are very abundant and form a characteristic component of the vegetation; represented in the eastern United States by 4 species of Rhexia (deer-grass, meadow beauty) Melastomaceæ is a very distinct, striking and peculiar tropical family related to the Myrtaceæ and the Lythraceæ, recognized by the venation of the leaves, and the unusual stamens The so-called "cauliflower" species, with the flowers borne directly on the tree-trunks, are pollinated by butterflies in the deep tropical forests. Some Melastomaceæ are myrmecophilous, i e, furnish habitations or food for ants, which in turn protect the plant

The fruits of several species are eaten The berries and bark of some yield coloring matter of some importance A yellow dye is obtained from the leaves of Memecylon of the East Indies and Africa, red and black dyes are secured from the berries of Tamonea (tropical America), Melastoma (East Indies), and so on The leaves of *Tamonea theæzans* are used by the Peruvians in place of tea Some, because of astringent properties, are locally used as medicine The most important use of the Melastomaceæ is ornamental The large, showy, queer flowers and striking foliage render them popular greenhouse plants in the North

Some 20 genera are cultivated in N America, mostly as warmhouse decorative plants, or for summer bedding Few, if any, have popular names

166 **Onagraceæ** (from the genus *Onagra*, now a part of Œnothera, derived from the Greek, *a wild ass*, in reference to a fancied resemblance between the ears of that animal and the leaves of these plants) Evening Primrose Family Fig 44 Mostly herbs, rarely shrubs leaves opposite or alternate flowers bisexual, regular, perigynous or epigynous, sepals 4, rarely 2–3, separate or united, valvate, petals 4, or rarely 2 or 0, mostly clawed, convolute, stamens of the same number as the petals or twice as many, outer alternate with the petals, ovary 2–4-celled, inferior; ovules numerous, style 1, stigmas 1–4 fruit a capsule, rarely a berry or nut

The 36 genera and 470 species are mostly natives of the temperate portion of the New World (western United States and Mexico), but are also abundant in South America Epilobium, containing 160 species, is widely distributed in the cooler regions of both hemispheres This is a distinct family, recognized by the numerical plan of 2 or 4, the usually perigynous flowers, and the inferior ovary with many ovules It is related to Lythraceæ, Melastomaceæ, Myrtaceæ, and other families of this group

Fuchsia is shrubby or even arborescent, and its fruit is a berry The tubular receptacle is prolonged beyond the ovary in most genera, but not in Jussiæa, Ludwigia, and Epilobium The seeds of Epilobium are comose, and are distributed, parachute-like, by the wind. The flowers of a number of species of Œnothera open only at night or in dark weather, and are pollinated by night-flying moths; hence the name evening primrose

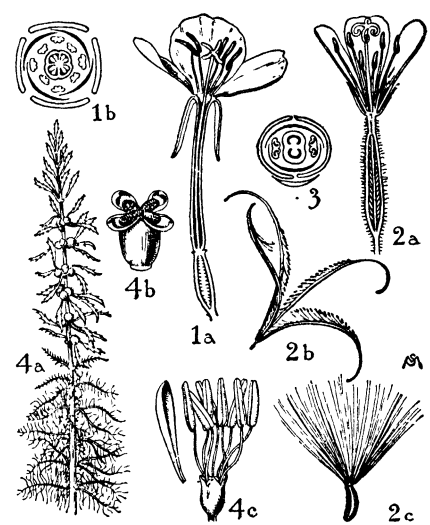
The wood of several species of Fuchsia furnishes ink and a black dye *Jussiæa pilosa* yields a yellow dye. The berries of many Fuchsias are eaten, and preserved with sugar The young shoots of *Epilobium latifolium* are eaten as greens The roots of *Œnothera biennis* have been improved in Europe and furnish "rhapontic" roots, which are eaten like celery The coma of the seeds of Epilobium has been used in Lapland to make lamp-wicks and has been spun into cloth, but without great success Many genera are cultivated for ornamental purposes because of the showy flowers

About a dozen genera are cultivated in N America, among which are the following: Circæa (Enchanter's Nightshade), Epilobium (Willow Herb, Fire Weed), Fuchsia, Ludwigia (Water-purslane, Seed-box or Rattle-box), Clarkia, (Œnothera (Evening Primrose, Sundrops), and Godetia These are mostly grown in the open as annuals or as hardy perennials, except Fuchsia, which is a greenhouse plant but often bedded out in summer

167 **Hydrocaryaceæ** (from the Greek signifying *water-walnut*) Water Chestnut Family Herbaceous, aquatic plants mostly floating stems slender, clothed with opposite, pinnatifid roots leaves alternate crowded at the summit of the stem, floating, rhomboid, petioled, petioles forming thick, hollow floats flowers bisexual, regular, slightly perigynous, axillary, sepals 4, petals 4, stamens 4, all sets alternating, ovary surrounded by an erect, corona-like disk, half-inferior, 2-celled, cells 1-ovuled, style and stigma 1 fruit a woody 1-celled, 1-seeded nut bearing on the surface the four divergent woody horn-like sepals and capped by the woody disk

A single genus and 3 species occur, distributed in the Mediterranean region and eastward to eastern Asia. This is an ancient family, more common in the tertiary. The family is related to the Onagraceæ, with which it is frequently united, and to the Haloragidaceæ, and is somewhat intermediate between these two families The fruit, disk, and habit are peculiar

The starchy seeds have a chestnut-like flavor and are eaten raw or cooked, for which reason the plants are often cultivated The fruits are regularly sold



44 Onagraceæ 1 Œnothera, *a*, flower, *b*, floral diagram 2 Epilobium, *a* flower, *b*, dehiscing fruit, *c*, seed 3 Circæa, floral diagram Haloragidaceæ. 4. Myriophyllum, *a*, portion of flowering plant, *b*, female flower, *c*, male flower, petals removed

in the markets of India; those of *Trapa natans* var. *verbanensis* are used as beads

Trapa natans (Water Chestnut, Water Caltrops) and *T bispinosa* (Singhara Nut) are grown in this country as aquarium plants See article on Trapa

168 **Haloragidaceæ** (from the genus *Haloragis*, meaning *sea + a berry*) Water Milfoil Family. Fig 44 Herbs, aquatic or terrestrial, of very diverse appearance: leaves opposite or alternate, often in the same genus, pectinate (aquatic) to very large and

divided: flowers bisexual or unisexual, regular; sepals 4, petals 4 or 0; stamens 8, the outer opposite the petals, or 4, rarely fewer; ovary inferior, 1–4-celled, each cell 1-ovuled: fruit nut-like, often crowned by the calyx.

Eight genera and about 100 species are known, of general distribution. These are most abundant in the southern hemisphere of the Old World. They are represented in South America and elsewhere by the queer Gunnera and in the eastern United States by Hippuris, Myriophyllum and Proserpinaca. The family is closely related to the Onagraceæ, but differs in having but 1 ovule in each cell of the ovary.

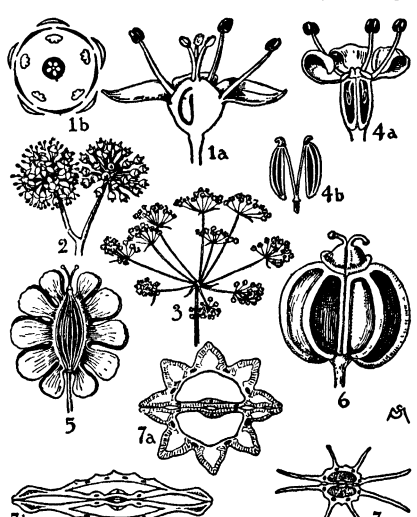
The aquatic forms are Utricularia-like and floating, with slender stems and either finely pectinate leaves with filiform divisions (Myriophyllum) or linear and entire leaves (Hippuris). Gunnera of South America has broad kidney-shaped leaves varying from small to gigantically large. The leaves of this genus in Costa Rica are said to be so large as to give shelter to three men on horseback.

The fruits of *Gunnera macrophylla* are used as a stimulant in Java. The giant leaves, six feet broad, of *Gunnera chilensis* are used in Chile for tanning skins.

Two species of Gunnera are almost, or quite, hardy in the mid-eastern United States, and are grown for luxuriant lawn foliage. Several species of the aquatic Myriophyllum are in cultivation, one of which is parrot's feather (*M. proserpinacoides*).

Order 45. Umbelliflorae

169 **Araliaceæ** (from the genus *Aralia*, the meaning of which is unknown). Ginseng Family. Fig 45. Herbs, shrubs, or trees, often prickly or climbing. stems solid, pithy leaves usually alternate, simple, or pinnately or ternately compound· flowers bisexual or unisexual, small, regular, epigynous, commonly in umbels; sepals minute, often almost wanting; petals 5, rarely more, valvate or imbricated, sometimes cohering at the apex and deciduous as a cap; stamens usually 5, alternate with the petals, and inserted at the edge of an epigynous disk, rarely twice or thrice as many; ovary inferior, 2–15-celled; cells 1-ovuled; styles as many as the carpels: fruit a berry, rarely splitting into segments.



45 Araliaceæ 1 Aralia, *a* flower; *b*, floral diagram. 2 Hedera, portion of inflorescence Umbelliferæ· 3 Cicuta, inflorescence 4 Fœniculum, *a*, flower, *b*, dehiscing fruit 5 Artedia, fruit 6 Apium, fruit 7. *a*, *b*, and *c*, fruits of Umbelliferæ, cross-section

Fifty-one genera and about 400 species are distributed in tropical and temperate regions of both hemispheres. The two great centers of distribution are tropical America and the Malay Peninsula. The family is very closely related to the Umbelliferæ, but differs in the berry-like fruit with more numerous carpels.

The leaves of the English ivy (*Hedera Helix*) were used in medicine in olden times. The roots of ginseng (*Panax Ginseng* and *Panax quinquefolium*) are much prized in China where they are carried about on the person as a charm against disease These roots are now extensively and profitably cultivated in America for the Chinese trade. The roots of *Aralia nudicaulis* (American sarsaparilla) are considered a tonic Chinese rice-paper is made from the pith of *Tetrapanax papyriferum* simply by cutting the pith spirally into thin sheets. Many Araliaceæ are grown as ornamental plants.

Many genera are cultivated in America. Among these are Acanthopanax; Aralia (including Spikenard, Hercules' Club or Devil's Walking-club, Wild Sarsaparilla, Bristly Sarsaparilla, Chinese Angelica Tree); Dizygotheca, Fatsia, Oreopanax, Polyscias, Pseudopanax; Hedera (English Ivy), and Panax (Ginseng)

170. **Umbelliferæ** (from the predominating type of flower cluster). Parsley Family. Fig 45 Herbs or rarely shrubs stems often hollow. leaves alternate, rarely simple, usually ternately or pinnately compound. flowers minute, bisexual, regular or the outer irregular, epigynous, borne in simple or compound umbels; sepals minute or wanting; petals 5, valvate and incurved in the bud; stamens 5, alternating with the petals, inserted around an epigynous disk, ovary 2-celled, inferior, each cell 1-seeded, styles 2 fruit very special, consisting of 2 dry, ribbed or winged, 1-seeded, indehiscent carpels (mericarps), which separate at the base but remain attached at the top to a very slender and flexuous Y-shaped stalk (carpophore) from which they dangle; between or under the ribs are oil-tubes.

About 231 genera and 1,500 species are very commonly found in all boreal temperate and subtropical lands, but are rare in the tropics except in the mountains. The Umbelliferæ is a distinct family, closely related to the Araliaceæ, and more distantly to the Cornaceæ. The umbels, the inferior ovary and the peculiar fruit are distinctive.

The leaves are exceedingly diverse in size, shape and extent to which compounded Those of Eryngium are sword-shaped, or yucca-like, often spiny, those of Hydrocotyle are simple and often peltate. Azorella of the Andes and New Zealand is turf-like or cushion-like, a xerophytic adaptation Some species of Angelica are immense herbs many feet high with enormous leaves. The flowers, in general, are uniform in structure and appearance, the greatest diversity being in the fruit

Economic plants are abundant in the Umbelliferæ; between 40 and 50 have been listed by some authors Various alkaloids and other compounds, some very poisonous, together with many kinds of resins, produced in the foliage, roots or seeds, form the basis of their economic importance. Plants used for food are celery (*Apium graveolens*), carrot (*Daucus Carota*), and parsley (*Petroselinum sativum*). Those used for flavoring are caraway (*Carum Carui*), anise (*Pimpinella Anisum*), sweet Cicely (Osmorhiza or Scandix), chervil (*Anthriscus Cerefolium*), dill (*Anethum graveolens*), fennel (*Fœniculum vulgare*), lovage (*Levisticum officinale*) Very poisonous plants are poison hemlock (*Conium maculatum*), fool's parsley (*Æthusa Cynapium*) and others The following drugs are obtained from this family. coriander (*Coriandrum sativum*), ammoniac resin (from *Dorema Ammon-*

tacum), galbanum (a resin from species of Ferula). From various species of Ferula is obtained the vile-smelling gum-resin asafetida, used in medicine, which the Persians are said to praise as a delicious condiment.

There are 40–50 genera in cultivation in America, mostly hardy. Some are grown for food, others for ornament. Sea Holly (Eryngium), Sanicle, or locally Black Snakeroot (Sanicula), Carrot (Daucus), Coriander (Coriandrum); Cumin (Cuminum), Celery (Apium), Caraway (Carum), Gout-weed (Ægopodium), Sweet Cicely (Osmorhiza), Myrrh (not of medicine) or European Sweet Cicely (Myrrhis or, more properly, Scandix), Fennel (Foeniculum), Lovage (Levisticum), Angelica (Angelica), Cow-parsnip (Heracleum). Poison hemlock (Conium) is a roadside weed.

171 **Cornaceæ** (from the genus *Cornus*, derived from the Latin *horn*, referring to the hardness of the wood). Dogwood Family. Trees or shrubs, rarely herbs; leaves opposite or alternate, entire, exstipulate; flowers bisexual, rarely unisexual, regular, epigynous, sepals 4, minute or absent, petals 4, usually valvate, stamens commonly of same number as petals and alternate with them, separate, epigynous disk usually present, ovary inferior, 2-celled, rarely 1–10-celled, ovules in each cell 1, rarely 2; fruit a drupe or berry.

The 15 genera and about 120 species, of which 45 species belong to the genus Cornus, are distributed in the temperate portions of the northern hemisphere, principally in North America and Asia, some, however, occur in South Africa and New Zealand. The relationships of the family are doubtful. Cornus is related to the Caprifoliaceæ, but some other genera suggest the Araliaceæ. The woody or sub-ligneous habit, 4-merous, polypetalous, epigynous flowers and the berry-like fruit with one seed in each cell are distinctive.

Many species of Cornus have capitate flowers surrounded by a large petaloid involucre (e.g., *Cornus mas*, *C. florida*, *C. canadensis*). *C. canadensis* and *C. suecica* are herbaceous dogwoods. *Helwingia ruscifolia*, of China and Japan, is a most remarkable plant with flowers borne at the center of the leaf-blade attached to the midrib on the upper side.

The acid fruits of *C. mas* are edible, and are used as a sherbet in the East. Those of *C. capitata* of the Himalayas have a flavor like strawberries and are eaten. Many Cornaceæ are ornamental woody plants.

Several genera are in cultivation here, of which may be mentioned: Cornus (Dogwood, Osier Dogwood), Aucuba, from Japan, Garrya from southern United States, Griselinia from New Zealand, Nyssa (Sour Gum, Pepperidge, Tupelo) from the eastern United States. Garrya, Nyssa and others have been separated by some into other families.

Sub-class II. Metachlamydeæ, or Sympetalæ.

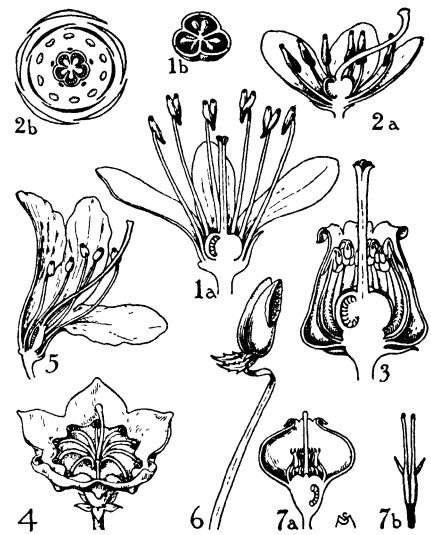
Order 46. Ericales.

172 **Clethraceæ** (from the genus *Clethra*, the ancient Greek name of Alder). Pepperbush, or White Alder Family. Fig. 46. Tall shrubs or low trees; leaves alternate; flowers bisexual, regular, hypogynous, disk absent, calyx 5-parted, persistent, corolla saucer-shaped, of 5 separate petals, stamens 10, hypogynous, anthers opening by terminal pores, at first inverted, later erect; ovary superior, 3-celled, style 1, stigmas 3; ovules numerous; fruit a capsule.

A single genus and about 30 species are distributed in the tropical and subtropical regions of both hemispheres, mostly American. Two species reach the eastern United States. The family is closely related to the Pyrolaceæ and Ericaceæ. The polypetalous corolla, temporarily inverted anthers and the 3-celled ovary are important characteristics. There is one fossil species known.

A few species of Clethra are grown in North America for ornamental purposes. *C. alnifolia* is the native white alder or sweet pepperbush.

173 **Pyrolaceæ** (from the genus *Pyrola*, diminutive of Pyrus, possibly a resemblance in the foliage). Shinleaf Family. Fig. 46. Very low perennial herbs:



46. Clethraceæ: 1 Clethra, *a*, flower, *b*, cross-section ovary. Pyrolaceæ: 2 Pyrola, *a*, flower, *b*, floral diagram. Ericaceæ: 3 Andromeda, flower. 4 Kalmia, flower. 5 Rhododendron, flower. 6 Erica, stamen. 7 Vaccinium, *a*, flower, *b*, stamen.

leaves alternate, basal or scattered, thick and evergreen in most species; flowers bisexual, regular, with or without a hypogynous disk; calyx 5-parted, persistent; corolla waxy, saucer-shaped, of 5 separate petals, stamens 10, hypogynous, anthers opening by terminal pores, inverted, ovary superior, 5-celled, many-ovuled; style and stigma 1; fruit a capsule.

There are 3 genera and 20 species distributed in the boreal and temperate parts of Europe, Asia and America. The polypetalous flowers, inverted anthers and 5 carpels are characteristic. The family is closely related to the Ericaceæ and Clethraceæ.

Two species of Chimaphila (Pipsissewa, Prince's Pine), one species of Moneses (One-flowered Pyrola), and a few species of Pyrola (Shinleaf) are offered in the American trade for ornamental purposes. Otherwise the family is of no economic importance.

174 **Monotropaceæ** (from the genus *Monotropa*, meaning *one turn*, in reference to the nodding flower). Indian-Pipe Family. Low, saprophytic herbs, without chlorophyll, white, yellowish, brownish, or blood-red in color; leaves alternate, reduced to scales; flowers 1 to several, bisexual, regular, a lobed, hypogynous disk sometimes present, calyx 5-parted, rarely 0, corolla of 4–5, separate, gibbous petals, these rarely coherent; stamens 8–10, hypogynous; anthers opening by slits, 1–2-celled, often appendaged; ovary 4–5-celled, superior, many-ovuled; style and stigma 1; fruit a capsule.

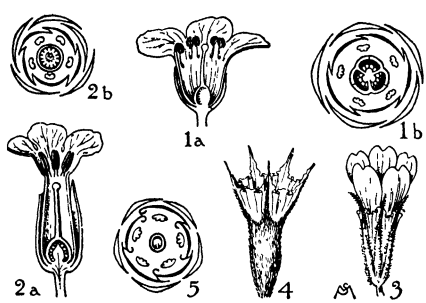
The Indian-pipe family contains 8 genera and about 12 species, all North American except 1 Himalayan species and 1 found in both Europe and America; most abundant in the West. The family is closely related to the Ericaceæ, Pyrolaceæ and Clethraceæ, from which it differs mainly in method of nutrition.

Sarcodes sanguinea, the Sierran snow plant, is bright red in color

The Monotropaceæ are not known to be in cultivation.

175 **Ericaceæ** (from the genus *Erica*, the ancient name of the heath, from *erico*, to break). HEATH FAMILY. Fig 46 Shrubs or sub-shrubs leaves alternate, often evergreen. flowers bisexual, regular or slightly irregular, calyx 4–5-fid, persistent corolla gamopetalous, rarely polypetalous, often urceolate, 4–5-lobed, convolute or imbricated, stamens alternate with the petals, of the same number or double the number, inserted at the base of a hypogynous disk, not epipetalous, anthers sometimes appendaged, opening by terminal pores, rarely by longitudinal slits, ovary superior or inferior, 4–5-celled or falsely 10-celled, many ovuled, style and stigma 1 fruit a capsule, rarely a berry or drupe

The 67 genera and about 1,400 species are very generally distributed Erica, the largest genus, with 420 species, is confined to the Old World The family is closely related to the Pyrolaceæ and Clethraceæ, also to the Epacridaceæ and Diapensiaceæ The northern Ericaceæ are largely evergreen and variously adapted



47 DIAPENSIACEÆ 1 Diapensia, *a*, flower, *b*, floral diagram PRIMULACEÆ 2 Primula, *a*, flower *b*, floral diagram PLUMBAGINACEÆ 3 Armeria, flower 4 Statice, calyx 5 Plumbago, floral diagram

in foliage to a xerophytic habitat Ledum is polypetalous Rhododendron has a funnel-form corolla, Kalmia, a cup-shaped corolla with elastic stamens in pockets The anthers of Epigæa dehisce longitudinally.

Arctostaphylos Uva-Ursi (bearberry) of Europe and America is medicinal The volatile oil of wintergreen is obtained from the leaves, and stems, of the North American *Gaultheria procumbens* A very poisonous substance is found in some species of Rhododendron, Lyonia and Leucothoe, and possibly the poisonous quality of Kalmia and Rhododendron honey is due to this Species of Gaylussacia (North America) yield huckleberries, species of Vaccinium yield blueberries The fruits of *V Myrtillus* (Europe) are bilberries The European heaths furnish commercial honey Cranberries are the fruit of *V macrocarpon* and *V Oxycoccus* Many species of Ericaceæ are ornamental

Forty to 50 genera are in cultivation in N America. Among these are the Strawberry Tree or Madrona (Arbutus), Bearberry (Arctostaphylos), Heather (Caluna); Heath (Erica), Trailing Arbutus or Mayflower (Epigæa), Labrador Tea (Ledum); Sourwood or Sorrel Tree (Oxydendrum), Azalea, Rhodora, Rhododendron or Pinxter Flower (Rhododendron), Laurel (Kalmia); Blueberry and Cranberry (Vaccinium); Huckleberry (Gaylussacia), also Menziesia, Chamædaphne, Cassiope, Andromeda. and others

176. **Epacridaceæ** (from the genus *Epacris*, derived from the Greek meaning on the top, many species growing on hilltops). EPACRIS FAMILY. Shrubs or small trees. leaves alternate, usually stiff, small, and heath-like flowers bisexual, regular, hypogynous, disk present; calyx of 4–5 sepals, bracted at the base, corolla gamopetalous, 4–5-lobed, stamens 4–5, hypogynous or epipetalous, anthers opening by longitudinal slits; carpels 4–5, ovary superior, 1–10-celled, ovules solitary or many; style and stigma 1. fruit a drupe or capsule.

The 21 genera and about 300 species are almost exclusively confined to Australia and New Zealand. One species is found in South America The family is closely related to the Ericaceæ, but has one whorl of stamens. The genus Styphelia contains 172 species. *S. sapida* furnishes edible berries

A few species of Epacris are grown as ornamental plants in the greenhouses of North America.

177 **Diapensiaceæ** (from the genus *Diapensia*, the derivation of which is obscure). DIAPENSIA FAMILY Fig 47 Low shrubs: leaves alternate, evergreen, reniform or imbricated or moss-like flowers bisexual, regular, hypogynous, disk absent, calyx of 3–5 sepals; corolla with 5 separate petals, or gamopetalous, lobes imbricated; stamens 5, epipetalous or hypogynous, alternating with the corolla lobes, often also alternating with 5 staminodia, anthers opening by a longitudinal slit, ovary superior, 3-celled, ovules very numerous, style 1, stigmas 1–3 fruit a capsule

Diapensiaceæ has 6 genera and about 10 species of circumpolar distribution, extending southward to Carolina and the Himalayas The family is related to the Ericaceæ, and to the Epacridaceæ The 3 carpels and 5 stamens are important distinguishing characteristics.

Four or more genera are in cultivation in America; of these, *Galax aphylla* (Galax) of North Carolina has reniform leaves; *Pyxidanthera barbulata* (Pyxie, Flowering Moss, or Pine-barren Beauty) of southern New Jersey has subulate leaves; Shortia, of North Carolina and Japan, and *Schizocodon soldanelloides* (Fringed Galax) of Japan both have orbicular leaves.

Order 47. PRIMULALES

178. **Myrsinaceæ** (from the genus *Myrsine*, the Greek name of Myrrh). MYRSINE FAMILY. Trees or shrubs leaves usually alternate, coriaceous, glandular-dotted. flowers bisexual or unisexual, regular, often very glandular; calyx 4–5-parted, persistent, corolla gamopetalous, rarely of separate petals, 4–5-lobed; stamens 5, opposite the lobes of the corolla, mostly epipetalous, separate or monadelphous; alternating staminodia often present, ovary superior or inferior, 1-celled, placenta basal or free-central, ovules few or numerous, style and stigma 1. fruit a few-seeded berry or drupe

Widely distributed in the tropics are 32 genera and about 550 species. Two species reach Florida. The family is related to the Primulaceæ, but is woody, glandular, and has indehiscent fruits, also related to the Sapotaceæ

The leaves of Jacquinia are used in America to stupefy fish, the fruits of this genus are poisonous. The fruits of some species of Ardisia are edible. Bread is made in San Domingo from the crushed seed of *Theophrasta Jussieui*

About a half-dozen genera are in cultivation in this country, but are little known. Jacquinia and Myrsine are grown in southern Florida and southern California; Ardisia is a genus of greenhouse shrubs. The species ascribed in the trade to Theophrasta on further study have been referred to other genera

179 **Primulaceæ** (from the genus *Primula*, from Latin *primus* (first), in reference to the early flowering of some European species). PRIMROSE FAMILY Fig 47. Herbs leaves mostly opposite or whorled, often dotted or mealy flowers bisexual, regular, rarely slightly irregular, calyx not bracteate, mostly 5-parted; corolla

gamopetalous, 5-lobed, rarely of separate petals; stamens 5, epipetalous, opposite the corolla lobes, often alternating with staminodia; ovary superior, rarely half-inferior, 1-celled, many-ovuled, placenta free-central, style and stigma 1 fruit a capsule opening by valves or by a transverse lid

The family has 28 genera and about 320 species of more or less cosmopolitan distribution, but most abundant in north temperate regions It is most closely related to the Myrsinaceæ and Plumbaginaceæ The herbaceous habit, dehiscent fruit, and many seeds are important distinguishing characteristics The flowers of this family often have styles and stamens of different lengths in the same species (heteromorphic), e g, Primula The free-central placentation is characteristic of this and related families

Rhizomes of Primula were formerly used for diseases of the bladder Primrose wine is made from the flowers of *Primula officinalis* and *P vulgaris* Rhizomes of Cyclamen are purgative and emetic In some countries these rhizomes are used to stupefy fish, roasted they become good food for pigs (sowbread of Europe) Other species have been used in medicine Many are ornamental plants

Twelve to 18 genera are in cultivation in North America Among these are the following well-known names Cyclamen, Dodecatheon (Shooting-star), Androsace (Rock Jasmine); Anagallis (Pumpernel, Poor Man's Weather-glass); Hottonia (Featherfoil, Water-Violet, Water-Yarrow) with aquatic inflated stems and fine leaves; Lysimachia (Loosestrife, Moneywort, Creeping Charlie), Primula (Primrose), Soldanella, Sternonema (Loosestrife); Trientalis (Star Flower)

180 **Plumbaginaceæ** (from the genus *Plumbago*, from *plumbum*, lead, perhaps in reference to the lead-like stain given by the roots to the fingers) LEADWORT FAMILY. Fig 47. Herbs or shrubs leaves alternate, linear or lanceolate flowers bisexual, regular, calyx bracteate, 5-fid, usually scarious, and plicate, angled or winged, sometimes colored, persistent, corolla gamopetalous, or of 5 nearly separate petals, mostly convolute, stamens 5, epipetalous, opposite the lobes of the corolla; ovary superior, 1-celled, ovule 1, basal, styles 5 fruit a capsule or utricle, invested by the calyx

The ten genera and about 250 species, of almost cosmopolitan distribution, are found usually inhabiting seacoasts and alkaline regions, they are most abundant in the Mediterranean region, and in Central Asia The family is closely related to the Primulaceæ, but has only one seed

A fatty substance in the root of certain Plumbagos gives a lead-colored stain to the fingers and paper These roots were formerly used for toothache, ulcers, and the like Beggars are said still to use them to produce sores The roots of *Statice latifolia* of Russia contain tannin and have been used for tanning

There are 5 or 6 genera in cultivation in North America, Acantholimon from Armenia, hardy, Armeria (Sea Pink, Thrift) of Europe and Asia, hardy, Ceratostigma of China, hardy, Plumbago (Leadwort), of Asia, Africa, Australia, mostly of the greenhouse, Statice (Sea Lavender), of Europe, Asia, North America, hardy Some species of this family are used for dry bouquets.

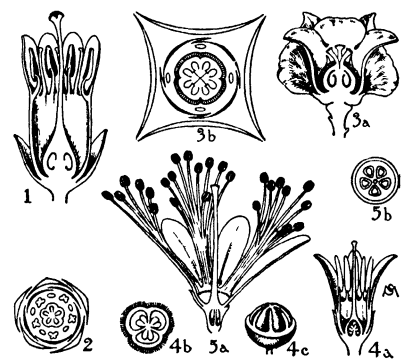
Order 48 EBENALES

181 **Sapotaceæ** (from the old generic name *Sapota*, derived from a native name of *Achras Sapota*) SAPODILLA FAMILY Fig 48 Trees or shrubs, juice milky leaves alternate, entire, coriaceous flowers usually bisexual, axillary, regular, calyx mostly of separate sepals in two whorls of 2, 3, or 4, or in one whorl of 5, corolla gamopetalous, lobes as many as the sepals, or twice as many, in one or two series, imbricated, sometimes with appendages which simulate extra corolla-lobes; stamens as many as the lobes of the corolla and opposite them, sometimes with intermediate staminodia, or twice as many, epipetalous, ovary superior, 4- to many-celled; ovules 1 in each cell, basal, style and stigma 1 fruit a berry.

There are 31 genera and about 400 species, of tropical distribution, rarely reaching the warm temperate zone One species extends to Virginia and two to Illinois. This is a distinct family, distantly related to the Myrsinaceæ, Ebenaceæ, and Styracaceæ

The fruits of *Lucuma mammosa* (marmalade plum) and *Achras Sapota* (sapodilla), are very agreeable. Fruits of Illipe and Mimusops, both Asiatic, are edible The oil from the seeds of the oriental *Illipe butyracea* and of other species is galam butter, and shea butter It is used for food and soap The wood of many species is very hard and valuable—so-called ironwoods Several species of Palaquium of the East Indies yield gutta percha, as do other species of the family Gum chicle is obtained from *Achras Sapota*. Star-Apple is *Chrysophyllum Cainito*. West Indian medlar is *Mimusops Elengi*

Six to 10 genera are in cultivation in North America, mostly in the warmer parts Mimusops, Lucuma (Marmalade Plum) and Sideroxylon are grown in southern California and Florida, Dichopsis or Palaquium (wrongly called Isonandra), the commercial gutta percha tree, is cultivated in the South Bumelia and Chrysophyllum are ornamental, the former hardy to Massachusetts



48 SAPOTACEÆ 1 Lucuma, flower 2 Sideroxylon, floral diagram EBENALEÆ 3 Diospyros, *a*, female flower, *b*, floral diagram, female flower STYRACACEÆ 4 Styrax, *a*, flower, *b*, cross-section ovary, *c*, fruit SYMPLOCACEÆ 5 Symplocos, *a*, flower, *b*, cross-section fruit

182 **Ebenaceæ** (from the Latin *ebenus*, meaning *ebony*) EBONY FAMILY Fig 48 Trees or shrubs leaves alternate, coriaceous, entire flowers rarely bisexual, usually dioecious, regular, calyx 3–6-parted, persistent; corolla 3–6-lobed, hypogynous, gamopetalous, urceolate, coriaceous, mostly imbricated and twisted; stamens short, usually double the number of the corolla-lobes, rarely as many or more numerous, hypogynous or epipetalous, separate or united in pairs, ovary superior, 2–16-celled, with 1–2 suspended ovules in each cell, styles and stigmas 2–8 fruit berry-like, rarely subdehiscent

In this family are 5 genera and about 280 species, of which 180 belong to the genus Diospyros, they are inhabitants of tropical and subtropical regions, principally of the eastern hemisphere The greatest development of the family is in the East Indies and Malay Archipelago One species of Diospyros occurs in the eastern United States, from Rhode Island southward. The family is related to the Styracaceæ, Sym-

plocaceæ and Sapotaceæ. The superior several-celled ovary, unisexual flowers and absence of milky juice are important distinctive characters.

The wood of many species, especially of the genus Diospyros, furnishes the ebony of commerce The fruit of *Diospyros Lotus* is known as date plum in Asia The fruit of the persimmon (*Diospyros virginiana*) is also edible The bark of persimmon is sometimes used in medicine

Three or 4 genera are in cultivation in North America for ornamental purposes Maba, from Natal, and Royena, from South Africa, are not hardy Diospyros (Common Persimmon and Kaki), hardy or tender, depending on the species, is grown for ornament or fruit

183 **Styracaceæ** (from the genus *Styrax*, the ancient Greek name of the storax tree) Storax Family Fig 48. Shrubs or small trees leaves alternate, simple flowers bisexual, regular; calyx 4–5-cleft, corolla mostly 4–5-lobed, the lobes almost separate, imbricated or valvate; stamens in one series, hypogynous or epipetalous, twice as many as the lobes of the corolla, rarely just as many, separate or more or less united, ovary superior, rarely half-inferior, 1-celled at the top, 3–5-celled at the bottom, 1, rarely several, ovules in each cell, style 1, stigmas 1–5 fruit a capsular drupe

Six genera and about 100 species are distributed in the warmer regions of South and Central America, southeastern United States, eastern Asia, and the Mediterranean region The family is very closely related to the Symplocaceæ, also to the Ebenaceæ and Sapotaceæ. The superior, imperfectly several-celled ovary, bisexual flowers and absence of milky juice are distinctive Fossil species are known

Styrax Benzoin of the East Indies yields the fragrant resin known as benzoin It is a pathological product of the tree Some Brazilian species of Styrax and some species of Pamphilia also yield a fragrant resin which is burned as incense in the churches The storax of the ancients was obtained from *Liquidambar orientalis* (family Hamamelidaceæ).

Two or 3 genera are in cultivation in America· Halesia (Silver Bell, Snowdrop Tree), of eastern United States, is hardy, Styrax (Storax) of China, Japan, and America, is semi-hardy. Pterostyrax of Japan is by some referred to Halesia.

184 **Symplocaceæ** (from the genus *Symplocos*, derived from the Greek, meaning *connected*, referring to the stamens). Symplocos Family. Fig 48 Trees or shrubs: leaves alternate, simple flowers bisexual, or less commonly unisexual, regular, calyx 5-lobed, gamosepalous, imbricated, corolla-lobes 5 or 10, in 1 or 2 series, gamopetalous, imbricated, stamens 15 to many in 1–3 or many series, separate, or slightly united with each other and the corolla, hypogynous or epipetalous, ovary inferior or half-inferior, 2–5-celled, with about 2 ovules in each cell, style 1; stigmas 1–5 fruit drupaceous

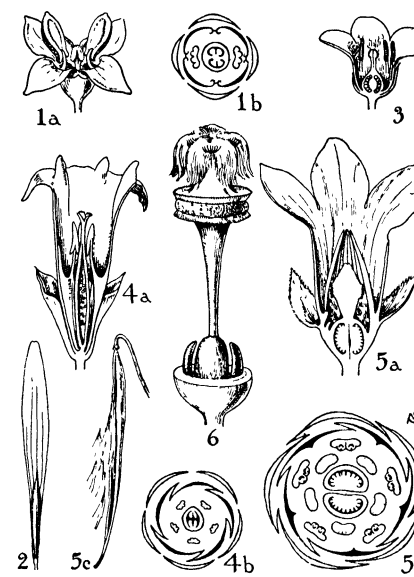
Only one genus and about 275 species are found in tropical lands; they are most abundant in the Malay region and East India A few species in Japan, and one in North America, extend the family into the temperate zone *Symplocos tinctoria* reaches Delaware. The family is related to the Styracaceæ, and is often united with it The inferior, completely several-celled ovary, and numerous stamens, are important characteristics Fossil species are known

The bark of *Symplocos racemosa* is used as a medicine in the East Indies under the name lotus bark The leaves of *S spicata* and the roots of *S tinctoria* are used in the preparation of yellow dye-stuffs *S cratægoides* is a hardy ornamental shrub from Japan

Order 49 Contortæ

185. Oleaceæ (from the genus *Olea*, derived from the Greek meaning, originally, *olive tree*, and later *oil*, i e, olive oil) Olive Family. Fig 49. Trees or shrubs leaves opposite, simple or pinnate. flowers bisexual or unisexual, regular, small and numerous, calyx 4-lobed, rarely 4–15-lobed, valvate, corolla 4-lobed, rarely 6–12-lobed, gamopetalous, rarely polypetalous, or 0, hypogynous, valvate, stamens 2, rarely 3–5, epipetalous, alternate with the corolla-lobes, ovary superior, 2-celled, ovules usually 2 in each cell, style 1 or 0, stigmas 1–2 fruit a drupe, berry, capsule, or samara

Oleaceæ has 20 genera and more than 400 species, of temperate and tropical lands; these are especially abundant in the East Indies and East Asia About 10 species are native in northeastern North America. Fossil species are known The family is related to the Loganiaceæ, possibly also to the Celastraceæ and



49 Oleaceæ 1 Olea, *a*, flower, *b*, floral diagram 2 Fraxinus, fruit Loganiaceæ 3 Logania, flower Gentianaceæ 4 Gentiana, *a*, flower, *b*, floral diagram Apocynaceæ 5 Apocynum, *a*, flower, *b*, floral diagram, *c*, fruit 6 Vinca, pistil.

Rubiaceæ The numerical plan of 4, the 2 stamens and the superior ovary are important distinctive characteristics

The most useful plant is the olive (*Olea europæa*) of the Orient, long cultivated in the Mediterranean region The oil expressed from the fruit is used as food, and for other purposes. The unripe fruits, preserved in brine, are the olives of commerce The bark of the fringe tree and privet contains medicinal principles of minor importance, as do also the leaves of the lilac. A saccharine exudation from the bark of *Fraxinus Ornus* of Sicily, induced by the puncture of a cicada, is manna (See, also, *Tamarix mannifera*) The wood of olive and ash are valuable The flowers of *Osmanthus fragrans* have been used to scent tea in China.

A dozen genera are in cultivation in North America: Chionanthus (Fringe Tree), hardy, Forsythia (Golden Bell), hardy; Fontanesia, hardy; Fraxinus (Ash), hardy; Jasminum (Jasmine, Jessamine), of the greenhouse and the South; Ligustrum (Privet), hardy, Olea (Olive),

not hardy; Osmanthus (Fragrant Olive and Devilwood), not hardy; Phillyrea, not hardy, Schrebera, not hardy; and Syringa (Lilac), hardy.

186 **Loganiaceæ** (from the genus *Logania*, named in honor of J Logan, a botanist). LOGANIA FAMILY. Fig 49. Herbs, shrubs, or trees· leaves opposite, simple flowers usually bisexual, regular, calyx 4–5-lobed or -parted, corolla 4–5-, or 10-lobed, imbricated or convolute; stamens epipetalous, of the same number as the lobes of the corolla and usually alternate with them, rarely reduced to 1; ovary superior, usually 2-celled, rarely 1-or 4-celled, ovules usually numerous, styles 1; stigmas 1–2 fruit a capsule, rarely a berry or drupe.

The family contains 32 genera and about 360 species, of tropical distribution A few genera only reach the temperate zone, 4 species of which are native in northeastern North America Fossil species are known. The family is related to the Apocynaceæ, Gentianaceæ, Solanaceæ, Rubiaceæ, and Scrophulariaceæ. The opposite stipulate leaves, and 2-celled superior ovary, are important distinctive characters

The seeds and bark of *Strychnos nux-vomica* contain a very poisonous alkaloid, strychnine, used as a nerve tonic Curare, with which the Indians of South America poisoned their arrows, is probably obtained from the bark of *S toxifer*. Other species of Strychnos are used in Java to poison arrows. The root of Spigelia (pink-root), an American plant, has been used as a vermifuge It is also poisonous *Strychnos Ignatia* yields the poisonous ignatius bean of India The nut of *S potatorum* is the clearing nut of India, which is used to purify foul water, by rubbing it on the inside of the vessel The roots of yellow jasmine (*Gelsemium sempervirens*) of the southeastern United States are used as a nerve tonic

Three or 4 genera are in the North American trade, all ornamental· Buddleia, semi-hardy; Gelsemium (Yellow Jessamine), woody vine, semi-hardy, Spigelia (Pink-Root), herbaceous, hardy

187. **Gentianaceæ** (from the genus *Gentiana*, named in honor of King Gentius of Illyria, who, according to Pliny, first discovered the medicinal properties of these plants). GENTIAN FAMILY Fig 49. Herbs, rarely shrubs or small trees· leaves opposite, rarely alternate or whorled, exstipulate flowers bisexual, regular, calyx 4–5-parted, persistent, corolla 4–8-lobed, gamopetalous, hypogynous, convolute or induplicate, rarely valvate; stamens of the same number as the corolla-lobes and alternate with them, epipetalous, hypogynous disk usually present; ovary superior, 1-celled, with 2 parietal placentæ, rarely 2-celled, ovules numerous fruit a capsule.

The 63 genera and about 750 species are almost cosmopolitan in distribution Three hundred species belong to the genus Gentiana, distributed mostly in the mountains of the north temperate zone, in the arctic zone and in the Andes, they are wanting in Africa Fossil species of Menyanthes are known The family is closely related to the Loganiaceæ The commonly 1-celled ovary, exstipulate leaves and the presence of a bitter principle are important characters.

The general occurrence of a bitter principle renders the majority of Gentianaceæ valuable as tonics, and appetizers. Most of the drug, gentian, is obtained from *Gentiana lutea* of Europe *G punctata*, *G purpurea*, and *G. Pannonica* are also used. *Erythræa Centaurium* (centaury) furnishes a medicinal bitter principle. *Tachia guianensis* is used as bitters in South America, under the name quassia. The bitter principle of Menyanthes is used as a medicine, and also as a substitute for hops in flavoring beer. The Gentianaceæ are used medicinally in all parts of the globe.

Several genera are in cultivation in North America: Erythræa, Eustoma, Frasera; Gentiana (Gentian); Menyanthes (Buckbean), Sabbatia; and Swertia. Nymphoides (Limnanthemum) (Floating Heart, Water Snowflake) is a genus of peculiar aquatic plants. Villarsia is a close relative of Nymphoides.

188 **Apocynaceæ** (from the genus *Apocynum*, the ancient name of the dogbane, from the Greek). DOGBANE FAMILY Fig 49 Herbs, shrubs or trees with milky juice, often climbing leaves opposite or whorled, rarely alternate, entire, exstipulate flowers bisexual, regular; calyx 4–5-parted, corolla 4–5-lobed, hypogynous, gamopetalous, usually with appendages or folds in the throat, convolute or valvate, stamens 4–5, epipetalous, alternating with the corolla lobes, anthers usually sagittate and acute, pollen granular, hypogynous disk usually present and variously lobed; ovaries usually 2, rarely more or less united, mostly superior, each 1-celled, many-seeded, style 1, usually bearing a fleshy ring below the solitary stigma fruit follicular with comose seeds, or indehiscent, or berry-like, or of nutlets, sometimes winged or prickly

One hundred and thirty genera and about 1,000 species occur, mostly in tropical countries in both hemispheres Five or 6 species reach northeastern North America The family is related to the Asclepiadaceæ and Gentianaceæ The milky juice, sagittate anthers, absence of corona, stylar ring, and usually separate ovaries but connate styles and stigmas, are important characteristics

Many species of Landolphia yield commercial caoutchouc, as do also other genera, such as Urceola and Willoughbya Some are very poisonous, e g, Tanghinia of Madagascar, also Cerbera and Acocanthera Tanghinia, the ordeal tree of Madagascar, "is the most poisonous of plants, a seed no larger than an almond suffices to kill twenty people" Death has followed the use of oleander wood as meat-skewers An infusion of its leaves is an insecticide, of its bark, a rat-poison. Some are heart-poisons, for example Strophanthus and Aspidosperma (quebracho bark) The bark of Alstonia is a tonic *Allamanda cathartica* is purgative Several species furnish edible fruits tasting like citron *Wrightia tinctoria* furnishes an indigo, *W tomentosa*, a yellow dye

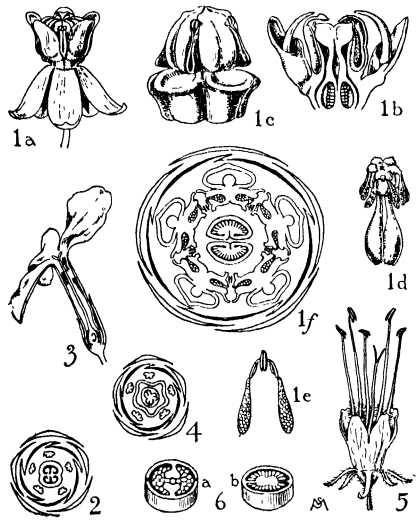
About 20 to 25 genera are in cultivation in N America as ornamental plants, mostly in the South or in the greenhouse. Among these are· Allamanda, Carissa (Caraunda, Christ's Thorn); Amsonia; Apocynum (Dogbane), Nerium (Oleander); Tabernæmontana (Crape Jasmine, Nero's Crown), Trachelospermum (Star Jasmine); and Vinca (Periwinkle).

189 **Asclepiadaceæ** (from the genus *Asclepias*, dedicated to Æsculapius) MILKWEED FAMILY Fig 50. Herbs or shrubs, sometimes fleshy, often climbing, generally with milky juice leaves opposite, rarely otherwise, exstipulate. flowers bisexual, regular, very frequently in umbels, calyx 5-parted, imbricated, corolla 5-parted or -lobed, gamopetalous, hypogynous, a crown present, which is either an outgrowth of the corolla, or of the stamens, or of both; stamens 5, mostly hypogynous, alternating with the lobes of the corolla, usually monadelphous, sometimes united with the styles, pollen usually agglutinated into pollinia, which are attached to glandular appendages of the stigma; disk absent; ovaries 2, superior, each 1-celled, many-seeded, styles 2; stigmas united. fruit of two follicles, seeds usually comose

There are 217 genera and about 1,900 species, principally of the tropics, but many reach the temperate zone The family is distinct, and closely related only to the Apocynaceæ. The Asclepiadaceæ is one of the most extraordinary of families Most species have a milky juice Many in South Africa are fleshy, cactus-like plants Some are epiphytes with variously modified foliage. One genus of epiphytes bears foliar pitchers that catch and hold rain-water Some species are like a bundle of leafless whip-lashes, others have remarkable tuberous bases to store water The floral crown is most diverse; and the details of insect-pollination, especially the behavior of the pollinia, is very compli-

cated The union of the two carpels by the stigma only is unique

Pleurisy root (*Asclepias tuberosa*) was formerly used extensively for lung and catarrhal disorders Condurango, from the bark of *Marsdenia Condurango*, is a stomach tonic. The milky juice of many is medicinal, some are emetics (Vincetoxicum, Gomphocarpus, Secamone); others are purgative (Solenostemma,



50 Asclepiadaceæ 1 Asclepias, *a*, flower, *b*, flower, vertical section, *c*, stamens, *d*, pistil and pollinia, *e*, pollinia and gland, *f*, floral diagram Convolvulaceæ 2 Convolvulus, floral diagram Polemoniaceæ 3 Phlox, flower 4 Polemonium, floral diagram Hydrophyllaceæ 5 Hydrophyllum, flower 6 Phacelia, *a*, and *b*, ovary of two species

Cynanchum); others are sudorifics (Hemidesmus) The acrid juice of Gonolobus is used to poison arrows, that of Periploca to poison wolves, hence the name wolfbane and dogbane. The milk of *Gymnema lactiferum*, the cow-plant of Ceylon, is edible, also that of the Cape, *Oxystelma esculentum* Some Indian species yield good bast fibers *Marsdenia tinctoria* yields a dye Several species yield caoutchouc The oschur or modar (*Calotropis procera*) is probably the sodom apple of the Bible The herbage of several species is cooked and eaten The acid stem of Sarcostemma is eaten as a salad In East Africa, *Cynanchum sarcostemmoides* is used to poison fish Many Asclepiadaceæ are ornamental plants

About 20 genera are in cultivation in N America, mostly in the tropical horticulture of Florida and California More generally cultivated and better known are Asclepias (Milkweed), Cynanchum (Mosquito Plant, Cruel Plant), Hoya (Wax-plant), and Periploca (Silk Vine).

Order 50. Tubiflorae

190 **Convolvulaceæ** (from the genus *Convolvulus*, signifying to *entwine*) Morning-Glory Family Fig 50 Herbs, shrubs or small trees, twining or erect, turf-forming shrubs, thorny shrubs, "switch plants," or yellow, leafless, twining parasites, often with milky juice leaves alternate. flowers bisexual, regular, peduncles very often bi-bracteate; calyx 5-parted, persistent, corolla more or less 5-lobed, usually plaited, gamopetalous, hypogynous, convolute; stamens 5, slightly epipetalous, alternating with the corolla-lobes; hypogynous disk present, usually lobed, ovary superior, 2-celled, rarely more or fewer celled, each cell 1–2-ovuled, micropyle directed downward and outward, styles 1–2, stigmas 1–2 fruit a capsule or a berry, very rarely breaking into 4 1-seeded nutlets

Convolvulaceæ has 40 genera with about 1,000 species, of which 300 species belong to the genus Ipomœa and 160 species to the genus Convolvulus They are distributed in all regions except the arctics, but are especially numerous in tropical Asia and tropical America The family is related to the Solanaceæ and Boraginaceæ, but also to the Polemoniaceæ and Hydrophyllaceæ The absence of a circinate inflorescence, the plaited corolla, the direction in which the micropyle is turned and the few-seeded fruit are important distinguishing characteristics The genus Cuscuta is parasitic and chlorophylless, receiving its nutriment by means of haustoria from the plant upon which it twines

Because of the substances contained in the milky juice, many species are medicinal The following are purges jalap (*Exogonium Purga*), of Mexico; turbith (*Operculina Turpethum*), of the East Indies, and scammony (*Convolvulus Scammonia*), of the orient The fleshy roots of *Ipomœa Batatas* (sweet potato) are edible, also those of *Convolvulus Sepium Ipomœa Pes-capræ* is used in India to bind the sands along the coast. *Convolvulus scoparius* of the Canaries furnishes the fragrant oil of rhodium, used to adulterate oil of rose, and sold also to rat-catchers as a lure for rats *Cuscuta Epilinum*, and several other species, are bad pests in cultivated fields

Several genera are in cultivation in N America Argyreia, tender twiners, Breweria, trailing, grown in Florida, Convolvulus (Bindweed, California Rose, Rutland Beauty), mostly twining, Ipomœa (Morning-glory, Moonflower, Cypress Vine, Indian Pink, Man-of-the-Earth, Blue Dawn Flower, Sweet Potato, Jalap), mostly twining, Jacquemontia, garden twiners, Lettsomia, twiners, grown in Florida

191 **Polemoniaceæ** (from the genus *Polemonium*, an ancient name of doubtful application) Polemonium Family. Fig 50 Herbs, rarely woody leaves alternate, or the lower sometimes opposite, simple or pinnate flowers bisexual, regular, or nearly so, calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous, convolute, stamens 5, epipetalous, alternate with the corolla-lobes; hypogynous disk present, ovary superior, 3-, rarely 2- or 5-, celled, ovules in each cell many, rarely 1, style 1, 3-fid, rarely 5-fid, stigmas 3, rarely 5 fruit a capsule

About 8 genera and 200 species are known, these are almost entirely American and principally North American Nearly 100 species belong to the genus Gilia The family is closely related to the Convolvulaceæ, and difficult to separate from that family. The 3 many-ovuled cells of the ovary are important The disk of Cobæa is large and 5-lobed The terminal leaflet of this plant is a branched tendril

Many Polemoniaceæ are grown as ornamental plants *Polemonium cæruleum* (Jacob's ladder, or Greek valerian) is used in some countries as a remedy for various ailments

About 6 to 8 genera are cultivated in this country as ornamental plants. Cantua, a shrub in the greenhouse; Cobæa, a climbing herb, mostly in the greenhouse, Gilia, many species, for bedding, Lœselia in the cool-house, Phlox (Phlox, Ground or Moss Pink), for bedding; Polemonium, for bedding.

192 **Hydrophyllaceæ** (from the genus *Hydrophyllum*, meaning *water-leaf*). Water-leaf Family Fig 50 Annual or perennial herbs leaves mostly alternate, often lobed flowers bisexual, regular, mostly in circinate raceme-like clusters, calyx 5-cleft; corolla 5-lobed, often

with scales in the throat, gamopetalous, hypogynous, imbricated; stamens 5, alternating with the corolla-lobes, slightly epipetalous, hypogynous disk present, ovary superior, 1-celled, rarely incompletely 2-celled, ovules 2 to several, style 1, stigmas 2. fruit a capsule.

The 17 genera and about 170 species are found most abundantly in temperate North America, less commonly southward to Patagonia A very few are found in south and east Africa, India, Japan, and the Hawaiian Islands The family is most closely related to the Boraginaceæ, but has a 1-celled ovary, more distantly related to the Convolvulaceæ and Polemoniaceæ

Eriodictyon glutinosum (yerba santa) of California has lately come into use as an expectorant in throat and lung trouble *Hydrophyllum canadense* has long had a reputation as a remedy for snake-bites, poison-ivy poisoning, erysipelas, and other skin troubles

About a half dozen genera are in cultivation in N Americaas ornamental plants They are used principally for outdoor bedding Emmenanthe (California Yellow or Golden Bells), Hesperochiron, Hydrophyllum (Waterleaf), Nemophila, and Phacelia

193 **Boraginaceæ** (from the genus *Borago*, an ancient name having reference to the roughness of the fohage) Borage Family Fig 51 Herbs, rarely shrubs or trees leaves usually alternate, very frequently rough-hairy flowers bisexual, regular, rarely irregular, inflorescence usually circinate, calyx 4–5-cleft, persistent; corolla 4–5-lobed, gamopetalous, hypogynous, imbricated, often with scales or folds in the throat, stamens 5, epipetalous, alternating with the corolla-lobes, hypogynous disk usually present; carpels 2, ovary superior, 4-celled, either entire and style terminal, or 2-lobed, or more commonly deeply 4-lobed with the style basal between the lobes, each cell 1-ovuled, style 1, stigmas usually 2 fruit rarely a berry, usually of 4 1-seeded nutlets, with the surface variously smooth, polished, wrinkled, barbed, winged, or crested

There are 85 genera and about 1,500 species widely distributed in the temperate and tropical zones, most abundant in the Mediterranean region and in western North America The largest genera are Cordia with 230 species, and Heliotropium with 220 species The family is most closely related to the Hydrophyllaceæ, also related to the Verbenaceæ and Labiatæ The circinate inflorescence, and 2-carpelled, 4-celled ovary with 1 seed in each cell, are distinctive characteristics. The fruit of the Boraginaceæ is most diverse, and very important in classification within the family

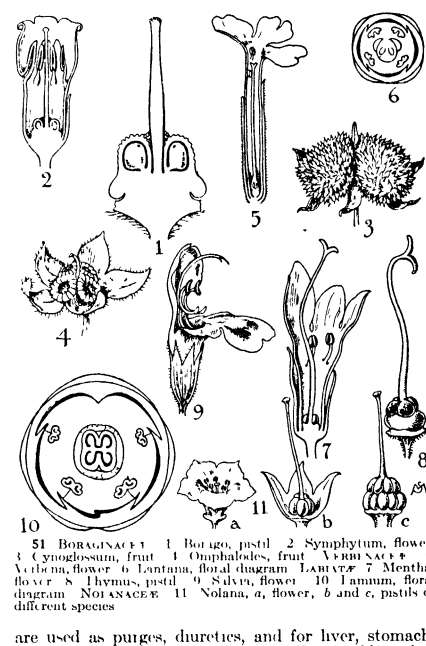
Many species, native in Europe, were formerly used for medicine, for example, comfrey (*Symphytum officinale*), borage (*Borago officinalis*), hound's-tongue (*Cynoglossum officinale*), lungwort (*Pulmonaria officinalis*), viper's bugloss (*Echium vulgare*), bugloss (*Anchusa officinalis*), gromwell (*Lithospermum officinale*), and heliotrope (*Heliotropium europæum*) *Tournefortia umbellata* was used in Mexico as a febrifuge The roots of alkanet (*Alkanna tinctoria*) of South Europe and Asia contain a red dye of commercial importance The roots of some species of Anchusa, Onosma, Lithospermum and Arnebia also contain a red pigment The wood of some species of Cordia is of value, as are also its bast fibers The wood of several species of Ehretia is valuable, and the fruit is edible.

About 30 genera are in cultivation in N America, mostly as hardy ornamental border plants Among these are Arnebia (Prophet's Flower, Arabian Primrose); Anchusa (Alkanet, not the real), Borago (Borage), used as a pot-herb or bee-plant, Cerinthe (Honeywort), Cynoglossum (Hound's-tongue), Echium (Viper's Bugloss), Lithospermum (Gromwell, Puccoon, Indian Paint), Myosotidium (Giant Forget-me-not), Myosotis (Forget-me-not); Mertensia (Virginian Cowslip, Virginian Lungwort); Omphalodes (Navelwort, Creeping Forget-me-not), Onosma (Golden Drops), Onosmodium (False Gromwell); Pulmonaria (Lungwort, Bethlehem Sage), and Symphytum (Comfrey)

194 **Verbenaceæ** (from the genus *Verbena*, the Latin name for any sacred herb, application obscure) Vervain Family Fig 51 Herbs, shrubs, or trees leaves opposite, rarely whorled or alternate, simple or compound flowers bisexual, rarely regular, usually oblique or 2-lipped, calyx 4–5-, rarely 6–8-, toothed, corolla 4–5-lobed gamopetalous, hypogynous, lobes imbricated, stamens 4, didynamous, rarely 5 or 2, epipetalous, hypogynous, disk present, ovary superior, of 2, rarely of 4 or 5, carpels, 2–5-celled, but by false partitions 4–10-celled, entire or 2–4-lobed, ovule usually solitary in each cell, style 1, stigma usually 1 fruit a drupe or berry, often separating into drupelets

Verbenaceæ has 67 genera and about 750 species, mainly of tropical and subtropical distribution Eleven species reach the northeastern United States Lippia is the largest genus with 100 species, Clerodendron has 90 species, and Verbena 80 species The family is closely related to the Labiatæ and not clearly distinct from that family The predominatingly terminal style, and not deeply lobed ovary are the only differentiating characters

Many species have been used in medicine *Verbena hastata* as bitters, species of Lippia as tonics, *Ægiphila salutaris* as a purge and remedy for snake-bites Species of Clerodendron have very sweet-scented flowers They



51 Boraginaceæ 1 Borago, pistil 2 Symphytum, flower 3 Cynoglossum, fruit 4 Omphalodes, fruit Verbenaceæ 5 Verbena, flower 6 Lantana, floral diagram Labiatæ 7 Mentha, flower 8 Thymus, pistil 9 Salvia, flower 10 Lamium, floral diagram Nolanaceæ 11 Nolana, *a*, flower, *b* and *c*, pistils of different species

are used as purges, diuretics, and for liver, stomach, and lung complaints *Lippia citriodora* yields a fragrant substance used in flavoring cream, and other foods Several species have been used as tea in America *Duranta Ellisia* and species of Lantana have edible fruit *Verbena officinalis* of Europe is a tonic, but more famous for its use in witchcraft It was celebrated among the Romans and Druids of Gaul and used by them in religious ceremonies The very valuable teak-

wood is obtained from *Tectona grandis* of farther India and the East Indies. The white mangrove trees of Brazil belong to various species of the tribe Avicenniæ

A score of genera are in cultivation in North America. Among these are. Amsonia, a greenhouse shrub, Callicarpa, greenhouse or hardy shrubs, Caryopteris, a shrub, not hardy, Clerodendron (Turk's Turban), greenhouse or hardy, Duranta (Golden Dewdrop), cultivated in the South, Lantana, greenhouse or bedding herbs or shrubs, Lippia (Lemon Verbena), greenhouse or hardy shrubs or herbs, Petræa (Purple Wreath), greenhouse climber, Verbena, bedding or greenhouse herbs; Vitex (Chaste Tree, Hemp Tree, Monk's Pepper Tree), semi-hardy shrubs or trees

195 **Labiatæ** (the name refers to the 2-lipped [bilabiate] character of the corolla of most species) MINT FAMILY Fig 51 Herbs or shrubs, commonly with a four-angled stem, and usually containing a fragrant oil leaves opposite or whorled. flowers bisexual, very rarely unisexual, irregular, rarely regular, usually bilabiate, calyx 5-toothed or cleft, regular or 2-lipped; corolla 5-lobed, rarely 4-lobed, gamopetalous and hypogynous, 1 lip sometimes obsolete, the lobes imbricated, stamens 4, didynamous, or only 2, epipetalous, hypogynous disk well developed, thick, entire or lobed, ovary superior, of 2 carpels, deeply 4-lobed, 4-celled, each cell 1-ovuled, style basal or sub-basal; stigmas 2 fruit of 4 1-seeded nutlets; the ectocarp rarely fleshy

One hundred and fifty-seven genera and about 2,800 species are distributed over the whole earth, but are especially abundant in the Mediterranean region and the orient, they are also abundant in the mountains of the subtropics The larger genera are Salvia, 500 species, Hyptis, 300 species, Stachys, 180–200 species, Scutellaria, 180 species; Nepeta, 150 species, Satureia, 130 species, and Teucrium, 100 species The family is related to the Verbenaceæ and to the Boraginaceæ, also to the Scrophulariaceæ and Acanthaceæ The 4-angled stem, fragrant oil, 4-lobed ovary, the solitary ovules, and the basal style are distinctive This is a difficult family for the student The characters for separating the genera reside mostly in the calyx, corolla and stamens The nutlets are less important in classification than in the Boraginaceæ

Owing to the volatile oil and bitter principles, the Labiatæ are of more than usual economic importance *Scutellaria lateriflora* (skullcap), tonic, nervine, *Salvia officinalis* (garden sage), tonic, also used as a condiment, *Marrubium vulgare* (hoarhound), tonic, anthelmintic, and expectorant; *Hedeoma pulegioides* (American pennyroyal), carminative and stimulant; *Mentha spicata* (spearmint) and *Mentha piperita* (peppermint), carminative; *Mentha Pulegium* (European pennyroyal), carminative, mints are also used as condiments. The following oils are from Labiatæ. Oil of thyme (*Thymus Serpyllum*), rosemary (*Rosmarinus officinalis*); Lavender (*Lavandula officinalis*); spike (*Lavandula Spica*), origanum (*Origanum Majorana*) Catnip (*Nepeta Cataria*) is a family sudorific Mother-wort (*Leonurus Cardiaca*) is a family stimulant and bitters The leaves of lavender and patchouli (*Pogostemon Patchouli*) are used to keep insects from woolens, furs, and the like. Many other species have been used locally for various purposes

Fifty or more genera are in cultivation in North America Most of these are garden annuals or hardy perennials cultivated for the flavor or odor, for ornamental purposes, or for medicine Among these are Acanthomintha (Thorny Mint), Ajuga (Bugle Weed); Cedronella (Balm of Gilead); Coleus, Collinsonia (Horsebalm, Horse-weed, Stonewort); Cunila (Maryland Dittany), Hedeoma (American Pennyroyal); Hyssopus (Hyssop), hardy shrub; Lamium (Dead Nettle); Lavandula (Lavender); Leonotis (Lion's Ear, Lion's Tail); Lophanthus (Giant Hyssop), Marrubium (Horehound); Melissa (Balm); Mentha (Mint, Spearmint, Peppermint, Japanese Mint, Bergamot Mint, Black Mint, White Mint, European Pennyroyal); Micromeria (Yerba Buena), Moluccella (Shell Flower, Molucca Balm), Monarda (Horsemint, Oswego Tea, Bee-balm, Fragrant Balm, Wild Bergamot); Nepeta (Catnip, Ground Ivy, Gill-run-over-the-ground); Ocimum (Basil); Origanum (Marjoram); Phlomis (Jerusalem Sage); Physostegia (False Dragonhead, Obedient Plant), Plectranthus (Cockle-spur Flower), Pogostemon (Patchouli Plant), Prunella or Brunella (Self-heal, Heal-all), Pycnanthemum (Mountain Mint), Rosmarinus (Rosemary, Old Man); Salvia (Sage, Clary, Scarlet Sage); Satureia (Savory); Scutellaria (Skull-cap), Stachys (Woundwort, Choro-gi, Chinese or Japanese Artichoke, Knot-root, Betony); Teucrium (Germander), Thymus (Thyme, Mother-of-Thyme); Trichostema (Blue Curls, Bastard Pennyroyal, Ramero), Westringia (Victorian Rosemary)

196. **Nolanaceæ** (from the genus *Nolana*, derived from *nola*, a little bell, in reference to the corolla). NOLANA FAMILY Fig 51 Herbs or small shrubs leaves alternate, or opposite. flowers bisexual, regular, calyx 5-cleft, corolla 5-lobed, gamopetalous, hypogynous, plicate in the bud, stamens 5, slightly epipetalous, alternating with the lobes of the corolla; hypogynous disk well developed, often lobed; ovary superior, typically of 5 carpels, radially lobed, or both radially and transversely lobed, lobes 5–30, in fruit forming 5–30 nutlets which are each 1–7-seeded, or sometimes both radially and transversely lobed

There occur 3 genera and 50 species, confined to the west coast of South America Many species are maritime. The family is related to the Convolvulaceæ, also to the Boraginaceæ and Solanaceæ. The plicate corolla and very peculiarly lobed ovary derived from 5 carpels are distinctive

A few species of Nolana, all prostrate plants, are cultivated in this country for ornamental purposes.

197 **Solanaceæ** (from the genus *Solanum*, the significance unknown) NIGHTSHADE FAMILY Fig 52 Herbs, erect or climbing shrubs, or small trees leaves usually alternate. flowers bisexual, rarely unisexual, regular, rarely irregular; calyx 5-cleft, corolla 5-lobed, gamopetalous, hypogynous, usually plicate in the bud, the folds twisted to right or left, rarely the tips of the folds valvate or imbricated; stamens 5, epipetalous, alternating with the corolla-lobes, hypogynous disk present, ovary superior, 2-celled, rarely falsely 1-, or more, celled, ovules in each cell 1 to many; style 1; stigmas 1–2: fruit a berry or capsule

About 70 genera and 1,600 species, 900 of which belong to Solanum, are distributed in the tropical and warm temperate regions, the greatest number being in Central and South America. The family is related to the Scrophulariaceæ, Convolvulaceæ and Nolanaceæ. The regular, plaited corolla, and usually numerous seeds are important distinguishing characteristics Datura has a prickly fruit The calyx of Physalis is accrescent and inflated, surrounds the fruit, and is often colored.

Many Solanaceæ contain narcotic or poisonous alkaloids and are used in medicine Belladonna (alkaloid atropine) is obtained from the roots of *Atropa Belladonna*, it was formerly used by women to dilate the pupils of the eye, hence the specific name. The leaves and flowers of *Datura Stramonium* (Jimson weed) constitute the stramonium of medicine (alkaloid daturine) Stramonium seeds were formerly used by magicians to produce fantastic visions, and by thieves to stupefy their victims. Henbane (alkaloid hyoscyamine) consists of the leaves and tops of *Hyoscyamus niger* and is narcotic Mandragora is similar in effect to belladonna. It was used by sorcerers to produce hallucinations in their victims *Scopolia carniolica* and *Solanum carolinense* (horse-nettle) have been used in medicine. The remedy, pichi, con-

sists of the dried twigs of *Fabiana imbricata* of Chile European bittersweet (*S Dulcamara*) has been used as medicine, it is poisonous Black nightshade (*S nigrum*) and others are poisonous Tobacco is the dried leaves of *Nicotiana Tabacum* Winter cherry (*Physalis Alkekengi*) is diuretic Chilli is a name for the fruits of *Capsicum annuum* of South America Cayenne pepper is the fruit of various species of Capsicum Tomato, or love apple, is the fruit of *Lycopersicum esculentum* (=*Solanum Lycopersicum*) Species of nightshade, when cooked, are eaten as greens Eggplant is the fruit of *S Melongena* of Asia Potatoes are the tubers of *S. tuberosum* of Peru and Chile

About 30 genera are cultivated in North America as ornamental plants or for food Among these are Atropa (Belladonna), Capsicum (Red or Cayenne Pepper), Cestrum, Cyphomandra (Tree Tomato), Datura (Angel's Trumpet, Datura), Hyoscyamus (Henbane), Lycium (Matrimony Vine, Box Thorn), Lycopersicum (Tomato), [Engler and Prantl unite this with Solanum]; Mandragora (Mandrake of history); Nicotiana (Nicotina, Tobacco), Nicandra (Apple of Peru), Nierembergia (Cup-flower, White Cup); Petunia, Physalis (Ground Cherry, Strawberry Tomato, Alkekengi, Bladder Cherry, Cape Gooseberry, Chinese Lantern Plant); Salpiglossis, Schizanthus (Butterfly Flower, Poor man's Orchid), Streptosolen, Solandra, and Solanum (Nightshade, Potato, Pepino, Melon Pear, Melon Shrub, Eggplant, Guinea Squash, Aubergine, Jerusalem Cherry, Potato Vine, Bittersweet)

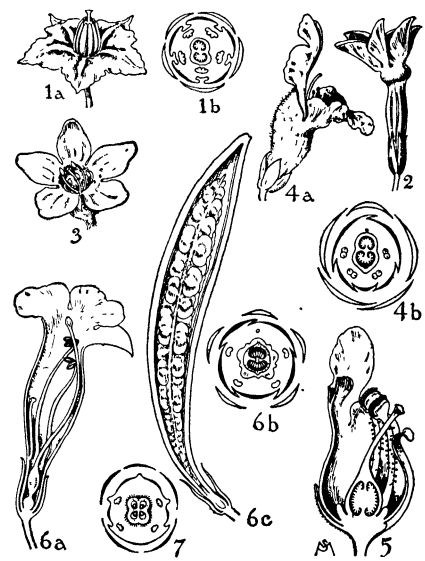
198 **Scrophulariaceæ** (from the genus *Scrophularia*, a reputed remedy for scrofula) Figwort Family Fig 52 Herbs, shrubs, or small trees leaves alternate, opposite or whorled flowers bisexual, regular or commonly irregular, often bilabiate, in which case the throat is often closed by a palate, calyx 5-cleft, corolla 5-lobed, gamopetalous, hypogynous, rarely spurred at the base, imbricated, fertile stamens rarely 5, usually 4 and didynamous, rarely 2, sterile often present as staminodia, epipetalous, hypogynous disk annular or unilateral, ovary superior, 2-celled, ovules many, style 1; stigmas 1–2 fruit generally a capsule, rarely a berry

Scrophulariaceæ is a family of 179 genera and about 2,500 species, distributed very generally over the whole earth A few are aquatic and have finely divided leaves Some are half-parasites on the roots of other plants A few are total parasites without chlorophyll The largest genera are Verbascum containing 160 species, Calceolaria with 134 species, Veronica with 200 species, and Pedicularis with 250 species The family is related to the Solanaceæ, to the Orobanchaceæ and Gesneraceæ The non-plicate imbricated usually irregular corolla, reduced number of stamens, and 2-celled, many-ovuled ovary, are distinctive characters.

The economic uses of the Scrophulariaceæ are medicinal and ornamental *Veronica officinalis* has been used as a tonic and an astringent *Veronica Beccabunga* has been used for scurvy *Scrophularia nodosa* was a remedy for fevers Antirrhinum was used as a diuretic *Euphrasia officinalis* was used in ophthalmia, and hence the name "eye-bright" *Gratiola officinalis* (poor man's herb) is a violent purgative *Digitalis purpurea* is the most valuable medicinal plant in the family It is poisonous, and a well-known diuretic and sedative-narcotic The tropical *Scoparia dulcis* is a febrifuge *Veronica virginica* (Culver's root), *Verbascum Thapsus*, *Linaria vulgaris*, and *Chelone glabra* have also been used in medicine The snapdragon and foxglove are well-known garden plants of this family

Because of the showy flowers, 30 to 40 genera are in cultivation in N America for ornamental purposes Among these are Antirrhinum (Snapdragon), garden and greenhouse, Calceolaria, greenhouse plants, mostly from South America, Castilleia (Painted Cup), garden plants; Chelone (Turtlehead), hardy garden plants, Collinsia, garden annuals; Digitalis (Foxglove), hardy garden plants, Erinus, hardy; Gerardia, hardy, Gratiola, hardy; Halleria (African Honeysuckle), cultivated in the southern borders, Linaria (Butter-and-Eggs, Kenilworth Ivy, Mother-of-Thousands, Toad-flax), hardy and greenhouse, Mimulus (Monkey Flower, Musk Plant), garden annuals or hardy; Paulownia, semi-hardy tree; Pedicularis (Lousewort, Wood Betony), hardy; Pentstemon (Beard Tongue, Pentstemon), hardy; Phygelius (Cape Fuchsia), mostly greenhouse, Rhodochiton (Purple Bells), vine, garden annual, Russelia, greenhouse, Scrophularia (Figwort), hardy, Tetranema (Mexican Foxglove), greenhouse; Torenia, garden, Verbascum (Mullein), hardy, Veronica (Speedwell, Culver's Root, Fluellen, Ground Hele, Angel's Eyes, Bird's Eyes), garden, mostly hardy or annual

199 **Bignoniaceæ** (from the genus *Bignonia*, named for the Abbe Jean Paul Bignon, court librarian at Paris,



52 Solanaceæ 1 Solanum, *a*, flower, *b*, floral diagram 2. Nicotiana, flower Scrophulariaceæ 3 Verbascum, flower 4 Antirrhinum, *a*, flower, *b*, floral diagram 5 Scrophularia, flower Bignoniaceæ 6 Campsis, *a*, flower, *b*, floral diagram, *c*, fruit and seeds Pedaliaceæ 7 Sesamum, floral diagram

and a friend of the botanist Tournefort). Bignonia Family Fig 52 Woody plants, rarely herbs, usually climbing or twining in the tropical forests leaves opposite, rarely alternate, usually compound flowers bisexual, more or less irregular, scarcely bilabiate, calyx 5-cleft, rarely bilabiate or spathe-like, sometimes with appendages, corolla 5-lobed, gamopetalous, hypogynous, imbricated, stamens 4, didynamous, or only 2, the others staminodial, epipetalous, anthers various; hypogynous disk present, ovary superior, 2-celled, rarely 1-celled, many-ovuled, style 1, stigmas 2 fruit a woody capsule, seeds usually winged and very compressed; endosperm 0

The family contains 100 genera and from 500–600 species, principally natives of the tropics, these are most abundant in America Three species reach the northeastern United States, from New Jersey and Ohio southward. The largest genus is Tabebuia with

80 species The family is related to the Scrophulariaceæ; but the peculiar fruit with winged seeds and the absence of endosperm are distinctive The climbing species may or may not have foliar tendrils These, when present, terminate in adherent disks The woody, tropical, climbing Bignoniaceæ are famed for the peculiar cambium growth which produces secondary thickening of such a nature as to give to the cross-section very odd and very diverse patterns, some of which are almost geometrical in their regularity The wood in these patterns may be either divided into four wedges at right angles to each other, or four wedges may be superimposed on a smaller circle of wood, or the wedges may be divided toward the periphery into peculiar finger-like portions, or there may be concentric rings of wood

Catalpa and Tecoma have been used in medicine but are not officinal Caraboa (*Jacaranda Copaia*) contains an aromatic resin of the odor of coumarin Many are ornamental plants with large, handsome flowers

About 20 genera are in cultivation in North America, all as ornamental plants. Among these are Bignonia (Trumpet Flower, Cross Vine, Quarter Vine), mostly greenhouse climbers, Catalpa, semi-hardy or hardy trees, Chilopsis (Desert Willow, Flowering Willow, Mimbres) cultivated in the South; Crescentia (Calabash Tree), cultivated South Others are Campsis (Trumpet Creeper, T Vine, T Honeysuckle), Tecoma (Yellow Elder), Pandorea (Wonga-Wonga Vine, Bower Plant of Australia), Tecomaria (Cape Honeysuckle, climbing or erect shrubs or trees, cultivated mostly in the South, only one of which is fully hardy North

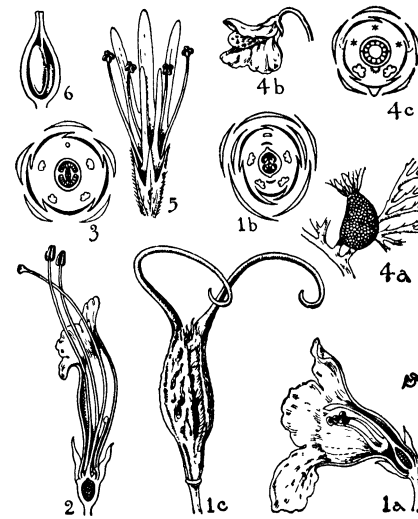
200 **Pedaliaceæ** (from the genus *Pedalium*, signifying a *rudder*, in reference to the winged angles of the fruit). PEDALIUM FAMILY Fig 52 Herbs, rarely shrubs, covered with peculiar slime-secreting glands leaves opposite, or alternate above flowers bisexual, irregular; calyx 5-cleft, corolla 5-lobed, gamopetalous, more or less curved but indistinctly if at all 2-lipped, stamens 4, didynamous, often with an extra staminodium, subepipetalous, hypogynous disk mequilateral, ovary superior or rarely inferior, 2-4-celled or falsely 1-celled, style 1; stigmas 2–4. fruit a capsule, or a hard indehiscent structure which is often covered with stiff or hooked spines or wings, seeds 1 to several, attached to central placentæ

In this family are 14 genera and about 50 species, of tropical and subtropical regions of Africa, Arabia, farther India, Ceylon, Australia, and East Indies They are mostly strand or xerophytic plants The family is most closely related to the Scrophulariaceæ, and to the Martyniaceæ, with which latter family it is often united The peculiar slime-glands, the queer fruit, and the axial seeds are important characters.

The seeds of *Sesamum indicum* yield an oil called benne oil or oil of sesame, which is used as food after the manner of olive oil The oil is also used as a cosmetic and as a medicine. This plant has been cultivated for ages in the orient, and is now cultivated in other lands, the oil being used in the manufacture of soap *Harpagophytum procumbens* is the famous grapple-plant of South Africa, the fruits of which are difficult to separate from wool and clothing The fruits of several species of Uncarina are almost as bad A mucilaginous medicinal drink is made from the leaves of *Pedalium Murex* in India. These leaves are also used to thicken milk, to which they give a rich appearance

The genera in cultivation in N America are: Ceratotheca, ornamental greenhouse plants, and grown in Florida, with indistinctly hooked capsules, Sesamum, grown for oil, medicine, or ornament, outdoor annual, capsule not hooked

201. **Martyniaceæ** (from the genus *Martynia*, in honor of Prof. John Martyn of Cambridge, England). MARTYNIA FAMILY. Fig. 53. Annual or perennial, glandular-hairy herbs. leaves opposite, or alternate: flowers bisexual, irregular, but not bilabiate; calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous; stamens 4, didynamous, rarely 2, the others staminodial, epipetalous, alternating with the corolla-lobes, hypogynous disk present, regular; ovary superior, of 2 carpels but



53 MARTYNIACEÆ: 1 Martynia, *a*, flower; *b*, floral diagram, *c*, fruit GESNERIACEÆ: 2 Gesneria, flower 3 Achimenes, floral diagram LENTIBULARIACEÆ 4 Utricularia, *a*, part of leaf with bladder, *b*, flower, *c*, flower diagram GLOBULARIACEÆ 5 Globularia, flower 6 Cockburnia, vertical section ovary

1-celled, placentæ parietal, ovules several, style 1, stigmas 2 fruit a more or less long, curved, beaked capsule, with a fleshy pericarp, becoming falsely 4-celled

About 3 genera and 10 species inhabit tropical and subtropical America One species reaches southern Indiana The family is closely related to the Pedaliaceæ, with which it has generally been united The horned fruit, 1-celled ovary, parietal placentæ and less slimy pubescence, are distinctive characters

The turnip-like root of *Craniolaria annua*, known in South America as escorzonera, is cooked with sugar or eaten as a vegetable The fruits of *Martynia* (or *Proboscidea*) *louisiana* (*M proboscidea*) are sometimes used as pickles

One genus is in cultivation in this country, namely Martynia (Unicorn Plant, Proboscis Flower), of which 3 or 4 species are grown The Craniolarias of the trade seem to be Martynias

202. **Gesneriaceæ** (from the genus *Gesneria*, named after the early botanist Conrad Gesner of Zurich). GESNERIA FAMILY Fig 53 Herbs, rarely shrubs or small trees, sometimes climbing leaves usually opposite or whorled, simple: flowers bisexual, irregular, often bilabiate, calyx 5-parted; corolla 5-lobed, gamopetalous, hypogynous, often gibbous below, imbricated; stamens rarely 5, usually 4 and didynamous, rarely 2, the sterile usually present as staminodia, epipetalous; hypogynous disk present, diverse; ovary superior or inferior, of 2 carpels but 1-celled with 2 parietal placentæ, often falsely 2–4-celled; ovules numerous; style 1; stigmas 1–2. fruit fleshy with pulpy placentæ, or capsular, or silique-like with twisted valves.

Eighty-four genera and about 500 species are widely distributed in the tropics and subtropics of both hemispheres The largest genera are Cyrtandra containing 180 species and Rœttlera with about 100 species The family is related to the Scrophulariaceæ, Orobanchaceæ and Bignoniaceæ The 1-celled ovary without winged seeds, and the non-parasitic habit are distinctive

The only economic plants in the family are the ornamental, of which there are many The flowers throughout the family are uncommonly large and showy.

Twenty or more genera are in cultivation in N America Among these are the following, all of greenhouse culture: Agalmyla, climbers, Episcia, Gesneria, Isoloma (Kohleria), Nægelia (Smithiantha), Saintpaulia (Usambara Violet, African Violet), Sinningia, including the Gloxinias; Streptocarpus (Cape Primrose), Trichosporum (or Æschynanthus), trailing or drooping

203 **Lentibulariaceæ** (from the old generic name *Lentibularia*, said to mean *lens*, + *a small pipe*, significance obscure) Bladderwort Family Fig 53 Aquatic or marsh herbs, or epiphytes leaves alternate, rarely whorled, very diverse, sometimes finely dissected, or peltate, or oval, or lanceolate, sometimes of two very distinct kinds, usually with very small scattered bladder-like lobes consisting of a complicated trap-like mechanism for catching tiny swimming organisms, or with the whole upper surface of the undivided leaf very glutinous so that insects stick fast to it, either all basal or all cauline, or both flowers bisexual, irregular, calyx 2–5-cleft, persistent, corolla 5-lobed, more or less 2-lipped and with a spur or sack at the base, upper lip 2-lobed, lower 3-lobed, often with a palate in the throat; stamens 2, epipetalous, ovary superior, of 2 carpels but 1-celled, placenta free-central, style 1, stigmas 2 fruit a capsule

Belonging to this family are 5 genera and about 300 species, of which at least 200 belong to Utricularia, they are distributed in all parts of the globe but are more numerous in the tropics One fossil species is known. The family is related to the Scrophulariaceæ The irregular corolla, 2 stamens, and 1-celled ovary with central placenta, are important characters This is a most interesting family of insectivorous plants, with the exception of Pinguicula, they are adapted to catch organisms that swim in the water of ponds, or, in case of the epiphytes, in the rain-water in the cracks and crevices of the host plant

Utriculárias were formerly used locally as medicine. The secretion of the leaves of Pinguicula contains a pepsin-like digestive ferment The Lapps use these leaves to curdle the reindeer milk, hence the common name, butterwort Danish peasant girls are said to use the juice as a hair-pomade Another account says, "Pinguicula leaves, whether fresh or dry, are used by the Lapps to thicken fresh still-warm milk, which neither curdles nor gives cream thereafter, but forms a delicious compact tenacious mass, a small portion of which will act similarly on another quantity of fresh milk"

Two genera are in cultivation in N. America for their peculiar habit and curious orchid-like flowers, which are often very showy Pinguicula (Butterwort); and Utricularia (Bladderwort), mostly epiphytic

204 **Globulariaceæ** (from the genus *Globularia*, so named because the flowers are borne in heads) Globularia Family Fig 53 Shrubs or herbs leaves alternate, simple flowers bisexual, bilabiate, borne in involucrate heads on a chaffy receptacle; calyx mostly 5-parted, bilabiate or regular, corolla 5-lobed, gamopetalous, hypogynous, upper lip sometimes obsolete, the lobes imbricated, stamens 4, didynamous, epipetalous, anthers exserted, by constriction often falsely 4-celled; hypogynous disk usually reduced to a gland on one side; ovary superior, 1-celled, ovule solitary; style 1; stigmas 1–2. fruit a nutlet inclosed in the persistent calyx

The 3 genera and 20 species are confined to the Mediterranean region Seventeen species belong to the genus Globularia The family is related to the Scrophulariaceæ, but is distinguished by the solitary ovule and 1-celled ovary Globularias are easily mistaken for Scabiosas, because of the involucrate heads and exserted stamens

Some species are locally used as remedies

A few species of Globularia are in cultivation in this country, two are hardy, and a third is a greenhouse plant

205 **Acanthaceæ** (from the genus *Acanthus*, derived from the Greek, *a spine*, some of the plants are spiny). Acanthus Family Fig 54 Herbs, or rarely shrubs or trees leaves opposite, rarely whorled flowers bisexual, irregular, usually bilabiate, calyx 5-cleft, corolla 5-lobed, gamopetalous, hypogynous, the lobes imbricated; stamens usually 4, didynamous, rarely 2, sometimes a staminodium present, epipetalous, hypogynous disk present, mostly small, ovary superior, 2-celled, each cell 2-4-, rarely many-, ovuled, style 1, stigmas 1–2, one lobe often small or wanting fruit a capsule, seeds exalbuminous, aided in distribution by peculiar outgrowths of the funiculus

Acanthaceæ has 173 genera and about 1,500 species, of tropical distribution Few species extend into the Mediterranean region and into the United States Six species are found in the northeastern United States Two hundred species belong to the genus Ruellia, and 250 to Justicia The family is related to the Bignoniaceæ, and to the Scrophulariaceæ, as well as to the other



54 Acanthaceæ. 1 Ruellia, flower 2 Justicia, opened fruit Myoporaceæ. 3 Myoporum, *a*, flower, *b*, vertical section ovary. Phrymaceæ. 4 Phrymа, *a*, flower, *b*, fruiting calyx Plantaginaceæ. 5. Plantago, *a*, flower, *b*, vertical section ovary, *c*, fruit.

families of this group. The 2-celled ovary with 2–4 ovules and the queer outgrowths of the funiculus are distinctive

Many species are used in the tropics for medicine; for example, *Asteracantha longifolia*, a purge and sudorific, *Justicia Gendarussa*, astringent, used in India for rheumatism, and the leaves sprinkled in clothing to keep insects away, *Justicia pectoralis*, used for lung troubles. The young flowers of *Blepharis edulis* and *Asystasia gangetica* are eaten as vegetables *Ruellia ciliosa* of the United States has recently been sold spuriously as Spigelia (pink root)

Twenty to 30 genera are in cultivation in N America, except in a few cases, as ornamental greenhouse plants. Among these are. Acanthus (Bear's Breech), hardy

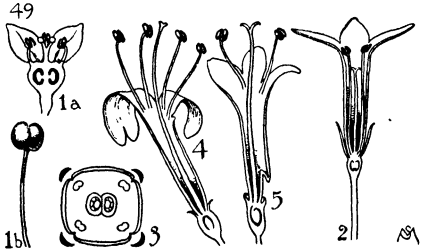
herbs; Adhatoda, shrubs; Aphelandra, shrubs, Crossandra, shrub, Fittonia, herbs, Graptophyllum (Caricature Plant), shrubs, Jacobinia, herbs; Justicia, referred to other genera, Peristrophe, Ruellia, herbs or shrubs; Strobilanthes, often used also for bedding

206. **Myoporaceæ** (from the genus *Myoporum*, signifying to *shut a pore*, in reference to the spots in the leaves which are closed by a membrane) MYOPORUM FAMILY Fig 54 Shrubs or trees leaves alternate, rarely opposite, usually glandular or woolly flowers bisexual, regular or irregular, calyx 5-cleft, persistent, corolla 5-lobed, gamopetalous, hypogynous, stamens 4, didynamous, the fifth a staminodium, epipetalous; ovary superior, 2-celled or falsely 3–10-celled; usually 1–2, rarely 8, ovules in each cell, style 1, stigmas 1–2 fruit drupaceous

There are 5 genera and about 90 species, of which 57 belong to Pholidia and 25 to Myoporum They are mainly natives of Australia, but scattered species occur in the West Indies, Japan, China, Hawaiian Islands, and elsewhere The family is related to the Scrophulariaceæ and to the Verbenaceæ. The few ovules, the presence of oil-glands and the pendulous seeds are distinctive

Myoporum platycarpum is the sandal-tree or sugar-tree or dogwood of Australia From it, a kind of manna is secreted, also a resin that is used like sealing-wax.

Two species of Myoporum are grown as ornamental plants in this country



55 RUBIACEÆ 1 Galium, *a*, flower, *b*, fruit 2 Houstonia, flower 3 Bouvardia, floral diagram CAPRIFOLIACEÆ 4 Lonicera, flower VALERIANACEÆ 5 Valeriana, flower

207 **Phrymaceæ** (from the genus *Phryma*, a name of unknown derivation) LOPSEED FAMILY Fig 54 Perennial herbs leaves opposite, simple flowers bisexual, bilabiate, calyx 5-cleft, 2-lipped, corolla 5-lobed, 2-lipped, gamopetalous, hypogynous; stamens 4, didynamous, included, epipetalous, ovary superior, 1-celled, ovule 1, sub-basal, straight (orthotropous), style 1, stigmas 2 fruit dry, indehiscent, inclosed in the abruptly reflexed calyx, the teeth of which are hooked

A single genus and species occurs in the eastern United States and East Asia The family is related to the Verbenaceæ and was formerly united with that family, but the peculiar, 1-seeded fruit, with a straight orthotropous seed is distinctive

Phryma Leptostachya (lopseed) has been in the trade as an ornamental garden plant

Order 51. PLANTAGINALES

208 **Plantaginaceæ** (from the genus *Plantago*, the Latin name of the plant) PLANTAIN FAMILY Fig. 54. Annual or perennial herbs leaves alternate or opposite: flowers bisexual, or rarely unisexual, regular; calyx 4-cleft; corolla 4-lobed, gamopetalous, hypogynous, scarious, imbricated; stamens 4, epipetalous or hypogynous, exserted, alternate with the corolla-lobes: ovary superior, 1–2-celled, rarely 4-celled, ovules 1 to many in each cell, style and stigma 1 fruit a circumscissile capsule, or an indehiscent nutlet, invested by the persistent calyx; seeds usually peltate

Three genera and about 200 species, of which all but 3 belong to the genus Plantago, are distributed over the whole earth The centers of distribution are the Mediterranean region and the Andes This is a very distinct gamopetalous family of doubtful relationship, possibly allied to the Labiatæ

Many European species were formerly used in medicine, the seeds as mucilaginous emollients in inflammatory ophthalmia, and the like, the leaves as bitters The seeds are used in India to stiffen muslins *Plantago lanceolata*, *P Coronopus* and *P major* are eaten as greens The seeds of several species are sold for feeding birds *P lanceolata* is used for early pasturage

The family is not cultivated in N America, except possibly for bird-seed, pasturage, or pond-border planting

Order 52 RUBIALES

209 **Rubiaceæ** (from the genus *Rubia*, signifying *red*, from the color of the roots of some species) MADDER FAMILY Fig 55 Trees, shrubs or herbs leaves opposite or whorled, simple, usually entire flowers bisexual, rarely unisexual, regular, rarely slightly irregular, calyx 2–6-cleft, or 0, corolla gamopetalous, 4–6-lobed, mostly valvate, stamens 4–6, epipetalous, ovary inferior, 1 to many-, commonly 2-, celled, ovules 1 to many in each cell, style 1, stigma 1, capitate or several-branched fruit a capsule, berry, or drupe

Rubiaceæ is a family of 343 genera and about 4,500 species, mainly tropical, about 34 species reach the northeastern United States The family is closely related to the Caprifoliaceæ, but usually has stipules or whorled leaves, it is also related to the Cornaceæ, Valerianeæ, Compositæ, and the like

A number of tropical Rubiaceæ are myrmecophilous, i e, provide a dwelling-place for protective ants The whorled leaves of some species have probably been developed from stipules

This is an important economic family. *Coffea arabica* (Abyssinia coffee) is generally cultivated in the tropics and used elsewhere as a beverage *Cinchona Ledgeriana* and *C succirubra* of the Andes furnish quinine *Uragoga (Cephalis) Ipecacuanha* of Brazil is the source of the emetic ipecac Cephalanthus of North America, and several species of Galium have been used in medicine *Rubia tinctoria* (Mediterranean) furnishes the red dye, madder Roots of Asperula and some species of Galium yield red dyes *Morinda citrifolia* (tropics) yields a yellow dye, morindin *Uncaria Gambir* (Malay) yields the dye known as catechu, gambir, or terra japonica The foliage of *Asperula odorata* has the fragrance of sweet grass, and is used for a similar purpose, and for flavoring wines *Galium triflorum* has a similar odor. *Galium verum*, the yellow bedstraw (Europe) contains a milk-curdling ferment, hence the name, "galium," also formerly given to women to increase lactation Berries of Mitchella contain a saponin-like substance The fruits of *Vangueria edulis* and several other species of Rubiaceæ are edible The wood of many species is valuable

Forty to 50 genera and a great many species are in cultivation in N America, mostly in the greenhouse and in tropical horticulture Among these are Indian Mulberry (Morinda), Cape Jasmine (Gardenia), Bluets (Houstonia); Manettia Vine (Manettia), Madder (Rubia); Buttonbush (Cephalanthus, hardy), Bedstraw or Cleavers (Galium), Coffee (Coffea), Cinchona (Cinchona), and Partridge Berry (Mitchella)

210 **Caprifoliaceæ** (from the old genus *Caprifolium*, meaning a *goat-leaf*, possibly in reference to the climbing habit) HONEYSUCKLE FAMILY. Fig 55 Shrubs, very rarely herbs leaves opposite, simple or pinnate: flowers bisexual, regular or irregular, calyx 4–5-toothed,

or 4–5-fid, corolla gamopetalous, 4–5-lobed, tubular or rotate; stamens of the same number as the corolla-lobes and alternate with them, epipetalous, ovary inferior, 1–5-celled, each cell 1 to many-ovuled, style 1 or obsolete, stigmas 1–5 fruit a berry or capsule

The 11 genera and about 350 species are distributed principally in the north temperate zone The tropical species are mostly confined to the mountains A few species of Sambucus and Viburnum occur in the southern hemisphere The family is very closely related to the Rubiaceæ but the leaves are exstipulate; also to the Cornaceæ and Valerianaceæ Some fossil species have been found

Many species of Honeysuckle exhale a sweet odor after sunset The berries of *Lonicera Caprifolium* are said to be diuretic, those of *L Xylosteum* are laxative The berries of the European elder (*Sambucus nigra*), and of the American elder (*S canadensis*) are cooked and eaten and are also made into wine The dried flowers of elder were formerly used in cases of fever The roots of the North American *Triosteum perfoliatum* furnish a kind of ipecac Other species are locally used in medicine Many are ornamental

Eight or 10 genera are in cultivation in N America Viburnum (Shepherry, Hobble-bush, Wayfaring Tree, Arrowwood, High Cranberry, Snowball Bush), Sambucus (Elder), Triosteum (Feverwort, Horse Gentian, Wild Ipecac), Symphoricarpos (Snowberry, Coral Berry), Abelia, Diervilla (Weigela, Bush Honeysuckle), Linnæa (Twin-flower), Lonicera (Bush and Climbing Honeysuckles, Woodbine, Trumpet Honeysuckle)

211 **Valerianaceæ** (from the genus *Valeriana*, a word of uncertain origin) VALERIAN FAMILY Fig 55 Annual or perennial herbs, often strongly scented leaves basal and cauline, the latter opposite, simple or pinnate flowers bisexual or unisexual, regular or irregular, epigynous, calyx of 1–3 minute, but often accrescent, sepals, corolla 5-, rarely 3–4-, lobed, gamopetalous, often produced into a spur at the base, lobes imbricated, stamens 1–4, rarely 5, epipetalous, exserted, ovary inferior, 3-celled, only 1 cell maturing, seed 1, style 1, stigmas 3 fruit dry, indehiscent, 1-seeded

Eight genera and about 280 species are known, mostly in the north temperate regions of the Old World, especially in the region just north of the Mediterranean, and in South America, where the genus Valeriana is mostly distributed The family is related to the Dipsacaceæ and the Caprifoliaceæ, and more remotely to the Compositæ The epigynous, gamopetalous flower, separate stamens, 3 carpels and 1-seeded fruit are distinctive

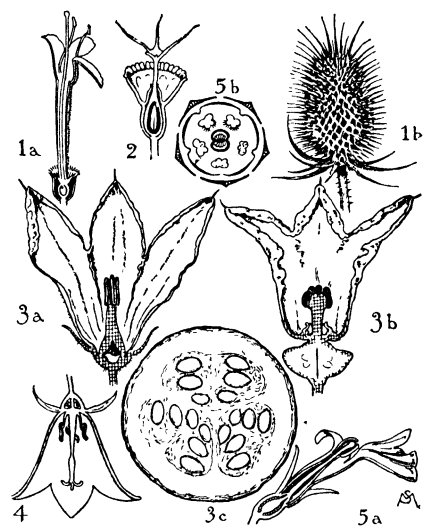
Valeriana officinalis is a powerful nerve sedative with a peculiar odor Many other Valerianaceæ are used as local remedies for the same purpose The foliage of various species of Valerianella (lamb's lettuce, corn salad) is eaten as a salad, less commonly as a pot-herb

In this country few genera are in cultivation Patrinia as a pot-herb, Centranthus (Red Valerian, Jupiter's Beard) and Valeriana (Valerian) as ornamental plants, and Valerianella (Corn Salad, Fetticus) for food.

212 **Dipsacaceæ** (from the genus *Dipsacus*, derived from the Greek *to thirst*, in allusion to the water-holding leaf-bases) TEASEL FAMILY Fig 56 Annual or perennial herbs leaves opposite, rarely whorled flowers small, bisexual, mostly irregular, epigynous, in dense involucrate heads, each flower also surrounded by a cup-shaped, more or less scarious, involucre, which is a metamorphosed bracteole, calyx of setaceous segments or crown-like, or plumose, or various, corolla 4–5-lobed, gamopetalous, usually irregular, lobes imbricated, stamens 4, rarely 2–3, mostly epipetalous, ovary inferior, 1-celled, 1-ovuled; style 1, stigmas 2 fruit an achene

The family has 10 genera and about 150 species, all natives of warm-temperate regions of the Old World, and mostly of the eastern Mediterranean region The family is related to the Valerianaceæ, and more distantly to the Compositæ The gamopetalous corolla, 2 carpels, involucrate heads and involucrate flowers are distinctive

Dipsacus and Scabiosa have been used in medicine The spiny hooked bracts of *Dipsacus ferox* (fuller's teasel of southwestern Asia) have been used to full cloth, whence the common name; and the plant was once cultivated extensively for this purpose The connate leaf-bases of *Dipsacus sylvestris* hold several ounces of rain-water until evaporated This contrivance



56 DIPSACACEÆ 1 Dipsacus, *a*, flower, *b*, fruiting head 2 Scabiosa, fruit CUCURBITACEÆ 3 Cucurbita *a*, male flower, *b*, female flower, *c*, crosssection fruit CAMPANULACEÆ, 4 Campanula, flower 5 Lobelia, *a*, flower, *b*, floral diagram

may be of benefit in preventing the ascent of harmful insects

Four genera are in cultivation in North America Cephalaria, Morina, and Scabiosa as ornamental plants, *Dipsacus ferox* (*D fullonum*), locally cultivated in New York state for fulling cloth.

Order 53 CAMPANULALES

213 **Cucurbitaceæ** (from the genus *Cucurbita*, the classical name for the gourd) GOURD FAMILY Fig 56 Herbs, rarely shrubs, climbing, usually with branched tendrils leaves alternate, more or less rounded, veins palmate flowers usually unisexual, perigynous, regular, stamens 5, rarely separate, usually connate in 2 pairs and 1 free stamen (thus apparently, stamens 3), or monadelphous, inserted at the summit of the ovary, anthers 2-celled, the cells often queerly curved and contorted, carpels usually 3, rarely more or fewer, ovary inferior, mostly 3-celled, many-ovuled fruit a dry berry with thick rind and spongy center (Pepo), or juicy with hard rind, very exceptionally dehiscent

There are 87 genera and about 650 species, widely distributed over the earth but most abundant in the tropics, they are wanting in the cold regions Several are wild in the eastern United States The family is related to the Campanulaceæ, possibly also to the Passi-

floraceæ. The tendrils are usually borne singly at the nodes and are thought to be modified axillary branches The fruits are exceedingly diverse and odd Some are the largest fruits of the vegetable kingdom, others are very tiny The gourds are very diverse in shape and color,—club-shaped, globular, or flattened from above, or curiously curved

The family is of considerable economic importance The fruits of many are edible; e g, *Cucurbita Pepo* (pumpkin, summer crookneck squash), *C maxima* (squash), *C moschata* (winter crookneck squash), *Cucumis Melo* (muskmelon and other melons), *C sativa* (cucumber), *Citrullus vulgaris* (watermelon). The gourds are cultivated as curiosities and for the fruit to be used as household utensils, e g, bottle-gourds and calabash (Lagenaria) The leaves, stems, or roots of very many species contain bitter, subresinous substances which render them drastic purgatives The roots of *Bryonia alba* (bryony) of Europe are highly purgative The fruits of colocinth (*Citrullus Colocynthis*) of the orient and North Africa furnish a purgative known to the ancients. The fruit of Luffa of India and Arabia is purgative when ripe but edible when green The outer portion of the fruit of Luffa is very fibrous and reticulated, and, when cleaned, serves as a sponge or dish-cloth in the Antilles (luffa-sponge or Egyptian bath-sponge) The small gourd of *Benincasa hispida* (wax gourd or Chinese watermelon) of tropical Asia is considered an emblem of fertility in India and is presented to newly married couples Xanthosicyos of the South African desert is remarkably erect and spiny, but the small fruit is considered a delicacy Elaterium is a drug obtained from the juice of *Ecballium Elaterium*

The most remarkable fruit is the squirting cucumber (*Ecballium Elaterium*) of the Mediterranean region The prickly fruit, about 2 inches long, becomes very turgid and finally explodes with a considerable report The basal end is blown out like a cork from a bottle, and the pulpy interior, containing the seeds, is projected to a considerable distance

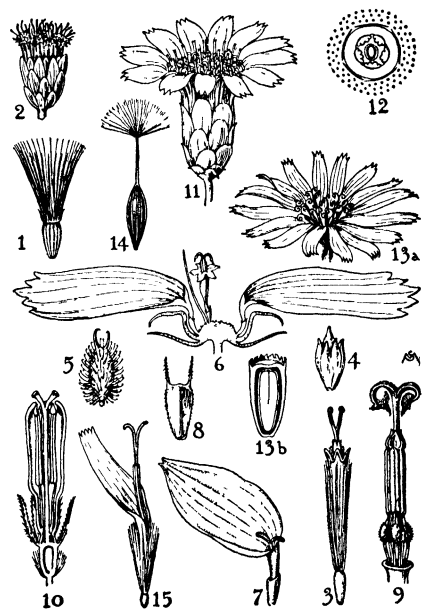
Twenty to 30 genera are in cultivation in N America Among these are the various melons, squashes, gourds, and the like, mentioned above, also Bryony, Wax Gourd, Balsam Pear or Balsam Apple (Momordica), Dish-cloth Gourd, Squirting Cucumber, Curuba (Sicana), and Snake Gourd (Trichosanthes)

214 **Campanulaceæ** (from the genus *Campanula*, a diminutive of *campana*, a little bell) BELLFLOWER FAMILY Fig 56 Herbs, shrubs, or trees, mostly with milky juice leaves usually alternate, exstipulate, rarely lobed or divided flowers bisexual, rarely unisexual, regular or irregular, often bilabiate and split down the back, usually epigynous, calyx of usually 5, separate, valvate sepals, corolla usually 5-lobed, gamopetalous, very rarely polypetalous, stamens as many as the lobes of the corolla, often slightly epipetalous, separate or united; ovary usually inferior, 2–5-celled or 6–10-celled, rarely 1-celled, ovules many, style 1, stigmas 1 to several fruit a capsule, rarely a berry

Campanulaceæ has 59 genera and about 1,500 species, occurring in all parts of the world but mostly in the temperate regions A large part are alpine. Arborescent forms occur in the Hawaiian Islands The family is rather distantly related to the Compositæ, Dipsacaceæ, Caprifoliaceæ Formerly the Lobeliaceæ were separated as a distinct family, but the only differences are in the irregular flowers and syngenesious or monadelphous stamens, both of which show abundant transitions When united, the family constitutes a very distinct group The gamopetalous epigynous flower, the many ovules and the frequently united stamens are distinctive The stamens are sometimes united by their filaments with the anthers free (monadelphous), or by the anthers with the filaments free (syngenesious), or by both filaments and anthers.

Lobelia inflata (lobelia, Indian tobacco) of North America is poisonous The foliage furnishes the medicinal lobelia *L. syphilitica* was used for syphilis by the Indians, but is of no value The roots of this latter plant and of the cardinal flower (*L cardinalis*) are more or less poisonous The berries and fleshy roots of some Campanulaceæ have been used as food.

In cultivation in N America are some 20 genera Among these are Shepherd's Scabious, or Sheep's-bit (Jasione); Chinese or Japanese Bellflower or Balloon Flower (Platycodon), Venus's Looking-glass (Specularia), Horned Rampion (Phyteuma); Giant Bellflower (Ostrowskia), Lobelia and the Cardinal Flower (Lobelia), and the Bellflowers or Bluebells (Campanula).



57 COMPOSITÆ 1 Vernonia, fruit. 2 Eupatorium, head 3. Erigeron, disk flower. 4. Ambrosia, fruiting involucre 5 Xanthium, fruiting involucre. 6 Coreopsis, head. 7 Dahlia, ray flower 8 Bidens, fruit 9 Cosmos, disk flower, corolla removed 10 Helenium, disk flower, vertical section 11 Mutisia, head 12. Senecio, floral diagram 13 Cichorium, *a*, head, *b*, fruit 14. Lactuca, fruit 15 Hieracium, ray flower.

215 **Compositæ** (name having reference to the aggregation of the flowers into heads or false flowers, i e., composite flowers) COMPOSITE FAMILY Fig 57. Herbs, shrubs, or rarely trees, sometimes twining, often with milky juice leaves alternate, opposite or whorled, very diverse in shape, size and texture flowers bisexual or unisexual, regular or irregular, epigynous, subtended by a bract called chaff, aggregated into 1- to many-flowered involucrate heads; calyx (pappus) reduced to hairs, scales, awns, or a border, or wanting; corolla gamopetalous, normally regular, 4–5-lobed, the lobes valvate, in one tribe bilabiate, often enlarged and split down one side, and flattened out (ligulate or ray flowers), stamens usually 4–5, epipetalous, syngenesious, alternating with the corolla lobes, carpels 2; ovary 1-celled, 1-ovuled, inferior, style 1; stigmas 2, rarely 1 fruit an achene, often crowned by the persistent pappus, seed exalbuminous.

This is the largest family of flowering plants, consisting of more than 800 genera and 10,000 to 12,000 species, distributed over all parts of the earth, each tribe usually having a definite center of distribution. The largest genera are. Senecio, 1,200 species, Centaurea, 470, Vernonia, 450, Hieracium, 400, Helichrysum, 300, Baccharis, 275, Cousinia, 210, Artemisia, 200, Crepis, 170; Erigeron, 150, Chrysanthemum, 140, Saussurea, 125, Gnaphalium, 120, Circium, 120, Scorzonera, 100, Anthemis, 100 The Compositæ, taken in the broad sense, is a well-defined family not closely related to any other large families Its affinities are with the Campanulaceæ, Dipsaceaceæ, and Valerianaceæ In general, the involucrate heads, epigynous gamopetalous flowers, syngenesious stamens, 1-seeded dry fruits and exalbuminous seeds are distinctive In some genera the heads have no ray flowers (discoid), in others they have a marginal row, and in still others all the flowers are ligulate Except in the last case, the ray flowers are without stamens, and frequently without a pistil (neutral) The style-branches are very diverse, and are important in the characterization of tribes They are often provided with sweeping hairs which push the pollen from the introrse anthers up out of the anther tube as the style elongates The anthers are caudate in two tribes, and in some genera the filaments contract abruptly when stimulated by touch In Ambrosia and Xanthium, the anthers are separate, and the bracts of the 1–2-flowered pistillate involucre are fused, woody, indehiscent, and covered with spines or hooks

The family is divided by Hoffman into 13 tribes, several of which are by some authors considered separate families.

Sub-family I. Disk flowers not ligulate, no milky sap Consists of twelve tribes, separated on a basis of style-branches, anther-tails, chaff on the receptacle, and so on, as follows Ironweed Tribe, Boneset T, Aster T, Elecampane T, Sunflower T, Sneezeweed T, Chamomile T, Senecio T, Pot Marigold T, Arctotis T, Thistle T, Mutisia T

Sub-family II All flowers ligulate, juice milky One tribe,—the Dandelion or Lettuce Tribe

Medicinal Plants The Compositæ are rich in ethereal oils, fatty oils, resins and bitter principles, and therefore many species are used in medicine Among others of less importance, the following may be noted *Artemisia Absinthium* (wormwood), tonic, febrifuge, anthelmintic, *A. Cina* which furnishes santonica from which santonin is extracted, anthelmintic, stimulant, *A vulgaris* (mugwort) has been used as an emmenagogue and for epilepsy, *Anthemis nobilis* (Roman chamomile), tonic, nervine, emmenagogue, *Matricaria Chamomilla* (German chamomile), with similar properties, *Tanacetum vulgare* (tansy), tonic, anthelmintic, emmenagogue, diuretic, *Arnica montana* (arnica, leopard's bane), skin stimulant, diuretic; *Inula Helenium* (elecampane), skin stimulant, *Eupatorium perfoliatum* (boneset, thoroughwort), tonic, diaphoretic, laxative, many Eupatoriums of the tropics, famed remedies for snake-bites, *Tussilago Farfara* (coltsfoot), sedative; *Arctium Lappa* and *A minus* (burdock), diaphoretic, alterative, used for rheumatism, *Calendula officinalis* (marigold), diaphoretic, alterative, *Lactuca sativa* (lettuce), the thickened juice a narcotic, a substitute for opium, *L virosa* (wild lettuce), furnishing lactucarium or lettuce opium, a poisonous anodyne, hypnotic, and sedative, *Taraxacum officinale* (dandelion), tonic, but injurious to digestion, species of Grindelia, tonic, sedative, used for asthma and rheumatism, *Erigeron canadense* (fleabane), used for diarrhea and uterine hemorrhage; *Anacyclus Pyrethrum* (pellitory), skin irritant, *Achillea Millefolium* (yarrow), an old remedy, styptic, tonic, sudorific, antispasmodic Brauneria (Echinacea), Prenanthes, Xanthium, Helenium, Spilanthes, Baccharis, and *Chrysanthemum Leucanthemum* have been used locally to some extent The pollen of ragweed (*Ambrosia artemisiifolia*), less commonly of species of Solidago and other Compositæ, is said to be the cause of autumnal hay-fever.

The following are used for food, as salads or cooked in various ways Young foliage of Circium (thistles), *Cynara Cardunculus* (cardoon), *Taraxacum officinale* (dandelion), *Cichorium Intybus* (chicory), *Lactuca sativa* (lettuce), *Cichorium Endivia* (endive, succory), *Pacourina edulis*, and *Scolymus hispanicus*, (Spanish oyster plant), young flower heads of *Cynara Scolymus* (globe artichoke), roots of *Tragopogon porrifolius* (vegetable oyster, salsify), *Scorzonera hispanica* (Scorzonera, black salsify), *Helianthus tuberosus* (Jerusalem artichoke) Roots of chicory, roasted, are a substitute for coffee

The following yield dyes *Carthamus tinctorius*, (safflower) yields the red dye, carthamine, *Serratula tinctoria* (dyer's savory) yields a yellow dye

The powdered heads of species of Chrysanthemum furnish insect powder An oil is obtained from the seeds of *Guizotia abyssinica* (niger seeds) of India and Abyssinia, used for food, painting, and burning Seeds of *Madia sativa* furnish an oil similar to olive oil, edible, illuminating, and lubricating The seeds of *Helianthus annuus* also furnish a commercial oil.

Many Compositæ are ornamental The species of Helichrysum, Anaphalis, and related genera, have papery involucres, and furnish well-known everlastings

More than one hundred and fifty genera are in cultivation in N America, or are important weeds Many of our most important and most showy ornamental plants belong to the Compositæ Among these genera are Achillea (Milfoil, Yarrow, Sneezewort), Ageratum, Anaphalis (Everlasting, Moonshine); Antennaria (Everlasting, Cat's-ear, Pussy's Toes, Ladies' Tobacco), Anthemis (Chamomile, Mayweed, Golden Marguerite); Arctium (Burdock), Arnica (Mountain Tobacco, Mountain Snuff), Artemisia (Wormwood, Tarragon, Estragon, Southernwood, Roman Wormwood, Old Man and Old Woman, Sage Brush); Aster (Aster, Starwort, Michaelmas Daisy), Bidens (Bur Marigold, Beggar's Ticks, Pitchfork Bur), Boltonia (False Chamomile); Brachycome (Swan River Daisy), Brickellia (Tassel Flower), Buphthalmum, Calendula (Marigold), Callistephus (China Aster), Cnicus or Carbenia (Blessed Thistle), Carthamus (Safflower, False Saffron), Centaurea (Centaury, Dusty Miller, Bachelor's Button, Cornflower, Knapweed, Bluebottle, Bluet, Ragged Sailor, Sweet Sultan, Basket Flower, Hardheads), Chænactis, Chrysanthemum (Feverfew, Golden Feather, Turfing Daisy, Marguerite, Paris Daisy, Costmary, Mint Geranium, Giant Daisy, Ox-eye Daisy, Whiteweed); Cichorium (Chicory, Succory), Cineraria, Circium or Cnicus (Common Thistles), Coreopsis (Tickseed, Golden Wave); Cosmos, Cynara (Artichoke, Cardoon), Dahlia, Doronicum (Leopard's-Bane), Echinacea or Brauneria (Purple Coneflower), Echinops (Globe Thistle), Emilia (Tassel Flower), Erigeron (Fleabane, Poor Robin's Plantain), Eupatorium (Boneset, Joe-Pye Weed, Thoroughwort, White Snakeroot), Felicia (Blue Daisy, Blue Marguerite); Gaillardia, Gazania (Peacock Gazania), Grindelia (Gum Plant), Gynura (Velvet Plant), Helenium (Sneezeweed), Helianthus (Sunflower, Indian Potato, Jerusalem Artichoke), Helichrysum, Heliopsis; Helipterum, Hidalgoa (Treasure Vine); Hieracium (Hawkweed, Rattlesnake Weed, Devil's Paint-brush), Inula (Elecampane), Krigia (Dwarf Dandelion), Lactuca (Lettuce), Leontopodium (Edelweiss); Leptosyne; Liatris (Blazing Star, Button Snakeroot), Lonas (African Daisy); Madia (Tarweed) Matricaria, Mikania (Climbing Hempweed, Climbing Boneset), Onopordon (Scotch Thistle), Parthenium (American Feverfew, Prairie Dock), Pentachæta; Petasites (Winter Heliotrope, Sweet Coltsfoot), Piqueria: Podolepis, Polymnia (Leaf-cup), Prenanthes (Rattle

snake Root); Rudbeckia (Black-eyed Susan, Yellow Daisy, Coneflower, Golden Glow), Santolina (Lavender Cotton); Scolymus (Golden Thistle, Spanish Oyster Plant); Scorzonera (Black Salsify); Senecio (Groundsel, Canada Plant, Ragwort, German Ivy, Leopard Plant, Dusty Miller), Silphium (Rosin-Weed, Compass Plant, Prairie Dock, Cup Plant), Solidago (Goldenrod); Spilanthes (Para Cress); Stokesia (Stoke's Aster); Tagetes (French Marigold, African Marigold); Tanacetum (Tansy); Taraxacum (Dandelion), Thelysperma; Townsendia, Tragopogon (Salsify, Goat's Beard, Vegetable Oyster, Oyster Plant); Trilisa (Vanilla Plant); Tussilago (Coltsfoot); Verbesina (Crownbeard); Vernonia (Ironweed), Zinnia (Zinnia, Youth-and-Old-Age).

INDEX TO THE FOREGOING FAMILIES (PAGES)

Acanthaceæ, 73.
Aceraceæ, 49.
Aizoaceæ, 30
Alismaceæ, 13.
Amarantaceæ, 29.
Amaryllidaceæ, 20.
Anacardiaceæ, 48
Andreales, 7.
Annonaceæ, 34
Anthocerotales, 6.
Apocynaceæ, 67
Aponogetonaceæ, 13.
Aquifoliaceæ, 48.
Araceæ, 17
Araliaceæ, 62
Aristolochiaceæ, 28.
Asclepiadaceæ, 67
Balsaminaceæ, 50.
Basellaceæ, 30
Begoniaceæ, 57.
Berberidaceæ, 33.
Betulaceæ, 25
Bignoniaceæ, 71
Bixaceæ, 55
Bombacaceæ, 53.
Boraginaceæ, 69
Bromeliaceæ, 18
Bruniaceæ, 39.
Bryales, 7
Burseraceæ, 45
Butomaceæ, 14
Buxaceæ, 47
Cactaceæ, 57
Calycanthaceæ, 34.
Campanulaceæ, 76
Cannaceæ, 22
Capparidaceæ, 36
Caprifoliaceæ, 74
Caricaceæ, 57
Caryophyllaceæ, 31.
Casuarinaceæ, 23
Celastraceæ, 49
Cephalotaceæ, 38
Ceratopteridaceæ, 8.
Chenopodiaceæ, 29
Chloranthaceæ, 24
Cistaceæ, 55
Clethraceæ, 63
Combretaceæ, 60
Commelinaceæ, 18.
Compositæ, 76
Convolvulaceæ, 68.
Coriariaceæ, 47.
Cornaceæ, 63
Crassulaceæ, 38.
Cruciferæ, 36.
Cucurbitaceæ, 75.
Cunoniaceæ, 39
Cyatheaceæ, 8
Cycadaceæ, 11
Cyclanthaceæ, 17.
Cyperaceæ, 15
Cyrillaceæ, 48
Diapensiaceæ, 64
Dilleniaceæ, 53
Dioscoriaceæ, 20.
Dipsacaceæ, 75
Droseraceæ, 38
Ebenaceæ, 65
Elæagnaceæ, 59
Elæocarpaceæ, 51
Empetraceæ, 47
Epacridaceæ, 64
Equisetaceæ, 10
Ericaceæ, 64
Erythroxylaceæ, 44.
Euphorbiaceæ, 46
Fagaceæ, 25
Flacourtiaceæ, 56
Fouquieriaceæ, 55
Fumariaceæ, 36
Gentianaceæ, 67.
Geraniaceæ, 42
Gesneriaceæ, 72
Ginkgoaceæ, 11
Gleicheniaceæ, 9
Globulariaceæ, 73
Gnetaceæ, 12
Gramineæ, 14
Guttiferæ, 54
Haloragidaceæ, 61
Hamamelidaceæ, 40
Hippocastanaceæ, 50
Hydrocaryaceæ, 61
Hydrocharitaceæ, 14
Hydrophyllaceæ, 68
Hymenophyllaceæ, 8
Hypericaceæ, 54
Iridaceæ, 21
Juglandaceæ, 25
Juncaceæ, 19
Jungermanniales, 6
Labiatæ, 70
Lardizabalaceæ, 33.
Lauraceæ, 35
Lecythidaceæ, 59.
Leguminosæ, 41.
Lemnaceæ, 18
Lentibulariaceæ, 73.
Liliaceæ, 19
Limnanthaceæ, 48.
Linaceæ, 43
Loasaceæ, 57.
Loganiaceæ, 67.
Loranthaceæ, 27
Lycopodiaceæ, 10.
Lythraceæ, 59
Magnoliaceæ, 33
Malpighiaceæ, 45.
Malvaceæ, 52
Marantaceæ, 22.
Marattiaceæ, 7
Marchantiales, 6
Marsileaceæ, 9
Martyniaceæ, 72
Melastomaceæ, 60.
Meliaceæ, 45
Melianthaceæ, 50
Menispermaceæ, 33.
Monimiaceæ, 35
Monotropaceæ, 63
Moraceæ, 26
Moringaceæ, 37.
Musaceæ, 21
Myoporaceæ, 74
Myricaceæ, 24
Myristicaceæ, 35
Myrsinaceæ, 64
Myrtaceæ, 60
Naiadaceæ, 13
Nepenthaceæ, 38.
Nolanaceæ, 70
Nyctaginaceæ, 29
Nymphæaceæ, 31.
Ochnaceæ, 53
Olacaceæ, 27.
Oleaceæ, 66
Onagraceæ, 61
Oomycetes, 5
Ophioglossaceæ, 7.
Orchidaceæ, 22.
Osmundaceæ, 9
Oxalidaceæ, 43
Palmaceæ, 16
Pandanaceæ, 13
Papaveraceæ, 35
Passifloraceæ, 56.
Pedaliaceæ, 72
Phascales, 7
Phrymaceæ, 74
Phytolaccaceæ, 30.
Pinaceæ, 12
Piperaceæ, 23.
Pittosporaceæ, 39
Plantaginaceæ, 74.
Platanaceæ, 40
Plumbaginaceæ, 65.
Polemoniaceæ, 68.
Polygalaceæ, 46
Polygonaceæ, 28.
Polypodiaceæ, 8.
Pontederiaceæ, 18.
Portulacaceæ, 30.
Primulaceæ, 64
Proteaceæ, 27.
Punicaceæ, 59
Pyrolaceæ, 63
Ranunculaceæ, 32.
Resedaceæ, 37.
Rhamnaceæ, 51
Rhizophoraceæ, 59.
Ricciales, 6
Rosaceæ, 40
Rubiaceæ, 74
Rutaceæ, 44
Salicaceæ, 24
Salviniaceæ, 10.
Santalaceæ, 27.
Sapindaceæ, 50.
Sapotaceæ, 65
Sarraceniaceæ, 37.
Saururaceæ, 23
Saxifragaceæ, 39
Schizæaceæ, 9
Scrophulariaceæ, 71.
Selaginellaceæ, 10.
Simarubaceæ, 44
Solanaceæ, 70
Sphagnales, 6
Stachyuraceæ, 56
Stackhousiaceæ, 49.
Staphyleaceæ, 49
Sterculiaceæ, 53
Styracaceæ, 66
Symplocaceæ, 66
Taccaceæ, 20
Tamaricaceæ, 55.
Taxaceæ, 11
Ternstrœmiaceæ, 54.
Theaceæ, 54
Thymelæaceæ, 58
Tiliaceæ, 52
Tremandraceæ, 46.
Trochodendraceæ, 32.
Tropæolaceæ, 43.
Typhaceæ, 13
Ulmaceæ, 25
Umbelliferæ, 62.
Urticaceæ, 26
Valerianaceæ, 75.
Verbenaceæ, 69.
Violaceæ, 56.
Vitaceæ, 51.
Zingiberaceæ, 21.
Zygomycetes, 5.
Zygophyllaceæ, 44.



IV. Upland vegetation.—Trees on a wind-swept plateau.

KEY TO THE FAMILIES AND GENERA

In one of the editions of the Cyclopedia of American Horticulture, a key to the families and genera contained therein was placed in the introductory part to Vol. I This key is now modified and adapted to the present work. The original key was prepared by Wilhelm Miller, Associate Editor of that Cyclopedia The main part of Dr. Miller's introduction to that key is here reprinted, with adaptations, as explaining the purpose of a key and the way in which it is constituted.

The key has now been extensively revised, but the original form and method are still retained.

The purposes of the key.

The following key attempts to supply what is probably the greatest deficiency in cyclopedic works on horticulture:

(1) It helps the gardener to determine the name of any plant cultivated in America, including the wild flowers and other plants native to the United States and Canada that are commonly or even frequently offered for sale.

(2) It helps the student towards a scientific knowledge of the plant world, since it gives a condensed and orderly catalogue of that part of the vegetable kingdom which is of interest to gardeners, farmers and foresters

No merely alphabetical work can accomplish either of these results For example, suppose the person has a flower that is known to be an Iris, but of what species of Iris is not clear to him; and that he wishes to find the name If he were to consult the best works in which the species of Iris are arranged alphabetically, it might require hours to read the pages of description, comparing the items with the specimen, and the chances are that in the end he would not be sure of a determination, since related species are not compared and contrasted

It was to provide a short-cut to such information that every large genus or group of plants described in the Cyclopedia of American Horticulture was classified according to shape, color, size, season, height or other characters of interest to the gardener These short-cuts, or "keys," have long been in common use with students of botany, and are a feature of all floras, but they have not been sufficiently employed in writings on horticultural subjects

No valid objection can be made to keys, synopses or other classified arrangements, since they do three things more clearly and briefly than any other device: (1) They help one to find out the name of a plant (2) They show the difference between the given species and other species of the same genus (3) They show the relation of each species to every other, i. e., some of the points of likeness and unlikeness.

But classified schemes alone have one serious limitation They are not so convenient for ready reference if one knows one's plant and merely wishes to find out the native country or how to spell the name. The Cyclopedia of American Horticulture met this need by numbering the species and providing an alphabetical list or index in each large genus. It therefore met the needs by presenting both systems—the classified and the alphabetical—one for taxonomic study, the other for convenience.

All this supposes that one knows the genus to which the plant belongs,—whether it is an Iris, Pæonia or Rhododendron. But he may not know the genus: the key will aid him to determine it. The key leads to the family and the genus; having the genus, he can run down the species in the Cyclopedia itself, for the genera are to be found in alphabetical order. This key, therefore, deals only with families and genera, since the species are described and distinguished elsewhere It ties the whole work together and makes it an organism, instead of a series of detached articles on Iris, Rosa, Solanum, and other genera. In other words, the key is not merely supplementary: it is structural and even fundamental.

The preparation of the key.

It must be confessed, however, that the preparation of the key was undertaken with serious misgivings. During the preparation of the Cyclopedia of American Horticulture, the Editor was often importuned for something of the kind, by students, botanists, and others who made increasing use of the volumes as issued In response to these urgent appeals, it was necessary to point out three objections. (1) Such a key would necessarily be highly technical (2) It would have to use a scheme of arrangement that may pass with another generation (3) The labor and expense would be great.

In response to this demand the following key has been prepared It is based on the system of Bentham and Hooker as set forth in their "Genera Plantarum," a work published in parts from 1862 to 1883 The system of Bentham and Hooker is not now the latest, but it is the only one that was in general use at the time the first Cyclopedia was begun. The system of Engler and Prantl in "Die Natürlichen Pflanzenfamilien" is now well known; this no doubt presents the best system for the present generation, but in its turn it is likely to be superseded In Engler and Prantl's system the plants are arranged, as far as possible, in the order in which the various families probably have made their appearance on the earth's surface, or at all events in accordance with the evolution from simple to complex Perhaps the new system is better adapted for showing relationship or likeness, while the old system is well adapted for bringing out differences. This furnishes an additional reason for the use of the older system on the present occasion, as most of those who use this part of the Cyclopedia will probably be in search of differences.

In the present revision, the Bentham and Hooker key-plan has been retained The authors of the main groups in the new Cyclopedia have made revisions and adaptations to meet the changes and requirements of their own work. New conceptions of the limitations of families and genera have naturally found expression in the revision It is not designed to insert in the key all the genera that are mentioned in a minor or incidental way, for to include them all would unnecessarily encumber and complicate the lists and tend to make them unworkable; but it is intended to include all the genera that afford species prominently in the trade in the United States and Canada. When it has seemed to be desirable to omit genera from the key, the relatively unimportant native groups have often been left out, for they may be readily traced in the current botanies.

The way to use a key is explained in the prefatory part to this volume (page xii).

The general plan.

The key is divided into two main parts: a key to the families (page 80), and a key to the genera (page 86) When the student has determined the family to which the plant belongs, the further tracing of it is to be made in the key to the genera, when the genus has been found, he turns to its alphabetic place in one of the volumes and there runs down the plant to its species.

The families are arranged in accordance with the following framework (for another and fuller outline of the vegetable kingdom, see pages 2–4).

	Families
Division 1 Flowering Plants or Phanerogams . . .	1–209
Subdivision 1 Dicotyledons or Exogens . .	1–181
Class 1 Angiosperms	1–176
Subclass 1 Polypetalæ	1–101
Series 1 Thalamifloræ	1– 39
Cohort 1 Ranales	1– 12
Cohort 2 Parietales .	13– 22
Cohort 3 Polygalales	23– 25
Cohort 4 Caryophyllales	26– 29
Cohort 5 Guttiferales	30– 34
Cohort 6 Malvales . .	35– 39
Series 2 Discifloræ	40– 69
Cohort 1 Geraniales	40– 53
Cohort 2 Olacales	54– 56
Cohort 3 Celastrales	57– 60
Cohort 4 Sapindales	61– 69
Series 3 Calycifloræ	70–101
Cohort 1 Rosales	70– 79
Cohort 2 Myrtales	80– 88
Cohort 3 Passiflorales	89– 93
Cohort 4 Ficoidales	94– 95
Cohort 5 Umbellales	96–101
Subclass 2 Gamopetalæ	102–144
Series 1 Inferæ	102–107
Cohort 1 Rubiales	102–103
Cohort 2 Asterales	104–106
Cohort 3 Campanales	107
Series 2 Heteromeræ	108–120
Cohort 1 Ericales	108–113
Cohort 2 Primulales	114–116
Cohort 3 Ebenales	117–120
Series 3 Bicarpellatæ	121–144
Cohort 1 Gentianales	121–125
Cohort 2 Polemoniales	126–131
Cohort 3 Personales	132–138
Cohort 4 Lamiales	139–144
Subclass 3 Apetalæ or Monochlamydeæ	145–176
Series 1 Curvembryeæ	145–149
Series 2 Multiovulatæ Terrestres	150–151
Series 3 Microembryeæ	152–156
Series 4 Daphneæ	157–160
Series 5 Achlamydosporeæ	161–162
Series 6 Unisexuales	163–174
Series 7 Anomalous Families	175–176
Class 2 Gymnosperms	177–181
Subdivision 2 Monocotyledons or Endogens	182–209
Series 1 Microspermæ	182–183
Series 2 Epigynæ	184–193
Series 3 Coronariæ	194–196
Series 4 Calycinæ	197–198
Series 5 Nudifloræ	199–203
Series 6 Apocarpæ	204–207
Series 7 Glumaceæ	208–209
Division 2 Pteridophyta	210–223

PART I.—KEY TO THE FAMILIES

(See page 86 for Part II)

Division 1. Flowering Plants or Phanerogams or Spermatophytes. those producing real flowers and seeds (pages 80 to 86)

Subdivision 1. Dicotyledons Sts formed of bark, wood and pith, the wood forming a zone between the other two, and increasing when the st continues from year to year by the annual addition of a new layer to the outside next to the bark lvs usually netted-veined embryo with a pair of opposite cotyledons, or, in Subdivision 2, often 3 or more in a whorl parts of the fl. mostly in 4's or 5's (pages 80–84)

Class 1. Angiosperms Pistil consisting of a closed ovary, which contains the ovules cotyledons 2

Subclass 1. Polypetalæ Calyx and corolla both present, the latter of separate petals (See exceptions listed under Subclass 2, Gamopetalæ, page 82)

Series 1. Thalamifloræ Calyx mostly inserted under the ovary, petals often in 2 or more series, sometimes 1 series; stamens ∞ or definite, inserted on the often small or raised or stipitate receptacle, which is not developed into a glandular disk, ovary very generally free

Cohort 1 Ranales Stamens ∞, or if definite then the perianth in 3–∞ series, carpels 1 or more, usually distinct, rarely united. (See exceptions in Saxifragaceæ, also hypogynous Leguminosæ.)

A. Sepals 5, or fewer, or 0, petals in about 1 series.
- B Seeds not arillate sepals deciduous, usually colored herbs or shrubs 1. Ranunculaceæ.
- BB Seeds not arillate calyx and corolla wanting, ovary of 2 carpels but 1-celled 7 Eucommiaceæ.
- BBB Seeds arillate sepals persistent, herbaceous shrubs or trees 2 Dilleniaceæ.

AA Sepals or petals in 2–∞ series, rarely wanting
- B. Plants not aquatic
  - c Perianth wanting, stamens numerous, fls polygamous, dicecious, or perfect
    - D Lvs pinnately veined, alternate 5. Trochodendraceæ.
    - DD Lvs palmately veined, opposite 6. Cercidiphyllaceæ.
  - cc Perianth present
    - D. Petals and stamens mostly ∞: ovules 1–∞
      - E Torus tubular, inclosing carpels endosperm 0 lvs opposite shrubs 3. Calycanthaceæ.
      - EE Torus short or long, bearing carpels outside endosperm copious lvs alternate woody 4 Magnoliaceæ.
    - DD. Petals 5 stamens 10 carpels 5 10 ovule solitary lvs opposite (See No 68, Cornaceæ)
    - DDD. Petals and stamens mostly multiples of 3 or 2
      - E. Stamens and carpels usually numerous ovules 1–∞, sepals 3, petals 6, fls bisexual shrubs or trees 8 Annonaceæ.
      - EE. Stamens usually 6 ovule solitary carpels 3, sepals and petals usually 6 fls dicecious mostly woody or herbaceous vines 9 Menispermaceæ.
      - EEE. Stamens 4, 6, or 9, anthers opening by 2 lids rarely birimose carpel 1 ovules 2–∞ fls bisexual herbs or shrubs 10 Berberidaceæ.
      - EEEE. Stamens usually 6, anthers birimose carpels mostly 3 ovules many fls unisexual vines or erect, woody 11 Lardizabalaceæ.

BB. Plants aquatic 12 Nymphæaceæ

Cohort 2. Parietales Stamens definite or ∞ ovary 1-celled, or several-celled by spurious partitions, carpels several, placentæ parietal (See Actæa in Ranunculaceæ, also Berberidaceæ)

A Embryo minute, near the base of the fleshy endosperm
- B Pitcher plants 13 Sarraceniaceæ.
- BB Not pitcher plants
  - c Petals all alike, or nearly so 14 Papaveraceæ.
  - cc Petals in 2 series, the inner unlike the outer 15 Fumariaceæ

AA. Embryo curved, endosperm 0
- B Stamens 6, tetradynamous, rarely 4 16 Cruciferæ
- BB Stamens ∞, or, if few, not tetradynamous 17 Capparidaceæ.
- BBB Stamens usually ∞, not covered in æstivation by the small petals ovary often open above 18 Resedaceæ.

AAA Embryo not curved, rather large, endosperm fleshy
- B Radicle remote from hilum ovule generally orthotropous 19 Cistaceæ.
- BB Radicle very near hilum ovule anatropous, or amphitropous
  - c. Anthers dehisce introrsely mostly herbs 20 Violaceæ.
  - cc. Anthers dehisce extrorsely or at apex insectivorous plants with capitate glandular tentacles on lvs (See No 76, Droseraceæ)
  - ccc. Anthers dehisce by apical cracks or pores woody
    - D. Shine-cells present, receptacle not enlarged 21. Bixaceæ.
    - DD. Slime-cells absent, receptacle enlarged 22. Flacourtiaceæ.
  - cccc. Anthers versatile, dehiscing by longitudinal fissures woody. (See No. 34, Stachyuraceæ.)

Cohort 3. POLYGALALES. Stamens as many or twice as many as petals carpels usually 2 ovary usually perfectly or imperfectly 2-celled, usually compressed.

A Fls regular or slightly oblique
B Stamens 5, as many as sepals or petals woody . 23 PITTOSPORACEÆ.
BB Stamens twice as many as sepals or petals, which are usually 4 or 5, rarely 3 woody . 24 TREMANDRACEÆ.
AA Fls irregular herbaceous or woody 25 POLYGALACEÆ

Cohort 4 CARYOPHYLLALES Stamens definite, rarely ∞; ovary 1-celled or imperfectly septate, placenta central, rarely parietal embryo curved, or coiled, rarely straight

A Sepals of same number as petals placenta 1, central herbs 26 CARYOPHYLLACEÆ
AA Sepals fewer than petals placenta 1, central herbs 27 PORTULACACEÆ.
AAA Sepals of same number as petals placentæ several mostly woody
B Corolla polypetalous, stamens without scale, glabrous, fls spicate or racemose 28. TAMARICACEÆ
BB. Corolla gamopetalous, stamens with scale, hairy, fls. thyrsoid-paniculate 29 FOUQUIERIACEÆ.

Cohort 5 GUTTIFERALES Stamens usually ∞, sepals imbricated ovary septate, placentæ on the inner angles of the cells, i e, axile (See also, as exceptions with disk absent, the Linaceæ, Erythroxylaceæ, Malpighiaceæ, Geraniaceæ, Tropæolaceæ, Limnanthaceæ, Oxalidaceæ, Balsaminaceæ, Ochnaceæ, Rutaceæ, Anacardiaceæ and Sapindaceæ, all belonging to the Discifloræ (See also Nigella of the Ranunculaceæ)

A. Lvs opposite or whorled, herbaceous fls cymose or panicled, bisexual 30 HYPERICACEÆ.
AA Lvs opposite or whorled, coriaceous fls cymose or panicled
B Receptacle not enlarged, fls unisexual 31 GUTTIFERÆ.
BB Receptacle enlarged, barrel-shaped between pistil and corolla, bearing the stamens, fls bisexual 32 EUCRYPHIACEÆ
AAA Lvs alternate, coriaceous fls mostly racemose
B Cells of ovary 2-10 stamens numerous 33 TERNSTROEMIACEÆ
BB Cells of ovary 1 stamens 8 34 STACHYURACEÆ

Cohort 6 MALVALES Stamens usually ∞ or monadelphous, sepals valvate ovary septate, placentæ axile

A. Anthers 1-celled, pollen rough herbs or woody 35 MALVACEÆ
AA. Anthers 1- to several-celled, pollen smooth woody plants 36 BOMBACACEÆ
AAA. Anthers 2-celled fls with staminodia and queer stamen-tube woody plants 37 STERCULIACEÆ.
AAAA Anthers 2-celled, stamens nearly free, no staminodia ovule often pendulous with raphe toward axis
B Petals ordinary herbs or woody 38 TILIACEÆ
BB Petals firm, often hairy or incised woody plants 39 ELÆOCARPACEÆ.

Anomalous Group Stamens ∞, sepals valvate carpel 1 ovary 1-celled fls regular lvs compound herbs or woody (Mimoseæ, incl in Leguminosæ)

Series 2 DISCIFLORÆ Calyx usually inserted under the ovary, petals in 1 series stamens usually definite, inserted within or upon or around the receptacle, which is usually expanded as a disk within the calyx ovary usually free, or imbedded in the disk (See Flacourtiaceæ and Trapaceæ)

Cohort 1 GERANIALES Disk usually a ring between stamens, or adnate to staminal tube, or reduced to glands alternating with the petals, rarely 0 ovary commonly lobed, rarely entire or subapocarpous, ovules 1-2 in each cell, pendulous, raphe toward axis (See Stackhousiaceæ)

A Ovary more or less lobed or grooved
B. Anthers elongated, disk enlarged in fr 51. OCHNACEÆ.
BB. Anthers normal
C Calyx-lobes 5, all or mostly with 2 glands outside woody 42 MALPIGHIACEÆ.
CC. Calyx-lobes not biglandular
D. Foliage glandular-dotted carpels sometimes separate 49 RUTACEÆ
DD. Foliage not glandular-dotted
E. Lvs usually opposite, compound 43. ZYGOPHYLLACEÆ.
EE Lvs. alternate
F Disk well developed, irregular, petals often irregular, ovary usually open above, herbs, rarely shrubs. (See No. 18, Resedaceæ.)
FF. Disk well developed, regular petals regular ovary closed woody plants . 50. SIMARUBACEÆ.
FFF. Disk indistinct, otherwise as in the last herbaceous
G. Ovule solitary stamens 6-10
H. Fr dehiscent stamens connate at base, fls regular or irregular . 44. GERANIACEÆ.
HH Fr indehiscent stamens free, fls irregular ovule pendulous 45. TROPÆOLACEÆ.
HHH Fr indehiscent stamens free fls regular ovule ascending 46 LIMNANTHACEÆ.
GG. Ovules several fr dehiscent
H Stamens 10 fls. regular 47. OXALIDACEÆ.
HH Stamens 5 fls irregular 48. BALSAMINACEÆ.
AA Ovary entire
B Stamens monadelphous, at least below woody plants
C Stamen-tube stipitate, disk various . 53 MELIACEÆ.
CC Stamen-tube sessile, disk 0
D Petals not appendaged fr capsular 40 LINACEÆ.
DD Petals appendaged fr drupaceous 41. ERYTHROXYLACEÆ.
BB Stamens free
C Ovules several or many
D Mostly herbaceous plants (See No 17, Capparidaceæ)
DD Woody plants (See No. 22, Flacourtiaceæ)
CC Ovules 1-2 . 52 BURSERACEÆ.

Cohort 2 OLACALES Disk cup-shaped or ring-shaped, free, or bearing the stamens and petals on its edge ovary 1-∞-celled, entire, ovule solitary, pendulous, raphe away from axis.

A Petals or corolla-lobes usually valvate woody 54 OLACACEÆ.
AA Petals or corolla-lobes imbricate or convolute
B fr drupaceous, slightly fleshy, 3-18-stoned, stones 1-seeded fls not racemose woody 55 AQUIFOLIACEÆ.
BB. Fr crustaceous or spongy, 2-4-celled, 1-4-seeded fls racemose woody 56 CYRILLACEÆ

Cohort 3 CELASTRALES Disk tumid or adnate to the calyx or covering its base stamens inserted around the disk or affixed to its margin ovary usually entire, ovules usually 2 in each cell, erect, raphe turned toward axis lvs simple or rarely compound

A Calyx valvate, petals small, concave, stamens opposite the petals woody 59 RHAMNACEÆ
AA Calyx imbricate
B Stamens alternate with the petals, the latter imbricate
C Petals spreading calyx small woody 57 CELASTRACEÆ
CC Petals erect, often connate calyx-tube hemispherical herbs 58 STACKHOUSIACEÆ
BB Stamens opposite the petals, the latter valvate, dropping off early woody, rarely herbaceous 60 VITACEÆ (Incl. Leeaceæ)

Cohort 4 SAPINDALES Disk various, stamens variously inserted on the disk ovary entire, or more often lobed, or subapocarpous, ovules commonly 1-2 in each cell, ascending, with raphe toward axis, or reversed, or solitary and pendulous from an ascending funicle, rarely ∞ and horizontal lvs pinnate, rarely simple (No 62), or (No 65) digitate

A Carpels 2 fr a samara 62 ACERACEÆ.
AA Carpels 2-3 fr a drupe, 1-seeded 61 SABIACEÆ.
AAA Carpels 3-5 fr rarely samaroid in Sapindaceæ
B Bark containing resin disk intrastaminal 67. ANACARDIACEÆ.
BB Bark not resinous, or, if so, disk extrastaminal
C. Endosperm abundant, embryo straight
D Disk intrastaminal, carpels 3 63 STAPHYLEACEÆ.
DD Disk extrastaminal, carpels 4-5 64 MELIANTHACEÆ.
CC. Endosperm sparse or wanting, embryo curved disk extrastaminal (See Sapindaceæ, No 66)
D. Lvs opposite, palmately compound . 65 HIPPOCASTANACEÆ.
DD. Lvs alternate, variously compound, or simple . . . . 66. SAPINDACEÆ.

Anomalous Families Disk 0 sepals and petals 5 stamens 10, carpels 5–10, distinct ovule solitary, pendulous, raphe away from axis Approaches Thalamifloræ. 68 CORIARIACEÆ.

Disk investing calyx-tube stamens 10, of which 5 have no authers ovary 1-celled, with 3-parietal placentæ, ovules ∞. Approaches Calycifloræ 69 MORINGACEÆ.

Series 3 CALYCIFLORÆ Petals in 1 series stamens ∞ or definite, inserted with the petals and sepals on the edge of the cup-shaped receptacle (hypanthium), or on a disk lining the latter: ovary often adnate to this receptacle, and therefore inferior (See also Calycanthaceæ)

Cohort 1 ROSALES. Carpels superior solitary or free or united only at base, sometimes to the apex and then rarely inferior styles distinct, rarely united in a column and easily separated (styles connate in some Bruniaceæ and Saxifragaceæ) (See also Tropæolaceæ and Capparidaceæ.)

A. Endosperm rare
  B. Fr a legume, when rarely otherwise the corolla is either papilionaceous or the stamens are very numerous and exserted lvs usually compound with pulvini 70 LEGUMINOSÆ.
  BB Fr not a legume, either a follicle, drupe, pome, achene or aggregate lvs simple or compound without pulvini 71 ROSACEÆ.
AA. Endosperm moderate or copious
  B Plants insectivorous
    C Lvs bearing many tentacles tipped with capitate viscid glands herbs 76 DROSERACEÆ
    CC Lvs bearing pitchers 74 CEPHALOTACEÆ.
  BB Plants not insectivorous
    C. Carpels 5, rarely 3 or more, separate, with a scale at the base of each, superior ovules many often fleshy plants herbs 75 CRASSULACEÆ.
    CC Carpels 2 to several, rarely separate, no scale at the base plants not conspicuously fleshy
      D. Ovary usually 2-celled, usually superior, ovules ∞, usually axile fr a caps or berry or follicle
        E Lvs opposite, stipulate 73 CUNONIACEÆ
        EE Lvs alternate, or opposite and exstipulate 72 SAXIFRAGACEÆ
      DD. Ovary 2-celled, inferior or rarely superior, ovules 1-∞, pendulous or axile fr a woody 2-valved caps, with a separating inner layer of different texture 77 HAMAMELIDACEÆ.
      DDD. Ovary 1–4-celled, usually inferior, ovules 1 to several, pendulous fr indehiscent or cocci irregularly and tardily dehiscent
        E. Plants heath-like stamens and petals 5 78 BRUNIACEÆ.
        EE Plants ordinary stamens often many 79 HALORAGIDACEÆ

Cohort 2 MYRTALES Ovary syncarpous, inferior or inclosed in a cup-shaped receptacle, usually divided into cells, style undivided, ovules 2–∞ in the cells.

A. Ovules pendulous from apex of cells woody
  B Ovary 2–6-celled . 80 RHIZOPHORACEÆ
  BB Ovary 1-celled 81 COMBRETACEÆ
AA Ovules affixed to the inner angles of the cells or to basilar placentæ, ascending, horizontal or pendulous
  B. Stamens ∞, rarely definite woody
    C Oil-glands in foliage, sieve-tubes in pith-rays 82 MYRTACEÆ.
    CC. Oil-glands absent, no sieve-tubes in pith-rays 83 LECYTHIDACEÆ.
  BB. Stamens definite, rarely ∞
    C. Calyx-lobes usually imbricate or open, anthers curved, usually opening by pores at the apex, connective usually appendaged or thickened 84. MELASTOMACEÆ.
    CC. Calyx-lobes usually valvate, anthers normal, not appendaged, opening longitudinally
      D Ovary superior, petals corrugated 85 LYTHRACEÆ.
      DD. Ovary inferior or half-inferior
        E. Carpels in stories, superimposed petals corrugated 86 PUNICACEÆ.
        EE. Carpels in 1 whorl petals convolute 87 ONAGRACEÆ.
        EEE. Carpels in 1 whorl petals imbricate, a dentate or wavy cup-shaped disk under ovary water-plants 88. TRAPACEÆ.

Cohort 3 PASSIFLORALES Ovary syncarpous, inferior, semi-inferior, or inclosed in the hollow receptacle, rarely exserted, 1-celled with parietal placentation, or divided into cells; ovules 1–∞; styles united or distinct from the base.

A Crown inserted on calyx-tube or within petals, single, double or multiple 90. PASSIFLORACEÆ.
AA Crown 0
  B. Fls bisexual (see Caricaceæ), petals unlike the sepals foliage-hairs stinging or rigid or queerly constructed 89 LOASACEÆ.
  BB Fls unisexual
    C Stamens 5 or 10 perianth of the 2 sexes unlike 91 CARICACEÆ
    CC. Stamens usually 3 perianth of both sexes similar 92 CUCURBITACEÆ.
    CCC Stamens ∞ perianth of the 2 sexes often unlike . . . 93. BEGONIACEÆ

Cohort 4 FICOIDALES Ovary syncarpous, inferior or superior, divided into cells with sub-basilar placentation, or rarely 1-celled with parietal placentæ, ovules 1–∞, styles distinct or united to near apex, embryo curved or excentric

A. Calyx-lobes, petals and stamens usually ∞ ovary 1-celled 94 CACTACEÆ.
AA Calyx-lobes usually 4–5 ovary 2–∞-celled 95 AIZOACEÆ.

Cohort 5 UMBELLALES Ovary syncarpous, inferior, crowned by the disk, divided into cells, or 1-carpelled, styles distinct or united part way, ovules solitary and pendulous in the cells.

A Fr separating into 2 dry indehiscent carpels 96 UMBELLIFERÆ.
AA Fr usually drupaceous, the stones distinct but not separating naturally
  B Lvs compound, or simple, and palmately veined 97 ARALIACEÆ
  BB Lvs simple, pinnately veined
    C Ovules 2 in each cell ovary 1-celled raphe toward axis fls in catkins lvs opposite . 98 GARRYACEÆ.
    CC Ovule 1 in each cell
      D Raphe toward axis ovary 1-celled fls in heads lvs alternate 99 NYSSACEÆ
      DD Raphe lateral ovary 1–2-celled, fls in cymes lvs alternate 100 ALANGIACEÆ
      DDD Raphe exterior ovary 1–5-celled fls in heads or cymes lvs opposite or alternate 101. CORNACEÆ

Subclass 2 GAMOPETALÆ Calyx and corolla both present, the petals usually more or less united stipules present only in the Rubiaceæ and Loganiaceæ, rarely in the Caprifoliaceæ corolla polypetalous in some Ericaceæ, in Monotropaceæ, Pyrolaceæ, Clethraceæ, some Styracaceæ and Oleaceæ, also in Galax, Statice, Lysimachia, corolla gamopetalous in some Fouquieriaceæ, Stackhousiaceæ, Leguminosæ, Fumariaceæ, Polygalaceæ, and Oxalidaceæ of the Polypetalæ

Series 1 INFERÆ Ovary inferior (see Ericaceæ) stamens as many as lobes of the corolla, rarely fewer

Cohort 1 RUBIALES Stamens affixed to the corolla· ovary 2–∞-celled, cells 1–∞-ovuled lvs. opposite or whorled

A Fls regular or irregular stipules usually absent 102 CAPRIFOLIACEÆ.
AA Fls regular stipules present, inter- or intrapetiolar, various in form, sometimes like the lvs and disposed in the same whorl with them . . 103 RUBIACEÆ.

Cohort 2 ASTERALES Stamens affixed to corolla ovary of the 2-merous pistil 1-celled, 1-ovuled

A Anthers free lvs opposite or whorled
  B Endosperm 0 104 VALERIANACEÆ
  BB Endosperm present 105 DIPSACACEÆ
AA. Anthers united in a ring around the style except in a few genera. lvs. alternate or opposite . . 106 COMPOSITÆ

Cohort 3. CAMPANALES Stamens usually free from the corolla: ovary 2–6-celled, the cells usually ∞-ovuled lvs usually alternate.

107 CAMPANULACEÆ (Incl Lobeliaceæ)

Series 2. HETEROMERÆ Ovary usually superior· stamens free from the corolla, or opposite the lobes or twice as many, or ∞, or, if borne on the corollas, the alternate with its lobes and equal in number to them, carpels more than 2

Cohort 1. ERICALES Stamens twice as many as the corolla-lobes, or as many and opposite them ovary 2-∞-celled, ovules numerous (except in Epacridaceæ) fr fleshy or berry-like

A Anthers dehisce by an apical crack or pore, often produced into a tube, stamens usually 8 or 10 (5 in some Ericaceæ)
B Chlorophylless plants polypetalous 108 MONOTROPACEÆ
BB Chlorophyll-bearing plants
c Anthers inverted, at least at first, polypetalous
D Ovary 3-celled shrubs 109 CLETHRACEÆ
DD Ovary 5-celled low or acaulescent plants 110 PYROLACEÆ
cc Anthers erect, rarely polypetalous (Ledum) 111 ERICACEÆ
AA Anthers dehisce by longitudinal fissures (see also Epigæa), stamens 5
B Plants shrubs or trees carpels 4–5 112 EPACRIDACEÆ
BB Plants low or acaulescent carpels 3 113 DIAPENSIACEÆ

Cohort 2 PRIMULALES Stamens as many as the corolla-lobes and opposite them, ovary 1-celled, placentæ free-central or basal

A Ovary 1-ovuled 114 PLUMBAGINACEÆ
AA Ovary 2 to many-ovuled
B Fr capsular herbs 115 PRIMULACEÆ
BB Fr indehiscent trees or shrubs 116 MYRSINACEÆ

Cohort 3 EBENALES Stamens as many as lobes of the corolla and opposite them or twice as many, or ∞, ovary 2-∞-celled, seeds usually few and rather large woody

A Fls usually bisexual, stamens usually borne on the corolla
B Stamens 15-∞ ovary inferior, 2-5-celled 117 SYMPLOCACEÆ
BB Stamens 5–10 ovary superior
c Ovary 1-celled at top 118 STYRACACEÆ
cc Ovary 1-∞-celled 119 SAPOTACEÆ
AA Fls dioecious, stamens usually free from corolla 120 EBENACEÆ

Series 3 BICARPELLATÆ Ovary usually superior stamens alternate with corolla-lobes, as many as them or fewer carpels 2, or rarely 1 or 3

Cohort 1 GENTIANALES Corolla regular stamens alternate with corolla-lobes and equal to them in number, or, if fewer, usually alternate with carpels lvs usually opposite

A Stamens 2, alternate with the carpels, rarely 4, stigma terminal, ovary 2-celled, ovules affixed to septum rarely herbaceous 121 OLEACEÆ
AA Stamens and corolla-lobes usually 5, sometimes 4, rarely ∞
B Ovary usually compound, with 2 or 3 (rarely 4 or 5) cells or placentæ
c Caps mostly 2-celled lvs connected by transverse lines or stipules 122 LOGANIACEÆ
cc Caps mostly 1-celled, with parietal placentæ lvs not connected as above 123 GENTIANACEÆ
BB Ovaries 2, usually becoming follicles
c Anthers permanently attached to a large stigmatic body, pollen mostly in waxy masses 124 ASCLEPIADACEÆ
cc Anthers distinct or merely connivent, pollen ordinary 125 APOCYNACEÆ

Cohort 2 POLEMONIALES Corolla regular stamens as many as lobes of corolla lvs, usually alternate ovary 1-∞-ovuled

A Pistil 3-merous, corolla-lobes convolute 126 POLEMONIACEÆ
AA Pistil not 3-merous
B Corolla-lobes imbricated or rarely convolute
c Style usually deeply 2-cut, or even split into 2 distinct styles caps 1-celled, 2-valved, with 2 parietal or introflexed placentæ, or sometimes 2-celled 127 HYDROPHYLLACEÆ.
cc. Style usually entire or shortly 2-cut, rarely otherwise, ovary 4-ovuled, usually 4-lobed and maturing as 4 separate or separable nutlets, or not lobed, 3–4-celled, and separating when ripe into 2 or 4 nutlets 128 BORAGINACEÆ
BB. Corolla-limb more or less plicate or rarely imbricate
c. Ovary 2-celled (sometimes 3- or spuriously 4-celled, becoming a globular 4–6-seeded caps seeds basal 129. CONVOLVULACEÆ
cc Ovary 2-celled (rarely 3–5-celled), with numerous ovules on expanded axillary placentæ, becoming a pod or berry 130 SOLANACEÆ
ccc Ovary 5 30-celled, 5–30-lobed, often transversely as well as longitudinally so 131 NOLANACEÆ

Cohort 3 PERSONALES Corolla usually irregular or oblique, posterior stamen differing from the others, abortive or even absent carpels ∞-ovuled, or with 2 ovules, one above the other

A Seeds usually with endosperm ovary perfectly 2-celled, placentæ central 132 SCROPHULARIACEÆ
AA Seeds without endosperm
B Plants insectivorous, often aquatic ovary 1-celled, globose, with a free-central or basal placenta 133 LENTIBULARIACEÆ
BB Plants not insectivorous, not aquatic
c Seeds winged ovary 2-, rarely 1-, celled trees or climbing shrubs 134 BIGNONIACEÆ
cc Seeds not winged
D Ovary 1-celled or falsely 2-4-celled
E Fr straight or spiral 135 GESNERIACEÆ
EE Fr falcate-rostrate 136 MARTYNIACEÆ
DD Ovary 2–4-celled
E Plant very mucilaginous no hooks among seeds fr often hooked or spiny 137 PEDALIACEÆ
EE Plants not conspicuously mucilaginous hooks in caps aiding in seed-dissemination 138 ACANTHACEÆ.

Cohort 4 LAMIALES Corolla usually irregular or oblique posterior stamen smaller than the others, usually abortive or quite deficient carpels with 2 ovules placed side by side, or else 1-ovuled

A Fr not divided into 4 nutlets ovary not 4-lobed
B Ovary 1-celled, 1-ovuled
c Fls in heads plant often heath-like 139 GLOBULARIACEÆ
cc Fls in slender interrupted spikes 140 PHRYMACEÆ
BB Ovary 2–10-celled
c Cells with 2–10 ovules trees or shrubs 141 MYOPORACEÆ
cc Cells with 1 ovule herbs or shrubs 142 VERBENACEÆ
AA Fr divided into 4 nutlets ovary 4-lobed 143 LABIATÆ

Anomalous Family Remarkable for its scarious 4-lobed corolla stamens few, ovary 1–4-celled fr a circumscissile caps, or rarely indehiscent, seeds peltate 144 PLANTAGINACEÆ

Subclass 3. APETALÆ OR MONOCHLAMYDEÆ Corolla wanting or undifferentiated from the calyx (except in some Euphorbiaceæ and one genus of Phytolaccaceæ), and sometimes also the calyx wanting, perianth simple, the lobes or segms in 1 or 2 series, similar among themselves and usually calyx-like, sometimes minute or wanting (See also Ranunculaceæ, Flacourtiaceæ, Memispermaceæ, Trochodendriceæ, Rosaceæ, Lythraceæ, Onagraceæ, Hamamelidaceæ, Rutaceæ, Aceraceæ, Rhamnaceæ, Lucommiaceæ, Cornaceæ, and Caryophyllaceæ with corolla sometimes absent)

Series 1 CURVEMBRYEÆ Embryo curved, excentric, lateral or peripheral, rarely straight in sub-central and narrow (Polygonaceæ), ovule solitary in the ovary or in each carpel or in the Amarantaceæ more than 2 ovules erect in the center of the cell fls bisexual or, in a few genera, unisexual or polygamous, petals very rarely present, stamens as many as the perianth-segms or fewer, rarely more

A Fr the hardened or membranous closed base of the corolla-like perianth with a utricle inclosed 145 NYCTAGINACEÆ.
AA Fr a utricle, ovule not orthotropous, embryo annular or spiral perianth mostly persistent, small 4 5-lobed, or parted, or 0
B Perianth herbaceous, or scarious at the margin, persistent, stamens perigynous, style branched or styles 2–3 stipules scarious (Illecebraceæ, incl in Caryophyllaceæ).
BB Perianth dry, chaff-like, not herbaceous, subtended by a bract and 2 bractlets, stamens hypogynous or perigynous, filaments connate at base, style simple or 2–3-fid stipules 0 146 AMARANTACEÆ.
BBB Perianth-lobes or -segms membranous or herbaceous, stamens hypogynous or perigynous, nearly always free, style simple or 2–3-lobed, or styles 2–3 stipules none 147 CHENOPODIACEÆ.

AAA. Fr. composed of 1 to several carpels, which are crowded or connate in a ring, each with a style, baccate, corn-aceous or samaroid, ovule not ortho-tropous, embryo coiled stamens hypogynous, perianth herbaceous or coriaceous, rarely membranous 148 PHYTOLACCACEÆ.
AAAA Fr an achene, triangular or lens-shaped, style branched or styles 2–3, ovule orthotropous, embryo straight. perianth herbaceous, membranous or colored, rarely adherent to base of ovary usually a stipular sheath at each lf -node . . . . . 149. POLYGONACEÆ.

Series 2 MULTIOVULATÆ TERRESTRES Terrestrial herbs or shrubs, often climbers ovary syncarpous; ovules in each cell or on each placenta numerous

A. Fls dicœcious, ovary superior lvs. bearing tendrils and pitchers 150. NEPENTHACEÆ.
AA. Fls bisexual, ovary inferior lvs without tendrils and pitchers . 151. ARISTOLOCHIACEÆ

Series 3. MICREMBRYEÆ Ovary syncarpous, monocarpous or apocarpous, ovules solitary for each carpel, rarely 2 or few, endosperm copious, fleshy or mealy, embryo minute

A. Perianth 0
B Lvs alternate carpels 3–4 ovules 2 to several stamens 3–6 152 SAURURACEÆ
BB Lvs alternate, rarely opposite or whorled carpel 1 ovule 1, basal stamens 2–8 153 PIPERACEÆ
BBB Lvs opposite carpel 1 ovule 1, pendent stamens 1–3 154 CHLORANTHACEÆ
AA Perianth calyx-like
B Carpel solitary perianth of 3 parts, connate 155 MYRISTICACEÆ
BB Carpels several, together with the stamens scattered over the face of the cup-shaped receptacle 156 MONIMIACEÆ

Series 4 DAPHNEÆ Ovary monocarpous, 1-celled, rarely syncarpous with 2–4 cells, ovules solitary, or twin and side by side in the ovary or in each cell, rarely a few pairs superposed.

A. Radicle superior, ovule solitary, pendulous
B Anthers dehiscing by uplifting valves, rarely laterally dehiscent perianth-tube short, lobes 6 or 4, in 2 series, usually imbricated: ovary 1-celled woody 157 LAURACEÆ.
BB Anthers normal perianth-tube long, lobes 4–5, imbricated: ovary 1–2-celled woody 158 THYMELÆACEÆ.
AA. Radicle inferior
B Perianth-tube cylindraceous, lobes 4, valvate, stamens as many and opposite them ovule erect or pendulous, or geminate, rarely ∞ 159 PROTEACEÆ
BB. Perianth-tube medium, constricted above the ovary, persistent at base, deciduous above, lobes 2 or 4, stamens twice as many as the lobes silvery-scaly plants woody 160 ELÆAGNACEÆ

Series 5. ACHLAMYDOSPOREÆ. Ovary 1-celled, cells 1–3-ovuled, cells and ovules often inconspicuous before anthesis, endosperm of seed without a coat, either free in the pericarp or attached to its walls plants often parasitic.

A Ovule 1, not easily distinguishable from ovary 161 LORANTHACEÆ
AA. Ovules 1–3, pendulous from summit of free-central placenta . . . 162. SANTALACEÆ

Series 6. UNISEXUALES Fls unisexual; ovary syncarpous or monocarpous, ovule solitary or in pairs side by side in the ovary or in each cell. trees or shrubs, rarely herbs.

A. Ovary 1-celled
B. Ovule solitary, stamens 2 to many.
C. Fls of both sexes in globose long-peduncled pendent heads, crowded very densely on a central receptacle radicle inferior woody 163 PLATANACEÆ.
CC Fls not as above radicle superior
D Male perianth free from the bract, stamens as many as its lobes and opposite them, or by abortion fewer, rarely numerous
E. Stamens uncoiling elastically
F Ovule suspended, anatropous 164. MORACEÆ
FF. Ovule basal, orthotropous 165 URTICACEÆ.
EE. Stamens not elastic ovule suspended, anatropous 166 ULMACEÆ.
DD. Male perianth wanting, sometimes grown to the bract in Juglandaceæ; stamens ∞, often 2 in Myricaceæ.
E Lvs pinnate male fls in catkins woody 167. JUGLANDACEÆ.
EE. Lvs simple male infl spicate, subamentaceous woody
F. Carpel 1, placenta parietal ovule amphitropous 168 LEITNERIACEÆ.
FF. Carpels 2, placenta basal ovule orthotropous 169 MYRICACEÆ
BB. Ovules 2, stamen 1 equisetum-like plants, woody 170 CASUARINACEÆ.
AA Ovary 2–3-celled, rarely more-celled
B Endosperm usually copious fr usually separating into 2-valved berries, sometimes fleshy and indehiscent, or various infl various
C Hypogynous disk present micropyle externally directed, juice often milky 171 EUPHORBIACEÆ.
CC Hypogynous disk absent micropyle toward axis, no milky juice 172 BUXACEÆ
BB Endosperm 0 fr a nut male infl usually in catkins woody
C Carpels 2 pistillate fls usually in spikes 173 BETULACEÆ.
CC Carpels 3 pistillate fls not in spikes 174 FAGACEÆ

Series 7 Anomalous Families Somewhat related to the Unisexuales

A Fls in catkins caps 2–4-valved: woody 175 SALICACEÆ.
AA Fls axillary, or rarely in a terminal head drupe 2–∞-stoned, stones 1-seeded low shrubs 176 EMPETRACEÆ

Class 2 GYMNOSPERMÆ Ovules naked upon a scale, bract or disk cotyledons 2 or more fls unisexual.

A Lvs undivided
B The lvs fan-shaped fls in pairs 177. GINKGOACEÆ
BB The lvs not fan-shaped
C Perianth present no resin-tubes, but true vessels in wood 178 GNETACEÆ.
CC Perianth wanting no true vessels, but resin-tubes present
D Ovule solitary, arillate 179 TAXACEÆ
DD Ovules in cones, not arillate 180 PINACEÆ
AA Lvs pinnatisect, ample, crowded at apex of the woody st fls of both sexes in cones 181. CYCADACEÆ

Subdivision 2 MONOCOTYLEDONS St without central pith or annular layers, but having the woody bundles distributed irregularly through it (a transverse section showing the bundles as dots scattered through the cellular tissue) embryo with a single cotyledon early lvs always alternate parts of the fl usually in 3's, never in 5's lvs mostly parallel-veined

Series 1 MICROSPERMÆ Perianth corolla-like, at least inside: ovary inferior, 1-celled with 3 parietal placentæ, or rarely 3-celled with axile placentæ seeds very small and numerous, without endosperm

A Fls regular, usually unisexual, stamens usually 2, 6, or 9 aquatic herbs 182 HYDROCHARITACEÆ
AA Fls usually very irregular, stamens and styles connate into a column, anther 1, rarely 2 terrestrial or epiphytic herbs, rarely climbers 183 ORCHIDACEÆ.

Series 2 EPIGYNÆ Perianth corolla-like, at least within. ovary generally inferior endosperm copious.

A Fls normally unisexual, stamens 6, or those opposite the inner perianth-lobes imperfect or deficient, ovary 3-celled seeds 2 . 184. DIOSCOREACEÆ.
AA. Fls normally bisexual, sometimes polygamous or otherwise
B. Stamens regular, perianth regular or nearly so embryo small, included in the endosperm
C. Ovary 1-celled, endosperm solid; embryo minute. stamens 6, hooded . . . 185. TACCACEÆ.
CC. Ovary usually 3-celled.
D. Stamens 3, opposite the outer lobes endosperm horny 186 IRIDACEÆ
DD Stamens 6, rarely 3 and opposite the inner lobes, rarely ∞: endosperm fleshy.
E. Placentæ scarcely intruding.. 187 AMARYLLIDACEÆ.

EE. Placentæ intruding lamella-like, and peltate 188. VELLOSIACEÆ.
BB. Stamens 1 or 5 perfect, the other 5 or 1, variously changed into antherless staminodia, fls. irregular embryo in a central canal of endosperm, straight, incurved, or horseshoe-shaped
C Fertile stamens 5 189. MUSACEÆ.
CC Fertile stamen 1
D. Staminodium 1, often traces of more, a ligule at top of petiole, anther 2-celled 190. ZINGIBERACEÆ
DD Staminodia 5, no ligule, anther 1-celled
E Ovary-cells 1-seeded a joint at summit of petiole 191 MARANTACEÆ
EE Ovary-cells ∞-seeded nojoint 192 CANNACEÆ.
BBB. Stamens regular or nearly so perianth regular embryo in a small marginal cave or pit of endosperm, rarely much intruded, never wholly included
C. Endosperm mealy perianth calyx-like outside, stamens 6. lvs. rigid . 193. BROMELIACEÆ.
CC. Endosperm fleshy perianth corolla-like or woolly outside, stamens sometimes 6 and equal, sometimes 1–3 and slightly dissimilar, or 3 opposite the inner lobes
(Hæmodoraceæ, mostly incl in Liliaceæ and Amaryllidaceæ)

Series 3 CORONARIEÆ Perianth corolla-like, at least inside ovary free, rarely shortly adnate at the base endosperm copious

A Embryo minute or more or less elongated, included in fleshy or horny endosperm perianth regular stamens 6 ovary usually 3-celled 194 LILIACEÆ
AA. Embryo straight, in a central canal of mealy endosperm perianth regular or irregular, from a spathe, stamens 3 or 6 ovary 1- or 3-celled 195 PONTEDERIACEÆ.
AAA Embryo marginal, lying in mealy endosperm and under a little callosity of the seed-coat perianth regular or slightly irregular, of 3 herbaceous sepals and 3 deliquescent colored petals some stamens usually sterile and altered, stamen-hairs conspicuous 196 COMMELINACEÆ

Series 4 CALYCINEÆ Perianth calyx-like, small, somewhat rigid or glumaceous, or rarely herbaceous ovary free, endosperm copious

A Fr a 3-valved, many-seeded caps, embryo included in more or less fleshy endosperm plant grass-like 197 JUNCACEÆ
AA Fr berry- or drupe-like, 1-seeded, rarely 2–3-seeded, embryo immersed in a small pit near the periphery of the endosperm palm-like plants 198 PALMACEÆ

Series 5 NUDIFLORÆ Perianth 0, or reduced to scales or bristles, ovary superior, carpels solitary or, if more, syncarpous, 1–∞-ovuled seeds usually with endosperm

A. Plants minute, thalloid, 1–3 lines wide, aquatic fls solitary or in pairs from marginal fissures 199 LEMNACEÆ.
AA Plants larger fls on spadices
B Fls dœcious, perianth 0, carpels usually confluent in clusters, spadices clustered or paniced stiff plants 200 PANDANACEÆ.
BB. Fls dœcious, or monœcious in different spadices, perianth 0, or the short segms distinct or connate, spadices solitary stiff plants 201 CYCLANTHACEÆ.
BBB. Fls. monœcious in different spadices, rarely dœcious, perianth reduced to membranous scales or thread-like chaff, spadices rarely solitary reed-like marsh plants 202 TYPHACEÆ.
BBBB. Fls bisexual, or monœcious in same spadix, rarely dœcious, perianth 0, or of 4 membranous or fleshy imbricate scales, spadices solitary herbaceous or fleshy plants 203 ARACEÆ

Series 6 APOCARPÆ Perianth in 1–2 series, or 0· ovary superior; carpels solitary, or, if more, distinct seeds without endosperm.

A. Embryo complicate or horseshoe-shaped perianth-segms 6, in 2 series, the inner petaloid
B. Ovules 1, rarely 2–5, basal 204. ALISMACEÆ.
BB. Ovules numerous, borne between the margins and midrib of the carpel... 205 BUTOMACEÆ.
AA. Embryo curved perianth of 4 herbaceous segms, or 0 ovule solitary 206 NAIADACEÆ.
AAA. Embryo straight perianth of several petaloid parts ovules 2–6 207. APONOGETONACEÆ.

Series 7 GLUMACEÆ Fls disposed in spikes or spikelets which are variously arranged, bracts of the spikelet scale-like (glumes), usually imbricate, perianth-segms small, scale-like, bristle-like, or 0, ovary 1-celled, 1-ovuled seeds with endosperm

A Fr an achene, seed free from the pericarp, palets and lodicules 0 208. CYPERACEÆ.
AA. Fr a caryopsis, seed usually adherent to pericarp, palets and lodicules present . 209 GRAMINEÆ.

Other families, of which plants are more or less in cultivation and described in this Cyclopedia, are Adoxaceæ (Adoxa), Baselaceæ (Anredera), Candolleaceæ (Candollea), Caryocaraceæ (Caryocar), Datiscaceæ (Datisca), Frankeniaceæ (Frankenia), Goodeniaceæ (Goodenia, Scævola), Icacinaceæ (Pyrenacantha), Orobanchaceæ (Aphyllon), Restionaceæ (Restio), Turneraceæ (Turnera), Vochysiaceæ (Vochysia)

Division 2. PTERIDOPHYTA Bearing spores instead of seeds, but with a usually separate more insignificant stage which bears sexual organs Ferns, lycopods, horsetails and the like

A Plants like large moss-plants, with scale- or needle-like lvs
B Spores all alike, minute 210 LYCOPODIACEÆ.
BB Spores of two kinds, larger (megaspores) and smaller (microspores) 211 SELAGINELLACEÆ.
AA Plants consisting mainly of slender-jointed herbaceous sts with whorls of scale-like appressed lvs at the joints 212 EQUISETACEÆ.
AAA Plants true ferns, with usually expanded lvs (Azolla, a moss-like water-plant is exceptional) (Filicales)
B Ferns epiphytic or terrestrial (one Ceratopteris partly aquatic). spores uniform, minute
C Sporangia with thick walls, arising from tissues beneath the epidermis
D The sporangia in spikes or panicles 213 OPHIOGLOSSACEÆ.
DD The sporangia in round or oval sori on under surface of ordinary lf 214 MARATTIACEÆ.
CC Sporangia walls only 1 cell thick, derived from epidermis
D. Small membranous ferns sporangia borne on thread-like projections along margin of lvs 215 HYMENOPHYLLACEÆ.
DD. Usually larger, thicker-lvd ferns sporangia not on thread-like projections
E Plants terrestrial
F Ring of sporangia obsolete, sporangia in panicles 216 OSMUNDACEÆ
FF Ring of sporangia apical, sporangia ovate, sessile 217 SCHIZÆACEÆ.
FFF Ring of sporangia vertical
G. The sporangia mostly long-stalked lvs pinnate or palmate 218 POLYPODIACEÆ.
GG. The sporangia mostly sessile or very short-stalked
H. Sporangia in sori of 2–8, radiating in a single plane, lf-branching often dichotomous growth indeterminate 219 GLEICHENIACEÆ.
EH Sporangia numerous in the globose sori mostly arborescent 220 CYATHEACEÆ.
EE. Plants aquatic, with floating sterile lvs and pod-like sporophylls sporangia sessile with broad ring or 0 221 CERATOPTERIDACEÆ.
BB. Ferns, aquatic, unfern-like in appearance, spores of 2 sorts,—large macrospores and minute microspores
C Plants floating lvs simple, folded microspores and macrospores in separate sporocarps 222 SALVINIACEÆ.
CC Plants rooting in mud lvs quadrifoliate, cloverlike microspores and macrospores in the same sporocarp . 223 MARSILEACEÆ.

PART II.—KEY TO THE GENERA

1. RANUNCULACEÆ.

A Sepals usually valvate lvs opposite . . 1. *Clematis*
AA. Sepals imbricate
B Carpels 1-ovuled fr an indehiscent achene.
C Ovule pendulous, raphe dorsal
D Petals conspicuous 2 *Adonis*
DD Petals 0, or very small
E Fls not subtended by involucres 3 *Thalictrum*
EE Fls subtended by involucres remote from the calyx or close under it
F Involucre remote from calyx 4 *Anemone*
FF Involucre of 3 simple, sessile lvs closer under the fl 5 *Hepatica*
FFF Involucre of 3 compound sessile lvs 6 *Syndesmon*
CC Ovules ascending
D Petals wanting 7 *Trautvetteria*
DD Petals 3 to many 8 *Ranunculus*
BB Carpels several- or many-ovuled fr usually dehiscent at maturity, rarely berry-like
C. Petals large and showy 9 *Pæonia*
CC. Petals medium small, deformed, or 0
D Fls irregular
E Posterior sepal forms a spur 10 *Delphinium*
EE Posterior sepal forms a hood 11 *Aconitum.*
DD Fls regular
E Infl racemose
F Stamens 5 or 10 shrubs 12 *Xanthorrhiza*
FF Stamens numerous herbs
G Fr a berry 13 *Actæa*
GG Fr consisting of follicles, dehiscent 14 *Cimicifuga*
EE. Infl paniculate, or fls solitary
F Lvs palmately veined or cut, not ternate
G Petals wanting
H Ovules many, in 2 series along the ventral suture 15 *Caltha*
HH Ovules only 2 16 *Hydrastis*
GG. Petals small or narrow, mostly nectar-bearing
H Sepals commonly deciduous, petals not 2-lipped, nor scale-bearing 17 *Trollius*
HH Sepals persistent, broad petals 2-lipped or bearing a scale 18 *Helleborus*
HHH Sepals deciduous, narrow, petals bearing a scale 19 *Eranthis*
FF. Lvs ternately or subpinnately decompound
G Sepals 5–6
H Petals spurred 20 *Aquilegia*
HH Petals not spurred, often small or 0
I The carpels connate at the base or higher 21 *Nigella*
II The carpels free
J Carpels stalked 22 *Coptis*
JJ Carpels not stalked 23 *Isopyrum*
GG Sepals and petals numerous 24 *Anemonopsis*

The genus Calhanthemum is also in cultivation

2. DILLENIACEÆ.

A Anthers adnate, linear carpels 5–20, partly connate upright trees or shrubs 1 *Dillenia*
AA Anthers oblong or rarely orbicular, the cells parallel and contiguous 2 *Hibbertia*
AAA Anthers versatile, emarginate at the base, carpels completely connate fr a berry twining shrubs.
B Stamens and carpels ∞ winter-buds inclosed in the swollen base of the petiole . 3 *Actinidia*
BB Stamens 10 carpels 5. winter-buds free . 4 *Clematoclethra.*

3. CALYCANTHACEÆ.

A. Stamens 10–∞ all sepals brownish red. . 1. *Calycanthus.*
AA Stamens 5 outer sepals white, inner purple 2 *Meratia.*

4. MAGNOLIACEÆ.

A. Stamens ∞. perianth-segms 6–∞.
B Fls bisexual upright trees or shrubs.
C. Stipules 0. . . . . 1. *Illicium.*
CC Stipules present, inclosing young lvs. in the bud
D. Anthers face out . . . . 2. *Liriodendron.*
DD Anthers face in
E Structure bearing the carpels stalked 3 *Michelia.*
EE Structure bearing the carpels sessile
F Dehiscence of carpel circumscissile 4 *Talauma.*
FF Dehiscence 2-valved 5 *Magnolia.*
BB Fls unisexual twining shrubs
C Carpels after anthesis spicate 6 *Schizandra.*
CC Carpels after anthesis globose-capitate 7 *Kadsura*
AA. Stamens 4 perianth-segms 4, fls in slender spikes, small lvs palminerved tree 8 *Tetracentron.*

Members of the genus Drimys are sometimes cultivated

5. TROCHODENDRACEÆ.

A Carpels 5–8, sessile, with many seeds fls perfect evergreen tree 1 *Trochodendron.*
AA Carpels ∞, stipitate, developing into winged nutlets with 1 or few seeds fls polygamous deciduous tree 2 *Euptelea*

6. CERCIDIPHYLLACEÆ.

The only genus *Cercidiphyllum.*

7. EUCOMMIACEÆ.

The only genus *Eucommia.*

8. ANNONACEÆ.

A. Fr an aggregation of many carpels closely crowded into a spheroid or ovoid mass, ovules solitary
B Carpels fused together with the receptacle (torus) into a fleshy (often edible) syncarpium
C Corolla gamopetalous, 3-lobed or 3-spurred, almost closed, with only a minute opening above the stamens and pistils 1 *Rollinia*
CC Corolla polypetalous, petals 6 in 2 series, inner series sometimes minute or even wanting, outer petals valvate 2 *Annona.*
BB Carpels distinct, rigid, polygonal, becoming detached from the receptacle when mature, corolla polypetalous, the petals imbricate or overlapping 3 *Duguetia*
AA Fr a cluster of distinct carpels, usually stipitate, never crowded so closely as to become polygonal or prism-shaped, ovules geminate or many in 1 or 2 series
B Ovules geminate, vertical, parallel 4 *Artabotrys*
BB Ovules horizontal or in 2 vertical rows
C Petals narrow, long, strap-shaped 5 *Canangium.*
CC Petals suborbicular to obovate-oblong
D Inner petals with their margins involute, ear-shaped or boat-shaped 6,*Cymbopetalum*
DD Inner petals with margins not involute 7 *Asimina*

Fusæa, Unona, Uvaria, and Xylopia are also slightly in cultivation

9. MENISPERMACEÆ.

A. Filaments coalesced into a column which is subpeltate at apex
B Sepals 6, petals 0 1 *Anamirta*
(See article Cocculus.)
BB Sepals 4, petals grown together, making a small cup 2 *Cissampelos.*
AA Filaments free, either at base or apex
B Stamens 9–20
C Sepals and petals 6, in whorls, stamens 9–12 3 *Sinomenium.*
CC. Sepals and petals irregularly arranged, sepals 4–10, petals 6–9, stamens 12–24 4 *Menispermum.*
BB Stamens 6.
C. Petals 6, shorter than sepals, stamens high-monadelphous 5 *Cocculus.*
CC Petals 0, unless the 3 inner and larger sepals are regarded as petals, outer stamens free 6. *Abuta.*

Calycocarpum and Jatrorrhiza are sometimes cultivated.

10. BERBERIDACEÆ.

A. Venation or lobing pinnate, lvs penninerved, pinnatisect, pinnately 2-3-ternate or decompound
B Ovules few, erect from the base
c Plants are shrubs
D Foliage-lvs simple, often fascicled branches usually bearing reduced spine-lvs 1 *Berberis*
DD Foliage-lvs pinnate evergreen branches unarmed
E Lfts serrate, lvs simply pinnate 2 *Mahonia.*
EE Lfts entire, lvs 2-3-pinnate 3 *Nandina.*
cc Plants are herbs
D Petals 6, reduced to small nectaries 4 *Leontice*
DD Petals 6, scarcely smaller than sepals and flat 5 *Leontice*, § *Bongardia.*
BB Ovules placed ventrally in 2 series herbs
c Sepals 12-15, petals 0, reduced to nectaries 6 *Vancouveria*
cc Sepals 8, petals 4, reduced to nectaries 7 *Epimedium*
ccc Sepals 7-8, petals 4, a little smaller flat 8 *Aceranthus*
AA Venation or lobing palmate, lvs palminerved, palmilobed, or 2-parted
B Sepals 6, petals 6 ovules in 2 series 9 *Diphylleia*
BB Sepals 6, petals 6 9 ovules in many series 10 *Podophyllum.*
BBB Sepals 4, petals 8 11 *Jeffersonia*
BBBB Sepals and petals 0 12 *Achlys*

The species of Caulophyllum may be expected in wild gardens

11. LARDIZABALACEÆ.

A Lvs pinnate upright shrub 1 *Decaisnea.*
AA Lvs digitate twining shrubs
B Carpels 3, many-seeded
c Stamens monadelphous
D Sepals 6, petals 6, much smaller 2 *Lardizabala.*
DD Sepals 6, petals 0 3 *Stauntonia*
cc Stamens free
D Sepals 6, petals 6
E Pedicels elongated, sepals acuminate, connective produced above the anthers 4 *Holboellia.*
EE Pedicels short, sepals rounded, connective not produced, racemes very long 5 *Sinofranchetia*
DD Sepals 3, petals 0 6 *Akebia*
BB Carpels ∞, 1-seeded, stamens free lvs deciduous . 7 *Sargentodoxa.*

12. NYMPHÆACEÆ.

A. Fls small (½-1 in.)
B Stamens 3-6 submerged lvs dissected 1 *Cabomba.*
BB Stamens 12-25 lvs all peltate 2 *Brasenia.*
AA Fls large and showy (1½-12 in.), sepals 4-5, petals and stamens ∞
B Carpels in pits in a top-shaped receptacle 3 *Nelumbo.*
BB Carpels forming a distinct many-seeded ovary
c Plants prickly
D Stamens, inner ones, sterile 4 *Victoria.*
DD Stamens all fertile 5 *Euryale.*
cc. Plants not prickly
D Ovary wholly free and superior 6 *Nuphar.*
DD Ovary with stamens and inner petals inserted on it . . 7. *Nymphæa*

13. SARRACENIACEÆ.

A. Style umbrella-shaped 1 *Sarracenia.*
AA. Style 5-cut at apex 2 *Darlingtonia.*

Heliamphora may be expected in choice botanical collections.

14. PAPAVERACEÆ.

A. Stigmas distinct lvs mainly opposite or whorled sepals usually 3, petals usually 6, in 2 series placentæ never separate from the valves
B Lvs lobed 1. *Romneya.*
BB Lvs entire
c Filaments dilated stigmas ∞, linear. fr not capsular 2. *Platystemon.*
cc Filaments slightly dilated, stigmas 3, broader. fr. capsular . . . . . 3. *Platystigma.*
AA Stigmas confluent lvs alternate, ternately decompound sepals 2, petals 4 placentæ remain attached to the margin of the valves
B Sepals coherent and covering fl like a candle-extinguisher 4 *Eschscholtzia.*
BB Sepals separate
c Lobes of stigma 2, erect 5 *Dendromecon.*
cc Lobes of stigma 4, spreading 6 *Hunnemannia.*
AAA Stigmas confluent lvs alternate or mainly so fls rarely 3-merous caps dehiscing by pores or valves, the placentæ remaining as a frame alternate with and free from the valves
B Caps dehiscent by pores near the top 7. *Papaver.*
BB Caps shortly dehiscing by valves
c Stigmatic lobes radiating on the depressed summit of a very short style 8 *Argemone.*
cc Stigmatic lobes radiating on the club-shaped top of a distinct style 9 *Meconopsis.*
BBB Caps dehiscing by valves to the base or nearly so
c The caps long and linear
D Seeds pitted 10 *Glaucium*
DD Seeds crested 11 *Chelidonium.*
cc The caps ovoid, oblong or cylindrical
D Petals 4
E Style distinct, but short 12 *Stylophorum.*
EE Style long 13 *Romecon*
DD Petals 8-12 14 *Sanguinaria.*
DDD Petals 0 . . . . . 15 *Bocconia.*

Hypecoum is in the trade

15. FUMARIACEÆ.

A Corolla 2-spurred or bigibbous, the 2 outer and larger (lateral) petals similar
B Seeds crestless petals permanently united into a subcordate persistent corolla which incloses the ripe caps 1 *Adlumia.*
BB Seeds mostly crested petals less or slightly united into a 2-spurred or bigibbous corolla 2 *Dicentra.*
AA Corolla with only 1 of the outer petals spurred or gibbous by torsion becoming posterior a nectariferous spur from the base of the filaments projects into the petal-spur
B Style mostly persistent 3 *Corydalis.*
BB Style deciduous fl smaller 4 *Fumaria.*

16. CRUCIFERÆ.

A The silique transversely 2-jointed
B Lower joint indehiscent pedicel-shaped, the larger joint globose, 1-loculed, 1-seeded 1 *Crambe.*
BB Lower joint dehiscent, 2-valved, many seeded 2 *Morisia.*
AA The silique not 2-jointed, indehiscent
B Siliques in pairs 3 *Senebiera.*
BB Siliques not in pairs
c Texture horny or bony 4 *Isatis*
cc Texture leathery, or membranaceous
D Shape straight 5 *Raphanus*
DD Shape curved 6 *Sobolewskia.*
DDD Shape orbicular 7 *Peltaria*
AAA The silique dehiscent for its whole length (except that some Brassicas are not dehiscent at the apex)
B Valves markedly concave, compressed contrary to the septum, which is often very narrow, silique short
c Cotyledons accumbent.
D Sts leafy 8 *Iberis*
DD Sts scapes 9 *Hutchinsia.*
cc Cotyledons incumbent
D The valves usually wingless
E Fls rosy or violet 10 *Ionopsidium.*
EE Fls white 11 *Lepidium.*
DD The valves winged 12 *Æthionema.*
BB Valves (transversely septiferous in Anastatica), flat or concave, not compressed contrary to the septum (Smelowskia and certain Vesicarias are laterally compressed) septum as wide as the valves, silique long or short
c Cotyledons longitudinally conduplicate
D Seeds in 1 series 13 *Brassica.*
DD Seeds in 2 series 14 *Eruca.*
cc Cotyledons accumbent (sometimes incumbent or convolute in Cheiranthus)
D Seeds in 1 series (except certain species of Radicula and Arabis siliques long and narrow (except in Anastatica and sometimes Radicula and Parrya).

E. Valves appendaged 15 *Anastatica.*
(See article Resurrection Plants)
EE. Valves not appendaged
F. Stigmatic lobes erect, connate or decurrent along the style
G. Plants are herbs or branched sub-shrubs woolly 16 *Matthiola.*
GG Plants are tufted, scape-bearing herbs 17 *Parrya.*
FF. Stigma undivided or shortly lobed
G Valves elastic seeds in 1 or 2 series, silique long and linear 18 *Arabis.*
GG Valves not elastic
H Sepals unequal, the lateral ones saccate at the base 19 *Chevranthus.*
HH Sepals equal
I Seeds in 2 series .. 20 *Radicula*
II. Seeds in 1 series
J Fls yellow 21 *Barbarea.*
JJ Fls white or purple
K. Rhizome not scaly valves delicately net-ted-nerved 22 *Cardamine.*
KK Rhizome scaly valves with very delicate midrib 23 *Dentaria.*
DD. Seeds in 2 series and siliques short and broad (except in some species of Aubrietia, Draba and Cochlearia)
E. Siliques 2-locular, many-seeded, seeds much compressed, winged or margined
F Lvs entire or dentate siliques long-stalked, very broad 24 *Lunaria.*
FF Lvs pinnatisect siliques sessile 25 *Selenia.*
EE. Siliques 1–2-loculed, 2- to many-seeded, seeds rarely winged, valves often turgid
F Sepals often unequal, the lateral saccate at the base
G Fls purple siliques oblong lateral sepals saccate 26 *Aubrietia.*
GG Fls generally yellow siliques mostly oblong sepals equal or unequal 27 *Vesicaria.*
FF Sepals equal
G Stamens often appendaged 28 *Alyssum.*
GG Stamens not appendaged.
H Plants tomentose 29 *Draba*
HH Plants glabrous 30 *Cochlearia.*
(See also Kernera)
CCC. Cotyledons incumbent, straight, convolute or transversely plicate
D. The cotyledons transversely biplicate 31 *Heliophila.*
DD. The cotyledons not transversely biplicate
E Petals pinnatifid 32 *Schizopetalon*
EE Petals not pinnatifid
F Stigmas erect, free or connate into a cone, sepals long and straight
G The stigmas bilamellate, lamellæ erect 33 *Hesperis.*
GG The stigmas bilamellate, lamellæ connivent or connate into a cone 34 *Malcomia.*
FF. Stigma simple, capitate, emarginate or shortly 2-lobed cotyledons straight
G Silique stipitate..... 35. *Stanleya.*
GG Silique sessile
H Sepals equal 36 *Smelowskia.*
HH Sepals unequal 37. *Erysimum.*

The additional genera are also treated. Braya, Physaria, and Physoptychis.

17. CAPPARIDACEÆ.

A. Fr. capsular, 1-loculed herbs.
B. Torus short, often produced into a posterior appendage ... 1. *Cleome.*
BB. Torus long, produced into a gynophore which is elongated at the middle and bears the pistil to which the filaments are united 2 *Gynandropsis.*
AA. Fr berry-like or drupe-like
B Lvs simple 3 *Capparis.*
BB. Lvs. with 3 lfts 4. *Cratæva.*

Polanisia is also to be expected in cultivation.

18. RESEDACEÆ.

In cultivation..... *Reseda.*

19. CISTACEÆ.

A. Placentæ with many seeds lvs opposite at least below, flat.
B Valves 5, rarely 3, embryo circinate or spiral fls solitary or cymose, rarely racemose 1. *Cistus.*
BB Valves 3, embryo biplicate, runcinate or circumflex fls commonly racemose 2 *Helianthemum.*
AA Placentæ with 2 seeds lvs alternate, scale-like or awl-shaped heath-like shrubs ... 3 *Hudsonia.*

20. VIOLACEÆ.

A. Sepals subequal, produced or spurred at base, lower petal spurred or saccate herbs . 1. *Viola.*
AA Sepals not produced at base
B Lower petal spurred or enlarged
C With a very large spur seeds complanate woody climber 2 *Corynostylis.*
CC With lower petal merely gibbous seeds obovoid-subglobose herbs 3 *Solea*
BB Lower petal not greatly unlike the others shrubs or trees 4 *Hymenanthera.*

21. BIXACEÆ.

A. Caps 2-valved, seeds straight and naked lvs entire 1 *Bixa*
AA Caps 3-valved seeds spiral, hairy or woolly lvs digitate or palmately lobed 2 *Maximiliana.*

22. FLACOURTIACEÆ.

A. Sepals and petals alike, 9–15, spirally arranged, red, stamens 7–10 twining shrub 1. *Berberidopsis.*
AA. Sepals 3–6, whorled, stamens usually numerous (except in No 1) upright trees or shrubs
B Petals 4–10, sepals 3–5 2 *Oncoba.*
BB. Petals wanting
C Infl axillary lvs penninerved, leathery fr a berry or drupe
D Style simple, sometimes lobed at apex, ovary 1-celled
E The sepals imbricate, style short . 3 *Xylosma.*
EE The sepals valvate, style elongated, stamens sometimes 5 or 10 4. *Azara.*
DD Styles several, ovary irregularly divided
E. Fls perfect or polygamous, in axillary racemes or panicles fr a drupe 5 *Flacourtia.*
EE Fls dioecious, the pistillate solitary or few fr a berry 6 *Aberia*
CC. Infl terminal lvs hand-nerved or 3-nerved at base, long-stalked, deciduous (or *Doryalis.*)
D Fr a berry, styles usually 5, sepals imbricate 7. *Idesia.*
DD. Fr a caps
E. Styles 3, 2-parted at apex, sepals valvate 8. *Polothyrsus.*
EE. Styles 3–4, 3-parted at apex, sepals reduplicate, large . . . . . 9. *Carrierea.*

23. PITTOSPORACEÆ.

A. Fr indehiscent
B Filaments longer than anthers, petals more or less connivent from the base to beyond the middle 1. *Billardiera.*
BB Filaments shorter than anthers, petals spreading from the base . 2 *Sollya.*
AA. Fr a caps which is loculicidally dehiscent
B Caps thick-coriaceous, seeds numerous
C Seeds not winged, thick or slightly compressed 3 *Pittosporum.*
CC Seeds winged, flat, compressed, horizontal 4 *Hymenosporum*
BB. Caps thinly coriaceous seeds 1–2 in each locule, compressed, not winged, vertical 5. *Bursaria*

24. TREMANDRACEÆ.

A. Anthers 2-celled, or 4-celled in 2 planes 1 *Tetratheca.*
AA. Anthers 4-celled in 1 plane 2. *Platytheca.*

25. POLYGALACEÆ.

In cultivation ..... *Polygala.*

26. CARYOPHYLLACEÆ.

A. Ovary 1-ovuled: corolla absent
  B. Segms of involucrate perianth hooded near apex and mucronate on back 1. *Paronychia.*
  BB. Segms of hardly involucrate perianth not hooded, and blunt 2. *Herniaria.*
AA. Ovary several-ovuled petals usually present
  B. Sepals coalesced into a toothed or lobed calyx, petals and stamens hypogynous, being raised with the ovary on a gynophore, rarely sessile, petals with or without a scale at the apex of the claw.
    C. Hilum facial, embryo straight
      D Calyx tubular, multistriate 3. *Dianthus.*
      DD Calyx top-shaped or long-tubular, 5- or 15-ribbed plants and fls smaller 4. *Tunica.*
    CC. Hilum lateral, embryo peripheral.
      D. Calyx 10-nerved, rarely with many parallel nerves
        E Styles commonly 3 caps shortly 5- or 6-valved 5 *Silene.*
        EE Styles commonly 5 or 4 caps shortly 5-10- or 4-8-valved . 6. *Lychnis.*
      DD Calyx obscurely veined 7 *Saponaria.*
      DDD Calyx broadly or obscurely 5-nerved 8 *Gypsophila.*
  BB Sepals free or only coalesced at the very base, petals and stamens hypogynous on a short torus or usually very shortly perigynous
    C Stipules small, scarious 9 *Spergula.*
    CC Stipules 0
      D Valves (or rather teeth) of the caps twice as many as the styles. . 10 *Cerastium.*
      DD Valves of the caps as many as the styles
        E Petals 2-fid, styles commonly 3 11 *Stellaria*
        EE Petals entire, styles commonly 3 12 *Arenaria.*
        EEE Petals entire or 0, styles as many as the sepals . . 13 *Sagina*

Alsine is also cultivated

27. PORTULACACEÆ.

A. Ovary cohering below with the calyx-tube 1 *Portulaca.*
AA Ovary free from the calyx
  B. Embryo arched, endosperm scant 2 *Anacampseros.*
  BB Embryo more incurved or annular, including the endosperm
    C. Sepals usually deciduous 3 *Talinum.*
    CC Sepals persistent, at least usually in Calandrinia
      D Number of sepals 5–8 4 *Lewisia*
      DD. Number of sepals 2
        E Shape of sepals roundish heart-shaped, scarious 5 *Spraguea.*
        EE Shape of sepals ovate, herbaceous
          F Stamens 3, rarely 5 6 *Montia*
          FF. Stamens definitely 5 7 *Claytonia.*
          FFF Stamens indefinitely 5 to many 8 *Calandrinia.*

28. TAMARICACEÆ.

A. Stamens 4–5, free 1 *Tamarix*
AA. Stamens 10, connate below 2 *Myricaria.*

29. FOUQUIERIACEÆ.

The only genus *Fouquieria.*

30. HYPERICACEÆ.

A. Fls. 4-merous . . 1 *Ascyrum.*
AA. Fls. 5-merous . . . 2. *Hypericum.*

31. GUTTIFERÆ.

A. Style very short or 0 ovules solitary in each locule of the ovary.
  B Sepals 4 1. *Garcinia.*
  BB. Sepals 2 . . . 2. *Rheedia.*
AA. Style elongated· ovules solitary or 2
  B Ovary 1-loculed, 1-ovuled . 3 *Calophyllum.*
  BB. Ovary 2–4-loculed, 4-ovuled . 4. *Mammea.*

The genera Ochrocarpus and Platonia are also treated.

32. EUCRYPHIACEÆ.

The only genus . . .. *Eucryphia.*

33. TERNSTRŒMIACEÆ.

A. Anthers basifixed.
  B. Calyx of 5 sepals, sub-connate at the base, at length fleshy and adhering to the ovary 1 *Visnea.*
  BB. Calyx inferior, sepals free
    C. Fls rather large, petals coalesced at base, anthers glabrous ovules 2–4 in each locule, pendulous from the apex ... 2. *Ternstræmia.*
    CC. Fls medium-sized, petals free or hardly coalesced, anthers pilose ovules ∞ in the middle of the locule 3 *Cleyera.*
    CCC. Fls. small, dicœcious, petals coalesced at base, anthers glabrous ovules ∞ in the middle of the locule . . 4. *Eurya.*
AA. Anthers versatile
  B. Radicles inferior
    C Ovules ascending, seeds lens-shaped, embryo straight 5 *Stuartia.*
    CC. Ovules laterally affixed, seeds flat, winged on back, cotyledons flat and radicle inflexed . 6 *Schima.*
  BB. Radicles superior.
    C Ovules ∞, seeds winged above 7 *Gordonia.*
    CC. Ovules few in each locule, seeds not winged
      D Fls sessile, sepals deciduous . 8 *Camellia.*
      DD Fls. pedicelled, sepals persistent 9. *Thea*

34. STACHYURACEÆ.

The only genus . *Stachyurus.*

35. MALVACEÆ.

A. Fr a caps, loculicidally dehiscent (in Adansonia indehiscent, and woody)
  B. Seeds usually kidney-shaped stigmas or style-branches finally spreading
    C Bractlets 5 to many, rarely 0, or reduced to teeth style-branches finally spreading 1 *Hibiscus.*
    CC Bractlets 0 or 3 stigmas distinct, free, radiating 2. *Lagunaria.*
  BB. Seeds obovoid or angled style club-shaped at apex, undivided or with short erect branches .
    C. Bractlets 3–5, small . 3 *Thespesia.*
    CC Bractlets 3, large, cordate 4 *Gossypium.*
AA. Fr composed of carpels which separate at maturity
  B Staminal column anther-bearing outside, truncate or 5-toothed at the apex, style-branches 10
    C Bractlets 5–8, herbaceous or setiform, carpels with or without 1–3 awns 5. *Pavonia.*
    CC Bractlets ∞, herbaceous or setiform, carpels fleshy outside, connate into a berry, later separating . 6 *Malvaviscus.*
    CCC Bractlets 4–6, large and colored, carpels naked, muticous . 7 *Gæthea.*
  BB. Staminal column bearing anthers at or near the apex
    C. Carpels ∞, crowded into a mass without order
      D Bractlets 3 . . . 8 *Malope.*
      DD. Bractlets 0 9. *Palava.*
    CC. Carpels in a single whorl
      D. Ovules 2 or more
        E Bractlets 4–6 10 *Kydia*
        EE Bractlets 0 11 *Abutilon.*
        EEE Bractlets 3 . 12 *Sphæralcea.*
      DD Ovule solitary
        E The ovule ascending
          F. Styles longitudinally stigmatose inside
            G. Fls dicœcious . . . 13. *Napæa.*
            GG Fls. bisexual. (See article Sida.)
              H Staminal column double, the outer of 5 clusters 14 *Sidalcea.*
              HH Staminal column single
                I. Bractlets 3–9, connate at base.
                  J. Axis of fr. not surpassing carpels . 15. *Althæa.*
                  JJ. Axis of fr surpassing carpels 16 *Lavatera.*
                II. Bractlets 0–3, distinct.
                  J. Carpels with transverse appendages inside under the beak. ... . ..17. *Callirhoë.*

JJ Carpels not appendaged 18 *Malva.*
FF. Style-branches tipped with small capitate or club-shaped stigmas 19 *Malvastrum.*
EE. The ovules pendulous
F. Style-branches longitudinally stigmatose inside 20. *Plagianthus.*
FF. Style-branches truncate at apex or with small capitate stigmas. . 21. *Sida.*

Other genera described are Hoheria, Ingenhousia, Kitaibelia, and Kosteletzkya.

36. BOMBACACEÆ.

A. Lvs digitate: cotyledons conduplicate or convolute
B. Staminal column separated above into numerous filaments
c Caps 5-valved, densely woolly within . 1. *Bombax.*
cc Caps woody, not woolly within.
D Calyx 5-cut .. 2 *Adansonia.*
DD Calyx truncate 3 *Pachira.*
BB Staminal column 5-cut or 5-toothed, the branches bearing 2–3 anthers
c. Column outside below the middle annulately 5–10-lobed 4 *Chorisia.*
cc Column not annulate 5 *Ceiba.*
AA. Lvs simple, feather-veined, entire cotyledons plane, leafy or fleshy 6 *Durio.*

37. STERCULIACEÆ.

A. Petals concave or hooded at the base
B Anthers solitary between the staminodes 1. *Rulingia*
BB Anthers 2 or more between the staminodes
C Fr a membranous caps 2 *Abroma*
cc Fr a woody caps. 3 *Guazuma*
ccc Fr drupaceous . . 4 *Theobroma.*
AA. Petals flat
B. The petals deciduous
c. Anthers sessile, calyx club-shaped or bell-shaped 5 *Reevesia.*
cc Anthers stipitate, sepals at length free. 6 *Pterospermum.*
BB. The petals persistent or marcescent.
c. Anthers 10 or 15, rarely 20
D Ovules 2 in each locule . . . 7 *Dombeya*
DD Ovules cc . . 8 *Pentapetes*
cc Anthers 5 . . 9 *Mahernia.*
AAA. Petals 0.
B Fls bisexual . 10 *Fremontia.*
BB Fls unisexual or polygamous
C Anthers crowded without order seeds without endosperm 11 *Sterculia*
cc Anthers in a single ring seeds with endosperm 12 *Cola*

Brachychiton, Chiranthodendron, and Hermannia are also treated

38. TILIACEÆ.

A. Calyx bell-shaped, 3–5-cut 1 *Berrya.*
AA Calyx composed of distinct sepals
B Petals pitted at the base, inserted around the base of a more or less elevated torus
C Fr unarmed, glabrous, or tomentose 2 *Grewia*
cc Fr echinate or setose 3 *Triumfetta*
BB Petals not pitted, inserted immediately around the stamens
C Fr indehiscent globose, usually 1-seeded . 4 *Tilia*
cc Fr a caps
D Caps loculicidally dehiscent
E The stamens all bear anthers
F The caps globose, echinate 5 *Entelea*
FF The caps pod-like, usually naked 6 *Corchorus.*
EE The outer stamens have no anthers 7 *Sparmannia.*
DD Caps dehiscing at the apex 8 *Luehea*

39. ELÆOCARPACEÆ.

A. Fr. a berry 1 *Aristotelia.*
AA. Fr a drupe . 2 *Elæocarpus.*
AAA. Fr a dehiscent loculicidal caps . . . 3. *Tricuspidaria.*

40. LINACEÆ.

A. Styles 5 lvs entire, glands equal 1. *Linum.*
AA. Styles 3–4 lvs usually serrate glands usually unequal or absent. . . 2. *Reinwardtia.*

41. ERYTHROXYLACEÆ.

In cultivation .... *Erythroxylon.*

42. MALPIGHIACEÆ.

A. Fr a fleshy 3-stoned drupe .. 1 *Malpighia.*
AA. Fr a caps composed of 3 dehiscent berries fls in terminal racemes 2 *Galphimia.*
AAA. Fr. consists of 1–3 samaras. fls in umbel-like corymbs . . . . . 3. *Stigmaphyllon.*

Other genera described are Byrsonima, Janusia, Sphedamnocarpus and Tristellateia.

43. ZYGOPHYLLACEÆ.

A. Ovary sessile lvs with 2 lfts, rarely 1 lft 1 *Zygophyllum.*
AA. Ovary stalked lvs abruptly pinnate 2 *Guaiacum*

44. GERANIACEÆ.

A. Fls. irregular, the posterior sepal spurred; spur adnate to the pedicel 1 *Pelargonium.*
AA Fls regular or nearly so
B. Stamens 10, usually all fertile tails of carpels usually not bearded inside 2 *Geranium.*
BB Stamens, 5 fertile and 5 reduced to scales, tails of carpels usually bearded inside 3 *Erodium.*
BBB Stamens 15, anther-bearing, in groups of 5 4 *Monsonia.*

45. TROPÆOLACEÆ.

The only genus *Tropæolum.*

46. LIMNANTHACEÆ.

In cultivation *Limnanthes.*

47. OXALIDACEÆ.

A. Fr a loculicidal caps
B Valves of caps separating to the middle 1 *Oxalis.*
BB Valves of caps separating to the base 2 *Biophytum.*
AA. Fr an indehiscent berry 3 *Averrhoa.*

48. BALSAMINACEÆ.

In cultivation . *Impatiens.*

49. RUTACEÆ.

A Ovary entire or slightly 2–5-lobed, style terminal, entire at base fr drupe-like or berry-like, but leathery, usually indehiscent
B Fls hermaphrodite, petals and stamens free or connate, ovules 1, 2 or many fr usually with a cortex outside and pulpy within, seeds ex-albuminous (Subfamily **Citratæ.**)
C Cotyledons thin and twisted in seed frs dry 1 *Micromelum.*
cc. Cotyledons thick and fleshy, plano-convex frs. more or less fleshy or pulpy
D Thorns absent lvs pinnate, lfts alternate on rachis frs fleshy berries
E Styles very short and thick, persistent, fls small, urceolate young growth densely covered with brown velvety pubescence 2 *Glycosmis.*
EE. Styles long or, if short, dehiscent
F Fls small ovarial cells with scattered hairs frs with thick fleshy dissepiments 3 *Clausena.*
FF. Fls large ovarial cells with tufted conducting hairs frs fleshy but with thin dissepiments 4. *Chalcas.*
DD. Thorns usually present lvs simple or, if compound, with the lateral lfts exactly opposite (Tribe Citreæ)
E. Frs large, hard-shelled, cells filled with mucilage (Subtribe Æglinæ)
F. Lvs pinnate ovary 5-celled but by confluence becoming 1-celled.
G. Seeds woolly, exocarp woody, continuous 5 *Feronia.*
GG. Seeds smooth, exocarp prismatic. 6 *Feronella.*
FF. Lvs trifoliate or simple: ovary 6–15-celled.

GG. The lvs always simple fr with thin dissepiments, 6-celled, seeds smooth 7. *Æglopsis.*
GG. The lvs trifoliate fr 8–15-celled.
H Seeds woolly
I The frs hard-shelled, 10–15-celled 8 *Ægle.*
II The frs long-oval, leathery, 8–10-celled 9. *Chætosper-*
HH Seeds smooth fr subglobose, very hard-shelled 10 *Balsamo-* [*mum.*
EE Frs not hard-shelled (Subtribe Lavanginæ) [*citrus*
F The frs small, fleshy or with mucilage in cells, without pulp-vesicles
G Petioles very long, lvs trifoliate climbing shrubs 11 *Lavanga.*
GG Petioles short, often winged
H The lvs pinnate, rachis broadly winged frs ½in diam 12 *Hespere-* [*thusa.*
HH. The lvs trifoliate or simple
I. Lvs trifoliate or bifoliate
J Petioles of medium length, narrowly winged frs 1 in diam 13 *Plesosper-* [*mum.*
JJ Petioles very short, wingless fls 3-merous frs ½in diam 14 *Triphasia*
II. Lvs simple or unifoliate
J Frs angled, seeds very long, flattened 15 *Merope*
JJ Frs not angled
K Plant a climbing shrub petioles long 16 *Paramignya*
KK Plant a shrub or tree petioles short
L. Diam of frs ½in lvs venose cells not filled with mucilage 17 *Severinia*
LL Diam of frs 1 in cells filled with mucilage lvs smooth 18 *Pamburus*
FF The frs hesperidia, the cells filled with stalked pulp-vesicles containing juice (Subtribe Citrinæ)
G Lvs pinnate, rachis broadly winged ovules 1 in each cell 19 *Citropsis.*
GG Lvs trifoliate or simple ovules usually 2 or more in each cell
H The lvs trifoliate, deciduous 20. *Poncirus*
HH The lvs simple, persistent
I Stamens 8 or 10, twice as many as the petals 21. *Atalantia*
II Stamens 16–40, 4 or more times as many as petals
J. Lvs isofacial, gray-green, with stomates and hairs on both faces frs small, 3–4-celled 22. *Eremocitrus*
JJ Lvs not isofacial, without stomates on upper surface
K. Ovary 3–5-celled lvs pale below, punctate 23 *Fortunella*
KK Ovary 6–15-celled
L. The stamens polyadelphous 24 *Citrus*
LL. Stamens free
M Cotyledons aërial on germination, first foliage lvs opposite fr small, 10–12-celled 25 *Papeda*
MM. Cotyledons hypogeous, first foliage-lvs alternate cataphylls frs 5- or 6-celled 26 *Microcitrus.*

BB. Fls. usually polygamo-dioecious, petals and stamens free, ovules 2, except in the first 2 genera seeds usually albuminous
C Ovules solitary
D. Petals 4–5, valvate, stamens 4–5. drupe 2–4-stoned 27. *Skimmia.*
DD. Petals 5, valvate, stamens 5, ovary 5-lobed, stigma sessile 28 *Casimiroa.*
CC Ovules twin
D Petals 2–5, valvate or imbricate, stamens 2–5 fr 4–7-loculed 29. *Toddalia.*
DD Petals 5–8, valvate, stamens 5–6 fr. a 5-stoned drupe 30 *Phellodendron*
DDD. Petals 4–5, imbricate, stamens 4–5. fr a 2–3-loculed samara 31. *Ptelea*

AA. Ovary deeply 2–5-lobed, styles basilar or ventral, or the stigmas connate· fr capsular or 3–5-berried.
B Ovules 3 or more in each locule
C Petals 4–5, equal, stamens 8–10, straight 32 *Ruta.*
CC Petals 5, unequal, stamens 10, declinate 33 *Dictamnus.*
BB Ovules 2 in each locule
C Fls irregular 34 *Ravenia.*
CC Fls regular
D The fls unisexual or polygamous.
E Lvs alternate
F Foliage pinnate fls polygamous 35 *Xanthoxy-*
FF Foliage simple fls unisexual 36 *Orixa* [*lum.*
EE Lvs opposite fls unisexual 37 *Evodia*
DD The fls hermaphrodite
E Albumen fleshy (unknown in Choisya)
F. Petals erect, long, connate or connivent, forming a cylindrical tube 38 *Correa.*
FF. Petals free, spreading
G The petals imbricate
H Stamens 8, petals 4 lvs opposite 39. *Boronia.*
HH Stamens 8–10, petals 4–5 lvs alternate 40 *Eriostemon.*
HHH Stamens 10, petals 5 lvs opposite 41 *Choisya*
GG The petals valvate 42 *Pilocarpus.*
EE Albumen 0
F The caps 5-loculed 43 *Calodendrum.*
FF The ovary-lobes 1–5, free 44 *Diosma.*
G Staminodes 0
GG Staminodes 5
H Style short, stigma capitate, fls terminal 45 *Adenandra.*
HH Style long, stigma simple, fls axillary 46 *Barosma*

The following genera are also described Amyris, Chloroxylon, Diplolæna, Limonia, and Spathelia

50. SIMARUBACEÆ.

A Stamens 10, twice as many as petals.
B Petals united into a tube 1 *Quassia*
BB Petals spreading 2 *Ailanthus*
AA Stamens 4–5, as many as petals 3 *Picrasma.*

51. OCHNACEÆ.

A Ovary 3–10-loculed locules 1-ovuled, seeds without endosperm
B Stamens many, panicle lateral 1 *Ochna*
BB Stamens 10, panicle terminal 2 *Ouratea*
AA Ovary 2–5-loculed, many-ovuled, with endosperm 3 *Cespedesia.*

52. BURSERACEÆ.

A Calyx-tube broadly urn-shaped, covered by the torus 1 *Garuga*
AA Calyx small, 4–6-parted . 2. *Bursera.*

53. MELIACEÆ.

A Stamens free
B Ovary 4–5-celled, cells 8–12-ovuled . 1 *Cedrela*
BB Ovary 2-celled, cells 1-ovuled 2 *Ptæroxylon.*
AA Stamens coalesced into a tube, at least at base
B Locules of the ovary many-ovuled 3 *Swietenia.*
BB Locules of the ovary 1–2-ovuled
C Lvs simple 4 *Turræa.*
CC Lvs 3-foliolate or 1–3-pinnate.
D Anthers 5 . 5 *Aglaia.*
DD. Anthers 8–12
E. Disk cup-like . 6 *Melia*
EE Disk ring-like . ... 7. *Trichilia.*

54. OLACACEÆ.

A Stamens twice as many as the petals, all fertile 1 *Ximenia.*
AA Stamens anther-bearing, 3–5, staminodia 6 or less. 2 *Olax*

55. AQUIFOLIACEÆ.

A. Petals connate at base, ovary 4–5-loculed 1 *Ilex.*
AA Petals free, linear, ovary 3–5-loculed 2 *Nemopanthus.*

56. CYRILLACEÆ.

A Racemes terminal, stamens 10 caps winged 1 *Cliftonia.*
AA. Racemes lateral, stamens 5. caps. not winged. 2. *Cyrilla.*

57. CELASTRACEÆ.

A. Fr. indehiscent . . . . . 1. *Elæodendron.*
AA. Fr. a dehiscent caps.
B. Lvs. opposite.
c Ovules 1–2, in the axis of the locule 2 *Evonymus.*
cc Ovules 2, in the locules, erect . 3. *Pachystima.*
BB. Lvs. alternate.
C. Ovary confluent with the disk.
D. Locules generally 1-ovuled plants unarmed fls solitary, clustered or cymose 4 *Maytenus.*
DD. Locules 2-ovuled. plants often armed fls cymose . . 5. *Gymnosporia*
CC. Ovary free 6 *Celastrus.*

Other genera treated are Cassine, Catha, and Tripterygium.

58. STACKHOUSIACEÆ.

In cultivation. *Stackhousia.*

59. RHAMNACEÆ.

A. Calyx-lobes persistent, the often star-shaped disk joining its tube to the entire surface of the ovary fr dry, 3-winged . 1 *Gouania.*
AA. Calyx-lobes deciduous
B. Disk lining the shallow calyx-tube nearly or quite free from the ovary. fr drupaceous, mostly fleshy and often edible, with a single 1–4-celled stone inclosing as many seeds, or 1-seeded by abortion, seed-coats membranous
c Petals 0 endosperm copious, ruminate 2 *Reynosia*
cc. Petals 5
D. Fr winged, dry, leathery plants prickly lvs 3-nerved 3 *Paliurus.*
DD. Fr. a fleshy drupe plants prickly lvs 3-nerved 4 *Zizyphus*
DDD. Fr a drupe with leathery sarcocarp plants unarmed lvs penninerved 5 *Berchemia*
BB. Disk lining the calyx-tube, or both adherent to ovary fr drupaceous or becoming dry,
c Lvs very small or wanting, the spines lf-like 6 *Colletia*
cc. Lvs ordinary
D Fr a fleshy drupe free from calyx, containing 2–4 separate nut-like stones 7 *Rhamnus*
DD. Fr becoming nearly or quite dry, partly inferior, separating into 3 nutlets ovary adnate to disk at its base 8 *Ceanothus*
DDD. Fr a caps with membranous covering, inferior, separating into 3 cocci, which are dehiscent inside 9 *Pomaderris.*
DDDD. Fr indehiscent, pea-shaped, 3-celled, 3-seeded ovary free 10. *Hovenia.*

The genus Rhamnella is sometimes cultivated

60. VITACEÆ.

A. Stamens free climbing shrubs or herbs
B. Petals expanding, fls in cymes bark close; pith white
C. Plants climbing, mostly by adhesion of dilated and disk-shaped tips of the tendril-branches no distinct disk or free nectariferous glands, but a nectariferous and wholly confluent thickening of the base of the ovary, or even this obsolete lvs never pinnate 1. *Parthenocissus.*
CC. Plants climbing by the prehension and coiling of naked-tipped tendrils. nectariferous disk or glands surrounding the ovary or its base, and at least partly free from it
D. Fls. 5-merous: woody plants, mostly hardy . 2. *Ampelopsis.*
DD. Fls 4-merous more or less fleshy, woody or herbaceous, mostly tropical or subtropical . . . . 3. *Cissus.*
BB. Petals cast off from the base while cohering by their tips, hypogynous disk or 5 nectariferous glands alternate with the stamens, fls in panicles: berries usually edible lvs. rarely compound, never pinnate . . . . . 4. *Vitis.*
AA. Stamens with connate filaments: lvs. 1-3-pinnate. upright trees or shrubs. . . . . 5. *Leea.*

Tetrastigma is also briefly treated.

61. SABIACEÆ.

In cultivation *Meliosma.*

62. ACERACEÆ.

A. Nutlets winged all around. lvs pinnate, with 9–15 lfts. 1. *Dipteronia.*
AA. Nutlets with an elongated wing on one side: lvs. simple or compound . . . 2. *Acer.*

63. STAPHYLEACEÆ.

A. Lvs opposite several seeds in each cell
B. Ovary 2–3-parted at base.
c Caps vesiculose 1 *Staphylea.*
cc Follicles coriaceous 2 *Euscaphis.*
BB Ovary 3-lobed fr fleshy or leathery 3 *Turpinia.*
AA. Lvs alternate 1 seed in each cell fr berry-like 4 *Tapiscia.*

64. MELIANTHACEÆ.

A. Calyx subsaccate, the segms narrow, very unequal at base ovules in the locules 2–4 1. *Melianthus.*
AA. Calyx of 5 free, roundish sepals ovules numerous in 2 series on the placentæ..... 2. *Greyia.*

65. HIPPOCASTANACEÆ.

In cultivation . *Æsculus.*

66. SAPINDACEÆ.

A. Fls irregular
B Ovules solitary in the locules (rarely 2 in Paullinia) plant climbing
c Fr a winged samara 1 *Serjania*
cc Fr bladdery, membranous, loculicidal. 2 *Cardiospermum.*
ccc Fr a pear-shaped, septicidal caps 3 *Paullinia*
BB Ovules 2 or more in the locules plant erect
c Sepals valvate, petals 3–4 4 *Koelreuteria.*
cc Sepals imbricate, petals 4–5 . 5 *Ungnadia.*
AA Fls regular, or nearly so
B. Stamens inserted at the base of the ovary inside the disk, often unilateral
C Fr dehiscent, ovules 2 or more in cells
D Disk produced into 5 horns, fls in racemes before the lvs, showy 6 *Xanthoceras.*
DD Disk annular or cup-shaped, fls. usually in panicles
E Lvs ternate sepals glabrous; disk cupular 7 *Delavaya*
EE. Lvs pinnate
F Petals 5, sepals imbricate, pubescent 8 *Blighia*
FF. Petals 0, sepals valvate 9 *Stadmannia.*
CC. Fr indehiscent.
D Aril present, fr edible
E Calyx deeply 5-parted, imbricate, petals present 10 *Euphoria.*
EE. Calyx with small valvate lobes or obsoletely toothed, petals 0 11 *Litchi.*
DD. Aril wanting
E. Fr deeply lobed or divided into 3 (–1) cocci sepals 5 lfts usually many 12 *Sapindus.*
EE. Fr not deeply lobed sepals 4 lfts 2–4 13 *Melicocca.*
BB. Stamens inserted outside the disk or disk wanting, petals 0 caps winged, papery or leathery lvs simple or pinnate 14 *Dodonæa*

Additional genera are somewhat cultivated, as Alectryon, Bersamo, and Diploglottis.

67. ANACARDIACEÆ.

A. Lvs simple
B. Stamens 5, styles 3 1. *Semecarpum.*
BB. Stamens 8–10 (all or some fertile), style eccentric, stigma a mere dot 2. *Anacardium.*
BBB. Stamens 1–5, style lateral, stigma simple. 3. *Mangifera.*
AA. Lvs. pinnate or composed of 3 lfts
B Ovary 1-celled
C. Ovules suspended at or near the apex.
D. Styles in the pistillate fls short, in the staminate fls. 4–5 . . . 4. *Tapirira.*
5. *Cyrtocarpa.*
DD Styles 2 . . 6. *Schinus.*
CC Ovules suspended by a basilar funiculus.
D Styles 3 ..... 7. *Pistacia.*

DD. Petals 4–6 or more.
E Stamens in a single whorl
F The petals valvate . . . . . 8. *Sorindeia.*
FF. The petals imbricate
G Style lateral in fr , pedicels becoming plumose lvs simple 9. *Cotinus.*
GG. Style terminal in fr , pedicels not plumose in fr. lvs compound, rarely simple .10. *Rhus.*
EE. Stamens in 2 whorls, the outer alternate with the petals, petals valvate . . 11. *Lithræa.*
BB Ovary 2–5-celled
c Fls polygamous; stamens 8–10, petals subvalvate 12. *Spondias.*
cc Fls dicecious, stamens 8–9, petals imbricate 13 *Harpephyllum.*

The genera Coryxocarpus and Smodingium are also described in this Cyclopedia

68. CORIARIACEÆ.

The only genus . *Coriaria.*

69. MORINGACEÆ.

The only genus *Moringa.*

70. LEGUMINOSÆ.

I. Summary of Suborders and Tribes.

Ignoring exceptions and six tribes of which no examples appear to be cult in America (Other genera of Leguminosæ may be met with now and then in cultivation, but they are so little grown and so many that the introduction of them here would make the key unnecessarily complicated, some of these are mentioned at the end of the Leguminosæ, p 95)

Suborder I —MIMOSEÆ.

A. Fls regular, small, calyx gamosepalous or valvately parted, petals valvate, often connate, below the middle
B Stamens numerous, ∞
c. The stamens free 1 ACACIA TRIBE
cc The stamens monadelphous 2 INGA TRIBE
BB. Stamens fewer, definite
c Anthers usually appendaged with a stalked gland, stamens twice as many as the petals, rarely as many fls generally 5-merous 3 ADENANTHERA [TRIBE.
cc Anthers not glandular stamens as many as the petals, rarely twice as many fls 4-5-merous, rarely 3- or 6-merous 4 MIMOSA TRIBE.
AA. Fls irregular and truly papilionaceous, i e , like a sweet pea, the standard outside of the other petals and inclosing them in the bud, sepals more or less united above the disk into a tube or cup, radicles inflexed, accumbent or rarely very short and straight (Compare AAA)

Suborder II —PAPILIONEÆ.

B. Lvs simple, or else digitately compound (Exceptions A few members of the Trifolium Tribe are digitately compound and some of the Phaseolus Tribe are subdigitately compound Some lvs that appear to be simple have been reduced from several lfts to 1, generally leaving a gland, joint or other indication of the reduction)
C. Stamens 10, free shrubs, rarely herbs 5. PODALYRIA TRIBE.
CC. Stamens 10, monadelphous, rarely diadelphous racemes terminal or opposite the lvs or the fls solitary or subfascicled at the axils 6. GENISTA TRIBE.
BB. Lvs. pinnate, rarely digitate in the Trifolium Tribe, or subdigitate in the Phaseolus Tribe or the lvs. sometimes reduced to a single lft.
C. Stamens 10, free lfts. 5 or more, sometimes reduced to 1 large lft , rarely 3 7. SOPHORA TRIBE.
CC. Stamens monadelphous or diadelphous.
D. The pod jointed, rarely 1-jointed, 1-seeded by abortion Otherwise like the Lotus, Galega and Phaseolus Tribes An artificial division 8. HEDYSARUM [TRIBE.
DD. The pod not jointed
E. Pod indehiscent, larger than calyx, membranous, leathery, woody or drupaceous lfts 5 or more, rarely 3–1 trees or tall shrubs or climbers 9 DALBERGIA [TRIBE.
EE. Pod dehiscent or if indehiscent usually of small size, generally 2-valved
F. Fls in heads or umbels, rarely solitary lfts 3 or more, entire alternate filaments usually dilated at the apex herbs or subshrubs 10 LOTUS TRIBE.
FF. Fls solitary or racemose, sometimes paniced or fascicled
G Plants typically climbing herbs, raising themselves by means of tendrils at the tips of the petioles sometimes there is a mere bristle lfts often denticulate at apex 11. VICIA TRIBE.
GG Plants twining or erect, not climbing by tendrils
H Lfts generally 3
I Habit of plants mostly twining 12 PHASEOLUS [TRIBE
II Habit of plants mostly erect 13 TRIFOLIUM TRIBE.
HH Lfts mostly 5 or more 14 GALEGA TRIBE.
AAA Fls more or less irregular, but not truly papilionaceous When they seem to be so, the petal answering to the standard will be found within the other petals instead of outside as in AA radicle straight, very rarely slightly oblique

Suborder III —CÆSALPINEÆ.

B Calyx gamosepalous beyond the disk or valvately parted lvs simple and entire or 2 lobed, or rarely cut into 2 lfts stipe of ovary free or adnate to calyx-tube 15 BAUHINIA TRIBE.
BB Calyx usually parted to the very disk and the segms imbricate
C Stipe of ovary adnate to the disk-bearing calyx-tube lvs mostly abruptly pinnate 16 AMHERSTIA TRIBE
CC Stipe of ovary free in the bottom of the calyx
D Anthers versatile lvs mostly bipinnate 17 CÆSALPINIA TRIBE.
DD Anthers basifixed, erect but longitudinally dehiscent by 2 pores or short cracks 18 CASSIA TRIBE.

II. Key to the Tribes.

1. Acacia Tribe.

The only genus . . 1 *Acacia.*

2. Inga Tribe.

A. Lvs once pinnate . . . 2 *Inga.*
AA Lvs. mostly twice pinnate
B Shape of pods circinate, arched or variously twisted
C. Pod usually 2-valved, seeds generally surrounded by a thin pulp 3 *Pithecolobium.*
CC Pod indehiscent, usually septate between the seeds 4 *Enterolobium.*
BB. Shape of pods straight, or at most slightly sickle-shaped
C. Valves separating from the persistent sutures 5 *Lysiloma.*
CC. Valves elastically dehiscent and revolute from apex to base 6. *Calliandra.*
CCC. Valves not elastic pod often indehiscent . 7. *Albizzia*

3. Adenanthera Tribe.

A. Fls short-pedicelled . . . . . 8. *Adenanthera.*
AA. Fls. sessile
B. The pod indehiscent (presumably so in Stryphnodendron).

c Pod straight, thick-compressed, transversely septate inside between the seeds 9 *Stryphnodendron*
cc. Pod straight, falcate or variously twisted, thick-compressed or subterete, usually septate inside between the seeds 10 *Prosopis.*
BB The pods 2-valved (See also BBB)
c Pod straight or arched, flat, valves entire, continuous within shrubs or trees 11 *Piptadenia.*
cc Pod obliquely oblong, deflexed from the stipe herbs or diffuse sub-shrubs, prostrate or floating 12 *Neptunia.*
BBB The pod flat, with thickened persistent continuous sutures, the valves transversely jointed between the sutures, the joints 1-seeded . . . . 13 *Entada*

4. Mimosa Tribe.

A. Pods provided with a replum, i e, a frame-like placenta, which remains after the valves have fallen away from it
B Valves wider than replum 14 *Mimosa*
BB Valves narrower than the replum or hardly wider 15 *Schrankia.*
AA Pods 2-valved in the ordinary fashion 16 *Leucæna.*

5. Podalyria Tribe.

A. Keel-petals free or slightly connate foliage herbaceous
B Pod linear or oblong-inflated 17 *Thermopsis.*
BP Pod globose or ovoid, turgid or inflated 18 *Baptisia*
AA Keel-petals connate on the back foliage mostly leathery
B Ovules 4 or more
c Keel about as long as the wings . 19 *Oxylobium.*
cc Keel much shorter than wings 20 *Chorizema*
BB Ovules 2
c Pod indehiscent calyx shortly 5-toothed 21 *Viminaria.*
cc Pod 2-valved calyx 5-fid, or bilabiate 22 *Pultenæa.*

6. Genista Tribe.

A Stamens coalesced into a sheath which is split above the middle
B Seeds strophiolate
c Lvs simple or reduced to mere scales 23 *Templetonia.*
cc Lvs pinnate, lfts 3 . 24 *Goodia*
PB Seeds not strophiolate . 25 *Crotalaria*
AA Stamens coalesced into a closed tube.
B Seeds not strophiolate
c Calyx-lobes or lips much longer than the tube 26 *Lupinus*
cc Calyx-lobes or -teeth shorter than the tube, rarely somewhat longer
D Lfts 3
E Pod stalked 27 *Laburnum*
EE Pod sessile
F Claws of petals adnate to staminal tube 28 *Petteria*
FF Claws of petals free
G Shrubs unarmed upper calyx-lobes distinct 29 *Adenocarpus*
GG Shrubs usually spinescent calyx short, truncate 30 *Calycotome.*
DD Lfts usually all wanting, rarely 3 or 1 shrubs with spiny or rush-like branches
E Shrub with rush-like branches 31 *Spartium*
EE Shrubs spiny or unarmed lfts reduced to 1 or 0, rarely 3
F. Fls yellow, calyx not inflated 32 *Genista*
FF Fls violet or blush, calyx inflated spiny shrub 33. *Ervnacea*
BB Seeds strophiolate
c Calyx colored, 2-parted, the upper segms 2-toothed, lower 3-toothed leafless shrubs, the branchlets and petioles transformed into spines 34. *Ulex.*
cc. Calyx with the 2 upper lobes or teeth connate or free, the 3 lower connate into a lower lip . 35. *Cytisus.*

7. Sophora Tribe.

A. Fl with petals all nearly alike .... 36. *Cadia.*
AA. Fl distinctly papilionaceous
B. Pod 2-valved 37. *Castanospermum*
BB. Pod indehiscent or at most tardily dehiscent to a slight extent
C The pod moniliform 38. *Sophora*
CC The pod not moniliform, linear
D Color of fls yellow in axillary racemes 39 *Calpurnia.*
DD Color of fls white, paniculed
E Winter-buds inclosed in the base of the enlarged petiole panicle loose, drooping 40 *Cladrastis.*
EE Winter-buds free panicle dense, upright 41. *Maackia*

8. Hedysarum Tribe.

A Stamens all free among themselves 42 *Adesmia.*
AA Stamens all connate in a closed tube 43 *Arachis.*
AAA. Stamens nearest the standard free or connate with the others only at the base or at the middle
B. Filaments all dilated above or only alternate ones
c Keel obtuse . . 44 *Ornithopus.*
cc Keel acute or beaked 45 *Coronilla.*
BB. Filaments normal
C. Wings short or very short, rarely as long as the keel lfts not provided with minute stipules
D Pod flat or compressed
E Joints many, rarely 2 standard-stamen free 46 *Hedysarum.*
EE. Joints 2 standard-stamen connate with others at middle 47 *Onobrychis.*
DD Pod thickish, subterete 48 *Alhagi.*
CC. Wings as long as or longer than the keel partial petioles of lfts bear minute stipules (except in Lespedeza 0)
D Pod indehiscent, rarely opening at the lower suture, joints flat 49 *Desmodium.*
DD Pod of about 1 small, distinct, 1-seeded, smooth, veined joints included in the calyx 50 *Uraria*
DDD Pod 1-seeded, indehiscent, no joints 51 *Lespedeza.*

9. Dalbergia Tribe.

A Fr drupaceous, globose or ovoid, indehiscent, the endocarp woody 52 *Andira.*
AA Fr not drupaceous
B Lfts mostly alternate
C Anthers versatile, the locules parallel, longitudinally dehiscent 53 *Tipuana*
CC Anthers small, erect, didymous, the locules placed back to back, generally dehiscent at apex by a short crack 54 *Dalbergia*
BB Lfts opposite
C Pod longitudinally 1-winged 55 *Piscidia.*
CC Pod with a narrow wing along the upper suture or both sutures 56 *Derris*

10. Lotus Tribe.

A Pod indehiscent or tardily 2-valved 57 *Anthyllis.*
AA Pod 2-valved
B Calyx-lobes usually longer than tube, keel rostrate 58 *Lotus*
BB. Calyx-teeth shorter than tube, keel obtuse 59 *Hosackia.*

11. Vicia Tribe.

A St woody infl subterminal, stamens 9, the standard-stamen absent 60 *Abrus*
AA St herbaceous fls solitary or racemose in the axils, stamens 10
B Wings adherent to the keel 61 *Lens*
(See article Lentil.)
BB Wings free or only slightly adherent
C Sheath of stamens oblique at the mouth, style slender, bearded or hairy only at the apex or all around the upper part 62 *Vicia*
CC Sheath of stamens equal at the mouth
D Calyx-lobes leafy, style rigid, dilated above and the margins reflexed and joined together so that it becomes flattened laterally, bearded down the inner edge 63 *Pisum.*
DD Calyx-lobes not leafy, style flattened above on the back and front, bearded down one face 64 *Lathyrus.*

12. Phaseolus Tribe.

A Style longitudinally bearded above on the inner side or rarely pilose only around the stigma, petals normal or the keel long-beaked or spiral infl nodose-racemose
B Calyx-tube not longer than lobe
C Keel spiral 65 *Phaseolus.*
CC Keel obtuse or arched beaked
D Stigma strongly oblique or introrse 66 *Vigna*
DD Stigma subglobose on inner face, style flattened out at apex 67 *Pachyrhizus*
DDD Stigma small, terminal, style filiform or subulate at apex 68 *Dolichos.*
BB Calyx-tube cylindrical, longer than lobes 69 *Clitoria.*
AA. Style not bearded
B. Standard-stamen free only at the very base, thence connate with the rest into a closed tube, calyx mostly 4-lobed
C Calyx bell-shaped
D Pod broad, the upper suture thickened or 2-winged. 70 *Brocles.*
DD. Pod linear, narrow or flat . . .. 71. *Pueraria.*

cc. Calyx bilabiate, the upper lip larger, entire or 2-lobed or 2-parted . 72. *Canavalia.*
BB. Standard-stamen free or connate only at the base
c. Calyx 4-lobed .. . 73. *Galactia.*
cc. Calyx not 4-lobed.
D Infl usually racemose, the rachis of the raceme jointed
E. Standard much larger than the wings and keel . .. 74 *Erythrina.*
EE. Standard smaller than the keel.
F Pod 2-valved
G Anthers of 2 kinds 75 *Mucuna.*
GG Anthers uniform 76 *Apios*
FF. Pod not dehiscent, except at the top 77 *Butea.*
DD. Infl sometimes racemose but the rachis of the raceme not jointed
E Lvs, especially beneath, with minute resinous dots infl racemose or subumbellate or the fls solitary
F Ovules 2 78 *Flemingia.*
FF. Ovules 4 or more
G Pod turgid, seeds strophiolate. 79 *Fagelia.*
GG Pod compressed, seeds not strophiolate 80 *Cajanus.*
EE. Lvs without minute resinous dots fls clustered or racemose in the axils, solitary or twin along the rachis
F Fls showy, standard large, flattened out, bracts persistent 81 *Centrosema.*
FF Fls medium-sized, standard, erect, complicate, sides often reflexed bracts persistent 82 *Amphi-* [*carpæa*
FFF. Fls small (showy in Kennedya), standard spreading or reflexed, bracts persistent or small and deciduous
G Seeds not strophiolate 83 *Glycine*
GG Seeds strophiolate
H The fls small, keel usually much smaller than wings 84 *Harden-* [*bergia*
HH The fls showy, keel usually equaling or surpassing the wings 85 *Kennedya.*

13. Trifolium Tribe.

A. Standard-stamen connate with the others into a closed tube, keel beaked 86 *Ononis.*
AA. Standard-stamen free, keel obtuse or in Parochetus acutish
B. Lfts digitate (rarely pinnate in Trifolium)
c Pod 2-valved keel acutish, petals not adnate 87 *Parochetus*
cc Pod usually indehiscent claws of all or the lower petals adnate to the staminal tube 88 *Trifolium*
BB Lfts 3, pinnate
c Pod straight, sickle-shaped or arched, sometimes thick and beaked, sometimes linear, sometimes broad and flat, indehiscent or follicularly gaping or rarely 2-valved 89 *Trigonella*
cc Pod spirally falcate, circinnate or cochleate 90 *Medicago.*
ccc. Pod small, subglobose or ovoid, thick, indehiscent or tardily 2-valved 91. *Melilotus.*

14. Galega Tribe.

A. Connective of the anthers appendaged with a small gland or mucro ovules mostly ∞, 1–2 in a few species, pod 2-valved 92 *Indigofera*
AA. Connective not appendaged
B. Ovules 1–2, rarely 3–4 (See also BB)
c Number of ovules 1 93 *Psoralea*
cc Number of ovules 2, rarely 3–4
D Stamens 10 94 *Amorpha*
DD Stamens 5 95 *Petaloste-* [*mon.*
BB. Ovules ∞ (1–2 in a few species of Tephrosia)
C. Infl terminal or opposite the lvs, mostly racemose (in Galega boti. axillary and terminal, in some Tephrosias axillary) pod 2-valved
D. Style longitudinally bearded on the inner side, calyx long-tubular, petals very long-clawed 96 *Barbieria.*
DD. Style glabrous (or merely penicillate at the stigma in some tephrosias)
E. Standard-stamen connate with the rest from the base 97 *Galega*
EE. Standard-stamen free or connate with the others from the middle.
F. The pod narrow or short, with slender valves and nerviform or hardly thickened sutures 98 *Tephrosia.*
FF. The pod thick, leathery or woody
G. Pod usually tardily dehiscent infl mostly paniced 99. *Milletia.*
GG Pod easily dehiscent infl racemose 100. *Wistaria.*
CC Infl axillary, except where noted below
D Pod flat, except where the seeds finally make it turgid 101 *Robinia.*
DD. Pod inflated, turgid or terete, longitudinally septate or undivided, rarely flat and when so always longitudinally septate
E Styles variously bearded above
F Petals acuminate 102 *Cianthus.*
FF Petals not acuminate
G Standard erect 103 *Suther-* [*landia.*
GG Standard spreading or reflexed. 104 *Swainsona.*
H Stigma small . 105. *Colutea.*
HH Stigma prominent
EE Style not bearded
F. Lvs even-pinnate shrubs or trees
G The pod stipitate, obovoid or oblong 106 *Halimoden-* [*dron.*
GG The pod linear, usually acute 107 *Caragana.*
FF. Lvs odd-pinnate or with a spiny petiole instead of an odd lft
G Anther-cells confluent at apex 108 *Glycyrrh-* [*iza.*
GG Anthers uniform
H Petals not all narrow, the standard obovate or orbicular 109 *Calophaca.*
HH Petals narrow
I Keel blunt 110 *Astragalus.*
II Keel acute 111 *Oxytropis.*

15. Bauhinia Tribe.

A Petals erect or spreading, only slightly unequal 112 *Bauhinia.*
AA. Petals falsely pea-like, the standard inmost . 113 *Cercis.*

16. Amherstia Tribe.

A The petals absent, sepals 4 .. . . 114. *Saraca.*
AA The petals present
B Bractlets persistent, inclosing the bud.
c Petals 5, slightly unequal 115. *Brownea.*
cc Petals unequal, 1 very wide, 2 narrow, 2 minute and rudimentary 116 *Amherstia.*
BB Bractlets small or deciduous
c Lfts 1 pair 117 *Hymenæa.*
cc Lfts 2 or more pairs
D Petals 5, 3 perfect, 2 rudimentary 118 *Tamarin-* [*dus.*
DD Petals 5, slightly unequal 119 *Schotia.*

17. Cæsalpinia Tribe.

A Calyx-lobes strongly imbricate, disk-bearing tube short seed not albuminous
B Pod indehiscent stigma peltate . 120 *Peltoph-* [*orum.*
BB Pod 2-valved stigma not peltate 121 *Cæsalpinia.*
AA Calyx-tube long, or top-shaped or bell-shaped, segms short or narrow and open seeds, when known, albuminous
B Pod turgid or subterete 122 *Gymnoc-* [*ladus.*
BB Pod flattish 123 *Gleditsia.*
AAA Calyx-segms valvate
B Segms 4, the upper ones connate, highest petal widest, lowest narrow 124 *Colvillea.*
BB Segms 5, petals roundish, abo it equal 125 *Poinciana.*
AAAA Calyx-segms slightly imbricate or valvate seeds albuminous
B Ovary adnate to calyx-tube 126 *Schizolob-* [*ium.*
BB Ovary free in bottom of calyx . .. 127 *Parkin-* [*sonia.*

18. Cassia Tribe.

A Petals 5, fls hermaphrodite 128 *Cassia.*
AA Petals 0, fls polygamous . 129 *Ceratonia.*

The following genera also are described as having more or less horticultural interest Afzelia, Amicia, Aotus, Baikiæa, Baphia, Brachysema, Camdensia, Carmichælia, Cicer, Copaifera, Dalea, Desmanthus, Dichrostachys, Diphysa, Ebenus, Eutaxia, Galedupa, Gliricidia, Hæmatoxylon, Hippocrepis, Hoffmanseggia, Hovea, Jacksonia, Kerstingiella, Krameria, Lonchocarpus, Minkelersia, Piptanthus, Podalyria, Pterocarpus, Pterolobium, Rhynchosia, Scorpiurus, Sesbania, Toluifera, Vouapa.

71. ROSACEÆ.

I. Summary of Tribes.

A. Ovary inferior; carpels 2–5, more or less connate and adnate to the cup-shaped receptacle, the whole developing into a fleshy fr (pome): trees or shrubs with free stipules. . . . 4. POME TRIBE.
AA. Ovary superior
B. Carpels usually many, if 1 or 2, fr not drupaceous calyx persistent.
C Fr follicular, dehiscent
D Seeds not winged fls small ... 1. SPIRÆA TRIBE.
DD. Seeds winged, flattened: fls. rather large . . .... 2. QUILLAJA TRIBE.
CC. Fr not follicular, indehiscent, or carpels growing into drupelets.
D. Pistils borne on a flat, hemispherical or convex receptacle, subtended by a cup-shaped portion of the receptacle (hypanthium), usually many.
E. The pistils 2–5. shrubs, with simple lvs
F. Stipules wanting fls small, in large panicles 3 HOLODISCUS
FF. Stipules present fls solitary or in few-fld corymbs . 5. KERRIA TRIBE.
EE. The pistils many (if few, lvs. compound) herbs or shrubs.
F. Carpels becoming dry achenes.
G. Ovules 2, carpels 5–15 calyx without bractlets herbs 9 ULMARIA TRIBE.
GG. Ovules 1 carpels many, calyx usually with bractlets alternating with the lobes 6. POTENTILLA
FF Carpels becoming drupelets [TRIBE.
ovules 2, but seed solitary 7. RUBUS TRIBE.
DD. Pistils inclosed in the tubular- or urn-shaped receptacle (hypanthium)
E Number of pistils 1 or 4, petals sometimes wanting
F. Hypanthium tubular or campanulate, the achenes loosely and usually only partly inclosing, pistils usually 1 shrubs 8 CERCOCARPUS
FF Hypanthium urceolate, completely inclosing the 1–4 achenes, sepals usually 4 herbs or shrubs 10 SANGUISORBA
EE. Number of pistils many, calyx-tube becoming fleshy, petals present shrubs with odd-pinnate lvs 11. ROSE TRIBE.
BB. Carpels 1, rarely 2 fr drupaceous: calyx usually deciduous
C. Fls symmetrical, style subterminal ovules pendulous, radicles superior . . 12. PRUNUS TRIBE.
CC. Fls often unsymmetrical, style basilar ovules ascending, radicles inferior . . 13. CHRYSOBALANUS [TRIBE.

II. Key to the Tribes.

1. Spiræa Tribe.

A. Pistils opposite to the petals or less than 5
B. Lvs simple, often lobed, rarely pinnatifid: stamens inserted on the margin of the hypanthium shrubs, rarely undershrubs
C. Stipules large, caducous staminal disk wanting seeds shining, crustaceous
D. Follicles dehiscent along both sutures, often inflated, 1–5 fls. in terminal corymbs 1. *Physocarpus.*
DD. Follicles dehiscent only along the ventral suture, 1–2, not inflated
E Fls in terminal panicles, style terminal, pistils, 2, rarely 1. follicles usually 5-seeded 2. *Neillia.*
EE. Fls in small terminal corymbs, style lateral, pistil 1 follicles 1-or rarely 2-seeded . . 3. *Stephanandra.*
CC. Stipules wanting. staminal disk usually present seeds dull.
D. The lvs entire, serrate or lobed: stamens free.
E. Carpels free.
F. Fls in panicles, corymbs or umbel-like racemes, carpels dehiscent along the ventral suture; lvs. usually serrate or lobed..... 4. *Spiræa.*
FF. Fls. in racemes; carpels dehiscent on both sutures lvs entire, evergreen cespitose undershrub 5 *Petrophytum.*
EE. Carpels connate at the base, fls polygamo-dioecious, in panicles lvs. entire, deciduous upright shrub . 6 *Sibræa*
DD. The lvs. twice trifid, stamens connate at the base fls. in racemes prostrate undershrub. . . . . 7. *Luetkea.*
BB. Lvs. 2–3-pinnate. fls. dioecious, in ample panicles composed of slender spikes. herbs . . . . 8 *Aruncus.*
AA. Pistils opposite to the sepals, 5.
B. Petals roundish, imbricate in the bud, carpels connate at the base lvs pinnate or bipinnate shrubs
C. Lvs pinnate, lfts coarsely serrate 9 *Sorbaria.*
CC Lvs bipinnate, segms minute, entire .10 *Chamæbatiaria.*
BB. Petals strap-shaped, convolute in the bud: carpels distinct lvs ternate herbs ....11. *Gillenia.*

2. Quillaja Tribe.

A. Carpels free, spreading, star-like at maturity: evergreen trees.
B Stamens 10 . 12 *Quillaja.*
BB Stamens 20 . . 13 *Kageneckia.*
AA. Carpels connate into a 5-celled caps : stamens 15–20 deciduous shrub . . . 14 *Exochorda.*

3. Holodiscus Tribe.

Lvs. doubly serrate or slightly lobed 15. *Holodiscus.*

4. Pome Tribe.

A. Carpels bony at maturity fr hence with 1–5 stones
B. Pistils with 2 fertile ovules. lvs. entire or crenate
C Lvs entire spineless shrubs styles 2–5 16 *Cotoneaster.*
CC. Lvs. crenate, persistent usually spiny shrubs styles 5 17. *Pyracantha.*
BB Pistils with only 1 fertile ovule lvs usually doubly serrate or lobed
C. Ovules 2, 1 fertile and 1 sterile lvs simple, often pinnately lobed
D. Number of carpels 5, wholly connate and covered at the top by the flesh of the fr fls solitary, 2 in across lvs entire or occasionally dentate 18 *Mespilus.*
DD. Number of carpels 1–5, more or less distinct at the ventral suture and free at the top fls 1 in or less across, usually in corymbs lvs often lobed 19 *Crataegus.*
CC Ovule but 1, stones 5 lvs pinnate (the simple-lvd species belong to Hespeco-meles, which is not in cult.) 20 *Osteomeles.*
AA. Carpels with leathery or papery walls at maturity fr hence 1–5-celled, each cell with 1 or 2, rarely many seeds
B Fls in compound corymbs
C Styles 1–5, distinct or connate, carpels partly free
D Fr solid and pointed at the top, walls of cells leathery lvs deciduous, simple or pinnate
E. Sepals deciduous lvs always simple, serrate with excurrent veins styles 2–3 21 *Micromeles.*
EE. Sepals persistent
F. Number of styles usually 2, rarely 3 or 5, free or connate lvs pinnate or simple and serrate or lobed with excurrent veins, deciduous 22 *Sorbus.*
FF Number of styles 3–5 lvs serrate to crenulate, with curving veins.
G. Lvs deciduous, with glands on the midrib above styles 5, connate below endocarp thin 23 *Aronia.*
GG. Lvs evergreen, without glands on the midrib styles 3–5 endocarp firm 24 *Stranvæsia.*
DD. Fr. hollow and rounded at the top, small, 1- or 2-seeded, walls usually papery styles usually 2 lvs simple, deciduous or evergreen with curving veins . 25 *Photinia.*
CC. Styles 5, distinct, carpels wholly connate fr pear-shaped, rather large, yellow. lvs. evergreen with excurrent veins.. 26 *Eriobotrya.*
BB. Fls in umbels, racemes or solitary
C. The carpels 4- to many-seeded
D. Styles free lvs entire . 27. *Cydonia.*
DD. Styles connate at the base lvs. serrate or serrulate.
E. Ovules many in each cell calyx glabrous outside . 28. *Chænomeles.*
EE. Ovules 4–5 in each cell, calyx densely tomentose outside. . . . . 29. *Docynia.*
CC. The carpels 1–2-seeded.

DD. Cells of the ovary as many as styles, each with 2 ovules.
B. Ovary 2-celled: fr 1-2-seeded, black fls in upright racemes, sometimes paniced lvs. evergreen 30. *Raphiolepis.*
BB. Ovary 3-5-celled. fls in umbels lvs deciduous 31. *Pyrus.*
DD. Cells of the ovary twice as many as styles, each with 1 ovule
E. Styles usually 5, fls. in racemes lvs serrate, or crenate at the apex 32. *Amelanchier.*
EE. Styles 2-3, fls in few-fld umbels, calyx-tube cylindric. lvs entire or denticulate, narrow.... . . . 33. *Peraphyllum.*

5. Kerria Tribe.

A. Petals wanting; fls. in few-fld corymbs: achenes 2-5, drupaceous 34. *Neviusa.*
AA Petals present, fls solitary, large
B. Lvs alternate fls 5-merous, yellow: achenes drupaceous, yellow 35 *Kerria*
BB. Lvs opposite fls 4-merous, white achenes dry, black 36 *Rhodotypus*

6. Potentilla Tribe.

A. Style deciduous
B Receptacle in fr much enlarged, colored.
C Fls white receptacle pulpy, juicy 37 *Fragaria*
CC Fls yellow receptacle dry 38 *Duchesnea*
BB. Receptacle not fleshy, even in fr.
C Pistils only 1-12
D Stamens 5, petals minute 39 *Sibbaldia*
DD Stamens numerous, petals conspicuous 40 *Waldsteinia.*
CC Pistils very numerous
D Petals white or yellow, obtuse or emarginate 41 *Potentilla*
DD Petals purple, abruptly acuminate, much smaller than calyx 42 *Comarum*
AA Style elongated after anthesis, often plumose
B Fls 5-merous lvs pinnate or pinnatifid
C Sepals valvate, hypanthium flat herbs 43 *Geum*
CC Sepals imbricate, hypanthium concave shrubs
D Calyx with bracts outside 44 *Fallugia*
DD Calyx without bracts 45 *Cowania*
BB. Fls 8-9-merous lvs undivided prostrate undershrub 46. *Dryas*

7. Rubus Tribe.

A. Drupelets pulpy 47 *Rubus*
AA. Drupelets nearly dry, inclosed by calyx . 48 *Dalibarda.*

8. Cercocarpus Tribe.

A. Fls. apetalous, style elongated and plumose in fr ; hypanthium tubular 49 *Cercocarpus.*
AA. Fls with petals
B. Style with terminal stigma: lvs. linear, needle-shaped .. 50. *Adenostoma.*
BB Style with decurrent stigma
C Lvs 3-fid at the apex sepals imbricate fr inclosed about half 51 *Purshia*
CC. Lvs bipinnate sepals valvate. fr inclosed 52. *Chamæbatia.*

9. Ulmaria Tribe.

Herbs with large pinnate lvs and large stipules and small white or pink fls. in large panicles. ..53. *Filipendula.*

10. Sanguisorba Tribe.

A. Calyx with 5-6 bractlets or 10-12-cut in 2 series or in Agrimonia with a setose limb.
B. Petals 0 .. 54 *Alchemilla*
BB Petals 4 or 5 55 *Agrimonia.*
AA Calyx without bractlets, petals 0 lvs pinnate.
B Fls axillary, solitary 56 *Margyricarpus.*
BB. Fls. spicate or capitate
C. The calyx valvate, stamens 1-10, short, carpels 1-2 . 57. *Acæna.*
CC. The calyx imbricate
D. Fr rarely rugose fls usually bisexual; carpel 1, stamens 4-12 58. *Sanguisorba.*
DD. Fr. often rugose fls polygamo-dicecious, rarely bisexual; carpels 2, stamens ∞ . .....59. *Poterium.*

11. Rose Tribe.

The only genus.....60. *Rosa.*

12. Prunus Tribe.

A. Sepals usually 10, small, petals often wanting or small, carpels in the staminate fl. 2, 1 in the fertile fl.....61. *Maddenia.*

AA. Sepals 5
B. Carpels solitary
C. Style terminal: lvs. usually serrate: pith of branches solid 62 *Prunus.*
CC. Style lateral. lvs entire. pith lamellate. 63. *Prinsepia.*
BB. Carpels 5 lvs. entire .. 64 *Osmaronia.*

13. Chrysobalanus Tribe.

Anthers small, short, didymous, ovary 1-loculed, inserted in the base of the calyx-tube, stamens 15 or more . 65. *Chrysobalanus.*

The genus Plagiospermum is also cultivated.

72. SAXIFRAGACEÆ.

I. Summary of Tribes.

A Plants are trees or shrubs
B Lvs opposite 1 HYDRANGEA TRIBE.
BB Lvs alternate
C Stipules absent lvs often coriaceous or glandular-serrate stamens usually isomerous with petals 2 ESCALLONIA TRIBE
CC. Stipules absent or adnate to petiole at base fls generally racemose, ovary 1-locular, 2-merous, seeds immersed in pulp 3 RIBES TRIBE.
AA Plants are herbs
B Fls 4-merous 4 FRANCOA TRIBE.
BB Fls generally 5-merous 5. SAXIFRAGE TRIBE.

II. Key to the Tribes.

1. Hydrangea Tribe.

A Ovary superior
B Number of petals 4, stamens 10, filaments 2-lobed, styles 3 1 *Fendlera.*
BB Number of petals 5 or 6
C Ovules solitary stamens 4-12, styles 3-5 2 *Whipplea.*
CC Ovules 4 stamens 15, carpels 2, separate 3 *Lyonothamnus.*
CCC Ovules numerous
D Petals 5, convolute stamens 10, styles 3-5 4. *Jamesia.*
DD Petals 5 or 6, imbricate stamens numerous, style 1, with a 5-7-lobed stigma 5. *Carpenteria.*
AA Ovary inferior or semi-superior
B Stamens 8, 10 or 12
C. Petals induplicate or imbricate: fr capsular . . 6. *Deutzia.*
CC Petals valvate
D Fr a caps
E Styles 4 or 5, free or connate at the base, petals 4 or 5 7 *Hydrangea.*
EE Style 1, with a 4-5-lobed stigma, petals 5 8. *Schizophragma.*
DD Fr a berry petals 5 or 6 styles 3-5, club-shaped 9 *Dichroa.*
BB. Stamens ∞
C Petals induplicate, 7-10, style 1.....10. *Decumaria.*
CC Petals imbricate, styles 1-5 ..... 11 *Philadelphus.*
CCC Petals valvate
D Styles 2, petals 4 ..... 12 *Platycrater.*
DD. Styles 3, petals 5 . ... .13. *Cardiandra*

2. Escallonia Tribe.

A. Petals imbricate, style 1, ovary 2- or 3-loculed 14. *Escallonia.*
AA Petals valvate, styles divisible into 2, ovary 2-loculed 15. *Itea.*

3. Ribes Tribe.

The only genus . 16 *Ribes.*

4. Francoa Tribe.

Sepals and petals equal . . . . . .17. *Francoa.*

5. Saxifrage Tribe.

A. Ovary 1-loculed
B Placentæ basilar or nearly so 18 *Tiarella.*
BB Placentæ parietal, opposite the stigmas. 19. *Parnassia.*
BBB. Placentæ parietal, alternate with stigmas
C Stamens 3, petals 5, capillary . 20. *Tolmiea.*
CC Stamens 5-10
D. Caps not beaked, superior petals 5, 3-cut or pinnatifid . .....21. *Mitella.*
DD Caps 2-beaked.
E. Number of stamens 5; petals 5 or 0: caps. inferior... ..... 22. *Heuchera.*

EE. Nunber of stamens 8 or 10: caps. semi-superior
F. Petals 0, stamens 8 or 10; fls. solitary . . . 23. *Chrysosplenium.*
FF. Petals entire or lobed, stamens 10, fls racemose 24. *Tellima.*
AA. Ovary 2- or 3-loculed, the placentæ in the axis of the fr , rarely composed of distinct carpels.
B Stamens 5 (See also BB)
c Carpels united at base, adnate to hypanthium 25 *Sullivantia.*
cc Carpels united and wholly adnate to hypanthium . 26 *Suksdorfia.*
ccc Carpels 2, united at base, free from but included in the inflated hypanthium 27. *Bolandra.*
BB. Stamens 10, rarely 8 (sometimes 5 in Boykinia)
c. Sepals valvate
D Petals 0 . . 28 *Rodgersia.*
DD Petals 5, deciduous, stamens 5 or 10 29 *Boykinia.*
cc Sepals imbricate
D Styles erect, petals 5 or 0; stamens 8 or 10 30 *Astilbe*
DD. Styles mostly recurved in fr , petals 5 31 *Saxifraga.*

The following genera also are treated Abrophyllum, Anopterus, Bauera, Deinanthe, Leptarrhena, and Tanakæa.

73. CUNONIACEÆ.

A Calyx valvate
B Stamens hypogynous, very long 1 *Acrophyllum.*
BB Stamens perigynous 2 *Ceratopetalum.*
AA. Calyx imbricate, the lobes very short 3 *Cunonia*

74. CEPHALOTACEÆ.

The only genus *Cephalotus.*

75. CRASSULACEÆ.

A. Stamens usually as many as the petals
B Petals free or connate only at the base; floral parts in 5's 1 *Crassula.*
BB Petals usually connate to the middle or beyond
c. Calyx bell-shaped, as long as the corolla-tube 2 *Grammanthes.*
cc Calyx many times shorter than the corolla-tube 3. *Rochea*
AA Stamens usually twice as many as the petals
B Petals free or connate only at the very base
c Fls usually 4–5-merous 4 *Sedum*
cc Fls 6-merous or more 5 *Sempervivum*
BB Petals usually connate to the middle or beyond
c Calyx large, inflated shortly 4-fid . 6 *Bryophyllum*
cc Calyx 4-parted . . 7 *Kalanchoë*
ccc Calyx 5-parted . . . 8 *Cotyledon.*

The following are also described Altamiranoa, Dudleya, Echeveria, Kitchingia, Lenophyllum, Oliveranthus, Pachyphytum, Stylophyllum, Tillæa, and Urbinia.

76. DROSERACEÆ.

A. Stamens 4–8, styles 2–5, placentæ parietal 1 *Drosera.*
AA. Stamens about 15, style columnar, placentæ basal . . 2 *Dionæa.*
AAA. Stamens 10–20, styles 5, filiform . 3. *Drosophyllum.*

77. HAMAMELIDACEÆ.

A. Ovary-locules 1-ovuled
B. Petals 0
C. Lvs evergreen
D. Stamens 2–8, with long filaments, fls. in racemes 1. *Distylium.*
DD. Stamens ∞, with short filaments, fls in heads, calyx-tube in the pistillate fl. tubular 2. *Sycopsis.*
CC. Lvs deciduous
D Number of stamens about 24; fls. in dense spikes 3. *Fothergilla.*
DD. Number of stamens 5–7
E. Calyx-tube not urn-shaped, sepals and stamens 5–7, fls. in short head-like racemes . 4. *Parrotia.*
EE. Calyx-tube urn-shaped, much longer than ovary, sepals and stamens 5, fls in long and slender racemes . 5. *Sinowilsonia.*
BB. Petals as many as calyx-lobes
C Fls borne in catkins, 5-merous.
D Shape of petals broad, stamens with long-filament, disk present . 6. *Corylopsis.*
DD. Shape of petals subulate, as long as sepals, stamens nearly sessile, disk 0.. 7. *Fortunearia.*
CC. Fls in clusters, 4-merous
D Lvs deciduous, crenate anthers obtuse, the locules opening with 1 valve. 8. *Hamamelis.*
DD Lvs persistent, entire anthers beaked, the locules opening with 2 valves. . 9. *Loropetalum.*
AA Ovary-locules 2- or more-ovuled
B Fls unisexual . . . 10. *Liquidambar.*
BB Fls bisexual
C The fls 5, in a head, surrounded by an involucre of which the outer bracts are small, the inner gradually larger 11 *Rhodoleia.*
CC. The fls 2 together with very short bracts at the base 12 *Disanthus.*

78. BRUNIACEÆ.

In cultivation *Audouinia*
(See article Diosma.)

79. HALORAGIDACEÆ.

A Stamens 1–2, calyx 3–4-lobed, ovary 1-loculed 1 *Gunnera*
AA Stamens 2–8, calyx truncate or 4-toothed, ovary deeply 2- or 4-grooved 2 *Myriophyllum.*
AAA Stamen 1, calyx truncate, ovary 1-loculed . 3 *Hippuris*

80. RHIZOPHORACEÆ.

A. Anthers 8, subsessile 1 *Rhizophora.*
AA Anthers 15–30, on filaments 2 *Cassipourea.*

81. COMBRETACEÆ.

A Petals 0, calyx-tube not produced beyond ovary 1 *Terminalia.*
AA Petals 5 (0 in a few species of Combretum)
B Calyx-tube straight, constricted above ovary
c Cotyledons convolute 2 *Poivrea.*
cc Cotyledons deeply furrowed or twisted and plaited 3 *Combretum.*
BB Calyx-tube produced to a great length beyond the ovary 4 *Quisqualis*

82. MYRTACEÆ.

A Ovary 1-loculed 1 *Thryptomene.*
AA Ovary 2- or more-loculed
B Fr a caps , which is loculicidally dehiscent at apex, rarely 1–2-seeded and subindehiscent
C Anthers basifixed .. .. 2. *Calothamnus.*
CC. Anthers versatile
D Individual fls pedicelled.
E Stamens 5-adelphous . ..... 3. *Tristania.*
EE Stamens free
F Fls in globose heads . ..... 4 *Syncarpia.*
FF Fls in forking cymes . .. . 5 *Metrosideros.*
DD. Individual fls not pedicelled.
E Fls solitary in the axils of the floral lvs or bracts
F Stamens distinct, not longer than petals . .. 6 *Leptospermum.*
FF Stamens distinct, long-exserted 7. *Callistemon.*
FFF Stamens united in clusters, long-exserted . . 8 *Melaleuca.*
EE Fls in cymose or umbellate heads
F Petals distinct 9. *Angophora.*
FF Petals wanting (or adnate to the calyx-lid) .10 *Eucalyptus.*
BB Fr. a berry or rarely an indehiscent drupe: lvs opposite, punctate
C. Stamens straightish in the bud. seeds with endosperm . . . 11. *Feijoa.*
CC Stamens inflexed or involute in the bud: seeds without endosperm
D. Calyx-limb closed in bud, deeply divided in anthesis . . .12 *Psidium.*
DD. Calyx 4–5-lobed or -parted in the bud, not cut deeper in antheses

EE. Ovules pendulous..... .....13. *Pimenta.*
EE. Ovules not pendulous
F Embryo thick and fleshy 14 *Eugenia.*
FF. Embryo curved, circular or spiral
G The ovary 2–3- rarely 4-loculed: ovules in each locule ∞ 15. *Myrtus.*
GG The ovary several-loculed by false septa, each ultimate locule 1-ovuled 16. *Rhodomyrtus*

Other genera treated incidentally are Backhousia, Barringtonia, Beaufortia, Blepharocalyx, and Kunzea.

83. LECYTHIDACEÆ.

A. Fr woody calyx mostly imbricate
B The fr large and spherical, not opening 1 *Couroupita.*
BB The fr opening by a lid.
C Style elongated 2 *Bertholletia*
CC Style short 3 *Lecythis*
AA Fr fibrous calyx subvalvate or imbricate
B Petals 6–8 4 *Japarandiba*
BB Petals 4 (rarely 5) 5 *Barringtonia.*
AAA Fr fleshy calyx mostly valvate or entire
B Ovary 4-loculed 6 *Grias*
BB Ovary 5-loculed 7 *Napoleona.*

84. MELASTOMACEÆ.

I. Summary of Tribes.

Excluding five tribes not represented in this work, and following Cogniaux in D C Monog Phaner vol 7 (1891)

A. Fr capsular (rupturing regularly in Melastoma) stamens usually unequal
B Caps and ovary 3–5-angled or winged, much dilated and hollowed out at apex
C Ovary-cells as many as petals 1 SONERILA TRIBE.
CC Ovary 3-loculed petals 5, rarely 4 2 BERTOLONIA TRIBE
BB Caps, and ovary terete or angular, convex or conical at the top
C Connective rarely produced below the locules, usually with posterior spur or appendage 3 RHEXIA TRIBE
CC Connective usually elongated at the base, produced beyond the insertion of the filament into an appendage or wing on the anterior side
D Seeds shaped like a snail-shell
E Ovary generally partly or wholly inferior sepals usually alternating with long, stellate hairs 4 OSBECKIA TRIBE
EE Ovary generally superior, no stellate hairs 5 TIBOUCHINA TRIBE.
DD Seeds oblong or ovoid 6 MICROLICIA TRIBE.
AA. Fr berry-like or leathery, rupturing irregularly stamens generally equal
B Lvs not finely striate between the primary nerves
C Connective usually appendaged or spurred on the posterior side 7 DISSOCHÆTA TRIBE.
CC Connective rarely produced at the base, usually not appendaged 8 MICONIA TRIBE.
BB. Lvs finely striate between primary nerves with very numerous transverse nerclets 9 BLAKEA TRIBE.

II. Key to the Tribes.

1. Sonerila Tribe.

A. Fls. 5-merous, stamens equal, connective with a posterior spur but no anterior appendage 1 *Gravesia.*
AA. Fls mostly 4-merous, stamens unequal, those opposite petals smaller 2. *Sonerila.*
AAA. Fls. mostly 4-merous, stamens equal, connective not produced 3. *Phyllagathis.*

2. Bertolonia Tribe.

A. The connective not appendaged on the anterior side.
B. Connective tuberculate on the posterior side at the base . . . . 4. *Bertolonia.*
BB. Connective with a short posterior spur and a long appendage . . . 5. *Salpinga.*
AA. The connective with a spur on the anterior side and a tubercle on the posterior side..... .. 6. *Monolena.*

3. Rhexia Tribe.

Stamens equal or subequal: ovary glabrous..... 7. *Rhexia.*

4. Osbeckia Tribe.

Stamens unequal, connective of the larger ones long-produced at base: fr. baccate fls. not involucrate .... 8. *Melastoma.*

5. Tibouchina Tribe.

A. Stamens unequal ovary 2–4-celled, usually glabrous, petals not acute, connective of larger stamens with a long, club-shaped, 2-fid appendage 9 *Heeria.*
AA. Stamens equal ovary setose at apex, connective with 2 lobes or tubercles on the anterior side, and no posterior appendage 10 *Tibouchina.*

6. Microlicia Tribe.

Stamens unequal, anthers short, not beaked; calyx-lobes shorter than tube .... 11. *Centradenia.*

7. Dissochæta Tribe.

Stamens equal or nearly so, fls mostly 4–5-merous . .12 *Medinilla.*

8. Miconia Tribe.

A Infl terminal
B Lvs provided with 2-lobed bladders at base 13. *Tococa.*
BB Lvs not provided with bladders outer calyx-lobes none or inconspicuous 14 *Tamonea.*
AA Infl lateral or axillary, petals obtuse, connective not produced at base 15 *Clidemia.*

9. Blakea Tribe.

The plants described as Amaraboya are now referred to the genus Blakea 16 *Blakea.*

Calvoa, Dissotis, Kendrickia, and Osbeckia are also cultivated.

85. LYTHRACEÆ.

A Hypanthium tubular, curved or gibbous at base 1 *Cuphea.*
AA Hypanthium straight
B Caps and ovary all included in hypanthium
C Petals 5, rarely 4, stamens 8–10 2 *Decodon*
CC Petals 6, stamens mostly 6 or 12 3 *Lythrum*
BB Caps not all included in hypanthium
C The sepals 4, petals 4, stamens 8 4 *Lawsonia.*
CC The sepals 6, petals 6, stamens numerous 5 *Lagerstræmia.*

86. PUNICACEÆ.

The only genus . *Punica.*

87. ONAGRACEÆ.

A Ovary 1–4-celled, cells 1-ovuled, rarely 2–4-ovuled fr nut-like, 1–4-celled, 1–4-seeded.
B Fls 2-merous, ovary 1–2-celled 1. *Circæa.*
BB Fls 3–4-merous, ovary 4-celled, rarely 3-celled 2 *Gaura.*
AA Ovary 2 6-celled, cells many-ovuled. fr. a caps (in Fuchsia a berry)
B Stamens 1 or 2 .. . 3 *Lopezia.*
BB Stamens 4–8, rarely 3
C Seeds bearded
D Hypanthium broadened out above ovary into a funnel-shaped tube 4 *Zauschneria*
DD Hypanthium hardly produced beyond ovary 5 *Epilobium.*
CC Seeds not bearded or winged
D Hypanthium usually long-produced beyond ovary (except in some Œnotheras)
E Number of stamens 4 6 *Eucharidium*
EE Number of stamens 8
F Fr a caps . . 7 *Œnothera.*
FF Fr a berry 8 *Fuchsia*
DD Hypanthium not or hardly produced beyond ovary
E Caps loculicidal . . 9 *Clarkia.*
EE Caps septicidal
F Stamens 8–12 10 *Jussieua.*
FF Stamens 3–6 . . 11. *Ludwigia.*

88. TRAPACEÆ.

The only genus . . .. *Trapa.*

89. LOASACEÆ.

A. Petals hooded.
B Caps. 3–5-valved at apex, rarely twisted — 1. *Loasa.*
BB. Caps longitudinally 5-10-valved, usually twisted spirally — 2 *Blumenbachia.*
BBB Caps narrow, straight, longitudinally 5-valved — 3. *Scyphanthus.*
AA. Petals not hooded.
B Seeds very numerous, arranged in many series — 4. *Eucnide.*
BB. Seeds few or, if numerous, arranged in 2 series — 5. *Mentzelia.*

90. PASSIFLORACEÆ.

A. Hypanthium long; petals and stamens 5 — 1 *Tacsonia.*
AA Hypanthium short, petals 4–5, rarely 0, stamens 4–5 — 2 *Passiflora.*
AAA Hypanthium medium or short; fls unisexual — 3. *Modecca*

91. CARICACEÆ.

In cultivation — *Carica.*

92. CUCURBITACEÆ.

I. Summary of Tribes.

A Series 1 Ovules horizontal — 1. CUCURBITA TRIBE
AA. Series 2 Ovules erect or ascending, rarely horizontal
B. Fr. ruptures elastically — 2 CYCLANTHERA [TRIBE.
BB Fr. does not rupture elastically — 3 ABOBRA TRIBE
AA. Series 3. Ovules pendulous — 4 SICYOS TRIBE

II. Key to the Tribes.

1. Cucurbita Tribe.

A. Anther-cells straight, rarely curved, not flexuous — 1. *Melothria.*
AA. Anther-cells flexuous or conduplicate
B. Corolla bell-shaped, 5-lobed to the middle or a little below
C. Anthers free — 2 *Sicana*
CC. Anthers coherent
D Filaments connate — 3 *Coccinia*
DD Filaments free — 4 *Cucurbita.*
BB Corolla rotate and 5-petaled or bell-shaped and 5-parted to the base
C Petals fimbriate or tendril-bearing
D Seeds large, fibrous — 5 *Telfairea*
DD Seeds small, not fibrous — 6. *Trichosanthes.*
CC Petals entire
D Hypanthium of male fls long, anthers coherent in an oblong head, usually included
E Pistillodes in male fls 1–3, subulate or setiform — 7. *Gymnopetalum.*
EE Pistillode absent or reduced to a gland
F Anthers coherent — 8 *Peponia*
FF Anthers free — 9. *Lagenaria.*
DD Hypanthium of male fls short, anthers free or slightly coherent, usually exserted
E Stamens inserted in the mouth of the hypanthium
F Scales in bottom of hypanthium — 10 *Thladiantha.*
FF Scales in bottom of hypanthium 2 3 — 11. *Momordica.*
EE. Stamens inserted in hypanthium
F Male fls in racemes
G Fr dry, fibrous, dehiscent by lid at top — 12 *Luffa.*
GG Fr fleshy, not fibrous
H Female fls solitary — 13. *Eballium.*
HH Female fls racemose or clustered — 14. *Bryonia.*
FF. Male fls solitary or fascicled.
G Sepals somewhat leafy, serrate, reflexed — 15. *Benincasa.*
GG. Sepals awl-shaped, entire, erect
H Pollen minutely muricate, pistillode 0 — 16. *Bryonopsis.*
HH Pollen smooth, pistillode reduced to a small gland
I Tendrils not branched connective usually produced upward beyond locule — 17. *Cucumis.*
II. Tendrils 2–3-fid connective not produced. — 18. *Citrullus.*

2. Cyclanthera Tribe.

A Fr. oblique, gibbous, rupturing elastically — 19. *Cyclanthera.*
AA. Fr not gibbous, opening by 1 or 2 pores at the top or by irregular rupture — 20 *Echinocystis.* (Incl Megarrhiza)

3. Abobra Tribe.

Anther-cells flexuous, stamens free — 21. *Abobra*

4. Sicyos Tribe.

Fls. 5-merous, monœcious fr. fleshy — 22 *Sechium.*

The genera Actinostemma, Gurania, Herpetospermum, Hodgsonia and Sicyos are sometimes cultivated

93. BEGONIACEÆ.

A. Ovary wholly inferior
B Petals all free — 1 *Begonia*
BB Petals of pistillate fl grown together — 2 *Symbegonia.*
AA. Ovary partly superior — 3 *Hillebrandia.*

94. CACTACEÆ.

A Fl.-tube wanting
B Lvs large and persistent
C Seeds black and shining — 1 *Pereskia*
CC Seeds white, dull and covered with hairs — 2. *Pereskiopsis.*
BB Lvs wanting or minute and caducous
C Plant epiphytic, spineless fls small
D Flowering joints bottle-shaped — 3 *Hariota*
DD Flowering joints not bottle-shaped — 4 *Rhipsalis*
CC. Plant not epiphytic, usually very spiny fls large
D. Petals spreading, filaments much shorter than the petals — 5 *Opuntia.*
DD. Petals erect and closely surrounding the stamens, filaments longer than the petals — 6 *Nopalea.*
AA Fl.-tube present, often much elongated
B Plants epiphytic or nearly so, either flat or 3-angled, usually spineless and always with spineless fr
C Sts 3-angled, bearing small spines at the areoles ovary and fr bearing large bracts — 7 *Hylocereus.*
CC Sts normally flat, spineless ovary and fr bearing only minute bracts
D The sts weak, divided into many short joints
E Fls irregular — 8 *Zygocactus*
EE Fls regular — 9 *Schlumbergera.*
DD. The sts stouter than the last, with elongated joints
E Fl.-tube very short or nearly wanting — 10 *Disocactus*
EE Fl.-tube very definite, often much elongated
F Fls small, diurnal — 11 *Wittia*
FF Fls large, nocturnal — 12 *Epiphyllum.*
BB. Plants not epiphytic, never flat, with several to many ribs
C. Sts globular or cylindrical, not jointed
D. Plant-body covered with more or less definite tubercles fr naked
E The plant terminated by a cephalium — 13 *Cactus.*
EE The plant without a terminal cephalium
F Without spines except in the seedlings
G Plant tumid, without woody tubercles — 14 *Lophophora.*
GG Plant with dry prominent woody tubercles — 15 *Ariocarpus.*
FF. With spines on the tubercles
G Tubercles terete or angled, with various kinds of spines — 16 *Mammillaria*
GG. Tubercles flattened, with pectinate spines — 17. *Pelecyphora.*
DD. Plant-body covered with more or less definite ribs fr scaly
E. Tubercles elongated, finger-like — 18 *Leuchtenbergia.*
EE Tubercles, if present, always low
F Top of plant naked or nearly so — 19. *Echinocactus.*
FF. Top of plant very woolly — 20. *Malacocarpus.*
CC. Sts. often tall, cylindrical, more-or-less branched, erect or climbing, sometimes low and then always with spiny fr.
D. Flowering plants taking on various forms like a cephalium, long hairs or wool, peculiar bristles or spines from near the top.
E Ribs of sts. 4–7 — 21. *Lophocereus.*
EE. Ribs of sts. many.

F. Fls. diurnal; flowering areoles with acicular spines, but no wool 22. *Carnegiea.*
FF Fls. nocturnal, wool or hairs usually produced in abundance with the fls
G. Ovary and fr nearly smooth, the few minute bracts with no hairs in their axils 23. *Cephalocereus.*
GG Ovary and fr covered with bracts with long hairs in their axils 24. *Oreocereus*
DD. Flowering plants not different from the sterile plants
E. Plants tall erect trees
F. Fl, after withering, dropping from the ovary 25. *Cereus.*
FF. Fl, after withering, persisting on the ovary
G. Fr and fls minute, often several coming from each flowering areole 26. *Myrtillocactus.*
GG. Fr and fls medium-sized or larger, only 1 coming from each flowering areole
H Ovary and fr covered with thin scales, but no fls 27. *Escontria.*
HH. Ovary and fr spiny but not bearing large chartaceous scales
I. The fr edible, juicy 28. *Lemaireocereus.*
II The fr dry 29 *Pachycereus.*
EE. Plants low, often vines, or, if at first elongated and erect, finally becoming procumbent or clambering
F. Fls. nocturnal
G Fr smooth, yellow 30 *Harrisia.*
GG Fr spiny, red
H Sts producing an abundance of aerial roots 31 *Selenicereus.*
HH Sts not producing an abundance of aerial roots
I Ribs usually 3 32 *Acanthocereus*
II Ribs 10 or more 33 *Nyctocereus*
FF Fls diurnal
G The fls irregular, narrow
H Sts slender, weak 34 *Aporocactus.*
HH Sts stout, at first erect
I Fr spiny, with red pulp 35 *Rathbunia*
II Fr not spiny, with white pulp 36 *Cleistocactus.*
GG The fls regular
H Fl-tube much elongated, spines on the ovary reduced to stiff bristles 37. *Echinopsis.*
HH Fl-tube short, at least never much elongated
I Plants producing a cluster of tubers 38 *Wilcoxia.*
II Plants without tubers
J Usually stout but low, sometimes procumbent stigmas green 39. *Echinocereus.*
JJ. Very slender, stigmas not green
K Fls small, yellow 40 *Bergerocactus.*
KK Fls large, red or white 41. *Heliocereus.*

Epiphyllanthus and Pterocactus are described.

95. AIZOACEÆ.

A. Petals numerous: caps 5- or more valved..... 1. *Mesembryanthemum.*
AA. Petals 0 drupe 3–8-stoned .. .. .. 2. *Tetragonia.*
AAA. Petals 5–∞. caps circumscissile.... . .... 3. *Sesuvium.*

96. UMBELLIFERÆ.

Key condensed from Coulter & Rose's "Monograph of North American Umbelliferæ" Not arranged in sequence of relationship.

A. Fls in dense heads ... ... 1. *Eryngium.*
AA. Fls. not in heads, evidently umbellate.
B Fr. conspicuously bristly
C The fr covered with spines or hooked bristles . 2. *Sanicula.*
CC The fr. with bristles only on the ribs .. .. 3. *Daucus.*
BB. Fr not bristly (except Osmorhiza and Cumnum)
C. Oil-tubes obsolete or obscure.
D The fr strongly flattened laterally. lvs. simple . 4. *Hydrocotyle.*
DD The fr not strongly flattened.
E. Seed-face concave.
F. Stylopodium conical
a. At base, fr. attenuate..... 5. *Osmorhiza.*
GG. At base, fr rounded.
H Ribs slender . .. 6. *Scandix.*
HH Ribs broad, 3-angled, or almost wing-like . . 7. *Myrrhis.*
FF. Stylopodium flat or wanting.
G Lvs simple and perfoliate 8. *Bupleurum.*
GG Lvs large and decompound 9 *Conium*
EE. Seed-face plane 10. *Ægopodium.*
CC. Oil-tubes distinct
D. Dorsally the fr strongly flattened, with lateral ribs more or less prominently winged (see Museneon)
E. The oil-tubes solitary in the intervals between the ribs, rarely 2
F Stylopodium conical
G Slender and glabrous plants 11 *Ozypolis.*
GG. Stout and pubescent, at least in the umbel 12. *Heracleum.*
FF. Stylopodium flat or wanting
G Plants caulescent and branching
H Color of fls white
I Lvs pinnately dissected, dorsal ribs filiform plant slender 13. *Anethum.*
II Lvs ternately or pinnately decompound dorsal ribs prominent but slender. plant stout 14. *Angelica.* (See Dill)
III Lvs pinnately decompound, dorsal ribs winged. plant stout 15 *Selinum.*
HH Color of fls yellow
I Dorsal ribs prominent 16 *Levisticum.*
II Dorsal ribs filiform 17 *Pastinaca*
GG Plants acaulescent or nearly so 18 *Lomatium.*
EE. The oil-tubes more than 1 in the intervals, usually several
F. Plants caulescent or nearly so fls yellow or white 18 *Lomatium.*
FF. Plants caulescent and branching
G Fr winged fls white 19. *Archangelica*
GG Fr not winged fls yellow 20 *Ferula.*
DD. Dorsally the fr not strongly flattened, usually more or less laterally flattened
E The oil-tubes solitary in the intervals between the ribs
F Stylopodium conical. lfts. linear or filiform
G Involucre wanting
H Fls white . . . 21 *Coriandrum.*
HH Fls yellow . 22 *Fœniculum.*
GG Involucre present
H Fls rose-color fr bristly .23 *Cuminum.*
HH Fls white fr smooth 24 *Carum*
FF Stylopodium flat or wanting.
G Fls white 25 *Apium*
GG Fls yellow. (See article Celery)
H Ribs equal, broad and corky 26 *Petroselinum.*
HH Ribs winged or filiform
I The ribs conspicuously winged 27 *Thaspium.*
II The ribs filiform 28. *Ziziа*
EE The oil-tubes more than 1 in the intervals
F Stylopodium conical 29 *Ligusticum.*
FF. Stylopodium flat or wanting
G Seed-face sulcate or decidedly concave
H Carpels flattened dorsally 30 *Musineon.*
HH Carpels strongly flattened laterally 31. *Erigenia.*
GG Seed-face plane or but slightly concave
H Ribs all filiform lfts entire 32. *Tænidia.*
HH Ribs corky at least the lateral
I Lvs simple and perfoliate. oil-tubes continuous about seed-cavity 8. *Bupleurum.*
II. Lvs. pinnate, usually serrate oil-tubes 1–3 in the intervals 33 *Sium.*

The following genera are also treated Aciphylla, Arracacia, Astrantia, Chærophyllum, Crithmum, Dorema, Hacquetia, Meum, Molopospermum, Peucedanum, Portenschlagia, and Seseli.

97. ARALIACEÆ.

A. Petals more or less imbricate, broadly affixed at base
B. Lvs pinnate
C. Lfts entire or indistinctly crenate: ovary 2-celled glabrous evergreen shrubs. 1. *Delarbrea.*
CC. Lfts. serrate ovary 2–5-celled herbs or small deciduous trees 2. *Aralia.*
BB. Lvs digitate, whorled. fls. in simple terminal umbels, styles 2–3, distinct in the fertile fls.: herbs. .... 3. *Panax.*

AA. Petals valvate
B. Pedicels jointed or fls sessile evergreen tropical or subtropical trees or shrubs.
C. Fls pedicelled
D. Lvs 1-3-pinnate ovary 1-10-celled, styles usually distinct 4. *Polyscias*
DD. Lvs digitate or occasionally simple styles 5, distinct 5. *Pseudo-*[*panax.*
CC. Fls. sessile, ovary usually 5-celled, rarely 1-4- or 6-12-celled endosperm usually ruminate lvs usually simple and lobed, rarely digitate 6. *Oreopanax.*
BB Pedicels not jointed
C. Lvs digitate
D Anthers 4-celled, ovary 10-celled, styles distinct evergreen 7 *Dizygotheca.*
DD Anthers 2-celled, styles usually connate
E Stipules wanting lvs deciduous ovary 2-5-celled 8 *Acantho-*[*panax.*
EE Stipules developed lvs evergreen ovary 5- to many-celled 9 *Schefflera.*
CC. Lvs simple, usually lobed
D Fls 4- or 8-12-merous lvs palmately lobed, large
E Styles, connate into a column fls 8-12-merous 10. *Trevesia.*
EE Styles distinct, 2 fls 4-merous lvs deciduous 11 *Tetrapanax.*
DD. Fls 5-merous, rarely 5-8-merous
E. With distinct styles
F Shrub, evergreen, unarmed styles 5 12 *Fatsia*
FF Shrub deciduous, prickly styles 2 13 *Echino-*[*panax.*
EE. With connate styles
F. Habit climbing endosperm ruminate lvs simple, usually lobed, evergreen 14 *Hedera.*
FF. Habit upright
G Ovary 5-8-celled, calyx indistinctly toothed lvs usually entire, occasionally 2-5-lobed, evergreen 15 *Gilibertia.*
GG. Ovary 2-celled, calyx with 5 short teeth lvs palmately lobed or digitate, deciduous 8 *Acantho-*[*panax.*

Meryta and Tupidanthus are also in cultivation

98. GARRYACEÆ.

The only genus *Garrya.*

99. NYSSACEÆ.

A. Ovary 1-celled, calyx minute, petals usually 5 pistillate and staminate fls in distinct heads with small deciduous bracts 1. *Nyssa.*
AA. Ovary 6-10-celled, perianth 0 in staminate fls, heads consisting of 1 pistillate fl and numerous staminate fls with 2 or 3 very large white bracts at the base 2. *Davidia.*

100. ALANGIACEÆ.

The only genus *Alangium.*

101. CORNACEÆ.

A. Fls. bisexual, usually in cymes, petals short, valvate, ovary 2-celled lvs. usually opposite . 1. *Cornus.*
AA. Fls. unisexual
B. Lvs opposite, evergreen fls in terminal panicles, ovary 1-celled 2 *Aucuba.*
BB. Lvs. alternate
C. Petals valvate, 4 fls. in few-fld cymes on the upper surface of the lvs . . 3. *Helwingia.*
CC. Petals imbricate, 5 fls. in terminal racemes or panicles . . . . . 4. *Griselinia.*

102. CAPRIFOLIACEÆ.

A. Corolla rotate or nearly so; limb regular; style short, deeply 2-5-cut.
B. Lvs. pinnately cut . . . . . 1. *Sambucus.*
BB. Lvs simple . . . . 2. *Viburnum.*
AA. Corolla tubular or bell-shaped, limb usually irregular, style long, usually with capitate stigma
B. Ovary 2-5-celled, all the cells 1-ovuled: herbs with rather small whorled fls 3. *Triosteum.*
BB. Ovary 3-4-celled, 1 or 2 cells 1-ovuled, the others with numerous ovules
C. Fr a berry, usually 2-seeded corolla campanulate or tubular-funneliform, nearly regular 4 *Symphori-*[*carpos.*
CC Fr a leathery achene
D. Achene inclosed between large peltate bracts corolla campanulate-funnelform, 2-lipped ovary 4-celled 5 *Dipelta.*
DD. Achene not inclosed between bracts ovary 3-celled, corolla nearly or quite regular
E Ovary narrow, sepals 2-5, large, persistent, corolla tubular or campanulate-funnelform 6 *Abelia*
EE Ovary subglobose, sepals 5, lanceolate deciduous, corolla campanulate-funniform trailing undershrub with the fls in pairs on slender upright stalks 7 *Linnæa.*
BBB Ovary 2 8-celled, the cells with many ovules or 1 cell empty
C Fr an achene or caps
D Stamens 4 fls in coalescent pairs inserted at unequal height, ovary 3-celled, often 1 cell empty fr an achene 8 *Kolkwitzia.*
DD Stamens 5 fls in cymes fr a 2-celled dehiscent caps 9 *Diervilla.*
CC Fr a berry
D Cells of ovary 2-3, rarely 4-5 fls in pairs or whorls, calyx deciduous 10 *Lonicera*
DD Cells of ovary 5-8 fls in whorls, calyx persistent . . . . . 11. *Leycesteria.*

Alseuosmia is also briefly treated.

103. RUBIACEÆ.

I. Summary of Tribes.

Ignoring exceptions and omitting eight tribes not within the scope of this work

A Number of ovules in each locule ∞
B Fr dry, capsular or 2-5-berried or nutlike
C Fls compacted or confluent into a spherical head 1 NAUCLEA TRIBE.
CC Fls not disposed in a spherical head
D Seeds winged or appendaged, with endosperm caps 2-celled. 2. CINCHONA TRIBE.
DD Seeds not winged
E Corolla valvate
F The seeds with endosperm: caps 2-celled 3. CONDAMINEA
FF The seeds minute fr indehiscent, 2-berried or capsular, 2 4-celled [TRIBE. 4. HEDYOTIS TRIBE
EE Corolla imbricate or convolute caps 2-celled, seeds with endosperm 5 RONDELETIA
BB Fr fleshy, bursting irregularly or dehiscent at apex, or a drupe with 2 or more stones, the stones many-seeded [TRIBE.
C Corolla valvate seeds numerous, minute, angled 6 MUSSÆNDA TRIBE.
CC Corolla imbricate or convolute seeds numerous, minute, often angled 7. HAMELIA TRIBE.
CCC. Corolla strictly convolute seeds numerous or few, large and compressed or smaller and angled 8. GARDENIA TRIBE.
AA. Number of ovules in each locule 1
B Radicles superior
C Stamens inserted at base of corolla, corolla valvate or imbricate 9. CHIOCOCCA TRIBE.
CC. Stamens inserted at throat of corolla
D Corolla strictly convolute 10 ALBERTA TRIBE.
DD Corolla valvate 11. VANGUERIA TRIBE.
BB. Radicles inferior
C Corolla strictly convolute 12. IXORA TRIBE.
CC. Corolla valvate
D. Ovules affixed to septum, rarely basilar, generally amphitropous trees and shrubs 13 MORINDA TRIBE.
DD. Ovules affixed to septum, amphitropous or anatropous herbs 14. GALIUM TRIBE.
DDD. Ovules basilar, erect, anatropous.
E. Stamens inserted on the throat of the corolla fr indehiscent style entire or with short branches .15. PSYCHOTRIA TRIBE.

BE. Stamens inserted on the throat, rarely at base of corolla fr capsular or 2-berried style-branches filiform. 16. PÆDERIA TRIBE.
BEE. Stamens inserted at base of corolla, rarely on throat fr. berry-like or indehiscent. style entire or with long branches . 17. ANTHOSPERMA [TRIBE.

II. Key to the Tribes.

1. Nauclea Tribe.

Calyx-tubes confluent fr a globose, fleshy syncarp ovary 2-celled, ovules solitary, pendulous . . . . . 1. *Cephalanthus.*

2. Cinchona Tribe.

A. Corolla valvate
B Placentæ ascending from the base of the septum, or erect 2. *Manettia.*
BB Placentæ adnate to the middle of the septum
c Caps septicidal 3 *Cinchona*
cc Caps loculicidal 4 *Bouvardia.*
AA Corolla imbricate, stamens inserted in the throat
B Sepals never bract-like 5. *Luculia.*
BB One of the sepals in some fls in each infl developing into a large white persistent appendage 6 *Emmenopterys.*

3. Condaminea Tribe.

One calyx-lobe dilated into an ample colored blade 7. *Pinckneya.*

4. Hedyotis Tribe.

A Calyx-lobes unequal caps loculicidal . 8. *Pentas.*
AA. Calyx-lobes equal caps loculicidal at the top . . 9. *Houstonia.*

5. Rondeletia Tribe.

Corolla imbricate, lobes equal or nearly so 10. *Rondeletia.*

6. Mussænda Tribe.

Infl terminal, corymbose, ovary 1–2-celled, calyx-lobes 5, 1 dilated and colored. 11 *Mussænda*

7. Hamelia Tribe.

A Corolla 5-ribbed berry 5-celled 12 *Hamelia*
AA Corolla 4 5-lobed berry 2–3-celled 13. *Hoffmannia*

8. Gardenia Tribe.

A. Infl usually terminal
B Corolla-tube short . . 14 *Burchellia.*
BB Corolla-tube long
c Calyx 5-toothed 15 *Posoqueria.*
cc Calyx-lobes large and leafy . 16 *Ixpetalina*
AA Infl usually axillary
B Style has a spindle or club-shaped stigma, entire or 2-toothed
c Seed-coat membranous
D Calyx-limb various, ovary 2-celled . 17 *Randia.*
DD Calyx-limb often tubular, ovary 1-celled 18 *Gardenia.*
cc. Seed-coat fibrous or subfibrous
D Corolla-tube long and slender . 19. *Oxyanthus.*
DD Corolla-tube short
E Calyx 5-parted . . . 20 *Mitriostigma.*
EE Calyx truncate or 5-toothed ... 21 *Genipa.*
BB. Style-branches 2, distinct (except sometimes in Kraussia)
c Throat of corolla bearded 22 *Kraussia*
cc Throat of corolla glabrous . . 23. *Tricalysia.*

9. Chiococca Tribe.

Corolla valvate infl axillary, racemose, anthers dorsifixed, stigma club-shaped .. . 24. *Chiococca.*

10. Alberta Tribe.

Infl. terminal; the 2–4 calyx-lobes dilated, anthers pilose on back . . ..25. *Alberta.*

11. Vangueria Tribe.

A. Drupe 1–2-stoned . . . .26. *Plectronia.*
AA. Drupe 3–6-stoned.. . .....27. *Vanguera.*

12. Ixora Tribe.

A. Fls. clustered in axils . . . 28. *Coffea.*
AA. Fls. in 2–3-forking corymbs
B. Style-branches 2, short, rarely connate lvs. leathery 29 *Ixora.*
BB. Style very far exserted, the slender spindle-shaped stigma usually long lvs. usually membranous..... . .. 30. *Pavetta*

13. Morinda Tribe.

A. Fls confluent in heads, which are many-fld., solitary or umbellate 31 *Morinda.*
AA. Fls free, calyx-limb 4–5-fid, corolla villous at throat, stigma club-shaped, 2–4-lobed drupe 1–4-stoned infl. axillary . 32. *Damnacanthus.*

14. Galium Tribe.

A. Corolla funnel-shaped or somewhat tubular.
B. Fls 4-merous, with or without bracts, but no bractlets, style-branches subequal 33. *Asperula.*
BB Fls 4–5-merous, bracted and with 2 bractlets, style-branches unequal 34 *Crucianella.*
AA Corolla rotate or rotate-campanulate
B Fls 5-merous . 35 *Rubia.*
BB Fls. 4-merous . .... . 36 *Galium.*

15. Psychotria Tribe.

Infl terminal, calyx usually 5-toothed, corolla 5-lobed, rarely 4-lobed, tube usually short . 37. *Psychotria*

16. Pæderia Tribe.

A. Ovary 2-celled, stigma 2, capillary, twisted fr drupaceous twining plant 38 *Pæderia.*
AA. Ovary 5-celled fr a caps small upright shrubs . 39 *Leptodermis*

17. Anthosperma Tribe.

A Stamens inserted in throat, style-branches 4 40 *Mitchella.*
AA. Stamens inserted at or near base of corolla
B Fls bisexual, style shortly 2-cut shrub 41 *Serissa.*
BB Fls unisexual or bisexual, style 2-parted to the base or near it
c Plants are creeping herbs 42 *Nertera*
cc Plants are shrubs or small trees 43 *Coprosma*

Other genera incidentally described are Catesbæa, Cephaelis, Exostemma, Fernelia, Guettarda, Oldenlandia, Plocama, and Sarcocephalus.

104. VALERIANACEÆ.

A Stamens 4 . . . 1. *Patrinia.*
AA Stamens 1, rarely 2 corolla-tube spurred, the limb spreading 2. *Centranthus*
AAA Stamens 2, corolla-tube spurred, the limb 2-lipped . 3. *Fedia*
AAAA Stamens usually 3
B Calyx-limb finally pappiform .. . . 4. *Valeriana*
BB Calyx-limb various but not pappiform... .. 5. *Valerianella*

105. DIPSACACEÆ.

A Stigma terminal, straight· fls densely crowded in the axils of the floral lvs, forming whorls after the manner of the mint family 1. *Morina.*
AA Stigma oblique or lateral, rarely straightish fls in terminal heads
B Bracts of involucre generally herbaceous, chaff of receptacle rigidly awl-shaped-acuminate or spinescent, corolla 4-fid 2. *Dipsacus.*
BB Bracts and chaff rigidly palæaceous, rarely sub-herbaceous, corolla 4-fid 3. *Cephalaria*
BBB Bracts leafy, in about 2 series, chaff short, or very narrow or abortive, corolla 4–5-cut . .. . 4. *Scabiosa.*

106. COMPOSITÆ.

I. Summary of Tribes.

Series 1 TUBULIFLORÆ. Corollas tubular and regular in all the bisexual fls.

A. Heads composed entirely of disk-fls., which are all perfect and never truly yellow
B Style-branches awl-shaped, acute, minutely hairy. lvs. generally alternate anthers sagittate at base . 1 VERNONIA TRIBE.

BB. Style-branches subterete, obtuse, covered with minute papillæ lvs. opposite or alternate. anthers subentire at base . . 2. EUPATORIUM [TRIBE.

AA. Heads with all perfect or some imperfect fls., with or without rays and often yellow

B. Anthers tailed

c. Style-branches linear: heads with or without rays . . 3. INULA TRIBE.

cc. Style-branches united or short, heads without rays, typically with spiny or scarious appendaged, many-bracted involucre and fleshy receptacle . 4. CYNARA TRIBE.

BB. Anthers not conspicuously tailed

c. Style-branches in disk-fls flattened out, and with a distinct though sometimes very short terminal appendage 5 ASTER TRIBE.

cc Style-branches not flattened out.

NOTE.—It is impossible to make a key to separate the following tribes from one another. Some of the important characters are italicized

Receptacle chaffy or rarely naked under the sterile disk-fls . style-branches truncate or appendaged or the style of the sterile fls undivided, *pappus* sometimes absent but generally of 2–4 *awns*, which are slender or somewhat chaffy and with or without intermediate scales which are free or connate at base *lvs opposite*, rarely alternate . 6 HELIANTHUS [TRIBE.

Receptacle naked, style-branches truncate or appendaged, pappus usually chaffy, rarely of awns or bristles, or absent *lvs opposite or alternate involucral bracts in 1 or 2 series*, rarely 3–4, *herbaceous or membranous· herbage often resinous-dotted* 7 HELENIUM TRIBE.

Receptacle chaffy or naked, style-branches truncate, *pappus* when present *crown-shaped*, rarely of short chaff· lvs mostly alternate *involucral bracts* in 2 or more series, *dry or scarious at apex* 8 ANTHEMIS TRIBE.

Receptacle usually naked, style-branches truncate or appendaged, *pappus* usually of *bristles* lvs mostly alternate *inner involucral bracts in 1 series, subequal, the outer ones small or wanting*, or rarely all imbricate in numerous series 9 SENECIO TRIBE.

Receptacle naked, style-branches truncate or the style of the sterile fls undivided, *pappus absent or wool-like lvs usually alternate or radical* involucral bracts in 1–2 series, subequal, *narrow* 10 CALENDULA TRIBE.

Receptacle naked, chaffy or alveolate, style-branches rounded at apex, obtuse or rarely truncate or the style of the sterile fls. undivided, pappus absent, or chaffy or crown-shaped *lvs radical* or alternate involucral *bracts* in an *indefinite* number of series, often scarious at apex or spinescent 11 ARCTOTIS TRIBE.

Series 2 LABIATÆFLORÆ Corollas of all or only of the bisexual fls. bilabiate... ...12. MUTISIA TRIBE.

Series 3. LIGULIFLORÆ Corollas all ligulate and fls. bisexual juice milky ... 13. CICHORIUM TRIBE.

II. Artificial Key to the Composite Tribes.

(Condensed from Engler & Prantl.)

A. Plants without milky juice· corolla of disk-fls not ligulate (except some of the Mutisia Tribe, recognized by the peculiar style and caudate anthers).

B. Style below its point of branching neither thickened nor with a ring of long sweeping hairs.

C Anthers not caudate

D. Style-branches awl-shaped, acute, minutely hairy outside and often on style below, stigmatose over the whole inner face .. VERNONIA TRIBE.

DD. Style-branches subterete, obtuse, covered with minute papillæ, stigmatose in 2 lines near the base EUPATORIUM TRIBE.

DDD Style-branches flattened, with distinct though often short-terminal, usually short-hairy appendages, stigmatose in 2 lines . .. . ASTER TRIBE.

DDDD. Style-branches flattened, stigmatose in 2 lines, very diverse in form (i e., truncate or appendiculate, but with a distinct tendency toward a ring of long sweeping hairs somewhere above the fork (transitions frequent to the above 3 tribes).

E. Pappus not capillary, but composed of scales, plumose bristles, or strong awns, or crown-like or wanting

F. Involucral bracts without scarious margins, rarely with narrow membranous margins (in some genera which may be separated by strongly developed scaly pappus from the Anthemis Tribe)

G. Chaff present HELIANTHUS TRIBE.

GG. Chaff absent HELENIUM TRIBE.

FF. Involucral bracts scarious margined pappus 0 or reduced, sometimes unilaterally developed ANTHEMIS TRIBE.

EE. Pappus capillary, simple SENECIO TRIBE.

DDDDD Style-branches of the bisexual fls (which are sterile) almost or quite wanting, rarely of normal size, not stigmatose

E. Plants more or less completely dioecious chaff 0

F. Involucral bracts in 1 row, of equal length (often with tiny bracteoles at the base) *Petasites.*

FF. Involucral bracts in many rows *Baccharis.*

EE. Plants not dioecious: heads bisexual

F. Chaff 0.

G. Achene of female fls. with pappus of coarse or fine bristles or hairs, sometimes plumose

H. Involucral bracts in several rows Some members of ASTER TRIBE.

HH Involucral bracts in 1 row, separate, with tiny bracteoles at base *Tussilago.*

HHH Involucral bracts in 1 row, connate at base *Othonna* and [*Gamolepis.*

GG Achene of female fls with scaly pappus *Gutierrezia*

GGG Achene of female fls. with no pappus

H. Lvs opposite or radical *Osteospermum*

HH. Lvs alternate Some members of CALENDULA TRIBE.

FF. Chaff present

G Involucre not scarious, nor woolly (see Milampodineæ and Ambrosieæ of the Helianthus Tribe)

GG. Involucre scarious margined, inner bracts woolly .. *Eriocephalus.*

CC. Anthers caudate.

D. Style-branches awl-shaped, acute, minutely hairy outside and often on style below, stigmatose on whole inner face Members of VERNONIA TRIBE.

DD. Style-branches otherwise.

E. Limb of corolla of bisexual fls. 5- (rarely 4-) toothed or -lobed, rarely, in the Inula Tribe, slightly 2-lipped.

F. Plants dioecious. ..... *Antennaria.*

FF. Plants not dioecious.

G. Heads with filiform female marginal fls., or fls all alike Some members of INULA TRIBE.

GG. Heads with fls. of 2 sexes: corolla of female fls. (marginal) ligulate, rarely tubular, with broad regular or 2-lipped limb.

H. Pappus present . Some members of INULA TRIBE.

HH. Pappus 0..... CALENDULA TRIBE.

EE. Limb of corolla of bisexual fls. regular and deeply 5-divided or 2-lipped — MUTISIA TRIBE.
BB. Style with sweeping hairs beginning at or below the point of forking, forming a ring, or style there thickened, or at least there different in color; style-branches often coherent
C. Head with female or neutral ligulate ray-fls — ARCTOTIS TRIBE.
CC. Head of all bisexual fls or with nonligulate neutral fls or rarely with female ray-fls — CYNARA TRIBE
AA. Plants with milky juice: fls. in head all ligulate — CICHORIUM TRIBE.

III. Regular Key to the Tribes.

1. Vernonia Tribe.

A. Genus anomalous with enlarged palmately quasiligulate outer corollas . 1 *Stokesia*
AA. Genus normal with tubular 5-lobed corollas 2 *Vernonia.*

2. Eupatorium Tribe.

A. Anthers truncate at apex, not appendaged. achenes 5-angled, secondary ribs not prominent . . 3. *Piqueria.*
AA. Anthers appendaged
B. Achenes 5-ribbed, no secondary ribs visible
C. Pappus wholly of capillary bristles
D Involucral bracts 4 4 *Milania*
DD Involucral bracts more than 4 5 *Eupatorium* (Incl Conoclinium)
CC. Pappus chaffy, awned, blunt or crown-shaped 6 *Ageratum*
BB. Achenes 10-ribbed (rarely 7-8-ribbed), secondary ribs conspicuous
C. Involucral bracts not herbaceous, striate-nerved, conspicuously so when dry
D Heads few-fld , corymbose 7 *Adenostyles.*
DD Heads always paniculate 8 *Brickellia*
CC Involucral bracts somewhat herbaceous or partly colored, inconspicuously striate if at all
D The outer bracts successively shorter 9 *Liatris*
DD. The bracts nearly all equal in length 10 *Trilisa*

3. Inula Tribe.

A. The fls containing both stamens and pistil all sterile, only the unisexual fls fertile, heads monoecious or dioecious
B. Pappus bristles, especially of fertile fls, united at the base in a ring
C Heads strictly dioecious, corymbose, rarely solitary, sterile pappus club-shaped 11 *Antennaria*
CC. Heads containing 1 or both sexes, monoecious or dioecious, crowded in a small cluster or cyme surrounded by a long conspicuous woolly involucre 12 *Leontopodium*
BB Pappus bristles free, involucre rosette-like, very white-papery 13 *Anaphalis*
AA. The fls containing both stamens and style usually fertile
B Heads with disk-fls only
C. The heads compound, 1-fld heads aggregated in an involucrate cluster, often with petaloid appendages . 14 *Myriocephalus*
CC The heads simple
D Pappus 0 15 *Humea*
DD Pappus crown- or cup-shaped . 16 *Ammobium*
DDD Pappus bristly
E Achenes not beaked
F Bristles often plumose at base 17. *Helipterum.*
FF Bristles smooth, scarious, barked or plumose at apex . 18 *Helichrysum.*
EE Achenes beaked .. 19. *Waitzia*
BB. Heads composed of both ray- and disk-fls.
C. Receptacle not chaffy
D Stigmatic lines not confluent at apex 20 *Pololepis*
DD Stigmatic lines fusing at apex . . . 21 *Inula*
CC. Receptacle chaffy or bristly . . . . . 22. *Buphthalmum.*

4. Cynara Tribe.

A. Heads 1-fld , aggregated into larger involucrate heads . . . . . 23. *Echinops.*
AA. Heads several-fld.
B. Fr with basal areole
C. The fr woolly, not margined.
D. Pappus scales pointed or terminated by a simple awn . . . . . 24. *Xeranthemum.*
DD Pappus-scales plumose 25 *Carlina.*
CC The fr glabrous, marginal at summit
D. Receptacle bristly
E Filaments glabrous involucre bracts hooked 26. *Arctium.*
EE Filaments warty, hairy, or pectinate-ciliate
F The receptacle not fleshy.
G Pappus-bristles not plumose.. 27. *Carduus.*
GG Pappus-bristles plumose . . . . 28 *Cirsium.*
FF The receptacle fleshy . . . . . 29 *Cynara*
DD. Receptacle not bristly . . . . . 30 *Onopordon*
BB Fr with oblique lateral areole
C. Heads not involucrate with lvs
D. Involucral-bracts without appendages 31 *Serratula*
DD. Involucral-bracts with dry, scarious or thorny appendages 32 *Centaurea.*
CC. Heads surrounded by an involucre of thorny lvs
D Pappus simple, of bristles, scales or 0 33 *Carthamus.*
DD Pappus of 2 unequally long rows of bristles . 34. *Cnicus.*

5. Aster Tribe.

A. Heads dioecious and composed wholly of disk-fls . . . . 35. *Baccharis.*
AA Heads not dioecious
B. Color of fls yellow
C Rays absent . . . . . 36 *Bigelovia.*
CC Rays present
D. The pappus composed of long paleæ, which are sometimes reduced to a crown . 37 *Gutierrezia.*
DD The pappus not as in D
E. Pappus-bristles few (4–8)
F Involucral bracts in 8 series, leathery or scarious at apex 38 *Grindelia.*
FF Involucral bracts in 2–3 series, scarious at margins 39 *Pentachæta.*
EE Pappus-bristles copious, in 2–8 series, sometimes few in ray-fls
F Bristles of 2 kinds, the inner series capillary, outer very short and setulose or squamellate 40 *Chrysopsis.*
FF Bristles mostly alike
G Rays usually wanting 41. *Linosyris.*
GG Rays present
H The bristles broad at base, aristate 42 *Xanthisma*
HH The bristles capillary
I Heads usually many-fld
J Achenes many-nerved 43 *Aplopappus.*
JJ Achenes few-nerved 44 *Hazardia.*
II Heads usually few-fld
J Bristles rudimentary, shorter than achene 45. *Brachychæta*
JJ Bristles longer than achene 46 *Solidago*
BB. Color of ray fls at least not yellow
C The pappus 0, or forming a more-or-less conspicuous ring of short bristles or hairs uniform in all fls
D Bracts dry or scarious at margin 47 *Brachycome*
DD Bracts herbaceous 48. *Bellis.*
CC The pappus composed of numerous bristles in 1 or more series, uniform in all fls.
D Involucre with outer bracts partly leafy, inner bracts membranous or scarious . 49 *Callistephus*
DD Involucral bracts all nearly alike
E Bracts in about 2 series
F Achenes usually small . . 50 *Erigeron.*
FF Achenes larger, longer, pappus more copious 51. *Vittadinia*
EE. Bracts usually in several series, sometimes 2 series in Aster and Felicia
F. Plants woody, resinous
G Achenes cylindrical 52 *Olearia*
GG Achenes compressed . . 53 *Felicia.*
FF. Plant herbaceous
G Involucral bracts coriaceous 54. *Sericocarpus.*
GG Involucral bracts membranous or herbaceous 55 *Aster.*
CCC. The pappus anomalous or absent from the rays
D Pappus-bristles shortly plumose, style-branches broad . 56 *Chaetis.*
DD Pappus-bristles in 1 series, unequal, rigid, thickened or dilated toward the base 57. *Townsendia*
DDD Pappus of the ray composed of very short paleæ, disk-pappus of copious slender bristles in 1–2 series. 58 *Heteropappus*
DDDD. Pappus-bristles very short, usually accompanied by 2–4 awns not longer than the achene . 59 *Boltonia.*

6. Helianthus Tribe.

Subtribe 1. MELAMPODIEÆ Rays pistillate, disk-fls. staminate: achenes usually with coriaceous or thicker pericarp. style mostly entire, receptacle chaffy throughout; pappus none.

A. Involucre of the many-fid heads broad; inner bracts concave, embracing and half inclosing the thick, turgid, obovoid achenes 60. *Polymnia.*
AA. Involucre broad, of plane or barely concave bracts, innermost subtending obcompressed achenes, but not inclosing nor embracing them
B. Rays, or rather their ovaries and achenes, in more than 1 series. 61. *Silphium.*
BB. Rays and achenes in a single series
C. Heads nearly discoid or rays short 62. *Parthenium.*
CC. Heads conspicuously radiate, mostly of 5 fertile and rather numerous sterile fls. 63. *Chrysogonum.*

Subtribe 2. AMBROISEÆ. Pistillate fls. apetalous, or with corolla reduced to a tube or ring around base of 2-parted style; staminate fls with 4–5-lobed corolla, anthers slightly united or free, style abortive, hairy only at the somewhat enlarged and depressed summit

A. Herbs: heads of 2 kinds, the fertile with a bur-like involucre . . . . . 64. *Ambrosia.*
AA. Shrubs heads all alike 65 *Iva.*

Subtribe 3 ZINNIEÆ Rays pistillate, the tube absent or very short, persistent on achene and at length papery, disk-fls. bisexual, rarely sterile, subtended or embraced by chaffy bracts: lvs. opposite.

A. Receptacle flattish 66. *Sanvitalia.*
AA. Receptacle conical, cylindrical or elongated.
B. Achenes, at least inner ones, 1–3-awned 67 *Zinnia*
BB. Achenes without pappus. .. 68. *Heliopsis.*

Subtribe 4 VERBESINEÆ Rays pistillate, or neutral, becoming papery and persistent, disk-fls bisexual, anthers often blackish achenes various, but those of disk never obcompressed pappus various.

A. Chaff of receptacle permanently investing achenes as an accessory covering 69 *Sclerocarpus.*
AA. Chaff of receptacle concave or complicate, loosely embracing or subtending the disk-achenes, mostly persistent
B. Rays sometimes absent Certain species of 70 *Spilanthes*
BB. Rays usually present
C Receptacle high, from conical to columnar or subulate, at least in fr
D The rays, if present, pistillate. 70. *Spilanthes*
DD The rays sterile
E. Color of rays rose or rose-purple 71 *Echinacea.*
EE Color of rays yellow or partly brown-purple (sometimes wholly so)
F. Achenes 4-angled, prismatic 72 *Rudbeckia.*
FF Achenes short and broad, compressed 73 *Lepachys.*
CC. Receptacle low, flat to convex, rarely becoming conical
D. Achenes not winged nor very flat, when flattened not margined nor sharp-edged.
E Rays pistillate . . . 74 *Balsamorhiza.*
EE Rays sterile
F. Achenes pubescent . .. 75 *Viguiera*
FF Achenes glabrous . .76. *Helianthus.*
DD. Achenes of the ray or margin often triquetrous, of the disk either flat-compressed and margined or thin-edged, or if turgid some of them winged.
E. Rays neutral.
F. Pappus 0, or an awn or its rudiment answering to each margin of the wingless achene 77. *Encelia.*
FF. Pappus of delicate squamellæ between the 2 chaffy teeth or awns which surmount the 2 acute margins of the achene 78. *Helianthella.*
FFF. Pappus of 2 slender-subulate naked awns, at length divergent, sometimes with 2 or 3 intermediate awns .. 79. *Actinomeris.*
EE. Rays pistillate, rarely neutral in Verbesina
F Pappus of ∞ distinct squamellæ. 80. *Pascalia.*
FF. Pappus of dilated awns or 2 awn-like paleæ on the angles of the achene, with 2 small intermediate squamellæ on each side 81. *Podachænium.*
FFF. Pappus of 2 awns, sometimes 1–3 or 0, and no intermediate squamellæ . .. . .82. *Verbesina.*

Subtribe 5 COREOPSIDEÆ Rays pistillate or neutral, disk-fls. fertile, receptacle chaffy, chaff flat or hardly concave achenes more or less dorsally compressed, often 2-awned

A. Involucral bracts distinct, the outer herbaceous, inner somewhat like paleæ 83. *Guizotia.*
AA. Involucre double, inner bracts membranous, subequal, connate at base or often higher, outer bracts few and small or minute.
B. Plants are all climbers with pistillate rays, achenes much enlarging and sterile disk-fls with individed style . 84 *Hidalgoa.*
BB. Plants not climbing rays usually sterile
C Style-branches with long hairy appendages 85 *Dahlia.*
CC Style-branches truncate, penicillate or with short appendages
D. Bracts of inner involucre united into a cup 86 *Thelesperma.*
DD. Bracts of involucre distinct, or united only at the common base
E Achenes beaked, slender rays purple or rose, in 1 species yellow, white vars in cult awns mostly deciduous 87 *Cosmos.*
EE. Achenes not beaked rays yellow or white
F. Tube of disk-fl without ring at top
G Lvs or divisions entire . . 88 *Coreopsis.*
GG Lvs or divisions serrate 89 *Bidens.*
FF. Tube of disk-fls with a ring near the top 90. *Leptosyne.*

Subtribe 6 GALINSOGEÆ Heads rayless and homogamous (in Marshallia). Pappus of ∞ distinct paleæ 91 *Marshallia.*

Subtribe 7 MADIEÆ Rays pistillate, each subtended by an involucral bract which partly or completely incloses its achene, disk-fls with both stamens and styles, but some or all sterile glandular, viscid and heavy-scented herbs

A. Achenes laterally compressed . 92 *Madia.*
AA. Achenes not laterally compressed . 93 *Layia.*

7. Helenium Tribe.

A. Involucral bracts united nearly throughout into an oblong cup or tube 94 *Tagetes.*
(See also Lasthenia.)
AA. Involucral bracts hardly at all imbricated, when broad, nearly equal or in 1 series
B. Receptacle mostly high-conical, and acute, beset after the achenes have fallen by projecting points (as if pedicels on which they were inserted)
C. The involucre a single series of bracts connate by their edges into a 5–15-toothed green cup 95 *Lasthenia*
CC The involucre of loose, distinct bracts 96 *Bæria*
(Also Actinolepis coronaria)
BB. Receptacle flat or convex, rarely obtusely conical achenes from linear to obpyramidal, rarely 5-angled (See also BBB)
C. Herbage mostly woolly involucral bracts erect, not membranous 97 *Eriophyllum*
CC. Herbage usually not woolly
D Disk-fls deeply 5-cleft involucral bracts mostly appressed 98 *Polypteris*
DD. Disk-fls with long and narrow throat and 5 short lobes or teeth
E Heads solitary . . 99. *Hulsea.*
EE Heads paniculate or corymbose
F Plants tomentose herbs, the lvs. dissected
G Involucral bracts free, narrow 100. *Chænactis.*
GG Involucral bracts connected at the base, broad and obtuse 101. *Baria*
FF Plants not tomentose, the lvs. not dissected 102 *Perscome*
BBB. Receptacle from convex to oblong achenes short, obpyramidal or top-shaped, 5–10-ribbed or angled, mostly silky hairy. disk-fls all fertile
C. The receptacle destitute of awn-like fimbrillæ among the fls
D Involucre erect or nearly so 103 *Actinella.*
DD Involucre spreading or soon reflexed. 104. *Helenium.*
CC. The receptacle beset with bristle-like or awl-shaped or rarely dentiform fimbrillæ among the fls.. . . . . .105. *Gaillardia.*

8. Anthemis Tribe.

A. Receptacle chaffy
B. Heads usually discoid
C. Shrubs with small, closely clustered lvs.. 106. *Eriocephalus.*
CC Herbs, or sometimes slightly shrubby
D. Corolla with a hood-like appendage at base 107 *Santolina.*
DD. Corolla without such appendage. ....108. *Lonas.*

BB. Heads usually radiate
c. Achene compressed, with 2 narrow margins . .109. *Achillea.*
cc. Achenes 4–5-cornered or ∞-ribbed 110. *Anthemis.*
D The heads pedunculate at tips of branches
DD The heads sessile in forks, surrounded by 5–6 dissected floral lvs 111. *Cladanthus*
AA. Receptacle naked or alveolate-fimbrilliferous
B Involucral bracts in many series
c. Rays present . . 112. *Chrysanthemum*
(Consult also Pyrethrum)
cc Rays absent 113 *Tanacetum*
BB Involucral bracts in 1 or 2 or few series
c Rays present 114 *Matricaria*
cc. Rays absent or inconspicuous.
D Involucre top-shaped 115 *Cenia*
DD. Involucre ovoid or broadly bell-shaped 116. *Artemisia*

9. Senecio Tribe.

A Involucral bracts in 1 series and connate at the base or beyond the middle in a cup, no outer bracts, style-branches of the fertile bisexual fls truncate at apex, usually penicillate
B Style undivided, disk-fls sterile 117 *Othonna*
BB Style bifid, disk-fls all or some fertile 118 *Gamolepis.*
AA Involucral bracts in 1 or 2 series, not connate in a cup but free, at least finally
B. Style-branches of hermaphrodite fertile fls roundish obtuse or at least not truncate and wholly without appendage or hairiness at summit
c Heads composed entirely of bisexual and fertile fls, homogamous, discoid 119 *Cacaliopsis.*
cc Heads subhomogamous or subdiscoid, the fls containing both stamens and pistils, sterile
D The heads radiate, yellow 120 *Tussilago.*
DD The heads discoid, purplish or white
E Style of hermaphrodite fls undivided, heads several 121 *Petasites*
EE Style branched, heads 2 122 *Homogyne.*
BB. Style-branches (of hermaphrodite fls) either truncate or capitellate at summit, which is either penicillate, hairy or naked and not rarely bears a short conical or flattened appendage
c Bracts of involucre herbaceous, acuminate
D Receptacle flat 123 *Arnica*
DD Receptacle hemispherical 124 *Doronicum.*
cc Bracts of involucre narrow, strict, usually ribbed or keeled
D Apex of style usually truncate and penicillate
E Involucral bracts numerous
F Achenes subterete 125 *Senecio*
FF Achenes dorsally compressed 126 *Cineraria*
EE Involucral bracts few, 4–5, heads homogamous 127 *Tetradymia.*
DD Apex of style with long, subulate hairy appendages heads homogamous 128 *Gynura.*
DDD Apex of style with appendages short and obtuse, or long and acutish, heads homogamous 129 *Emilia.*

10. Calendula Tribe.

A. Achenes of the rays thick, hard and bony, those of the disk usually all empty 130 *Osteospermum.*
AA. Achenes straight, those of the rays usually triquetrous, disk-achenes often flattish or 2-winged 131 *Dimorphotheca.*
AAA. Achenes incurved, heteromorphous . 132. *Calendula.*

11. Arctotis Tribe.

A. Involucral bracts free, the inner ones broadly scarious, at least at the apex
B Herbs glabrous or pubescent, receptacle chaffy 133 *Ursinia.*
BB Herbs tomentose receptacle naked or alveolate
c Achenes usually villous, crowned by hyaline paleæ which are often convolute 134 *Arctotis*
cc Achenes glabrous, with or without a crown of minute paleolæ 135 *Venidium*
AA. Involucral bracts grown together at the base lvs not spinescent: alveoli short . . 136. *Gazania.*

12. Mutisia Tribe.

A Rays in 1–2 series, 2-lipped 137 *Gerbera*
AA Rays in 2–3 series, the outer always strap-shaped . . . . 138. *Chaptalia.*

13. Cichorium Tribe.

A Pappus 0, or of 2–3 long bristles, which soon fall away 139 *Scolymus.*
AA Pappus paleaceous or partly so, or aristiform, or plumose
B Involucre of equal bracts and no short calyculate ones at base
c. Achenes long-beaked . . . . 140. *Tragopogon.*
cc Achenes truncate 141 *Krigia.*
BB. Involucre either calyculate or imbricate, i. e., principal bracts equal and some short ones at base, or less unequal bracts in 2 or more series
c Achenes (at least inner ones) tapering into a beak
D Receptacle with membranous chaff 142 *Hypochæris*
DD Receptacle naked 143 *Leontodon.*
cc Achenes usually short, with summit truncate or only a trifle contracted below apex
D Receptacle chaffy 144 *Catananche.*
DD Receptacle not chaffy
E Fls normally blue 145 *Cichorium.*
EE Fls yellow 146 *Scorzonera*
AAA Pappus of capillary bristles that are scabrous, rarely barbellulate, never plumose nor paleaceous-dilated receptacle naked (except in 1 species of Troximon)
B Achenes flattened pappus of copious fine soft capillary bristles
c The achenes distinctly beaked 147 *Lactuca.*
cc The achenes beakless 148 *Sonchus.*
BB. Achenes not flattened pappus persistent or bristles tardily falling (except 1 or 2 species of Crepis)
c. Beak distinct and slender (except in 1 or 2 species of Troximon)
D The achenes 10-ribbed or 10-nerved, not muricate 149 *Troximon.*
DD The achenes 4–5-ribbed or angled, muricate 150. *Taraxacum.*
cc. Beak 0, or achene merely narrow at apex
D Fls whitish or cream-color to violet or rose-red 151. *Prenanthes.*
DD Fls mostly yellow, sometimes orange-red or white
E Pappus of rather rigid, scabrous, fragile bristles which are usually rather dirty or neutral-colored 152 *Hieracium*
EE Pappus of copious white and usually soft capillary bristles 153 *Crepis*

The following genera (and others) also are briefly treated Amellus, Asteriscus, Bellium, Cacalia, Calimeris, Celmisia, Chamæmelum, Cotula, Cryptostemma, Erlangea, Luryops, Gymnolomia, Haplocarpha, Kuhnia, Leptocarpha, Montanoa, Oldenburgia, Pertya, Pseiostrophe, Pteronia, Saussurea, Tithonia, Tolpis, Tricholepis, Wedelia and Zaluzania.

107. CAMPANULACEÆ.

A. Fls irregular, rarely nearly regular, anthers united
B Corolla open down to the base on one side .. 1. *Lobelia.*
BB Corolla with a closed tube
c Stamens in a tube free from the corolla . 2. *Downingia*
cc Stamens more or less adnate to the corolla up to near the throat, then monadelphous and free or farther adnate on one side only 3. *Palmerella.*
ccc Stamens affixed at top of corolla-tube or above the middle caps 2-valved at apex . 4. *Isotoma.*
cccc Stamens affixed at base of corolla-tube.
D Fr an indehiscent berry . . 5 *Centropogon*
DD Fr a caps, 2-valved at apex 6. *Siphocampylus*
AA Fls regular or nearly so, anthers usually separate
B Fr an indehiscent, fleshy berry
c Ovary inferior 7 *Canarina*
cc Ovary superior as to calyx but not corolla 8 *Campanula*
BB Fr a caps
c. Caps dehiscing locuicidally by apical valves
D Corolla 5-parted nearly to base 9 *Jasione*
DD Corolla broadly bell-shaped, 5-lobed 10 *Platycodon*
DDD Corolla narrowly (or not broadly) bell-shaped or tubular
E Calyx-tube adnate, hemispherical 11. *Codonopsis.*
EE Calyx-tube free, long-campanulate or inflated 12 *Cyananthus*
cc Caps closed at apex, dehiscing laterally between the ribs by small lids or small solitary valves
D Corolla 5-cut-lobed, or -parted.
E. Ovary linear or narrowly oblong.. .13. *Specularia.*

EE. Ovary hemispherical or top-shaped.
F Anthers connate in a tube . 14. *Symphyandra.*
FF. Anthers not connate in a tube
G. Style girt at base by an epigynous fleshy disk, which is cup-shaped or tubular 15. *Adenophora.*
GG. Style without such disk
H. Corolla 5-parted to the base, lobes narrow, either long-cohering above or rotate-spreading 16. *Phyteuma.*
HH Corolla 5-cut shortly or to the middle, rarely farther, bell-shaped, tubular, funnel-shaped or subrotate 17. *Campanula.*
DD. Corolla narrowly tubular, shortly 3-cut at apex 18. *Trachelium.*
DDD. Corolla usually 7–10-cut, rarely 5-cut
E. Number of lobes 5–9, usually 7, fls. bell-shaped 19. *Ostrowskia.*
EE. Number of lobes 8–10, lobes narrow and spreading . 20 *Michauxia*

Githopsis, Leptocodon and Lightfootia are also mentioned in the Cyclopedia

108. MONOTROPACEÆ.

In cultivation *Sarcodes.*

109. CLETHRACEÆ.

The only genus *Clethra*

110. PYROLACEÆ.

A Style very short, obconical sts leafy 1 *Chimaphila.*
AA. Style mostly elongated, scape naked or leafy only at base
B. Fls solitary . . . . . 2 *Moneses*
BB Fls racemose . . 3 *Pyrola*

111. ERICACEÆ (Inc. Vacciniaceæ).

Subfamily 1. VACCINIEÆ. Ovary inferior fr a berry or drupe

Subfamily 2. ERICINEÆ. Ovary superior fr a caps, except in Tribe 1 of Subfamily 2

Fr fleshy, a berry or drupe 1 ARBUTUS TRIBE
Fr a loculicidal caps, chiefly 5-celled corolla deciduous 2 ANDROMEDA TRIBE
Fr a caps, with loculicidal or sometimes septicidal dehiscent and 4 or 5 cells corolla marcescent persistent 3 ERICA TRIBE
Fr a septicidal caps corolla deciduous 4 RHODODENDRON TRIBE

Subfamily 1. VACCINIEÆ

A Corolla tubular or cylindric, filaments connate or free
B. Filaments connate or cohering, anthers produced into a single long beak
C Stamens shorter than corolla 1 *Macleania*
CC Stamens equaling or exceeding the corolla 2 *Thibaudia.*
BB Filaments distinct, anthers ending in 2 long beaks 3 *Agapetes*
AA. Corolla campanulate, urceolate or rotate, filaments usually free
B The ovary wholly inferior
C Ovary 10-celled, 10-ovuled 4. *Gaylussacia.*
CC Ovary 4–5-celled, or by false partitions from the back of these cells, 8–10-celled, ovules numerous 5 *Vaccinium.*
BB. The ovary at first a third to half superior . 6. *Chiogenes.*

Subfamily 2. ERICINEÆ.

1. Arbutus Tribe.

A. The anthers have a pair of awns on the back.
B Ovary-cell many-ovuled . . 7. *Arbutus,*
BB. Ovary-cells 1-ovuled
C. Nutlets coalescent lvs persistent, entire . 8. *Arctostaphylos.*
CC Nutlets distinct lvs deciduous, serrate .. 9. *Arctous*
AA. The anthers awnless on back . ..10. *Pernettya.*

2. Andromeda Tribe.

A. Anther-cells opening through their whole length, not appendaged, stigma 5-lobed, the lobes adnate to a surrounding ring or cup ...11. *Epigæa.*
AA Anthers opening only at the top, stigma usually entire
B. Calyx becoming fleshy in fr., forming a berry and inclosing the small caps 12. *Gaultheria.*
BB Calyx unchanged and dry under the caps
C Sepals or calyx-lobes valvate or open in the bud, never overlapping
D. The anthers destitute of appendages or awns 13. *Lyonia.*
DD The anthers awned
E. The anthers short and obtuse, with 2 pores topped by slender, ascending awns, corolla urn-shaped 14. *Andromeda.*
EE. Anthers lanceolate, produced into 2 small tubes, each surmounted by a pair of slender, ascending awns, corolla bell-shaped 15 *Zenobia.*
EEE. Anthers with 2 spreading or deflexed awns or teeth, on the back of the filament or at its junction with the anther 16. *Pieris.*
CC Sepals or calyx-lobes imbricated, at least in the early bud
D. Lvs heath-like, small, thick or needle-like, mostly overlapping anther fixed near apex 17. *Cassiope.*
DD. Lvs not heath-like, usually larger, flat, broad and leathery
E. Corolla cylindraceous to conical-urceolate, anthers fixed near base
F Seeds imbricated in 2 rows 18 *Chamædaphne.*
FF Seeds pendulous or in all directions 19 *Leucothoë.*
FFF Seeds all ascending or erect . 20 *Oxydendrum*
EE. Corolla bell-shaped or urn-shaped 21 *Enkianthus*

3. Erica Tribe.

A Anthers 2-awned on back at base 22. *Calluna.*
AA. Anthers 2-parted, blunt or awned, usually cristate or lamellate at base 23 *Erica*
AAA. Anthers blunt on back, not cristate .24. *Bruckenthalia*

4. Rhododendron Tribe.

A Corolla polypetalous or nearly so
B Fls in elongated racemes or panicles lvs. deciduous
C Petals 4, stamens 8 25 *Elliottia*
CC Petals 5, stamens 6 26 *Tripetaleia*
BB Fls solitary, petals 5, stamens 10. lvs deciduous 27 *Cladothamnus.*
BBB Fls in umbel-like racemes, petals 5, stamens 5–10 lvs evergreen
C Lvs tomentose below caps 5-celled, seeds winged 28 *Ledum*
CC Lvs glabrous caps 2–3-celled, seeds angular 29 *Leiophyllum.*
AA Corolla gamopetalous
B Seeds compressed, winged corolla slightly irregular, stamens 5–10
C Stamens usually exserted, anthers opening by a round terminal pore, corolla rotate, campanulate or funnelform 30 *Rhododendron.*
CC Stamens included, anthers opening by an oblique pore corolla urceolate lvs deciduous 31 *Menziesia*
BB Seeds subglobose or trigonous, not winged corolla regular
C. Stamens 10
D The corolla cup-shaped with 10 pouches receiving the anthers, fls in corymbs or solitary 32 *Kalmia*
DD The corolla rotate, fls terminal, 1–3 lvs oblong-elliptic, ciliate 33 *Rhodothamnus.*
DDD The corolla urceolate or campanulate, fls terminal, solitary or in umbels lvs heath-like 34 *Phyllodoce*
CC Stamens 5 or 8
D Fls 5-merous, in umbels, 2–5, corolla broadly funnelform lvs elliptic, opposite, smooth 35 *Loiseleuria*
DD Fls 4-merous lvs alternate
E Corolla rotate, 4-parted, fls 2–10, in loose racemes lvs heath-like 36 *Bryanthus*
EE. Corolla campanulate-urceolate with short 4-toothed limb, fls in loose racemes lvs tomentose below 37. *Dabœcia.*

The genus Pentapterygium is included in the work

112. EPACRIDACEÆ.

Style inserted in the intruded vertex of the ovary; stamens epipetalous, anthers 1-celled, corolla-lobes quincuncially imbricate, bracts numerous, passing into sepals . . . . *Epacris.*

The recent genus Rupicola is also mentioned in the work.

113. DIAPENSIACEÆ.

A. Corolla persistent; staminodes 0.
B Fls sessile . .. . 1. *Pyxidanthera.*
BB Fls pedunculate . ... 2 *Diapensia.*
AA Corolla deciduous, staminodes 5
B Staminodes small, scale-like, separate; corolla-lobes crenate . 3. *Shortia.*
BB Staminodes long, linear, separate; corolla-lobes fimbriate 4 *Schizocodon.*
BBB Staminodes spatulate, connate with stamens, corolla-segms entire 5 *Galax.*

114. PLUMBAGINACEÆ.

A. Calyx-limb usually spreading, scarious and colored
B Lvs usually needle-like styles distinct at angles of ovary, stigmas sub-capitate . 1 *Acantholimon.*
BB. Lvs flat styles as above, stigmas capitate, oblong or linear, infl cymose or dense or scape 1- to few-fld 2 *Statice.*
BBB Lvs flat or linear-subulate styles shortly subconnate at vertex of ovary, stigmas linear, scape 1-headed 3 *Armeria*
AA. Calyx-lobes or teeth erect with merely scarious sinuses
B Stamens free, calyx glandular 4 *Plumbago.*
BB Stamens adnate to middle of corolla, calyx not glandular 5 *Ceratostigma.*

115. PRIMULACEÆ.

A. Corolla-lobes imbricated in quincunx fashion
B Plants aquatic ovules anatrophous, umbilicus basal 1 *Hottonia*
BB Plants terrestrial ovules semi-anatropous, umbilicus ventral
C Caps dehisces by a lid at top . 2 *Soldanella.*
CC Caps dehisces by valves
D The corolla-lobes bent back . 3 *Dodecatheon.*
DD The corolla-lobes spreading or ascending
E Stamens affixed to base of corolla, anthers long-acuminate 4 *Cortusa*
EE Stamens affixed to corolla-tube, anthers obtuse
F Corolla-tube usually longer than calyx
G Caps many-seeded 5 *Primula*
GG Caps 1 2-seeded 6 *Douglasia*
FF Corolla-tube as long as calyx or shorter caps few or many-seeded 7 *Androsace.*
AA. Corolla-lobes convolute in the bud ovules semi-anatropous, umbilicus ventral
B Caps circumscissile 8 *Anagallis.*
BB Caps longitudinally dehiscent by valves
C Lobes of corolla bent back 9 *Cyclamen*
CC Lobes of corolla bent back
D Corolla-lobes 5-6 testa of seed with a firm epidermis
E Staminodes 0 10 *Lysimachia*
EE Staminodes 5, each corolla-lobe curved around its stamen 11 *Steironema.*
EEE Staminodes 5, tooth-like, corolla-lobes not encircling stamens 12 *Naumbergia*
DD. Corolla-lobes usually 7 testa of seed with a lax epidermis 13 *Trientalis*

The genus Glaux may be met with occasionally in cultivation.

116. MYRSINACEÆ.

A. Staminodes 5, corolla gamopetalous.
B. Corolla cylindrical, shortly 5-lobed: fr. many-seeded 1. *Theophrasta.*
BB Corolla subrotate, deeply 5-parted fr. 1- to many-seeded 2 *Clavija.*
BBB. Corolla rotate-campanulate, deeply 5-cut fr few-seeded 3 *Jacquinia.*
AA. Staminodes 0, corolla gamopetalous or polypetalous fr 1-seeded
B Corolla imbricated, fls fascicled, lateral or axillary 4. *Myrsine.*
BB. Corolla convolute, panicles terminal or terminal and axillary . 5. *Ardisia.*

The genus Maesa is also accounted for

117. SYMPLOCACEÆ.

The only genus . ... *Symplocos.*

118. STYRACACEÆ.

A. Fr. superior, globular or ovoid, not ribbed nor winged 1. *Styrax.*
AA. Fr inferior, elongated ribbed, or winged
B Infl panicled, many-fld, drooping, subterminal . 2. *Pterostyrax.*
BB. Infl. of few-fld. fascicles, often lateral .. ... 3. *Halesia.*

119. SAPOTACEÆ.

A. Corolla-lobes, calyx-segms, stamens and staminodes (when present) isomerous
B. Staminodes 0 seeds usually albuminous: fls 5-merous, rarely 6–7-merous 1 *Chrysophyllum.*
BB. Staminodes small, usually affixed higher than stamens, sometimes few or 0 seeds not albuminous fls 4 5-merous 2 *Lucuma.*
BBB Staminodes alternate with stamens, rarely affixed higher, seeds albuminous 3 *Siderozylon.*
AA Corolla-lobes and calyx-segms isomerous, stamens twice as many or more 4. *Isonandra.*
AAA. Corolla-lobes usually 2 or 3 times as many as calyx-segms
B. Calyx-segms 1 series . . . . 5 *Bumelia*
BB. Calyx-segms 2 series . 6 *Mimusops*

The genus Pouteria is now described in this family.

120. EBENACEÆ.

A. The fls usually hermaphrodite, stamens in 1 series 1 *Royena.*
AA. The fls dioecious
B Fls usually 4-merous, stamens 3–∞, commonly 9, ovary 3- or 6-celled 2 *Maba.*
BB Fls usually 4–5-merous, stamens 4–8, usually in 2 series, ovary 4- or 8-celled 3 *Diospyros.*

121. OLEACEÆ.

Fr didymous or septicidally divisible into two corolla-lobes strongly imbricate ovules laterally affixed near base, seeds erect, without endosperm, radicle inferior 1 JASMINE TRIBE.
Fr terete or compressed parallel to the septum, loculicidally dehiscent, ovules pendulous from apex of cells, seeds winged, pendulous, radicle superior 2 LILAC TRIBE.
Fr entire, dry, indehiscent, winged, a samara, compressed contrary to the septum, ovules twin, pendulous from apex of cell, seeds pendulous with endosperm, radicle superior 3 ASH TRIBE.
Fr fleshy and indehiscent, a drupe or rarely a berry, not lobed, ovules twin, laterally affixed near the apex, seeds solitary, suspended or pendulous, with endosperm, radicle superior 4 OLIVE TRIBE

1. Jasmine Tribe.

Fr fleshy, indehiscent, didymous or by abortion simple . 1 *Jasminum.*

2. Lilac Tribe.

A Corolla-lobes imbricate
B Ovules 3–4 in a cell lvs pinnate and fls white corolla-lobes shorter than tube 2 *Nathusia*
BB Ovules 4–10 in a cell lvs entire or 3-foliolate and fls yellow lobes many times longer than tube 3 *Forsythia.*
AA Corolla-lobes induplicate-valvate, tube long or short ovules 2 in a cell, seeds albuminous 4 *Syringa.*

3. Ash Tribe.

A. Lvs usually pinnate fr elongate, with a terminal wing, generally 1-seeded by abortion 5 *Fraxinus.*
AA. Lvs undivided fr ovate or orbiculate, surrounded by a wing, usually 2-celled and 2-seeded . . .. 6 *Fontanesia.*

4. Olive Tribe.

A. Corolla of nearly distinct petals which are long and linear . . 7 *Chionanthus.*
AA Corolla-lobes imbricate, broad and obtuse.
B Endocarp of drupe thinly crustaceous 8 *Phillyrea*
BB Endocarp of drupe hard and somewhat woody . . .... 9. *Osmanthus.*
AAA. Corolla-lobes induplicate-valvate.

BB. Fr. a drupe; endocarp hard, thick or thin: infl. axillary, rarely terminal .. 10. *Olea.*
BB. Fr. a berry, hardly drupaceous, endocarp membranous or thinly coriaceous: panicles terminal..... 11. *Ligustrum.*

122. LOGANIACEÆ.

A. Style 2-fid, branches linear, 2-fid . . . 1. *Gelsemium.*
AA. Style simple
B Corolla-lobes valvate
c Fr a circumscissile caps 2 *Spigelia*
cc Fr an indehiscent drupe or berry . 3 *Strychnos.*
BB Corolla-lobes imbricate
c Anthers exserted 4 *Chilianthus.*
cc Anthers included . 5 *Buddleia*

The genus Logania may afford cultivated plants now and then.

123. GENTIANACEÆ.

A. Lvs. alternate or radical.
B Fr indehiscent . .. . 1. *Nymphoides*
BB Fr dehiscent
c Caps usually 4-valved at apex 2 *Villarsia.*
cc Caps irregularly sub-2-valved at apex 3 *Menyanthes.*
AA. Lvs opposite
B Ovary perfectly 2-celled, placentæ solitary in each cell, often thick, adnate to septum, liberated by dehiscence of caps 4 *Exacum*
BB. Ovary 1-celled, placentiferous margins of carpels more or less intruded within or even touching but not connate in the middle of the cell, spuriously 2-celled
c Style often deciduous, anthers usually erect
D. Anthers spirally twisted finally 5 *Erythræa*
DD Anthers finally recurved at apex 6 *Sabbatia.*
cc Style usually persistent, anthers versatile, finally recurved 7 *Lisianthus.*
BBB. Ovary 1-celled, margins of carpels rarely intruded, ovules and seeds affixed at each side of the suture in 1 series or more or less extended over the parietal surface, placentæ adnate, very thin
c. Corolla has 1–2 pits at base of each lobe
D Style short or scarcely any 8 *Swertia*
DD Style subulate 9 *Frasera*
cc. Corolla has no such pits 10 *Gentiana*

The genus Chironia may also be expected in cultivation

124. ASCLEPIADACEÆ.

Subfamily 1. PERIPLOCEÆ Pollen granular, loosely aggregated in 2 masses in each anther-cell

Character of subfamily 1 PERIPLOCA TRIBE

Subfamily 2. EUASCLEPIADEÆ. Pollen waxy, the masses solitary in each anther-cell

Anthers tipped by a membrane, which is inflexed or sometimes erect, and usually hyaline, rarely opaque or petal-like, pollen-masses suspended, attached in pairs (1 in each adjacent cell of different anthers) to the corpuscle or gland 2 CYNANCHUM TRIBE
Anthers usually tipped by an inflexed or suberect membrane, which is hyaline, rarely opaque, pollinia solitary in each cell, erect or very small 3. MARSDENIA [TRIBE.
Anthers obtuse at apex, not appendaged or rarely the connective produced, pollinia solitary in the cells, erect 4. CEROPEGIA TRIBE.
Anthers like those of the Ceropegieæ or more incumbent above the top of the stigma or submmersed, its thick and fleshy, leafless or with a few lvs at top 5 STAPELIA TRIBE
Anthers broad at the top, without appendages or more or less membranaceous on the margins, the cells somewhat transversely dehiscent, attached nearly or quite on the margin of the stigma-disk, pollinia horizontal or essentially so ... 6. GONOLOBUS TRIBE.

1. Periploca Tribe.

A. Scales of corona distant from staminal tube.
B. Corolla-tube short, scales linear or club-shaped . 1. *Cryptolepis.*
BB. Corolla large, funnel-shaped, scales acuminate or 2-fid . .. .. 2. *Cryptostegia.*
AA. Scales of corona close to stamens.
B. Corolla-lobes valvate . . . 3. *Chlorocodon.*
BB. Corolla-lobes imbricate..... 4. *Periploca.*

2. Cynanchum Tribe.

A. The outer or single crown either simple and composed of 5 scales or ring-shaped, adnate to the corolla and not the staminal tube, or rarely adherent to both
B. Stigma depressed 5 *Macrosceps*
BB. Stigma umbonate or 2-beaked at apex corona-scales attached at middle (or below) of corolla-tube 6 *Physanthus.*
BBB Stigma plane or umbonate, corona annular, adnate to corolla 7 *Philibertia.*
AA. The crown of 5 scales affixed to base of corolla and staminal tube, caudicles of pollinia appendaged with an erect fuscous tooth 8 *Oxypetalum.*
AAA The crown of 5 scales which are distinct, affixed or adnate to the staminal tube or the back of the anthers
B Scales concave or hooded with an acute ligula inside 9 *Asclepias:*
BB Scales fleshy, narrow, adnate to stamen-tube, but free and recurved at base 10 *Calotropis.*
BBB Scales (5 outer ones) carinate-complicate at base of staminal tube, the 5 scales at the apex of the long staminal tube, short, obtuse, spreading, alternate with anthers 11 *Podostigma.*
AAAA The outer or single crown affixed to the staminal tube, ring- or cup-shaped, entire, lobed or parted
B Corona villous inside 12 *Morrenia*
BB Corona with 5 scales or ligulæ inside 13 *Cynanchum.*
BBB Corona naked inside 14 *Vincetoxi-* [*cum*
BBBB. Corona of 5 short processed opposite anthers and 10 ligulæ alternate with anthers in pairs 15 *Rothrockia.*

3. Marsdenia Tribe.

A Corolla-lobes strictly valvate 16 *Hoya.*
AA Corolla-lobes usually overlapping dextrorsely
B Fls not pure white, urn- or salver-shaped, small or medium-sized 17 *Marsdenia*
BB. Fls. white, salver- or tunnel-shaped, large 18 *Stephanotis.*

4. Ceropegia Tribe.

Corona double, affixed to staminal tube 19 *Ceropegia.*

5. Stapelia Tribe.

Corona double, outer spreading, inner of 5 scales 20 *Stapelia.*

6. Gonolobus Tribe.

Crown cup-shaped or annular, entire or lobed 21 *Gonolobus*

Additional genera described in Asclepiadaceæ are Caralluma, Duvalia, Echidnopsis, Gomphocarpus, Hoodia, Huernia, Michoitzia, Pectinaria, Piaranthus, Raphionacme, Sphaerocodon and Trichocaulon.

125. APOCYNACEÆ.

A. Anther-cells not appendaged at base
B. Ovary entire (Carissa Tribe), fls 5-merous
c Fr a 2-valved caps ovary 1-celled 1. *Allamanda.*
cc Fr a berry, indehiscent ovary 2-celled, cells 1–4-ovuled
D Ovules laterly affixed cymes terminal, few-fld spines axillary 2 *Carissa*
DD Ovules erect from base cymes axillary, dense spines 0 3 *Acokanthera.*
BB. Ovaries 2 to several, style 1 (Plumeria Tribe)
c. Calyx with several glands inside or a ring of hairs
D Carpels 2-ovuled 4 *Thevetia*
DD Carpels many-ovuled 5 *Tabernæ-* [*montana*
cc Calyx without glands inside
D Carpels 2-ovuled
E Disk 2-scaled 6 *Kopsia*
EE Disk cup-shaped or annular 7 *Rauwolfia*
DD Carpels 6- to many-ovuled
E Ovules in 2 series
F Disk 0
G. Seeds truncate . 8 *Amsonia*
GG Seeds winged 9 *Gonioma.*
FF Disk of 2 scales 10 *Vinca*
EE Ovules in many series
F Stamens near base of tube 11 *Plumeria.*
FF Stamens above middle of tube 12 *Alstonia.*
AA. Anther-cells produced at base (Echites Tribe)
B. The cone of anthers more or less exserted at apex.
c Throat of corolla with 5 scales . 13 *Prestonia.*
cc Throat without scales . . . 14 *Vallaris.*
BB. The anthers included
c. Lvs. usually in whorls of 3 . ...15. *Nerium.*

cc. Lvs. opposite
D. Corolla bell-shaped, with 5 squamellæ alternating with stamens . 16. *Apocynum.*
DD. Corolla salver-shaped or funnel-shaped, the throat without scales
E. Disk of 2 scales . 17. *Dipladenia.*
EE. Disk many-toothed or crenulate 18 *Odontadenia.*
EEE. Disk of 5 lobes or scales, often truncate in Trachelospermum
F. Fls salver-shaped.
G Infl. lax corymbose cymes . 19. *Trachelospermum.*
GG Infl. racemose, rarely shortly dichotomous . 20 *Echites.*
FF. Fls funnel-shaped
G In cymes . . . . 21. *Beaumontia.*
GG In racemes . . . 22 *Mandevilla.*

Other genera treated are Hunteria, Landolphia, Pachypodium, Parsonsia, Pleiocarpa and Strophanthus

126. POLEMONIACEÆ.

A. Caps deeply loculicidal herbs or sub-shrubs
B. Stamens unequally affixed to corolla-tube, not declinate
C Lvs mostly opposite, entire 1 *Phlox*
CC Lvs mostly alternate, usually incised or pinnatifid 2 *Collomia*
BB Stamens equally affixed to tube or throat
C The stamens not declinate 3 *Gilia.*
CC. The stamens declinate
D Filaments pilose-appendaged at base 4 *Polemonium.*
DD Filaments not appendaged 5 *Læselia*
AA. Caps shortly loculicidal at apex, seeds broadly winged trees or shrubs 6 *Cantua.*
AAA. Caps deeply septicidal tall climbers 7 *Cobæa*

127. HYDROPHYLLACEÆ.

A. Styles 2, distinct from base, corolla-lobes imbricate 1 *Wigandia.*
AA Styles 2-cut, rarely undivided
B Corolla-lobes usually convolute
C Stamens exserted 2 *Hydrophyllum.*
CC Stamens included 3 *Nemophila.*
BB Corolla-lobes imbricated
C Fls marcescent, bell-shaped 4 *Emmenanthe.*
CC Fls deciduous
D The peduncles 1-fld 5 *Hesperochiron.*
DD The fls cymose or in 1-sided racemes 6 *Phacelia.*

128. BORAGINACEÆ.

A. Ovary undivided (or only laterally 4-lobed) and surmounted by the style
B Style twice bifid, stigmas not annular, cotyledons plaited or corrugated 1 CORDIA TRIBE.
BB Style once bifid or 2-parted (the divisions sometimes coalescent to the top), stigmas more or less capitate, cotyledons plane 2 EHRETIA TRIBE.
BBB Style entire, sometimes wanting, stigma shield- or ring-shaped, forming a complete ring surmounted usually by a tip or appendage which is entire or 2-lobed and varies from hemispherical to subulate 3. HELIOTROPE TRIBE.
AA Ovary 4-parted (rarely 2-parted) from above into 1-celled, 1-ovuled divisions surrounding the base of the undivided (rarely 2-lobed) style, stigma not annular . . . . . 4. BORAGE TRIBE.

1. Cordia Tribe.

Calyx tubular or bell-shaped, merely toothed or lobed . . . . . 1. *Cordia.*

2. Ehretia Tribe.

Calyx 5-parted, style 2-fid . . . . . 2. *Ehretia.*

3. Heliotrope Tribe.

A. Plants sarmentose or twining . . . . . 3. *Tournefortia.*
AA. Plants are herbs or sub-shrubs . . . . . 4. *Heliotropium.*

4. Borage Tribe.

A. Gynobase elevated
B. Apex of nutlets not projecting much beyond scar
C. Nutlets divergent or divaricate (either radiately or in pairs), extended outward or backward much beyond the insertion (which is by a roundish or oblong scar), gynobase little elevated or broadly conical.
D. Stamens included
E Nutlets covered with small cups or cavities . . . . 5. *Omphalodes.*
EE Nutlets covered with small warts or barbed bristles . . . . . 6. *Cynoglossum.*
DD. Stamens exserted
E Corolla-tube longer than spreading lobes . 7. *Lindelofia.*
EE Corolla tubular, lobes short, erect or somewhat spreading 8. *Solenanthus.*
CC. Nutlets adnate by the inner face or keel to an elevated, conical or columnar gynobase, forming a more or less globose or pyramidal fruit 9. *Myosotidium.*
BB. Apex of nutlets projecting conspicuously beyond scar
C. Pedicels persistent
D Nutlets keeled toward apex . . . 10 *Plagiobothrys.*
DD Nutlets not keeled . . . 11 *Oreocarya.*
CC Pedicels deciduous . . . . . 12. *Cryptanthe.*
AA. Gynobase flat or nearly so
B Scar excavated or often girt by a ring
C Throat of corolla has 5 scales inside.
D Filaments appendaged with a scale. . 13. *Borago.*
DD. Filaments not appendaged
E. Corolla-lobes very short and suberect . 14. *Symphytum.*
EE Corolla-lobes spreading . . 15. *Anchusa.*
CC Throat naked or pilose 16. *Pulmonaria*
BB Scar flat, either small at the inner angle or oblique
C Racemes without bracts (rarely a few bracts at base), anthers obtuse at apex.
D Throat of corolla scaly 17. *Myosotis.*
DD Throat almost naked . 18. *Mertensia.*
CC Racemes bracted
D Anthers obtuse at apex or hardly mucronate
E Lobes of corolla erect . 19. *Onosmodium.*
EE Lobes of corolla spreading
F Corolla-tube cylindrical; throat naked or 5-gibbous and subquamate 20 *Lithospermum.*
FF Corolla-tube slender, throat naked 21. *Arnebia.*
FFF Corolla tubular or salver-form; throat naked, lobes usually unequal . 22. *Echium.*
DD Anthers linear, often acuminate, arrow-shaped at base
E Nutlets distinct . . . 23 *Onosma.*
EE. Nutlets connate in pairs. . . . . 24. *Cerinthe.*

129. CONVOLVULACEÆ.

A. Corolla-lobes small, imbricate: plants parasitic, leafless sts thread-like, not green . . . 1. *Cuscuta.*
AA Corolla large, plicate or induplicate in æstivation
B Fr berry-like or harder, indehiscent. style undivided
C The ovary 4-celled, 4-ovuled . . . . . 2. *Argyreia.*
CC The ovary 2-celled, 4-ovuled . . . . 3. *Lettsomia.*
BB Fr a 2–4-valved caps with a thin or hard pericarp, or indehiscent with a thin pericarp styles 2 and distinct or the style entire or divided.
C. Stigma capitate, style entire or 2-parted; ovary 2-celled, 4-ovuled 4. *Perana.*
CC Stigma thick, globose, often twin; ovary 2–4-celled, 4-ovuled
D Stamens and style included within the corolla-tube . . . . 5. *Ipomœa.*
DD Stamens and style exserted.
E Plant a night-bloomer: corolla contorted in bud . . . 6. *Calonyction.*
EE. Plant a day-bloomer: corolla not contorted . . . 7. *Quamoclit.*
CCC Stigma capitate, ovary 2-celled . . . 8 *Breweria.*
CCCC. Stigmas 2, linear, filiform or thickish . 9 *Convolvulus.*
(Except Calystegia section. See also Rhodorhiza.)
CCCCC. Stigmas 2, flat, ovate or oblong . . . 10. *Jacquemontia.*
(Also Calystegia section of Convolvulus.)

130. SOLANACEÆ.

A. Stamens didynamous, the fifth (and sometimes also one of the pairs) smaller, abortive or missing
B. Number of perfect stamens usually 5
C. The stamens affixed at middle of tube or lower — 1. *Petunia.*
CC. The stamens affixed at apex of tube — 2. *Nierembergia.*
BB. Number of perfect stamens usually 4 or 2
C. Corolla-tube cylindrical, limb oblique, perfect stamens 2 — 3. *Schizanthus.*
CC. Corolla obliquely funnel-shaped, perfect stamens 4, didynamous — 4. *Salpiglossis.*
CCC. Corolla-tube cylindrical, straight, anthers of the 2 short stamens dimidiate, of the longer ones 2-celled — 5. *Browallia.*
CCCC. Corolla-tube twisted, anthers as in Browallia — 6. *Streptosolen.*
CCCCC Corolla-tube long, not twisted, slightly widened at apex, 4 perfect anthers with confluent cells — 7. *Brunfelsia.*
AA. Stamens all perfect not didynamous, normally 5.
B. Seeds little, if at all, flattened.
C. Fr a few-seeded berry — 8. *Cestrum.*
CC. Fr a many-seeded caps
D. Corolla with a narrow tube and short spreading lobes — 9. *Fabiana.*
DD Corolla funnel- or salver-shaped, limb equal or oblique — 10 *Nicotiana.*
BB. Seeds flattened.
C. Fr a caps.
D Corolla-lobes plicate
E. Caps 4-celled, and 4-valved (sometimes indehiscent) — 11 *Datura*
EE Caps circumscissile above the middle — 12 *Scopolia*
DD Corolla-lobes imbricate — 13 *Hyoscyamus.*
CC. Fr berry-like, or at least indehiscent.
D. Limb of corolla subequally plicate or divided into valvate or induplicate lobes
E. Anthers longer than filament, connivent connate in a cylinder or cone, acuminate at apex or dehiscent by 2 apical pores
F. Connective variously thickened on back — 14 *Cyphomandra.*
FF Connective slender or obsolete
G The anthers acuminate, hollow at tip, dehiscing by a longitudinal crack — 15 *Lycopersicum.*
GG The anthers opening by an apical pore which is sometimes continued into a longitudinal crack — 16 *Solanum*
EE. Anthers free, with parallel cells, and dehiscing by a longitudinal crack
F Stamens affixed above middle of tube — 17 *Salpichroa*
FF Stamens affixed near the base of tube
G Corolla nearly rotate or broadly bell-shaped
H Fruiting calyx hardly enlarged — 18 *Capsicum*
HH Fruiting calyx inflated or bladdery
I. Calyx cut shortly or to middle — 19 *Physalis*
II Calyx parted to base — 20 *Nicandra.*
GG Corolla tubular or narrowly funnel-shaped — 21 *Iochroma.*
DD. Limb of corolla more or less imbricate, flat and distinct or connected by induplicate sinuses
E. The lobes imbricated from the base, not plicate
F. Plants woody
G Berry with 4 stones, each 1-2-seeded — 22. *Grabowskia*
GG Berry with 2 cells, each 1-∞-seeded — 23 *Lycium*
FF Plants herbaceous — 24. *Atropa.*
EE. The sinuses of the corolla induplicate between the lobes
F Calyx long and tubular — 25. *Solandra.*
FF. Calyx leafy, 5-fid, increasing in fr. — 26. *Mandragora.*

131. NOLANACEÆ.

Single genus — *Nolana.*

132. SCROPHULARIACEÆ.

Series 1. PSEUDOSOLANEÆ Lvs. all alternate: infl. simple, introrse, corolla hardly if at all bilabiate, the 2 posterior lobes external in the bud.

A. Corolla-tube short, somewhat bell-shaped American species — 1. LEUCOPHYLLUM [TRIBE.
AA. Corolla subrotate: Old World species — 2. VERBASCUM TRIBE.

Series 2. ANTIRRHINIDEÆ Lvs prevailingly opposite, at least the lower infl simple or compound, partially centrifugal, i e, the peduncle cymosely few- to several-fld., posterior lip or lobes of corolla generally external in the bud.

A Corolla bilabiate, lips inflated, concave — 3. CALCEOLARIA
AA. Corolla bilabiate or nearly regular; lips nearly plane [TRIBE.
B Corolla saccate or spurred
C Tube wanting — 4 HEMIMERIS TRIBE.
CC Tube present — 5. ANTIRRHINUM
BB. Corolla-tube not saccate nor spurred [TRIBE
C. Infl centrifugal, cymose, usually compound, rarely sub-simple — 6 CHELONE TRIBE
CC Infl centripetal
D Anthers 1-celled — 7 MANULEA TRIBE
DD Anthers 2-celled — 8 GRATIOLA TRIBE.

Series 3 RHINANTHIDEÆ Lvs various infl simple or compound, corolla-lobes variously imbricated, the anterior or lateral ones usually exterior.

A. Anther-cells contiguous at apex and usually confluent plants not parasitic — 9. DIGITALIS TRIBE.
AA. Anther-cells everywhere distinct plants often root-parasitic
B. Corolla-lobes all flat, usually spreading — 10. GERARDIA TRIBE.
BB. Corolla with posterior lip erect, concave or galeate, anterior lip often spreading — 11. EUPHRASIA TRIBE.

1. Leucophyllum Tribe.

Corolla-lobes 5, subequal, spreading — 1. *Leucophyllum.*

2. Verbascum Tribe.

A Stamens 5 — 2. *Verbascum.*
AA. Stamens 4 — 3. *Celsia.*

3. Calceolaria Tribe.

The only genus — 4 *Calceolaria.*

4. Hemimeris Tribe.

A Corolla more or less rotate, resupinate, the grooves inconspicuous or obsolete — 5 *Alonsoa*
AA Corolla spread out flat, swollen or saccate under anterior lip — 6 *Angelonia.*
AAA Corolla flat or concave, with 2 basal spurs or pouches — 7. *Duascia*
AAAA Corolla-tube short with 1 spur or sac on the anterior side — 8. *Nemesia.*

5. Antirrhinum Tribe.

A Throat has a prominent palate
B Corolla spurred — 9 *Linaria*
BB Corolla saccate or gibbous at base — 10 *Antirrhinum*
AA Throat has no palate
B Caps opens by 2 apical pores which are sometimes confluent — 11. *Anarrhinum.*
BB Caps opens by transverse holes or irregularly
C Calyx ample, membranous — 12 *Rhodochiton*
CC Calyx smaller, herbaceous — 13 *Maurandia.*

6. Chelone Tribe.

A. Staminode often elongated
B Caps loculicidally dehiscent — 14. *Tetranema.*
BB Caps septicidally dehiscent
C. Fls bilabiate
D. Anterior lip with middle lobe folded upon itself and inclosing the stamens — 15. *Collinsia.*
DD Anterior lip of 3 flat spreading lobes
E Seeds winged — 16 *Chelone*
EE Seed not winged — 17. *Pentstemon.*
CC. Fls with all the lobes flat, spreading and subequal — 18. *Russelia.*
AA. Staminode usually in the form of a scale at apex of corolla-tube — 19. *Scrophularia.*
AAA Staminode small, minute or 0.
B. Stamens usually exserted.
C Calyx 5-parted caps tardily dehiscent — 20. *Physelius.*
CC Calyx cup-shaped berry indehiscent. — 21. *Halleria.*
BB. Stamens included, calyx 5-cut.
C. Fr an indehiscent berry — 22. *Teedia.*
CC. Fr a loculicidal caps — 23. *Paulownia.*

7. Manulea Tribe.

A. Calyx bilabiate or 2-parted — 24. *Zaluzianskya.*
AA. Calyx 5-parted — 25. *Chænostoma.*

8. Gratiola Tribe.

A. Perfect stamens 2 ..... . .26. *Gratiola.*
AA. Perfect stamens 4.
B. Stamens all affixed inside corolla-tube
c Calyx bell-shaped, 5-parted 27 *Mazus*
cc Calyx tubular, 5-toothed and -angled 28. *Mimulus.*
BB. Stamens partly inside corolla-tube, partly in throat, 2 affixed in each place . 29 *Torenia.*

9. Digitalis Tribe.

A. Caps opens by loculicidal valves.
B. Herbs creeping . . . 30 *Sibthorpia.*
BB Herbs upright 31 *Rehmannia.*
BBB Herbs thick-rhizomatous, the lvs nearly or quite radical 32. *Wulfenia.*
AA. Caps opens by septicidal valves.
B. Lvs alternate
c. Corolla declinate, tube swollen, or bell-shaped, posterior lip spreading 33 *Digitalis*
cc Corolla-tube slender, spreading 34 *Erinus*
BB. Lvs opposite 35 *Ourisia*
AAA. Caps 4-valved or loculicidally 2-valved
B Lvs all alternate or radical 36. *Synthyris*
BB Lvs. (at least lower ones) opposite . . 37 *Veronica*

10. Gerardia Tribe.

Calyx-lobes shorter than tube 38. *Gerardia*

11. Euphrasia Tribe.

A. The anther-cells equal 39 *Pedicularis*
AA. The outer anther-cell fixed by the middle, inner one pendulous or deficient
B Calyx laterally compressed, split on anterior side or both 40 *Castilleia*
BB Calyx 4-cut 41 *Orthocarpus*

Other genera to be looked for are: Bowkeria, Craterostigma, Herpestis, Lindenbergia, Scymeria

133. LENTIBULARIACEÆ.

A. Posterior lip of corolla erect; calyx 2-parted or deeply 2-lobed 1 *Utricularia.*
AA. Posterior lip of corolla spreading, calyx 4–5-parted . . 2 *Pinguicula.*

134. BIGNONIACEÆ.

A. Ovary 2-celled caps dehiscent lvs mostly opposite
B. Valves opening parallel with septum
C. Lvs 2–3-foliolate shrubs, climbing with tendrils
D Tendrils filiform, simple
E Disk present
F. Caps smooth or slightly warty, broadly linear calyx with black gland 1 *Adenocalymma.*
FF Caps rough, broad disk crenate, calyx not glandular, with 5 subulate teeth 2 *Clytostoma.*
EE Disk warting, calyx with 5 short teeth or truncate caps linear 3 *Cydista*
DD. Tendrils 3-parted, filiform, slender
E. Corolla straight or slightly curved, membranous caps narrow, smooth
F. Lobes of corolla imbricate, stamens inclosed tendrils twice or thrice 3-parted 4 *Anisostichus* (See under Bignonia)
FF. Lobes valvate, stamens exserted tendrils simply 3-parted 5. *Pyrostegia.*
EE. Corolla strongly curved, calyx leathery, tomentose
F. Stamens inclosed, fls white
G. Ovary warty caps broad, rough, not curved branches angular 6. *Pithecoctenium.*
GG. Ovary smooth caps oblong, curved, with a convex and a concave valve branches terete 7. *Distictis.*
FF. Stamens exserted, fls. red, ovary tomentose . 8. *Phædranthus.*
DDD. Tendrils 3-parted, the ramifications hooked, claw-like.
E Calyx truncate or lobed, disk simple 9 *Bignonia.*
EE. Calyx splitting on one side, disk double. . . 10. *Macfadyena.*
CC. Lvs. 2–3-pinnate upright tree 11. *Orozylon.*
BB. Valves opening at right angles to septum. upright plants or climbing without tendrils.
C. Habit climbing (upright in some forms of Campsis) lvs pinnate
D Stamens exserted lfts serrate. 12 *Tecomaria.*
DD. Stamens inclosed
E. Climbing by rootlets lfts serrate corolla campanulate-funnelform 13. *Campsis.*
EE. Climbing without rootlets. lfts. entire
F. Corolla club-shaped, straight, upright, fls in racemes.. . 14. *Campsidium*
FF. Corolla campanulate-funnelform, fls in panicles .15. *Pandorea*
CC. Habit upright herbs, with alternate lvs.: caps folliculately dehiscent.
D. Seeds with membranous wing' lvs. simple or compound . 16 *Incarvillea*
DD Seeds with fringed hairs, lvs pinnate 17. *Amphicome.*
CCC Habit upright trees or shrubs with usually opposite lvs
D Lvs simple or digitate
E Seeds fringed with hairs lvs. simple, entire
F Fertile stamens 4 lvs linear, alternate 18. *Chilopsis*
FF Fertile stamens 2 lvs cordate, opposite 19. *Catalpa.*
EE Seeds winged lvs simple or digitate 20. *Tabebuia.*
DD Lvs pinnate, rarely simple and serrate.
E. Septum flat
F. Calyx campanulate, truncate, toothed or lobed
G Staminode not elongated
H Anthers with enlarged leafy connective, calyx regularly 5-toothed shrubs lfts. serrate, lvs rarely simple 21. *Tecoma.*
HH Anthers without enlarged connective, calyx irregularly 2–5-lobed tree lfts usually entire 22 *Heterophragma.*
GG Staminode much elongated and enlarged at the apex calyx small, fls in large terminal panicles lvs 1–2-pinnate with numerous lfts 23. *Jacaranda.*
FF Calyx spathe-like, splitting on one side, corolla broadly campanulate 24 *Spathodea.*
EE. Septum thick, spongy
F Seeds in deep impressions of the septum calyx truncate or indistinctly toothed lvs usually bipinnate 25 *Radermachera*
FF Seeds in shallow impressions of the septum calyx 4–5-lobed lvs pinnate 26 *Stereospermum.*
AA Ovary 1-celled
B Fr a dehiscent caps corolla tubular, narrowed at the mouth lvs opposite, pinnate climbing with tendrils . 27 *Eccremocarpus.*
BB Fr indehiscent corolla campanulate or campanulate-funnelform trees or shrubs, with alternate lvs
C Lvs simple or 3-foliolate
D Calyx spathe-like, splitting on one side, corolla regular, fls on the old wood 28 *Parmentiera.*
DD Calyx campanulate, irregularly lobed, corolla very irregular, fls at the end of the branches 29 *Crescentia*
CC Lvs pinnate corolla irregular 30 *Kigelia*

The genus Colea is also more or less in cultivation within our limits.

135. GESNERIACEÆ.

A Ovary more or less inferior: fr. capsular.
B Disk 0 . . . . . 1. *Nsphæa.*
BB Disk annular
C Fls smallish, pallid or white ..... . 2. *Dicyrta.*
CC Fls largish, variously colored
D Corolla-tube broadly swollen or bell-shaped, calyx-lobes usually membranous or leafy 3. *Gloxinia.* (Of botanists, not of florists)
DD Corolla-tube cylindrical or broad-ened above, calyx-lobes narrow or short
E The fls axillary . 4 *Achimenes.* (Consult also Scheeria.)
EE. The fls alternate in a terminal, leafless raceme 5. *Nægelia.*
BBB Disk of 5 distinct or but slightly united glands, these equal or unequal
C Caps inferior to the middle or higher
D Anther-cells confluent at apex . 6 *Sinningia* (Gloxinia of florists.)
DD Anther-cells distinct . . 7. *Isoloma*
CC. Caps shortly immersed at base, almost superior . . . . . 8. *Gesnera-*

AA. Ovary wholly superior fr capsular or baccate, unknown in Saintpaulia
B. Anther-cells distinct and parallel.
C. Disk with a large posterior gland, otherwise small or wanting
D. Filaments free among themselves 9 *Episcia.*
DD. Filaments connate into a sheath which is split on the posterior side.
E. Anthers separate 10 *Alloplectus.*
EE Anthers connate cross-like . . . 11 *Columnea.*
CC. Disk annular, elevated, almost cup-shaped.
D. Perfect stamens 2 .... 12 *Agalmyla.*
DD. Perfect stamens 4 . ..... 13. *Trichosporum*
CCC. Disk obsolete . ... 14 *Mitraria.*
BB. Anther-cells divaricate or diverging, rarely sub-parallel
C. Disk 0
D Anthers free . . 15. *Ramonda.*
DD. Anthers cohering in a tube extending beyond the cells . 16 *Conandron.*
CC. Disk reduced to a posterior gland 17 *Codonanthe.*
CCC. Disk a ring (rarely dimidiate in Chirita)
E Lvs cauline, opposite
F. Stamens 4 .... .. 18 *Besleria.*
FF. Stamens 2 . 19 *Chirita.*
EE Lvs. basal (rarely opposite in Streptocarpus)
F. Stamens 4 . . . . . 20 *Haberlæa*
FF. Stamens 2 [*pus.*
G. Corolla-tube long . . 21 *Streptocarpus.*
GG. Corolla-tube short . . 22 *Saintpaulia.*

Additional genera described are: Acanthonema, Boea, Corytholoma, Cyrtandra, Klugia, Lysionotus, Rhabdothamnus and Roettlera.

136. MARTYNIACEÆ.

A. Corolla-tubes swollen above the short base 1 *Martynia*
AA. Corolla-tube very long, slender and cylindrical with a bell-shaped throat 2 *Craniolaria.*

137. PEDALIACEÆ.

A. Caps truncate at apex, the angles awned or horned . . 1 *Ceratotheca*
AA. Caps. obtuse or acuminate, unarmed .. . 2 *Sesamum*

138. ACANTHACEÆ.

A. Corolla expanded into a single obovate lip
B. Calyx of normal texture, posterior segms 3-5-nerved 1 *Blepharis.*
BB. Calyx usually cartilaginous, posterior segm 3-5-nerved 2. *Acanthus.*
AA. Corolla with subequal limb, or 2-lipped
B. The corolla contorted
C Ovary with 2 collateral ovules in each cell, or by abortion 1 3 *Thunbergia.*
CC Ovary with 2 to many ovules in each cell, in 1 series or alternately placed one above another
D. Filaments connate in pairs at the base.
E. Caps subterete 4 *Ruellia*
EE Caps compressed parallel to the septum 5 *Dædalacanthus.*
DD. Filaments equidistant or subconnate at the base in pairs, calyx-lobes obtuse 6 *Sanchezia.*
DDD. Filaments crowded or connate at the base on the posterior wall of the tube or 2 posterior filaments affixed a little higher
E Calyx ample, membranous or colored. 7. *Whitfieldia*
EE Calyx-segms linear, not colored.
F Ovules 2 in each cell ... . 8 *Strobilanthes*
FF Ovules 3 to many in each cell 9. *Hemigraphis*
BB. The corolla not contorted
C. Corolla of 5 flat lobes, not bilabiate.
D Stamens 4
E. The corolla-lobes variously imbricated, lateral ones usually outer
F Anthers all 2-celled . .. .. 10. *Barleria*
FF Anthers all 1-celled . .. 11. *Crossandra*
EE. The anterior corolla-lobe outside, posterior one inside
F Anthers all 1-celled . .. 12. *Stenandrium.*
FF. Anthers all 2-celled (in Chamæranthemum, the posterior anthers sometimes 1-celled).
G. Tube swollen into a long or broad throat..... .....13. *Asystasia.*
GG. Tube long, slender, scarcely swollen at apex ..... 14. *Chamæranthemum.*
DD Stamens 2 ovules in each cell 2 .. 15 *Eranthemum.*
CC. Corolla bilabiate or sub-equally 4-cut.
D. Ovules in each cell 3 or more 16 *Phlogacanthus*
DD. Ovules in each cell 2
E Fls with 2 or 4 bracts longer than calyx . . 17. *Peristrophe.*
EE Fls without such bracts
F Stamens 4, anthers all 1-celled . 18. *Aphelandra.*
FF Stamens 2, anthers 2-celled
G. Anther-cells unlike, one larger or affixed higher (In Jacobinia cells often subequal)
H The lower anther cell usually spurred 19. *Justicia.*
HH The anther-cells not spurred, sometimes equally mucronate at base
I. The corolla with short tube and ample lips 20. *Adhatoda.*
II The corolla-tube usually long and narrow 21. *Jacobinia.*
GG. Anther-cells equal
H. Staminodes at base of filaments small
I Corolla-tube swollen above, posterior lip incurved, anterior spreading, 4-cut 22. *Graptophyllum.*
II Corolla-tube elongated, limb sub-bilabiate, 4-lobed 23 *Thyrsacanthus*
HH Staminodes 0
I Veins of lvs white or colored 24 *Fittonia.*
II Veins of lvs green
J Calyx-segms linear or bristle-like 25 *Schaueria*
JJ Calyx small, lobes acute or acuminate 26 *Anisacanthus*

The following genera are also treated Anisotes, Beloperone, Dianthera, Dichptera, Duvernoia, Dyschoriste, Lepidagathis, Micranthus, Pseuderanthemum, Rungia and Warpuria

139. GLOBULARIACEÆ, or SELAGINACEÆ.

A. Calyx 5-cut, the 2 posterior lobes of the corolla narrow or connate or deficient 1 *Globularia.*
AA Calyx cut down one side, posterior lobes of corolla 4. 2 *Hebenstretia*

140. PHRYMACEÆ.

The only genus *Phryma*

141. MYOPORACEÆ.

Corolla more or less bell-shaped, rarely funnel-shaped, with a subregular limb, ovary 2- or more-celled, cells 1-ovuled, rarely 2-celled and 2-ovuled .... *Myoporum.*

142. VERBENACEÆ.

A. Infl centripetal
B Fls sessile in the spike
C Nutlets 2, or by abortion 1, 1-seeded.
D Fr a juicy berry . ... . 1. *Lantana*
DD Fr drupaceous calyx 2-4-cut or -toothed . .. ... 2. *Lippia*
DDD Fr. dry calyx 5-toothed . 3 *Stachytarpheta*
CC Nutlets or cells of fr. 4, or by abortion fewer, 1-seeded . ... 4. *Verbena*
BB Fls pedicelled
C Nutlets 1-seeded
D Number of nutlets 4. ..... 5. *Amasonia.*
DD Number of nutlets 2 or 1..... .... 6 *Petræa.*
CC. Nutlets 2-seeded, in pyrenes 2-5, 2-locellate . . . 7 *Duranta.*
AA Infl centrifugal.
B. Fr. drupe-like, entire or 4-lobed, exocarp usually pulpy or fleshy, the endocarp entire or 4-celled, often separating into 4 nutlets
C Corolla regular, stamens as many as petals . 8. *Callicarpa.*
CC. Corolla-limb oblique, with anterior lobe produced, or sub-bilabiate, stamens 4, didynamous or arched under posterior lobes
D. Drupe with one 4-celled stone.
E. Corolla-tube cylindrical, short..... 9. *Vitex.*

EE Corolla-tube strongly dilated above 10 *Gmelina.*
DD. Drupe 4-parted, with 4 stones, or by reduction 1-stoned (this 1-celled)
E Fertile stamens 2 11 *Ozera*
EE Fertile stamens 4 12 *Clerodendron.*
BB. Fr dry, subcapsular, exocarp with 4 valves involute at the margin from the base up, which carry off the nutlets and leave no central column .. . . 13. *Caryopteris.*

Other genera in cultivation in North America are Avicennia, Citharexylum, Congea, Diostea, Faradaya, Premna.

143. LABIATÆ.

I. Summary of Tribes

Ignoring exceptions.

A. The nutlets fleshy or drupe-like, affixed to a small basal or oblong introrsely oblique areole ovary 4-lobed 1 PRASIA TRIBE.
AA. The nutlets dry or hard
B. Ovary shortly, rarely deeply 4-lobed nutlets wrinkled or netted, affixed to an obliquely introrse or lateral, usually large, areole
C. Seeds, when known, with endosperm corolla with an ample throat and broad lobes 2 PROSTANTHERA TRIBE.
CC Seeds without endosperm corolla various 3 AJUGA TRIBE.
BB. Ovary 4-parted to the base nutlets affixed to a small basal or slightly oblique areole
C. Stamens declinate, perfect ones 4, rarely 2, anthers 1-celled by confluence 4 OCIMUM TRIBE.
D Subtribe 1 EUOCIMEÆ Areole basal, stamens usually exserted, anterior corolla-lobe usually unlike the others
DD. Subtribe 2 LAVANDULEÆ Areole extrorsely oblique, stamens included, corolla-lobes equal or the anterior lobe with the lateral ones forming the anterior lip
CC. Stamens ascending, or in the Stachys Tribe sometimes included (Consult also CCC)
D. Perfect stamens 2, anther-cells linear, separate, solitary or confluent 5 MONARDA TRIBE.
DD. Perfect stamens 4, rarely 2 in the Nepeta Tribe
E Calyx usually 15-nerved, posterior stamens longer than the anterior 6 NEPETA TRIBE.
EE Calyx 5- or 10-nerved, posterior stamens shorter than anterior, posterior lip of corolla erect, usually concave or fornicate, anterior spreading, 3-cut 7 STACHYS TRIBE.
F Subtribe 1 SCUTELLARIEÆ Calyx bilabiate or at length 2-parted, the mouth closed after anthesis
FF Calyx not bilabiate
G Subtribe 2 MELITTEÆ Corolla-tube long-exserted, calyx broad, of 5 short teeth or 3-4 broad lobes
GG. Corolla-tube included or slightly exserted, rarely long-exserted, calyx tubular or bell-shaped, 5-10-toothed.
H. Subtribe 3 MARRUBIEÆ Stamens included
HH Subtribe 4 LAMIEÆ Stamens exserted
CCC. Stamens straight, diverging or ascending, perfect ones 4 or 2, calyx 5-, 10-, or 13-nerved, rarely 15-nerved, corolla-lobes usually flat 8. SATUREIA TRIBE.
D Subtribe 1 POGOSTEMONEÆ. Anthers 1-celled, subglobose; stamens distinct, straight
DD Anthers 2-celled, at least the younger ones
E Subtribe 2. MENTHOIDEÆ. Calyx usually 5- or 10-nerved, stamens distant or divaricate.
EE. Subtribe 3 MELISSEÆ Calyx usually 13-nerved, stamens ascending, at least at the base.

II. Key to the Tribes.

1. Prasia Tribe.

Not in cultivation.

2. Prostanthera Tribe.

A. Calyx bilabiate; lips entire or anterior emarginate . . .. 1. *Prostanthera.*
AA. Calyx equal, 5-toothed..... ..... . 2. *Westringia.*

3. Ajuga Tribe.

A. Corolla-tube slender, lobes 5, subequal, spreading 3 *Trichostema.*
AA. Corolla-tube, quasi 1-lipped, the posterior lobes and small lateral ones declinate at the contracted base of the very large anterior lobe, or rarely erect 4 *Teucrium.*
AAA. Corolla-tube short or exserted, the posterior lip short, erect, 2-cut, anterior much longer and its middle lobe largest 5 *Ajuga.*

4. Ocimum Tribe.

A Subtribe 1 EUOCIMEÆ
B Anterior lobe of corolla hardly longer than the others, often narrower, declinate, flat or slightly concave
C Fruiting calyx deflexed 6 *Ocimum.*
CC Fruiting calyx scarcely enlarging, often declinate 7 *Moschosma.*
BB Anterior lobe of corolla longer than others, concave or boat-shaped
C Filaments connate at the base in a tube 8 *Coleus*
CC Filaments free 9 *Plectranthus.*
AA. Subtribe 2 LAVANDULEÆ Sole genus 10 *Lavandula.*

5. Monarda Tribe.

A Calyx tubular .11. *Monarda.*
AA Calyx bilabiate
B Fertile anther-cells 2 upper lip of corolla 4-lobed 12 *Perowskia.*
BB Fertile anther-cells 1 upper lip of corolla entire or bifid
C Connective continuous with filament and not indicated unless by a slender reflexed tooth 13. *Rosmarinus.*
CC Connective articulated to the filament but not produced or very shortly acuminate 14. *Audibertia.*
CCC Connective elongated, versatile on the short filament, its sterile end continued beyond the articulation and either dilated or bearing an abortive rudiment of the second anther-cell 15. *Salvia.*

6. Nepeta Tribe.

A Calyx bilabiate or with the posterior tooth much wider than the others 16 *Dracocephalum.*
AA Calyx tubular, mouth straight or oblique
B Stamens erect or divergent, anther-cells parallel or at length divergent 17 *Lophanthus.*
BB Stamens ascending or straightish, anther-cells parallel 18 *Cedronella.*
BBB Stamens ascending and parallel or in a few species rather lax and distant, anther-cells divergent or divaricate . ... 19. *Nepeta.*

7. Stachys Tribe.

Subtribe 1. Scutellarieæ.

A. The calyx-lip entire . 20. *Scutellaria.*
AA. The posterior calyx-lip 3-toothed, anterior 2-fid.... . . . . .21. *Brunella.*

Subtribe 2. Melitteæ.

A. Anther-cells parallel, calyx subequally 5-toothed 22. *Physostegia.*
AA. Anther-cells divergent, calyx 3-lobed .. .23. *Melittis.*

Subtribe 3. Marrubieæ

Calyx 5-10-toothed, corolla-tube included, anther-cells at length confluent.. . .. 24. *Marrubium.*

Subtribe 4. Lamieæ.

AA. The posterior lip of corolla often short or flat, glabrous or pubescent 25 *Colquhounia.*
AA. The posterior lip concave or fornicate, rarely flattish, usually villous
B. Teeth of calyx 6-13, rarely 5
c Calyx very broad at apex . 26 *Moluccella.*
cc Calyx long-tubular . 27 *Leonotis.*
BB Teeth of calyx 5
c. Stamens often cast to one side after anthesis 28 *Stachys.*
cc Stamens often hairy on the back of the anthers 29 *Lamium.*
ccc Stamens often have the posterior filaments appendaged at the base 30 *Phlomis.*

8. Satureia Tribe.

Subtribe 1. Pogostemoneæ

Calyx, 5-toothed, corolla 4-cut, anterior lobes usually wider spreading . 31. *Pogostemon.*

Subtribe 2. Menthoideæ.

A. Whorls spicate or racemose, not axillary
B Calyx equal, erect, often elongated in fr , whorls many-fld 32 *Elsholtzia.*
BB Calyx subequal in anthesis, but declinate and bilabiate in fr , whorls 2-fld
c Nutlets smooth 33 *Collinsonia*
cc Nutlets netted-veined 34 *Perilla*
AA Whorls axillary (or, in a few species of Mentha, crowded in a dense terminal spike)
B Perfect stamens 4 35 *Mentha*
BB Perfect stamens 2 36 *Cunila*
AAA. Whorls in dense heads surrounded by involucral bracts
B Corolla sub-bilabiate, whorls densely many-fld
c. Lobes of corolla ovate, heads often corymbose-paniculed 37 *Pycnanthe-*[*mum.*
cc. Lobes of corolla oblong or linear, heads globose, solitary 38 *Monardella.*
BB Corolla bilabiate, whorls 2-fld , rarely more, heads solitary, crowded or corymbose paniculed 39. *Origanum.*
AAAA Whorls few-fld , axillary or the upper ones spicate, calyx-throat closed by villous hairs 40. *Thymus.*
AAAAA Whorls axillary or the highest spicate, calyx open-bell-shaped, equal
B Calyx 10-nerved, stamens ascending 41 *Satureia.*
BB Calyx 15-nerved, stamens divergent . . 42 *Hyssopus.*

Subtribe 3. Melisseæ.

A. Posterior lip of corolla concave, sickle-shape or galeate 43 *Acantho-*[*mintha.*
AA. Posterior lip of corolla flattish or slightly concave
B. Calyx distinctly 2-lipped
c Corolla-tube straight or slightly curved 44 *Satureia* §
cc Corolla-tube below the middle recurved-ascending 45 *Melissa* [*Calamintha*
BB Calyx equal or sub-bilabiate
c Perfect stamens 4 46 *Micromeria.*
cc Perfect stamens 2 47 *Hedeoma*

Other genera treated are Eremostachys, Galeopsis, Pycnostachys, Sideritis, Synandra and Tinnea

144. PLANTAGINACEÆ.

One genus in cultivation *Plantago.*

145. NYCTAGINACEÆ.

A Fls involucrate
B Stigma with a small head, anthers didynamous . 1 *Mirabilis.*
BB Stigma linear, anthers not didynamous . 2 *Abronia.*
AA Fls not involucrate, but bracted
B Bracts large, colored 3 *Bougain-*[*villea.*
BB Bracts very small . . 4. *Pisonia.*

146. AMARANTACEÆ.

A Anthers 2-celled
B Ovary 2-ovuled
c Fr utricle . 1 *Celosia.*
cc Fr berry-like 2 *Deeringia.*
BB. Ovary 1-ovuled.
c. Ovule erect, with a short funiculus.
D Segms of perianth stellate in fr : fls. in terminal racemes shrubs . 3. *Bosea.*
DD. Segms of perianth upright in fr.: fls. in clusters or panicles herbs 4 *Amarantus.*
cc. Ovule suspended from the apex of an elongated funiculus
D. Perianth-segms scarious at apex, connate at base . 5. *Trichinium.*
DD. Perianth-segms hyaline, membranous or somewhat papery, lanate . . . . 6. *Ærva.*
AA. Anthers 1-celled
B Fls minute in glomerules or little-spiked along the sparse branches of the panicle . 7 *Iresine.*
BB. Fls in heads or spikes rarely panicled
c Stigmas 2
D Perianth-segms free or connate at base 8 *Gomphrena*
DD Perianth-tube 5-cut, cristate or winged in fr 9 *Fraelichia.*
cc Stigma simple
D Staminal tube short or long, with 5 anther-bearing awl-shaped laciniæ and 5 antherless laciniæ interposed 10. *Telanthera*
DD Staminal tubes with no antherless laciniæ interposed .11 *Pfaffia.*

147. CHENOPODIACEÆ.

A Fls with 4 bractlets, 2 of which are adnate to the perianth at the base, or higher
B Embryo spiral filaments straight in the bud 1 *Basella.*
BB Embryo semi-annular filaments recurved at apex or lower in the bud 2 *Boussin-*[*gaultia.*
AA Fls with bractlets not adnate to perianth
B Embryo spiral endosperm scant or 0 3 *Salsola.*
BB Embryo ring-shaped or horseshoe-shaped endosperm copious (Salicornia has conduplicate embryo and no endosperm)
c St and branches articulated fls immersed in caves in the superposed joints no foliage-lvs 4 *Salicornia.*
cc St not articulated
D Perianths heteromorphous, staminate without bracts, 3-5-lobed or parted, pistillate usually 0 fls with 2 bractlets accrescent in fr free or connate into a sack, and no perianth
E Pistillate fls without perianth, 3-4-toothed 5 *Spinacia.*
EE Pistillate fls with ample bracts which enlarge in fr , perianth 0 6 *Atriplex*
DD Perianths homomorphous, i e , not of two different forms in the same plant
E Fls hermaphrodite and feminine, solitary or glomerate seed horizontal, embryo annular, albumen scant 7 *Kochia.*
EE Fls glomerate, hermaphrodite or unisexual seed erect, inverse or horizontal, embryo annual or horseshoe-shaped
F. Perianth-tube surrounded by a wing stamens 5 seed horizontal, bony 8 *Cycloloma.*
FF. Perianth 5-parted, usually unchanged in fr stamens 1-5 seed erect or horizontal, bony or leathery 9. *Chenopod-*[*ium*
FFF Perianth 5-lobed, hardened at the base in fr seed horizontal, leathery 10 *Beta.*

The genus Ullucus, allied to Basella, is also described briefly.

148. PHYTOLACCACEÆ.

A. Ovary superior
B Carpel 1 1 *Rivina*
BB Carpels 2-∞, united into a berry 2 *Phytolacca*
BBB Carpels 1 or 2, united, the fr with scales at top 3 *Petiveria*
AA. Ovary semi-inferior fr inferior 4 *Agdestis.*

149. POLYGONACEÆ.

A. The fls fascicled in the axils or at the nodes of infl (In the first 3 genera sometimes along the rachis of infl)
B. Endosperm 3-6-lobed with longitudinal grooves and usually ruminate
c. Fruiting perianth fleshy or berry-like at the base or everywhere, the nut included or exserted at the apex 1 *Muehlen-*[*beckia.*
cc. Fruiting perianth with fleshy or berry-like tube, including the nut and often adnate to it, crowned by the unchanged connivent or marcescent limb . . . . 2. *Coccoloba.*

cccc. Fruiting perianth enlarged, membranous or scarious, colored, outer segms. larger and broadly cordate, inner ones oblong 3. *Antigonon.*
cccc. Fruiting perianth developing wings on the 3 outer parts 4 *Triplaris.*
BB. Endosperm equable, entire
c. Perianth 5-merous, rarely 4-merous; styles usually filiform and stigmas usually capitate.
D. Pistil 2–3-merous, stamens usually 6–8 shrubs, often spinescent 5. *Atraphaxis.*
DD Pistil 3-merous stamens 8 or fewer herbaceous, rarely suffruticose
E Nut entirely or nearly covered by the fruiting perianth 6 *Polygonum.*
EE. Nut much longer than the fruiting perianth . 7. *Fagopyrum.*
CC. Perianth 6-merous, rarely 4-merous
D Stamens 9, rarely 6, fruiting perianth unchanged nut 3-winged 8. *Rheum.*
DD. Stamens 6, rarely 9, inner segms of fruiting perianth much enlarged, erect and including the 3-angled nut 9. *Rumex.*
AA. The fls in infl dichotomously or umbellately branched, the floral lvs or bracts connate below the branches into one 3-cut bract, or free and 3–∞ in number . 10. *Eriogonum.*

150. NEPENTHACEÆ.

The only genus *Nepenthes.*

151. ARISTOLOCHIACEÆ.

A. Perianth persistent, 3-lobed above ovary, regular stamens 12 surrounding the style in 2 series, anthers free 1 *Asarum*
AA. Perianth deciduous, irregular, polymorphous, anthers 6–∞, adnate in 1 series to a stylar column 2 *Aristolochia.*

152. SAURURACEÆ.

A. Stamens 3 . . 1 *Houttuynia*
AA Stamens 5-8
B Carpels connate . 2 *Anemopsis*
BB. Carpels distinct . . . 3 *Saururus*

153. PIPERACEÆ.

A. Stamens 2–6, anther-cells usually distinct, stigmas 3–4, rarely 2 or 5 1 *Piper*
AA. Stamens 2, anther-cells confluent into one 2-valved anther, stigma terminal or lateral, penicillate or undivided 2. *Peperomia.*

154. CHLORANTHACEÆ.

In cultivation . *Chloranthus.*

155. MYRISTICACEÆ.

Sole genus . . . . . *Myristica.*

156. MONIMIACEÆ.

A. Stamens numerous, anther-cells dehiscing in a 2-valved fashion by a longitudinal crack... 1. *Peumus.*
AA. Stamens 6–12, anther-cells dehiscing above... 2. *Laurelia.*

157. LAURACEÆ.

A. Anthers 2-locellate, valves laterally dehiscent or quickly deciduous 1. *Hernandia.*
AA. Anthers extrorsely locellate, valves dehiscent upwards
B. The whole perianth persisting under the fr., appressed or slightly spreading, perianth sometimes deciduous from the base 2. *Persea.*
BB. The perianth-segms at length transversely cut, leaving the fruiting tube bell-shaped or expanded and 6-toothed .. . 3. *Cinnamomum.*
BBB. The perianth-segms deciduous from base, fruiting tube flattened or disk-shaped and entire or truncate 4 *Cinnamomum* § *Camphora*
AAA. Anthers introrsely locellate, valves dehiscing upward.
B. Fls in a short, lax raceme, accompanied by small and narrow bracts 5. *Sassafras.*
BB. Fls umbellate, capitate or rarely solitary, umbels or heads before anthesis included in a 4–6-bracted involucre.
C. Locellæ of anther 4 . . . . . 6. *Umbellularia.*
CC. Locellæ 2
D Stamens usually 9, fls dicœcious 7. *Benzoin.*
DD. Stamens usually 12–20, fls. polygamous 8 *Laurus.*

The genus Litsea is sparingly in cultivation

158. THYMELÆACEÆ.

A Stamens fewer than the corolla-lobes. . . . 1. *Pimelea.*
AA. Stamens twice as many as corolla-lobes
B. Disk 0 or a very short ring
C Perianth-tube cylindrical, limb spreading 2. *Daphne.*
CC. Perianth much swollen above, obliquely truncate, limb not spreading . 3 *Dirca.*
BB. Disk more or less lobed or oblique
C Fls 5-merous, disk cup-shaped .. .. 4. *Dais*
CC Fls 4-merous
D The disk annular, lobes very short..... 5 *Edgeworthia.*
DD The disk 4-cut or 2-cut .. 6 *Wikstræmia*

The genera Gnidia, Lagetta, and Thymelæa will also be found in the book

159. PROTEACEÆ.

Series 1. Fr an indehiscent nut or drupe: fls. usually solitary with a bract under each one

A. Fls dicœcious by abortion, regular ..... 1. *Leucadendron.*
AA Fls. hermaphrodite, irregular . .... 2. *Protea.*

Series 2 Fr follicular, capsular or rarely indehiscent and subdrupaceous fls usually in pairs along the rachis with only 1 bract for each pair

A Ovules 2, collateral
B Fls racemose or fascicled, involucre none or inconspicuous, bracts deciduous
C The ovules pendulous, orthotropous
D Fr scarcely or tardily dehiscent, pericarp thick, fleshy or hard, seeds with thick, often unequal cotyledons
E Perianth-limb recurved . 3 *Guevina*
EE Perianth straight 4 *Macadamia.*
DD Fr follicular or obliquely 2-valved, seeds compressed, margined or wing 5. *Roupala.*
CC The ovules laterally affixed or ascending
D Seeds with or without a narrow wing 6 *Grevillea.*
DD Seeds samara-like, wing oblong, terminal 7 *Hakea*
BB Fls in dense bracted spikes or cones 8 *Banksia*
AA Ovules 4 or more
B Fls umbellate seeds winged below 9 *Stenocarpus.*
BB Fls in dense racemes seeds samara-like, with an oblong terminal wing 10 *Telopea.*
BBB Fls twin, in short or long racemes seeds samara-like with a terminal truncate wing . 11 *Lomatia*

160. ELÆAGNACEÆ.

A Lvs alternate stamens 4
B Fls hermaphrodite . . . . . 1 *Elæagnus*
BB Fls unisexual, usually dicœcious..... 2 *Hippophaë.*
AA Lvs opposite stamens 8 . . . . . 3 *Shepherdia.*

161. LORANTHACEÆ.

A Perianth double .... 1. *Loranthus.*
AA Perianth single or simple ... . 2 *Phoradendron.*

Viscum is also of general interest.

162. SANTALACEÆ.

A. Plant herbaceous, low .. . . . 1 *Comandra.*
AA Plant woody, shrubs or trees.
B Fls perfect . . . . . 2. *Santalum*
BB Fls dicœcious or polygamous
C Lvs alternate . 3 *Pyrularia.*
CC. Lvs opposite .. .. 4. *Buckleya.*

163. PLATANACEÆ.

Sole genus... .. . . *Platanus.*

164. MORACEÆ.

A. Anthers reversed on the bud with inflexed filaments
  B. The male fls spicate, racemose or capitate, female globose, capitate.
    c. Female perianth dentate . ... 1. *Broussonetia*
    cc Female perianth deeply 4-fid . 2 *Maclura.*
  BB The fls of either sex spicate, spikes short and dense or long and lax 3. *Morus*
BBB. The fls crowded on fleshy receptacle 4. *Dorstenia.*
AA. Anthers erect from the beginning
  B. Plants, trees or shrubs fls. usually on a fleshy receptacle
    c. The receptacle fleshy, globose or ovoid, clearly inclosing the numerous fls, but with a small mouth which is bracteate introrsely, the mouth is closed in fr 5. *Ficus*
    cc. The receptacle androgynous, male fls numerous, females solitary in the center of the receptacle 6. *Brosimum.*
    ccc. The receptacle unisexual, with an involucre of numerous bracts overlapping in series 7. *Antiaris.*
    cccc. The fl -clusters unisexual, with or without 3-4 bracts at the base, in heads, spikes, rarely in racemes or the female 1-fld
    D. Stamens 4 8 *Cudrania.*
    DD Stamens 1 9. *Artocarpus.*
  BB. Plants, herbs fls not on a fleshy receptacle
    c St climbing lvs opposite. embryo spirally involute 10 *Humulus.*
    cc. St. not climbing lvs alternate or the lowest opposite embryo curved . . 11 *Cannabis.*

Coussapoa is also briefly treated.

165. URTICACEÆ.

A. Hairs stinging
  B Achene straight . .. . 1 *Urtica.*
  BB Achene oblique . ... 2. *Urera.*
AA Hairs harmless
  B Perianth of the female fl, 3-5-parted
    c Lvs opposite stamens 4, rarely 2-3 . 3 *Pilea.*
    cc Lvs alternate, distichous, oblique at base stamens 5, rarely 4 4 *Pellionia.*
  BB. Perianth of the female fl tubular, inclosing the achene, not adnate lvs opposite or alternate fls in clusters or panicles 5 *Boehmeria.*
BBB Perianth of the female fl tubular adnate to the achene lvs alternate, tomentose below fls in globular heads often forming cymes 6. *Debregeasia.*

Helxine, Parietaria, and Pipturus are described

166. ULMACEÆ.

A. Fr drupaceous fls on the young growth
  B Cotyledons very broad
    c Sepals connate, style excentric 1 *Zelkova*
    cc Sepals distinct or nearly so, style central
      D Fr globose, not winged 2 *Celtis*
      DD Fr winged . 3 *Pteroceltis*
  BB Cotyledons narrow
    c Fertile fls perfect, fls in cymes 4 *Trema*
    cc Fertile fls unisexual, solitary, staminate in cymes before the lvs 5 *Aphananthe.*
AA. Fr not drupaceous, winged or muricate fls on last year's branches
  B Fr. stalked, surrounded by a broad wing 6 *Ulmus.*
  BB Fr not winged, everywhere somewhat fleshy and muricate ... . 7 *Planera.*

167. JUGLANDACEÆ.

A. The fls. of either sex in erect spikes, imbricate-bractate 1. *Platycarya.*
AA. The staminate fls in pendulous catkins, pistillate fls spicate or subsolitary
  B. In germinating, cotyledons are borne above ground and remain green 2. *Pterocarya.*
  BB. In germinating, cotyledons remain inside the nut
    c. Husk at length splitting into segms.; nut smooth or angled . . 3. *Carya.*
    cc. Husk indehiscent, nut wrinkled or sculptured . . .. 4. *Juglans.*

168. LEITNERIACEÆ.

The only genus.. . . *Leitneria.*

169. MYRICACEÆ.

A. Lvs. serrate or entire, not stipulate ovary subtended by 2-4 bractlets 1. *Myrica.*
AA. Lvs pinnatifid, stipulate ovary subtended by 8 linear, persistent bractlets 2 *Comptonia*

170. CASUARINACEÆ.

Sole genus . . . . *Casuarina.*

171. EUPHORBIACEÆ.

A. Ovules 2 in each cell of ovary plant without milky juice (or red juice in Bischofia).
  B. Lvs alternate, simple (sometimes opposite in Poranthera)
    C. Calyx of staminate fls imbricate
      D Petals present, at least in staminate fls
        E. Plant a shrub with broad, glabrous or somewhat hairy lvs ovary 3-celled 1. *Andrachne.*
        EE. Plant a tree, with scaly herbage ovary 1-celled 2 *Actinostachys.*
        EEE. Plant a heath-like sub-shrub lvs narrow, with recurved margin 3. *Poranthera*
      DD. Petals 0
        E. Fls single or in axillary clusters
          F Styles slender or only broadened at apex
            G Rudimentary pistil present in staminate fls, disk present lvs entire
              H. Seed grooved on inner face disk of pistillate fl lobed 4. *Flueggea.*
              HH. Seed not grooved disk entire 5 *Securinega.*
            GG Rudimentary pistil absent
              H Disk present 6 *Phyllanthus.*
              HH Disk absent, at least from pistillate fls
                I Fr a caps . 7. *Glochidion.*
                II Fr more or less fleshy
                  J The styles 2-parted 8 *Breynia*
                  JJ The styles almost entire 9. *Sauropus*
          FF Styles broad, spreading
            G Stamens arising from a disk
              H Staminate fls with rudimentary pistil 10 *Drypetes*
              HH Staminate fls without rudimentary pistil 11 *Hemicyclia.*
            GG Stamens 2-4, without disk 12 *Putranjiva.*
        EE. Fls. in elongated catkin-like or branched infl, dœcious lvs large, broad and plane
          F. Ovary 1-celled, stamens 2-5 13 *Antidesma*
          FF Ovary 2-5-celled
            G Staminate fls with rudimentary pistil 14 *Baccaurea*
            GG Staminate fls without rudimentary pistil 15. *Daphniphyllum.*
      cc Calyx of staminate fls valvate, petals small 16 *Lebidieropsis.*
  BB Lvs alternate, compound 17 *Bischofia*
  BBB. Lvs opposite, compound 18 *Oldfieldia*
  BBBB Lvs whorled, simple 19 *Hyænanche.*
AA. Ovules 1 in each cell of the ovary
  B. Fls produced singly or in ordinary infl
    C. Stamens incurved in the bud, pubescence stellate or scaly, juice not milky 20 *Croton.*
    CC. Stamens erect in the bud
      D. Juice not milky (see also Codiæum and relatives) calyx valvate lvs simple
        E. Staminate fls with petals herbs 21. *Chrozophora.*
        EE. Staminate fls apetalous
          F. Stamens much branched herbs with lvs. palmately veined and peltate. . . . . 22. *Ricinus*
          FF. Stamens not branched
            G. Lvs opposite styles free (see also Mallotus)
              H. The stamens as many as 50 23. *Trewia*
              HH. The stamens 8-20 24. *Mercurialis.*
            GG. Lvs. alternate, or rarely opposite
              H. Plant a thorny shrub: stamens 8-15 . . . 25. *Adelia.*
              HH. Plant with holly-like spiny margined lvs.. stamens 3-8. 26. *Alchornea.*

BBB. Plant unarmed or with stinging hairs.
I. Styles free or united only at base
J. Anther-cells spherical to oblong
K Anthers 2-celled 27. *Mallotus.*
KK Anthers 3–4-celled lvs. usually peltate 28 *Macaranga.*
JJ. Anther-cells elongated, often vermiform 29. *Acalypha.*
II. Styles united above the base st often climbing
J. Infl without conspicuous involucre
K Number of stamens usually 3, styles free at apex 30. *Tragia.*
KK. Number of stamens 8-30, styles united to the apex into a swollen column 31. *Plukenetia.*
JJ Infl subtended by a conspicuous involucre 32 *Dalechampia.*
DD. Juice almost always more or less milky (chief exceptions in Cluytia and relatives)
E. The fls with petals, at least the staminate
F. Calyx valvate
G Lvs simple, palmate.. . .. 33 *Aleurites*
GG Lvs compound .. 34. *Joannesia.*
FF. Calyx imbricate
G Petals free from one another.
H The stamens in 2 or more whorls
I. Number of stamens about 10 lvs usually palmately veined 35 *Jatropha*
II. Number of stamens 15–30 or more lvs pinnately veined styles entire 36 *Codiæum*
HH The stamens in 1 whorl, usually about 3-5 37 *Cluytia*
GG. Petals connate lvs usually palmately veined
H Some of the filaments united lvs simple 35 *Jatropha*
HH Filaments free,lvs compound 38 *Ricinodendron*
EE. The fls apetalous
F. Sepals valvate or slightly imbricate in some
G Lvs trifoliate 39 *Hevea*
GG Lvs simple, pinnately veined
H Number of stamens 3 lvs spiny margined 40 *Pachystroma*
HH Number of stamens 1 lvs not spiny 41 *Ophthalmoblapton.*
FF. Sepals or lobes of calyx, if any, imbricate lvs simple
G. Number of stamens usually 10 or more (5-50)
H. Staminate calyx with 5 sepals connate, at least at base lvs usually palmately veined st erect
I Herbage with stinging hairs 35 *Jatropha.*
II Herbage usually glabrous 42 *Manihot.*
HH. Staminate calyx 3 -5-lobed lvs pinnately veined st climbing or trailing 43 *Mabea*
HHH Staminate calyx of 1 or 2 sepals 44. *Homalanthus.*
HHHH Staminate calyx cupulate, truncate or dentate lvs. broad, hairy 45. *Hura.*
GG. Number of stamens 1–5
H Staminate calyx with 4–5 free sepals st climbing 46. *Omphalea.*
HH. Staminate calyx with 2–3 sepals, free or connate at base
I. Infl usually terminal· seed caruncule 47. *Sebastiana.*
II. Infl usually axillary: seed not caruncule . 48. *Excœcaria.*
HHH. Staminate calyx with connate sepals, 1–3-lobed.
I. The stamens 2-3.
J. Stamens free
K Base of caps persistent as a pointed piece. 49. *Sapium.*
KK. Base of caps not persistent, only a 3-parted central column remaining 50. *Stillingia.*
JJ Stamens united
K Pistil 4-celled .... 51. *Maprounea.*
KK. Pistil 6–9-celled.... ..52. *Hippomane.*
II. The stamens 1
J Infl. terminal 51. *Maprounea.*
JJ Infl lateral or axillary 41. *Ophthalmoblapton.*
HHHH. Staminate calyx 0, or rarely 1–2 minute scales 53. *Colliguaya.*
BB. Fls. in cyathia (see explanation under Euphorbia)
C. Cyathia regular or nearly so.
D. Involucral glands free from one another, alternate with lobes of involucre . 54. *Euphorbia.*
DD. Involucral glands united into a ring around the lobes .... 55 *Synadenium.*
CC. Cyathia decidedly irregular ..... . .56. *Pedilanthus.*

172. BUXACEÆ.

A. Cells of ovary with 2 ovules each; stamens 4.
B. Lvs alternate
C Evergreen shrubs lvs entire ..... 1. *Sarcococca.*
CC. Evergreen herbs. lvs dentate..... 2. *Pachysandra.*
BB Lvs. opposite . . .... 3. *Buxus.*
AA Cells of ovary with 1 ovule each; stamens numerous lvs. opposite . ..... 4. *Simmondsia.*

173. BETULACEÆ.

A. Staminate fls with 4 perianth-segms. or by abortion fewer (Birch Tribe)
B Stamens 2 . 1. *Betula.*
BB Stamens 4 2 *Alnus.*
AA Staminate fls with no perianth (Hazel Tribe).
B Nut large, inclosed by a leafy involucre staminate fls with 2 bractlets, pistillate fls 2–4, capitate 3. *Corylus.*
BB Nut small, subtended by or inclosed in a large bractlet staminate fls with no bractlets, pistillate catkins spike-like
C Fruting bractlet flat, 3-cleft and incised 4. *Carpinus.*
CC Fruting bractlet bladder-like, closed, membranous . 5. *Ostrya.*

174. FAGACEÆ.

A. Ovary of pistillate fls 6-celled, spikes of either sex erect and strict fruiting involucre or bur densely covered with strong prickles 1. *Castanea.*
AA Ovary of pistillate fls 3-celled, rarely 4- or 5-celled in some species of Quercus
B Staminate fls 1–3 in a cluster lvs usually small 2. *Nothofagus.*
BB Staminate fls in loose, roundish pendulous heads lvs generally large 3 *Fagus.*
BBB Staminate fls in pendulous catkins or the spikes of either sex erect and strict
C. Involucre of numerous scales forming a cup in fr and subtending the acorn 4 *Quercus.*
CC Involucre in fr armed with clusters of prickles or tubercles, wholly including the fr, perfectly closed or at length split irregularly . 5. *Castanopsis*

175. SALICACEÆ.

A Lvs usually narrow disk composed of 1 or 2 glands which are distinct or barely connate at base .. 1. *Salix.*
AA. Lvs usually broad disk cyathiform, often oblique or cup-shaped, entire or lobed . 2. *Populus.*

176. EMPETRACEÆ.

A. Fls axillary, solitary, stamens 3, pistil 6–9-merous . 1. *Empetrum.*
AA. Fls axillary in 2's or 3's, stamens 2, pistil 2-merous 2 *Ceratiola.*
AAA. Fls subcapitate, stamens usually 3, pistil 3-merous .... 3. *Corema.*

177. GINKGOACEÆ.

Ovule-bearing blade, long-stalked, shortly 2-∞ cut at apex, the lobes dilated into a ring or short cup adnate to the seed: anther-cells 2, pendulous. lvs. fan-shaped..... .... . *Ginkgo.*

178. GNETACEÆ.

Leafless shrubs with jointed branches and scales opposite the nodes connate into a little sheath. *Ephedra.*

The very curious genus Welwitschia may be found in botanical collections.

179. TAXACEÆ.

A. Anthers 2-celled tropical or subtropical trees and shrubs
  B. Scales of pistillate aments few, adnate to peduncle and with it usually fleshy lvs. linear to ovate, rarely scale-like 1. *Podocarpus.*
  BB Scales of pistillate aments short, broad and somewhat fleshy, imbricate lvs minute and scale-like branchlets flattened and lf -like 2 *Phyllocladus.*
AA. Anthers 3-8-celled lvs linear hardy or nearly hardy trees and shrubs
  B Pistillate fls consisting of several decussate 2-ovuled carpicles lvs with 2 glaucous lines below broader than the 3 green lines 3. *Cephalotaxus.*
  BB Pistillate fls reduced to 1 ovule
    C. Carpicles at maturity inclosing the seed and adnate to it anthers 4-celled, cells free lvs with 2 glaucous lines below narrower than the green lines 4. *Torreya.*
    CC. Carpicles at maturity partly inclosing the seed, not adnate to it anthers 6-8-celled, cells connate lvs pale green below . . . 5. *Taxus.*

180. PINACEÆ.

A. Lvs. spirally arranged
  B. Carpicles simple, ovule 1, reversed, cone-scales with 1 seed 1. ARAUCARIA TRIBE.
  BB. Carpicles divided into scale and bract, sometimes connate
    C. Ovules 2, reversed, scale and bract always distinct, cone-scales with 2 usually winged seeds 2 ABIES TRIBE
    CC Ovules 2-8, axillary and upright or on the scale and at least finally reversed, cone-scales with 2-8 seeds 3. TAXODIUM TRIBE.
AA. Lvs opposite or whorled, often scale-like ovules upright . 4 CUPRESSUS TRIBE

1. Araucaria Tribe.

A. Seeds free from the scale, with 1 or 2 wings· lvs broad, generally elliptic, more or less distichous and rather remote 1 *Agathis.*
AA. Seeds adnate to the winged or wingless scale lvs large, scale-like or needle-shaped, spirally arranged, crowded . 2. *Araucaria*

2. Abies Tribe.

A. Foliage deciduous, partly fascicled
  B Male fls solitary in a leafless scaly bud, connective not produced beyond anther-cells nor scarcely prominent cones reflexed, scales persistent 3. *Larix.*
  BB. Male fls clustered, pendulous cone-scales deciduous . 4. *Pseudolarix.*
AA. Foliage evergreen
  B. Connective of anthers usually produced into a scale-like appendage
    C. Male fls subspicate at base of new shoots: cone-scales persistent lvs in clusters of 2-5, rarely solitary . 5. *Pinus.*
    CC. Male fls solitary in the cluster of lvs. which terminate short branchlets cone-scales finally deciduous. lvs partly fascicled as in the larch 6. *Cedrus.*
    CCC. Male fls solitary in the axils cones reflexed, scales persistent lvs solitary, 4-angled or flattened and glaucous above, green on the back 7. *Picea.*
  BB. Connective of anthers simply umbonate beyond the cells or hardly prominent, male fls solitary in axils lvs solitary, usually flattened, glaucous or paler below
    C. Cones reflexed, scales persistent
      D Subtending bract conspicuous 8 *Pseudotsuga.*
      DD Subtending bract small 9. *Tsuga.*
    CC. Cones erect
      D Scales persistent, seeds about as long as scales, bracts much shorter than scales lvs flattened, keeled above, pale below . . . . . 10. *Keteleeria.*
      DD Scales deciduous, seeds shorter than scales, bracts shorter or longer lvs flattened and grooved above, usually glaucous below, rarely 4-angled .. 11. *Abies.*

3. Taxodium Tribe.

A. Lvs connate into pairs, arranged in whorls: ovule-bearing blade finally much increased and hardened, making the greater part of the woody cone . . . .12. *Sciadopitys.*
AA. Lvs solitary, scattered
  B Scales of cone flat
    C. Carpicles entire at apex anther-cells 2-4: seeds surrounded by a narrow wing lvs lanceolate flat, rather large, glaucous below 13 *Cunninghamia.*
    CC Carpicles toothed at the apex· anther-cells 4-5 seeds 2-3-angled lvs. awl-shaped, curved . . 14 *Cryptomeria.*
  BB Scales peltate
    C Seeds usually 5, narrowly winged lvs scale-like or linear, persistent 15 *Sequoia.*
    CC Seeds 2, angular lvs linear, deciduous with the branchlets .. 16. *Taxodium.*

4. Cupressus Tribe.

A Fr a cone
  B Cone-scales all fertile, 4-8, forming apparently 1 whorl lvs usually scale-like, opposite or in whorls of 3 or 4, rarely alternate on sterile branches 17. *Callitris.*
  BB Cone-scales fertile at middle of cone and sterile at top and base 18 *Fitzroya.*
  BBB Cone-scales partly fertile, partly empty, arranged in opposite pairs lvs scale-like, opposite only on juvenile branches, sometimes needle-shaped
    C Scales of cone imbricate.
      D Seeds 4-5, pairs of scales 3-4 (excluding the upper connate pair) 19 *Thujopsis*
      DD Seeds 2
        E Pairs of scales 4, the upper pair fertile 20 *Libocedrus*
        EE Pairs of scales 6-8, the 2 upper pairs fertile 21 *Thuja*
    CC Scales of cone peltate
      D Number of seeds 2, cones small
        E Wings of seeds very large, unequal 22 *Fokienia*
        EE Wings of seeds narrow, equal 23 *Chamæcyparis.*
      DD Number of seeds many, cones usually rather large and woody 24 *Cupressus*
AA. Fr fleshy, indehiscent berry or drupe, with 2-6 fertile scales lvs scale-like, opposite or needle-shaped and usually in 3's . 25. *Juniperus.*

Consult also the genus Athrotaxis, allied to Celphalotaxus and Sequoia

181. CYCADACEÆ.

A. Lf -segms circinately involute in vernation· female cones proliferous after anthesis, scales elongate, the margins bearing 2 to many ovules 1. *Cycas.*
AA. Lf -segms straight in vernation female cones deciduous after anthesis, scales peltate
  B Cone-scales superposed in vertical series
    C Shield of the scales transversely 2-horned at apex 2 *Ceratozamia.*
    CC. Shield of the scales truncate, not horned at apex 3 *Zamia*
  BB. Cone-scales overlapping in alternating series
    C The lf -segms ribbed and nerved, nerves spreading on either side of midrib, very numerous, simple or forked 4 *Stangeria.*
    CC. The lf -segms with parallel, longitudinal nerves
      D. Shield of cone-scales flat, erect, ovate-cordate 5 *Dioon.*
      DD. Shield thickened, ascending, usually prolonged into an erect, acuminate blade 6 *Macrozamia.*
      DDD. Shield thickened truncate, decurved at apex . . . . 7. *Encephalartos.*

The genera Bowenia and Microcycas are also included.

182. HYDROCHARITACEÆ.

A. St elongated, submerged, everywhere leafy. lvs short spathes small, sessile in axils placentæ little prominent in ovary 1. *Elodea.*
AA. St very short, sometimes emitting creeping or floating stolons lvs crowded, immersed, sessile, elongated spathes pedunculate placentæ hardly prominent . . . . 2 *Vallisneria.*

AAA. St. very short: lvs. crowded, some sessile and submerged, others (except in Stratiotes) long-stalked, with a floating blade. spathes pedunciled placentæ of 2 lamellæ, strongly intruded, dividing the ovary more or less perfectly into 6 cells
B. Styles 3, stamens 3–9..... 3. *Limnobium.*
BB. Styles 0, 2-fid.
C. Stamens with 6 2-fid filaments, of which 3 have 2 anthers and 3 have 1 anther.. 4 *Hydrocharis.*
CC. Stamens 11–15 ..... 5 *Stratiotes.*

183. ORCHIDACEÆ.*

I. Summary of Tribes.

A. Fertile stamens 2, with a broad shield-shaped sterile one (staminodium) 1. CYPRIPEDIUM
AA. Fertile stamen 1, with no staminodium [TRIBE.
B. Anther persistent, pollinia with basal appendages
C. The anther erect
D Stigma flat, unappendaged . 2 SERAPIAS TRIBE
DD Stigma with appendages 3 HABENARIA TRIBE.
CC The anthers placed obliquely 4 SATYRIUM TRIBE.
BB. Anther usually readily deciduous, pollinia not appendaged or with terminal ones
C. Infl terminal
D. Lf-buds convolute
E. Lf-blade not jointed to stalk
F The anther commonly much exceeding the beak of the column which is not distinctly cut
G. Lip without hypochil, usually spurless
H. St short, with only 1 or 2 lvs 5 POGONIA TRIBE.
HH. St long, with many lvs 6 VANILLA TRIBE
GG Lip with distinct hypochil, which is often spurred 7 CEPHALANTHERA
FF. The anther commonly about as long as the beak of the column which usually bears a sharp cut or groove [TRIBE.
G Pollinia waxy or powdery, not divided
H Lip turned down 8 SPIRANTHES TRIBE.
HH Lip turned up 9 CRANICHIS TRIBE.
GG Pollinia divided into distinct masses 10 PHYSURUS TRIBE.
EE Lf-blade distinctly jointed to the petiole
F Pollinia 8 st slender fls usually with spurs or chins 11 THUNIA TRIBE.
FF Pollinia 4 st a short pseudobulb fls without spurs or chins 12 CŒLOGYNE TRIBE.
DD. Lf-buds conduplicate
E. Sepals and petals about equally developed, the lip usually very conspicuous
F. Lvs usually not jointed column footless 13. LIPARIS TRIBE.
FF. Lvs usually jointed
G. Nerves of lvs 1
H Pollinia 2–4, with very short stalks 14 POLYSTACHYA
HH. Pollinia 4–8, with distinct caudicles [TRIBE.
I. Column-foot forming a chin with the lateral sepals or a short sac with the lip 15 PONERA TRIBE.
II Column footless . 16 CATTLEYA TRIBE.
GG Nerves of lvs several 17. SOBRALIA TRIBE.
EE Sepals much more developed than the petals and lip 18 PLEUROTHALLIS
CC. Infl lateral, or on separate shoot. [TRIBE.
D. Lf-buds convolute
E. St. slender or gradually swollen.
F. Pollinia with caudicles but without stalks 19. PHAJUS TRIBE.
FF Pollinia without caudicles but with stalks
G Lip jointed to column-foot or forming a spur with it... . ..... 20. CYRTOPODIUM [TRIBE.
GG. Lip not jointed, often with a distinct hypochil 21. CATASETUM TRIBE.
EE. St. a short distinct pseudobulb
F. Lip jointed to the column-foot
G Callus-ridges lengthwise 22 LYCASTE TRIBE.
GG. Callus-ridges transverse 23 ZYGOPETALUM
FF. Lip continuous with column-foot . 24. GONGORA TRIBE. [TRIBE.
DD. Lf.-buds conduplicate
E. St terminating its growth in 1 year
F. Lip movably jointed to foot of column
G. Lvs not strap-shaped: pollinia unappendaged or with either caudicles or stipes, but not with both
H. Flowering st arising from near the apex of the slender st or from the pseudobulb 25. DENDROBIUM
HH. Flowering st arising under the pseudobulb or at the base of the st [TRIBE.
I. Pollinia without appendages 26 BULBOPHYLLUM
II. Pollinia with distinct stalks [TRIBE.
J. Pseudobulbs usually present flowering st arising lower than new growth 27. MAXILLARIA
JJ. Pseudobulbs usually wanting flowering st arising higher than new growth 28 HUNTLEYA TRIBE. [TRIBE.
GG Lvs strap-shaped pollinia with broad caudicles and stipes 29. CYMBIDIUM TRIBE.
FF. Lip immovably united to foot of column
G Fls with spurs 30. IONOPSIS TRIBE.
GG Fls without spurs
H The fls narrow, not open 31. ADA TRIBE.
HH The fls wide, open
I Lip enrolled around the column 32. TRICHOPILIA
II Lip not enrolled [TRIBE.
J The lip united to column to the middle 33. ASPASIA TRIBE.
JJ The lip united only to the base of the column 34 ODONTOGLOSSUM
EE. St increasing in length from year to year [TRIBE. 35. AERIDES TRIBE.

*For explanation of orchid flowers and of terms, see the article *Orchids*

II. Key to the Tribes.

1. Cypripedium Tribe.

A. Fl persistent, withering on the ovary: lf.-buds convolute 1 *Cypripedium*
AA. Fl. soon deciduous lf -buds conduplicate. [*sum*
B. Ovary 3-celled, the placentæ central, mouth of lip with broad inturned margin 2. *Phragmopedilum.*
BB. Ovary 1-celled, the placentæ parietal, mouth of lip usually with no broad inturned margins .. 3. *Paphiopedilum.*

2. Serapias Tribe.

A. Lip spurred
B Sepals free . . . . . 4 *Orchis*
BB Sepals united into an arching hood . 5. *Galeorchis.*
AA Lip spurless
B Pollinia glands in a single sac . 6 *Serapias.*
BB Pollinia glands separate, in 2 distinct sacs .. 7. *Ophrys.*

3. Habenaria Tribe.

A. Lip adnate to column at base, stigma broad .. 8. *Cynorchis.*
AA. Lip free, stigma slender . ... . 9. *Habenaria.*

4. Satyrium Tribe

Dorsal sepal helmet-shaped ....10. *Disa.*

5. Pogonia Tribe.

AA. Fls. on a scape with a terminal whorl of lf.-like bracts . . . . . 11. *Isotria.*
AA. Fls on a leafy st
B. Lip crested . . . . . 12 *Pogonia.*
BB. Lip not crested . . . . . 13. *Triphora.*

6. Vanilla Tribe.

Sts. rooting at nodes . . . . 14. *Vanilla.*

7. Cephalanthera Tribe.

A. Fls with a chin, lip long 15 *Cephalanthera.*
AA. Fls. chinless, lip round . . 16. *Epipactis.*

8. Spiranthes Tribe.

A. Dorsal sepal forming a hood with the petals
B Infl 1-sided, fls without a chin 17 *Spiranthes.*
BB. Infl. not 1-sided, fls with a chin 18 *Stenorrhynchus.*
AA. Sepals and petals spreading . . . . . 19 *Lysteria.*

9. Cranichis Tribe.

Lip and petals inserted upon the elongated column 20 *Ponthieva.*

10. Physurus Tribe.

A Lip with a distinct spur
B Lvs green lip concave above the spur 21 *Physurus*
BB. Lvs. usually variegated lip with a long fimbriate claw 22 *Ancectochilus*
AA. Lip spurless or nearly so
B. Column straight, fls symmetric
c The lip not clawed 23 *Goodyera*
cc The lip clawed 24 *Dossinia*
BB Column twisted, fls not symmetric
c The column with 2 upright appendages in front 25 *Macodes*
cc. The column without appendages 26 *Hæmaria.*

11. Thunia Tribe.

A. Fls without chin
B Sts without basal pseudobulbs 27 *Thunia.*
BB Sts with basal pseudobulbs 28 *Bletilla*
AA. Fls with a distinct chin, formed of lateral sepals and column-foot . . . . . 29 *Trichosma.*

12. Cœlogyne Tribe.

A. Base of lip with sac-like hollow
B Column short, winged above, sepals flat 30 *Pholidota.*
BB Column slender, sepals sac-like, concave 31 *Neogyne*
AA. Base of lip flat
B Column slender, without horns
c. Lvs and pseudobulbs perennial 32 *Cœlogyne*
cc Lvs and pseudobulbs annual 33 *Pleione*
BB. Column short, with 2 horns 34 *Platyclinis.*

13. Liparis Tribe.

A. Lvs green fls without chin.
B Lip shoe-shaped 35 *Calypso*
BB Lip not shoe-shaped
c Column short, lip turned upward 36 *Microstylis.*
cc Column slender, lip turned downward 37 *Liparis*
AA. Lvs wanting fls with chin 38. *Corallorhiza.*

14. Polystachya Tribe.

A. Lip spurred
B Plant tuberous spur slender 39 *Tipularia*
BB Plant not tuberous spur funnel-shaped 40 *Galeandra.*
AA Lip not spurred
B. The lip 3-lobed
c. Column short, chin distinct 41 *Polystachya.*
cc Column slender, curved, chin indistinct 42 *Ansellia.*
BB The lip entire 43 *Neobenthamia.*

15. Ponera Tribe.

A. Lip normal
B St slender, leafy; no pseudobulbs· pollinia 4 44 *Isochilus.*
BB St a pseudobulb pollinia 8 45. *Cœlia.*
AA. Lip forming a beaker-like cavity, with the column, or the former hollow at base.
B. Young shoots at the apex of the old 46 *Hexisea.*
BB. Young shoots from base of old
c. Fls in dense spikes, pollinia 8 . 47 *Arpophyllum.*
cc. Fls. in short clusters, pollinia 4. . . . . 48. *Hartwegia.*

16. Cattleya Tribe.

A. Anther not toothed, nor in an excavation.
B Pollinia 4
c Lip adnate to the column, at least at its base
D Ovary produced into a hollow neck . 49 *Broughtonia.*
DD Ovary not so produced 50 *Epidendrum.*
cc Lip free
D. The lip flat, with 2 elevations on upper side 51 *Diacrium.*
DD. The lip enrolled about column, with no elevations 52 *Cattleya*
BB Pollinia 5-7, some of them often abortive 53 *Lælio-cattleya.*
BBB Pollinia 8
c. Stigma pitted upon the front of the column, anther inclined
D. Base of lip gradually merging into blade
E Lip distinctly surrounding the column, sepals and petals not wavy 54 *Lælia.*
EE. Lip not as above, sepals and petals distinctly wavy 55 *Schomburgkia.*
DD. Base of lip tightly encompassing column, suddenly broadened into the broad blade 56 *Brassavola.*
cc. Stigma running up on 2 extensions of the column-apex, anther erect 57 *Sophronitis*
AA. Anther 2-toothed below, in an excavation in the column . . 58. *Leptotes.*

17. Sobralia Tribe.

A. St many-lvd, not bulbous at base lip not bearded 59 *Sobralia*
AA. St 1- or 2-lvd, bulbous at base lip bearded 60 *Calopogon*

18. Pleurothallis Tribe.

A. Lip turned upward, lateral sepals united into a boat-shaped hood . . . 61 *Scaphosepalum.*
AA. Lip turned down
B Sepals united 62 *Masdevallia*
BB Sepals free, or the lateral only united
c Dorsal sepal and petals attenuated into a club-shaped apex . 63 *Restrepia*
cc Dorsal sepal and petals not as above . 64 *Pleurothallis*

19. Phajus Tribe.

A Lvs not articulated to petiole
B Lip free, encompassing the column 65 *Phajus*
BB Lip adnate to column, the blade spreading 66 *Calanthe*
AA Lvs articulated to petiole
B Sepals and petals spreading
c Lip with its base tightly inclosing the column, the blade spreading 67 *Limatodes.*
cc Lip not inclosing column
D Fls with distinct chin 68 *Physis.*
DD Fls without chin
E Pollinia 8
Middle lobe of lip not clawed 69 *Bletia*
EE Middle lobe of lip clawed 70 *Spathoglottis.*
EE Pollinia 4 71 *Aplectrum*
BB Sepals and petals erect 72 *Acanthophippium*

20. Cyrtopodium Tribe.

A Fls spurred or with sac-like base
B Sepals narrower and less colored than petals. 73 *Lissochilus.*
BB Sepals and petals alike or nearly so . . 74 *Eulophia*
AA. Fls not spurred nor saccate
B Lip only inserted on column-foot . . 75 *Cyrtopodium.*
BB Lip and lateral sepals inserted on column-foot
c Chin distinct, rectangular . 76 *Warrea*
cc. Chin indistinct, round . . 77 *Eulophiella.*

21. Catasetum Tribe.

A Fls perfect, column twisted 78. *Mormodes.*
AA Fls of 2 or 3 forms, column not twisted
B Column stout, straight, fls with antennæ 79 *Catasetum.*
BB Column slender, curved, fls without antennæ . . . . . 80. *Cycnoches.*

22. Lycaste Tribe.

A. Pollinia upon a single stalk
B Fls globose . 81. *Anguloa.*
BB. Fls with spreading sepals and petals
c Stalk of pollinia long and narrow; fls. 1 to few
D. Infl of a single erect fl; lip turned down . . . . . 82. *Lycaste.*

DD. Infl. of 2 to few drooping fls.; lip turned upwards . . . . . 83. *Paphinia.*
CC. Stalk of pollinia short; fls. many . . . . . 84. *Batemannia.*
AA. Pollinia upon 2 separate stalks . . . . . 85. *Bifrenaria.*

23. Zygopetalum Tribe.

A. Lip clawed distinctly . . . . . 86. *Colax.*
AA Lip not distinctly clawed
B. The lip with horseshoe-shaped callus . . . . . 87. *Zygopetalum.*
BB. The lip with few longitudinal lamellæ . . . . 88. *Eroperia.*

24. Gongora Tribe.

A. Lip turned downwards
B Fls with sepals and petals erect or incurved.
C. Hypochil separated from column by a strong stricture, no pleuridia 89. *Lacæna.*
CC. Hypochil united with column by a broad base pleuridia present
D Epichil movably attached to hypochil, pollinia with short stalk at most 90 *Peristeria.*
DD Epichil immovably attached to hypochil, pollinia with elongated stalk 91 *Acineta.*
BB Fls with sepals and petals spreading or reflexed
C. Lateral sepals much larger than the dorsal sepal and petals . 92 *Coryanthes.*
CC. Sepals and petals nearly alike
D Hypochil concave, epichil flat.
E Pollinia 2 . . . . 93 *Stanhopea.*
EE. Pollinia 4 94 *Aganisia.*
DD Hypochil not concave 95 *Houlletia.*
AA Lip turned upwards . 96 *Gongora.*

25. Dendrobium Tribe.

A. Sts many-jointed, rhizome short
B Lip without callus, or with lamellate or elevated lines 97 *Dendrobium.*
BB Lip with basal callus joints of st long-filamentose 98 *Inobulbon*
AA. Sts 1- or rarely 2-jointed, rhizome long-creeping 99. *Sarcopodium.*

26. Bulbophyllum Tribe.

A. Lateral sepals with their outer margins adhering, except at the free base 100 *Cirrhopetalum.*
AA Lateral sepals free 101 *Bulbophyllum.*

27. Maxillaria Tribe.

A. Lip without claw, movable lvs normal 102 *Maxillaria.*
AA Lip clawed, or adnate to column-base lvs whip-shaped 103. *Scuticaria.*

28. Huntleya Tribe.

A. Pseudobulbs distinct 104 *Promenæa.*
AA. Pseudobulbs wanting or rudimentary
B Lip entire 105. *Chondrorhyncha.*
BB Lip lobed
C Callus of lip fringed . . 106. *Huntleya.*
CC Callus not fringed
D Column boat-shaped, concave 107 *Bollea.*
DD Column slender, not concave
E Claw very short callus free in front and resting upon the lip 108. *Warscewiczella.*
EE Claw distinct callus not free in front 109. *Pescatorea.*

29. Cymbidium Tribe.

A Lvs many sts elongated . . . 110 *Grammatophyllum.*
AA Lvs few sts short
B Sts concealed by the lf -sheaths
C Pollinia pear-shaped, upon a quadrate stalk st not bulbous 111. *Cyperorchis.*
CC Pollinia round, upon a stalk much broader than high st bulbous 112 *Cymbidium.*
BB. Sts naked lvs. only at its apex . . . . . 113 *Grammangis.*

30. Ionopsis Tribe.

A. Sepals free . . . . . 114 *Trichocentrum.*
AA. Sepals, the lateral ones, united, at least below.
B The lip spurred . . . . . 115. *Rodriguezia.*
BB. The sepals spurred.
C. Spur short . . . . . 116 *Ionopsis*
CC. Spur long and slender . . . . . 117. *Comparettia.*

31. Ada Tribe.

A. Lvs. flat
B. Sepals free . . . . . 118. *Ada.*
BB. Lateral sepals united . . . . . 119. *Mesospinidium.*
AA. Lvs. cylindric . . . . . 120. *Quekettia.*

32. Trichopilia Tribe.

Lip rolled around the column . . . . . 121. *Trichopilia.*

33. Aspasia Tribe.

A. Middle lobe of lip broad . . . . . 122 *Aspasia.*
AA. Middle lobe of lip narrow. . . . . 123. *Cochlioda.*

34. Odontoglossum Tribe.

A. Lip surrounding column with 2 longitudinal calluses blade reflexed . . . . . 124. *Gomesa.*
AA. Lip not as above
B Base of lip parallel to column and sometimes adnate to it . . . . . 125. *Odontoglossum.*
BB. Lip spreading from base of column.
C. Lateral sepals united entirely, lip like dorsal sepal . 126. *Palumbina.*
CC. Lateral sepals free or only partly united, lip unlike dorsal sepal
D. Sepals and petals long and much attenuated, lip entire or fiddle-shaped 127. *Brassia.*
DD. Sepals and petals not much attenuated
E. The lip entire, flat, broad 128. *Miltonia.*
EE The lip mostly 3-lobed, with warts or a cushion at base . . . . 129. *Oncidium.*

35. Aerides Tribe.

A Lip movably jointed to column
B Middle lobe of spurless lip flat . . . . . 130. *Renanthera.*
BB Middle lobe of spurred lip compressed . . 131. *Arachnanthe.*
AA Lip immovably united with column.
B Spurless
C Column without a foot
D Summit of lip laterally compressed 132 *Vandopsis.*
DD Summit of lip not compressed 133 *Luisia.*
CC. Column with a foot, the lateral sepals attached to it . . 134. *Phalænopsis.*
BB Spurred
C. Column without a foot
D. Pollinia upon a single stalk.
E Spur appendaged
F With a longitudinal septum 135. *Sarcanthus.*
FF With the mouth covered with a plate . . 136. *Cleisostoma.*
EE Spur not appendaged
F. Stalk of the pollinia filiform.
G Fls firm, lip turned downwards 137. *Saccolabium.*
GG Fls fragile, lip turned upwards 138 *Acampe.*
FF Stalk of the pollinia broadened upwards or throughout
G Spur short and broad . 139 *Vanda*
GG Spur long and slender . . 140. *Angræcum.*
DD. Pollinia on 2 separate stalks, or these united by the gland
E Stalks membranous, the pollinia attached to the face
F Plants leafy lip entire . . . . 141 *Macroplectum.*
FF Plants without lvs . lip 3-lobed . 142 *Polyrrhiza.*
EE Stalks slender
F. Column bent toward the dorsal sepal . . 143 *Listrostachys.*
FF Column straight 144. *Mystacidium.*
CC. Column with a foot, the lateral sepals attached to it
D. Spur curved upwards against the lip-blade . . 145. *Aërides.*
DD. Spur straight or reflexed
E. Lip 3-lobed . . . 146 *Camarotis.*
EE. Lip entire . 147. *Rhynchostylis.*

Other orchid genera entered are Acriopsis, Arethusa, Bromheadia, Collabium, Corysanthes, Cryptophoranthus, Cryptostylis, Diuris, Eria, Eriochilus, Geodorum, Govenia, Holothrix, Ione, Lepanthes, Lueddemannia, Megaclinium, Monomeria, Moorea, Neolauchea, Neottia, Nervilia, Neuwiedia, Notylia, Oberonia, Octomeria, Ornithidium, Ornithocephalus, Ornithochilus, Panisea, Physosiphon, Platylepis, Polycycnis, Pterostylis, Sarcochilus, Satyrium, Scaphyglottis, Schlimmia, Sievekingia, Sigmatostalix, Solenidium, Stauropsis, Stelis, Stenia, Tainia, Thecostele, Thelymitra, Trichoglottis, Trigonidium, Xylobium, and many bi- and tri-generic hybrids.

184. DIOSCOREACEÆ.

A Fr globose and berry-like, indehiscent . . . . . 1. *Tamus.*
AA Fr capsular, winged
B Caps 1-carpelled by abortion . 2. *Rajania.*
BB. Caps. 3-carpelled or -lobed, winged above 3 *Testudinaria.*
BBB. Caps. 3-carpelled or -lobed, winged below or all around, or rarely not at all . . . . . 4. *Dioscorea.*

185. TACCACEÆ.

In cultivation. . ... *Tacca.*

186. IRIDACEÆ.

A. Fls. never more than 1 to a spathe, spicate, not fugitive
B. Style-branches simple, not bifid.
C Stamens equilateral, perianth regular
D The style short branches long and subulate
E Rootstock not bulbous, roots in dense tufts, fibrous, some fleshy 1 *Schizostylis.*
EE Rootstock bulbous 2 *Hesperantha.*
DD. The style longer branches shorter and more or less broadened
E The spathe-valves oblong, green or brownish upwards 3 *Geissorhiza.*
EE The spathe-valves scarious or hyaline, cut or 3-parted at apex 4 *Derama.*
EEE The outer spathe-valve short, emarginate, membranous or papery 5 *Ixia*
CC Stamens unilateral and arched
D Foliage very hairy and plaited ... 6 *Babiana*
DD Foliage not hairy and plaited
E Perianth-limb irregular
F Tube funnel-shaped, spathe-valves lanceolate 7 *Gladiolus.*
FF. Tube cylindrical in lower half, suddenly dilated at the middle, spathe-valves oblong-lanceolate 8 *Antholyza.*
EE. Perianth-limb subregular
F Fls small, no tube, segms very acuminate 9 *Melasphærula.*
FF. Fls larger, tube present, segms more or less oblong
G Spathe valves large, green, lanceolate 10 *Acidanthera*
GG Spathe-valves small, oblong
H Caps inflated, globose 11 *Crocosmia*
HH Caps small, oblong 12 *Tritonia*
GGG Spathe-valves scarious and deeply lacerated 13 *Sparaxis*
BB Style-branches bifid, stamens unilateral
C Tube broadly funnel-shaped, with stamens inserted below the throat 14 *Freesia*
CC Tube slender with stamens inserted at the throat 15 *Lapeyrousia*
CCC. Tube broadly funnel-shaped above the middle where the stamens are inserted 16 *Watsonia.*
AA. Fls usually more than 1 to a spathe, stalked, often fugitive and opening one after another
B. Style-branches opposite stamens and outer perianth-segms
C Stigmas transverse, style-branches have crests that overtop anthers
D Inner perianth-segms not convolute
E Ovary 1-celled, with 3 parietal placentæ rootstock digitate 17 *Hermodactylus.*
EE Ovary 3-celled
F Perianth-tube usually present, filaments free rootstock usually a rhizome, sometimes a bulb 18 *Iris.*
FF Perianth without a tube, filaments monadelphous rootstock usually a tunicated corm 19 *Moræa.*
DD Inner perianth-segms convolute
E Style-crests petaloid lvs in 2-ranked rosette, not plaited, peduncle flattened rootstock not bulbous 20 *Marica.*
EE Style-crests large, spur-like or flattened lvs superposed, plaited st terete rootstock bulbous 21 *Cypella.* (See also Phalocallis.)
CC. Stigmas terminal, style-branches do not overtop anthers
D. Perianth without any tube; inner segms small, not convolute, style-branches bifid at tip 22 *Herbertia.*
DD. Perianth-segms connivent in a cup, without any spreading blade 23. *Hydrotænia.*
DDD Perianth-segms connivent in a cup, then spreading, st least the outer ones
E. Style-branches with 2 petal-like stigmatose crests 24 *Homeria.*
EE. Style-branches bifid
F. Ditto penicillate, i e, shaped like an artist's brush, a dense tuft of hairs . 25. *Ferraria.*
FF. Ditto not penicillate
G. Inner segms very small, outer with a large, reflexed blade 26. *Rigidella.*
GG. Inner and outer segms dissimilar, various 27. *Tigridia.*
BB. Style-branches alternate with anthers.
C. Rootstock not a bulb or corm.
D. Spathes essentially 1-fld.
E. Peduncle short, hidden, perianth with a long tube and ascending segms 28. *Crocus.*
EE Peduncle long, perianth-segms much longer than the short tube 29 *Romulea.*
DD. Spathes usually with more than 1 fl 30 *Nemastylis.*
CC Rootstock not a bulb or corm spathes usually more than 1-fld
D. Perianth-segms unequal.
E Inner segms shorter, connivent, upper stamen imperfect 31 *Diplarrhena.*
EE. Inner segms obovate-cuneate, outer oblong, usually shorter, stamens all perfect 32 *Libertia.*
DD Perianth-segms subequal
E. Style-branches flattened and emarginate at apex infl a lax corymb 33 *Belamcanda.*
EE Style-branches subulate
F Pedicels short, clusters panicled 34 *Orthosanthus.*
FF Pedicels long, clusters terminal, single or fasciculed 35 *Sisyrinchium.*

Other genera described are: Aristea, Cipura, Eleutherine and Ennealophus

187. AMARYLLIDACEÆ.

A. Subterranean axis a bulb scapose infl umbelloid and involucrate, or solitary 1. AMARYLLIS TRIBE.
AA. Subterranean axis a rhizome st leafy, at least at base
B Plants with large, thick, fleshy, rosette-like lvs infl racemose or paniculate 2 AGAVE TRIBE.
BB Plants with ordinary lvs of small size infl various
C Lf-blades inverted, upper face downward infl an involucrate umbel 3 ALSTRŒMERIA
CC Lf-blades normal, linear infl not umbelloid [TRIBE.
D Plant hairy or glabrous, scapose infl spicate or racemose 4 HYPOXIS TRIBE
DD Plant glabrous, with leafy sts infl loose, racemose or solitary, anther opening by apical pore 5 CONANTHERA
DDD Plant densely woolly with leafy sts infl scorpioid. lvs capitate . . . [TRIBE. 6 CONOSTYLIS TRIBE

1. Amaryllis Tribe.

Subtribe 1 CORONATÆ Fl furnished with a crown between the perianth and stamens, which is not to be confused with a staminal cup formed by the growing together of filaments 1 *Narcissus*

Subtribe 2 AMARYLLEÆ GENUINEÆ Corona 0, and filaments not united into a staminal cup

A. Anthers erect, filaments inserted at or near the base of anthers
B Stamens epigynous, filaments short
C The perianth-segms all alike 2 *Leucojum.*
CC. The inner segms different, permanently connivent 3 *Galanthus*
BB. Stamens perigynous
C Fls solitary . 4 *Cooperia*
CC Fls umbellate 5 *Chlidanthus*
AA Anthers dorsifixed, versatile
B Ovules many, superposed, testa black
C Fls solitary, spathe tubular in the lower half
D. The fl gaping, horizontal, bright red, 3 lower segms convolute 6 *Sprekelia*
DD The fls regular, erect or suberect
E Seeds globose fls yellow, peduncle short or long 7. *Sternbergia.*
EE. Seeds flat peduncle long 8. *Zephyranthes.*
CC. Fls umbellate, spathe 2-4-valved, and pedicels subtended by filiform bracteoles.
D Perianth-tube short or almost 0, rarely long in Hippeastrum
E Peduncle solid seeds few in a cell .. 9. *Lycoris.*
EE. Peduncle hollow
F. Fl often furnished with minute scales or a distinct neck at the throat seeds many in a cell . 10. *Hippeastrum.*
FF. Fl with a sort of corolla, which is funnel-shaped, and deeply cut, the divisions emarginate 11. *Placea.*
DD. Perianth-tube long
E Tube broadly funnel-shaped, pulvinate at throat .12. *Vallota.*
EE. Tube 2-3 times longer than segms, naked at throat 13. *Cyrtanthus.*

BB Ovules 2, basal, collateral, testa pale 14 *Griffinia*
BBB. Ovules 2 or few, collateral or fascicled from the center of the placenta.
c. Fr. baccate
D Bulb imperfect ovules several . 15 *Clivia*
DD Bulb large, tunicated ovules 2 16 *Hæmanthus.*
cc Fr capsular 17 *Buphane.*
BBBB Ovules few or many, superposed, seeds few, turgid, testa green
c. Fr indehiscent or bursting irregularly.
D Perianth-tube long . . . 18 *Crinum.*
DD Perianth-tube short.
E Segms broad . . . ... 19 *Amaryllis*
EE Segms narrow. . . .. 20 *Ammocharis.*
cc. Fr a 3-valved caps
D Caps top-shaped, acutely angled. 21 *Brunsvigia.*
DD Caps. globose, obtusely angled .. .22. *Nerine*

Subtribe 3 PANCRATIEÆ Corona 0, but stamens appendaged toward base and often united into a distinct cup.

A. Ovules superposed, many or few.
B. Lvs broad, petioled
c. Perianth white
D Ovary globose
E Filaments with a large tooth on each side of the anthers . 23 *Calliphrurus.*
EE Filaments united in a distinct cup 24 *Eucharis*
DD Ovary 3-lobed hybrid 25. *Urceocharis.*
cc Perianth colored
D The perianth-tube cylindrical, suddenly dilated 26 *Urceolina*
DD The perianth subcylindrical, segms long or short 27. *Phadranassa*
BB. Lvs linear or ligulate, sessile
c. Perianth colored, subcylindrical, tube long filaments united in an entire or toothed cup 28 *Stenomesson*
cc Perianth white, tube funnel-shaped, staminal cup large 29 *Pancratium.*
AA Ovules collateral, basal, 2–6 30 *Hymenocallis.*
AAA Ovules medial, 2–3
B Perianth funnel-shaped, segms narrow 31 *Vagaria*
BB Perianth with a slender tube and broad segms 32 *Eurycles*

2. Agave Tribe.

A Lvs thick, fleshy, usually spiny at edge and point
B Perianth funnel-shaped, filaments normal 33 *Agave*
BB Perianth rotate, filaments swollen on one side at base 34 *Furcræa*
AA Lvs comparatively thin, not spiny at edge or point
B Segms short
c Fls white, in a lax, simple spike, tube long, curved, subcylindrical 35 *Polianthes*
cc Fls greenish brown in a lax raceme, tube abruptly curved and dilated at middle 36 *Prochynanthes*
cc c Fls red or white, laxly spicate or racemose, tube curved, subcylindrical 37 *Bravoa*
BB Segms long, tube scarcely any
c Fls greenish red, in a simple or panicled raceme, segms oblanceolate 38 *Beschorneria.*
cc Fls bright red, in a capitulum or thyrsoid panicle, segms narrow, falcate 39 *Doryanthes.*

3. Alstrœmeria Tribe.

A Rootstock bulbous perianth-segms subequal 40 *Ixiolirion*
AA Rootstock 0 3 outer perianth-segms different from 3 inner
B Inner segms unequal st erect. . 41. *Alstrœmeria.*
BB Inner segms equal st with runners or stolons 42 *Bomarea*

4. Hypoxis Tribe.

A. Ovary often produced into a long slender beak simulating a perianth-tube fr succulent, indehiscent . 43 *Curculigo.*
AA. Ovary not beaked: fr. a caps. usually circumscissile at apex ... .44. *Hypoxis.*

5. Conanthera Tribe.

Stamens, 3 only, fertile .. ..45. *Tecophilæa.*

6. Conostylis Tribe.

Fls. irregular..... .... . . 46. *Anigozanthos.*

Also in cultivation: Anoiganthus, Callipsyche, Cummingia, Cyanella, Gethyllis.

188. VELLOZIACEÆ.

A. Perianth-tube more or less extended beyond the ovary .... 1. *Barbacenia.*
AA. Perianth-tube practically none .... 2. *Vellozia.*

189. MUSACEÆ.

A. Calyx tubular, later split-spathaceous . .. 1. *Musa.*
AA. Calyx of free sepals (lateral ones sometimes adnate to corolla in Heliconia)
B Fr a caps locuicidally 3-valved, seeds ∞,
c Petals 2, lateral connate 2 *Strelitzia*
cc Petals separate 3 *Ravenala.*
BB. Fr indehiscent or separating into berries, the cells 1-seeded 4 *Heliconia.*

190. ZINGIBERACEÆ.

A. Ovary 1-celled, with 3 parietal placentæ 1. *Globba.*
AA. Ovary perfectly 3-celled, or at least 3-celled much above the middle, placentæ axile
B. Lateral staminodes ample and petal-like
c Connective not appendaged at the base
D Filament short, bracts 1-fl 2 *Kaempferia*
DD Filament long, bracts 1 ∞-fld 3 *Hedychium*
cc Connective appendaged at the base
D Spur 2-fid, lateral staminodes narrowed at base 4. *Roscoea.*
DD Spurs 2, lateral staminodes connate with the petaloid filament 5. *Curcuma.*
BB Lateral staminodes small, tooth-like or 0, rarely longer, narrow and adnate to labellum
C. Filament short or very short.
D. Infl cone-like
E Anther-cells divergent at apex, connective either short or produced beyond cells into an entire or 3-lobed crest 6 *Amomum.*
EE Anther-cells contiguous, connective produced beyond the cells into a long, linear appendage 7. *Zingiber.*
DD Infl not cone-like
E Connective not produced beyond cells
F Anther-cells contiguous to apex . 8 *Elettaria*
FF Anther-cells separate 9. *Renealmia.*
EE Connective produced beyond cells into a long lanceolate, concave appendage 10 *Burbidgea.*
cc Filament elongated (in Costus petal-like)
D Infl cone-like 11 *Costus*
DD Infl not cone-like 12 *Alpinia*

Also in cultivation Bamburanta, Brachychilus, Cautlea Rhynchanthus

191. MARANTACEÆ.

A Ovary 1-celled after a fashion, the other cells being minute and empty
B Bracts narrow, convolute, inclosing the rachis 1. *Maranta*
BB Bracts and bractlets usually colored, spreading, long persistent 2 *Stromanthe*
BBB Bracts spreading, deciduous 3 *Thalia*
AA Ovary usually 3-celled and 3-ovuled.
B Corolla-tube usually short 4. *Phrynium*
BB Corolla-tube usually slender and longer. 5. *Calathea*

Ctenanthe is also briefly treated

192. CANNACEÆ.

Sole genus .. *Canna.*

193. BROMELIACEÆ.

(Following Mez in DC Monog Phaner. vol. 9.)

A. Fr a berry, indehiscent ovary inferior seeds not winged nor plumed
B. Pollen-grains entire, not provided with pores or a longitudinal membranous fold.
c Calyx without a tube or cup . . 1. *Bromelia*
cc Calyx with a tube or cup . . 2 *Cryptanthus*
BB Pollen-grains furnished with pores.
c. Infl. immersed in a central bowl of lvs. and surrounded by an involucre formed from the reduced inmost lvs. and usually colored

D. Petals without ligules, connate, at least toward base
E. The infl simple.. .. . . . . 3. *Aregelia.*
EE The infl compound . 4 *Nidularium.*
DD Petals with ligules, free . . 5. *Canistrum.*
CC Infl not surrounded by a distinct involucre st or scape tall
D. Petals furnished with 2 ligules inside
E Berries connate among themselves and also to the bracts and axis 6. *Ananas.*
EE Berries free
F. Sepals with long awns, or, if awnless, the ovules with very long tails 7 *Æchmea*
(See also Echinostachys.)
FF Sepals without awns or only obscurely awned ovules obtuse 8 *Quesnelia.*
DD. Petals not provided with ligules inside.
E Fls very flat and crowded into dense cones 9 *Hohenbergia.*
EE Fls more or less loosely spicate on the branches of the infl 10 *Streptocalyx.*
BBB Pollen-grains furnished with a longitudinal membranous groove 11. *Billbergia.*
AA. Fr a dehiscent caps ovary superior or nearly so
B Seeds winged, or appendaged pollen grooved
C Ovary semi-superior . 12 *Pitcairnia.*
CC Ovary superior
D Fls of 2 forms and dioecious . 13 *Hechtia.*
DD Fls all the same form
E Petals free to the very base 14 *Puya*
EE Petals coalesced toward the base 15 *Dyckia.*
BB Seed with a long, plumose appendage ovary superior
C Petals free
D The petals ligulate inside 16 *Vriesia*
DD The petals not ligulate inside 17 *Tillandsia*
CC Petals connate or intimately conglutinate 18 *Guzmania.*
(See also Massangea.)

Catopsis and Neoglaziovia are also in cultivation

194. LILIACEÆ.

I. Summary of Tribes.

Ignoring many exceptions.

Series 1 Anthers introrsely dehiscent fr usually berry-like: plant not bulbous, usually scaly at the base of the st and leafy above, sometimes with a scaly scape

A. Stigma not broadly peltate
B. Ovules orthotropous or hemianatropous "foliage" abnormal, in the Smilax Tribe 3–5-nerved but with netted vernlets, in the Asparagus Tribe lf -shaped or needle-like "phylloclades" are present
C. Anthers abnormal, the inner valve of each cell being so narrow that the open anther seems to be 1-celled st. sarmentose or scandent 1 SMILAX TRIBE.
CC Anthers normally 2-celled, or cells confluent at apex st branched or scandent 2 ASPARAGUS TRIBE.
BB. Ovules anatropous, rarely hemianatropous in the Luzuriaga Tribe
C. St shrubby and branched, or scandent 3 LUZURIAGA TRIBE.
CC St herbaceous, unbranched or sparingly branched, leafy above 4 SOLOMON'S SEAL [TRIBE.
CCC Stemless herbs with lvs clustered on the rhizome and often inclosed (together with the lateral leafless scape) by sheathing scales at the base 5 LILY-OF-THE-[VALLEY TRIBE.
AA. Stigma usually very broadly peltate lvs on the rhizome few, ample scape very short and 1-fld or bearing a dense spike at apex 6. ASPIDISTRA TRIBE.

Series 2 Anthers introrsely dehiscent fr loculicidally dehiscent, rarely indehiscent or berry-like lvs on a rhizome, or densely crowded at the apex of a caudex, or forming a bulb at the base of the scape

A. Anthers with a pit on the back into which the filament intrudes
B. Lvs linear or membranous, crowded on a short rhizome perianth cylindrical, funnel-shaped, or bell-shaped 7. LEMON-LILY OR [HEMEROCALLIS [TRIBE.
BB. Lvs usually thick, fleshy or rigid, sometimes spiny rhizome hard, often extended above ground into a woody caudex perianth-segms. connivent or connate into a tube or sometimes with spreading tips . . 8. ALOE TRIBE.

AA. Anthers not pitted (sometimes slightly pitted in the Asphodel Tribe) lvs. not thick, and fleshy as in a century plant
B. Rootstock, if any, rhizomatous, rhisome usually short, often very short in Asphodel Tribe, sometimes produced into a woody caudex in Dracæna Tribe (see also BB)
C Seeds fleshy perianth marcescent. 9. OPHIOPOGON
CC Seeds not fleshy [TRIBE.
D Perianth tubular-bellshaped, connate, persistent, infl racemose .. .. 10. ALETRIS TRIBE.
DD Perianth shaped like a bell or cylinder, rarely a funnel, the segms usually distinct, deciduous, infl often paniculed . 11 DRACÆNA TRIBE.
DDD. Perianth-segms usually distinct and spreading, deciduous, infl sparingly branched, if at all 12 ASPHODEL TRIBE.
BB. Rootstock bulbous as a rule in the Onion Tribe sometimes a corm and rarely a very short rhizome, bulb usually tunicated, but in the Tulip Tribe often scaly
C. Stemless plants with the infl terminal on a leafy scape
D Infl an umbel with an involucre of at least 2 bracts 13 ONION TRIBE.
DD Infl a raceme, or rarely a spike 14. SQUILL TRIBE.
CC. St leafy, or at least with 1 lf fls few or in a lax raceme . . 15. TULIP TRIBE.

Series 3 Anthers usually introrsely affixed but extrorsely dehiscent (the whole Colchicum Tribe exceptional) fr usually a septicidal caps, rarely loculicidal or in the Medeola Tribe an indehiscent berry Plants fibrous-rooted, rarely cormous or bulbous

A. Fr. a berry plant not bulbous lvs few, subradical or whorled on the st 16 MEDEOLA OR
AA. Fr a caps rarely, in the Bellwort Tribe, a berry [CUCUMBER-ROOT [TRIBE.
B. Anthers introrsely dehiscent The only tribe in Series 3 with a cormous rootstock 17 COLCHICUM OR
BB Anthers extrorsely dehiscent, rarely otherwise in the Narthecium Tribe plants not bulbous except sometimes in False Hellebore Tribe [AUTUMN CROCUS [TRIBE.
C. St -lvs smaller than the radical lvs which are either crowded or petiolate), sometimes very small or 0 caps septicidal or loculicidal 18 NARTHECIUM
CC St leafy, herbaceous or high climbing lvs alternate, sessile or clasping, without sheath [TRIBE.
CCC St usually tall, leafy or hardly so beyond the radical lvs plants not bulbous or bulbous anthers with confluent cells, roundish-peltate after dehiscence 19 BELLWORT OR [UVULARIA TRIBE
20 FALSE HELLEBORE [OR VERATRUM TRIBE.

II. Key to the Tribes.

1. Smilax Tribe.

A. Perianth 6-parted 1 *Smilax.*
AA. Perianth undivided, mouth minutely toothed . 2 *Hetero-*[*smilax.*

2. Asparagus Tribe.

A. Filaments connate into a little urn, with the anthers sessile at the mouth of the urn
B Anthers 3, fls clustered on the middle of the face of the phylloclade 3 *Ruscus.*
BB Anthers 6, fls clustered on the margins, or rarely at the middle of the phylloclade 4 *Semele.*
BBB Anthers 6, fls terminal in short racemes. 5 *Danaë.*
AA. Filaments free . . 6 *Asparagus.*

3. Luzuriaga Tribe.

A. Fls large or rather large, solitary or few, perianth-segms erect, ovary 1-celled with 3 parietal placentæ
B. Lvs 3–5-nerved perianth-segms of about equal length 7 *Lapageria.*
BB. Lvs. 1-nerved outer perianth-segms much smaller than inner 8 *Philesia.*
AA. Fls small; perianth-segms. spreading, ovary 3-celled: lvs. with ∞ slender nerves
B. The fls. clustered in the axils 9 *Eustrephus.*
BB. The fls. mostly terminating the branches....10 *Geitono-*[*plesium.*

4. Solomon's Seal Tribe.

A. Fls 1-2 in the axils, rarely more, usually nodding
B. Perianth-tube cylindrical, lobes short, style undivided, with a small stigma 11 *Polygonatum.*
BB Perianth-tube 0, segms spreading above or from the base, style shortly or more deeply 3-fid 12 *Streptopus*
AA. Fls in a terminal raceme or panicle
B Floral parts in 4's 13 *Smilacina*
BB. Floral parts in 2's 14 *Maianthemum.*

5. Lily-of-the-Valley Tribe.

A. Fls racemose, nodding, perianth subglobose, lobes shorter than tube 15 *Convallaria*
AA. Fls spicate, far apart, perianth-tube cylindrical, lobes recurved-spreading 16 *Reineckia.*

6. Aspidistra Tribe.

A. Fls 4-merous, stigma very large, roundish-peltate, undivided 17 *Aspidistra.*
AA. Fls 3-merous, stigma broadly peltate, 3-lobed 18 *Rohdea*

7. Lemon-Lily, or Hemerocallis Tribe.

A. Fls erect, stamens affixed at apex of tube lvs long and narrow
B Perianth funnel-shaped, the cylindrical tube shorter than the lobes, panicles few-fld 19 *Hemerocallis.*
BB Perianth with subincurved segms loosely connivent above the top-shaped tube, panicles much branched 20 *Phormium.*
AA Fls pendulous
B Stamens affixed at middle of tube lvs long and narrow perianth-tube swollen above, lobes short 21 *Blandfordia.*
BB Stamens often hypogynous
c Lvs petioled, usually broad fls racemose, perianth funnel-shaped, tube short or long 22 *Funkia*
cc Lvs long and narrow fls spicate, perianth a long narrow tube with short lobes 23 *Kniphofia*

8. Aloe Tribe.

A Perianth-segms strongly connate into a tube which is swollen at the base, segms free at apex, stamens included in tube 24 *Gasteria*
AA Perianth-segms coherent or connivent to the very apex in a tube, or barely spreading at the very apex, stamens usually exserted 25 *Aloe*
AAA Perianth-segms coherent or connivent, stellate-spreading at apex, stamens a little shorter than perianth 26 *Apicra*
AAAA Perianth usually incurved, the segms cohering or connivent, at the apex recurved and spreading somewhat as if 2-lipped, stamens not exceeding perianth 27 *Haworthia*
AAAAA Perianth of Aloe, but stamens a little shorter than the perianth 28 *Lomatophyllum.*

9. Ophiopogon Tribe.

A Perianth-tube long and slender, filaments normal 29 *Sansevieria*
AA Perianth more or less erect or spreading above the ovary, filaments shorter than the linear anthers, style longish 30 *Ophiopogon.*
AAA Perianth spreading from base of ovary, filaments about as long as the oblong anthers 31 *Liriope*

10. Aletris Tribe.

One genus cultivated 32 *Aletris*

11. Dracæna Tribe.

A. Ovary 1-celled, cells 3-ovuled 33 *Dasylirion*
AA Ovary 3-celled
B Cells 1-ovuled 34 *Dracæna.*
BB. Cells 2-ovuled 35 *Nolina*
BBB Cells ∞-ovuled
c Fls racemose 36 *Hesperocallis.*
cc Fls panicled
D Anthers small, sessile on a club-shaped filament, perianth subglobose or bell-shaped, segms hardly connate at base 37. *Yucca.*
DD. Anthers dorsifixed on normal or flattened filaments, perianth cylindrical or narrowly bell-shaped, with a short tube .. . 38 *Cordyline.*

12. Asphodel Tribe.

Summary of Subtribes.

A Anthers dorsifixed, versatile
B Subtribe 1 Euasphodeleæ Plant not bulbous lvs crowded at base of st.; cauline lvs. smaller, when present
BB Subtribe 2 Lomandreæ Plant not bulbous lvs grass-like fls in spikes
BBB Subtribe 3 Chlorogaleæ Plant bulbous: lvs few
AA Anthers erect, affixed at or near the base.
B Subtribe 4 Bowieæ Lvs few, from a thick tuber or fleshy bulb, quickly vanishing before or at anthesis
BB Lvs numerous, crowded at base of st or sometimes in Subtribe 5 arranged along st
c Subtribe 5 Anthericeæ Lvs not 2-ranked
cc. Subtribe 6 Dianelleæ Lvs 2-ranked.

Subtribe 1. Euasphodeleæ.

A. Ovules 2 in a cell
B. St or scape leafless
c Anthers pitted where the filament is inserted, fls yellow . 39 *Asphodelus.*
cc Anthers not pitted 40 *Bulbinella.*
(Consult Chrysobactron.)
BB St more or less leafy fls usually white 41 *Asphodeline.*
AA Ovules ∞ in a cell
B Anthers pitted, filaments glabrous 42 *Paradisea.*
BB Anthers not pitted, filaments long bearded 43 *Bulbine*

Subtribe 2 Lomandreæ.

In cultivation 44 *Xanthorrhœa.*

Subtribe 3 Chlorogaleæ

A Perianth-segms 4-nerved 45 *Chlorogalum.*
AA Perianth-segms 1-nerved 46 *Hastingsia.*

Subtribe 4 Bowieæ

Lvs linear, vanishing before anthesis bulb tuber-like 47. *Bowiea.*

Subtribe 5 Anthericeæ

A. Infl clustered down among the radical lvs on a very short st 48 *Leucocrinum.*
AA Infl on a scape, simple or with few branches, racemose or spicate
B Stamens finally as long as the perianth or longer, raceme long, simple and dense 49 *Eremurus.*
BB Stamens shorter than perianth
c Caps with hardly prominent angles 50 *Anthericum.*
cc Caps 3-cornered or 3-winged 51 *Chlorophytum.*

Subtribe 6 Dianelleæ.

Filaments fleshy or thickened at apex or middle 52 *Dianella.*

13. Onion Tribe.

A Rootstock a short rhizome, with clusters of root-fibers 53 *Agapanthus.*
AA Rootstock a tunicated bulb or corm
B Perianth salver-shaped or urn-shaped
c Stamens 6, perianth-tube cylindrical
D Tube often crowned at throat with 3-6 scales, stamens included inside the tube in 2 series 54 *Tristagma.*
DD Tube constricted at the mouth by a scarcely noticeable ring, stamens exserted at mouth of tube, filaments very short 55 *Milla.*
cc Stamens 3, affixed at throat
D Perianth-tube subglobose, constricted at mouth, stamens alternate with a like number of staminodes 56. *Strophostrion.*
DD Perianth-tube broadly cylindrical, shortly 6-sacate at base, stamens with a like number of staminodes connate into a spurious corona behind the anthers 57 *Brevoortia.*
BB Perianth funnel-shaped or bell-shaped, lobes as long as the tube or longer
c Filaments connate into a tube, stamens 6, affixed to throat
D Tube about as long as lobes 58 *Androstephium.*
DD Tube much shorter than lobes . . 59. *Bessera.*
cc. Filaments free, normal or very short, perfect stamens 6 or 3, affixed to throat or tube
D. Pedicels articulated at apex. .....60. *Brodiæa.*

DD. Pedicels not articulated at apex . 61. *Trisetaria.*
BBB. Perianth wheel-shaped or bell-shaped, segms connate at the base into a ring or cup.
C. Rootstock a fibrous-tunicated corm.
D Filaments dilated at base into truncate scales surrounding ovary 62 *Bloomeria.*
DD. Filaments slightly dilated below the middle 63 *Muilla.*
CC. Rootstock a tunicated bulb
D. Alliaceous odor absent, perianth-segms connate at base or to the middle 64 *Nothoscordum.*
DD. Alliaceous odor nearly if not quite always present, perianth-segms distinct or barely united at base in a ring 65. *Allium.*

14. Squill Tribe.

A. Perianth-segms distinct, or united only at the very base
B Seeds strongly compressed, ovules numerous
C. The outer segms of the persistent perianth spreading, the inner a little shorter, erect, connivent at apex and variously crested 66 *Albuca*
CC. The segms of the deciduous perianth subequal, connivent into a bell, or spreading 67. *Urginea.*
BB. Seeds obovoid or globose, not flattened or angled, ovules 2–∞ in a cell
C. Infl a long dense raceme, bearded at the apex by empty bracts, which may be herbaceous or colored 68 *Eucomis*
CC. Infl not as in C
D Nerves of perianth-segms 1 69 *Scilla*
DD Nerves of perianth-segms 3–∞ 70 *Camassia*
DDD Nerves of perianth segms obscure 71 *Ornithogalum.*
AA. Perianth-segms united into a tube or bell.
B Ovules ∞, usually numerous
C Seeds strongly compressed or angled
D The outer lobes spreading, inner ones erect and shorter 72 *Dipradi*
DD The lobes all spreading and subequal, or the inner ones a little wider 73 *Galtonia*
CC Seeds obovoid or globose 74 *Lachenalia*
BB. Ovules 2–6 in a cell, rarely more, seeds not flattened or angled
C Lobes very short, tooth-like, much shorter than tube
D Perianth cylindrical 75 *Veltheimia*
DD Perianth urn-shaped, constricted at throat 76 *Muscari*
CC Lobes considerably longer than the bell-shaped tube fls few, in a lax raceme
D. Filaments erect, not connate, all or only alternate ones dilated and petal-like 77. *Chionodoxa.*
DD Filaments connate into a sort of cup which is produced beyond the anthers into a cone 78 *Puschkinia.*
CCC. Lobes shorter than the tube or about as long, sometimes a trifle longer, filaments normal or dilated at base 79 *Hyacinthus*

15. Tulip Tribe.

A. Caps septicidally dehiscent or 3-parted fls. erect or pendulous, outer perianth-segms usually narrower or smaller, inner ones pitted 80 *Calochortus.*
(Consult also Cyclobothra.)
AA. Caps loculicidally dehiscent
B Anthers dorsifixed, versatile, fls nodding or pendulous, rarely erect, claw of segms usually furnished with a nectariferous groove 81. *Lilium.*
BB. Anthers basifixed, erect, filament usually intruded
C. Fls usually erect, perianth bell-shaped or somewhat funnel-shaped, segms often spotted near the base, not pitted 82 *Tulipa.*
CC. Fls nodding or pendulous
D Perianth bell-shaped, segms usually furnished with a pit or nectar-bearing spot above the base 83 *Fritillaria.*
DD. Perianth-segms narrow, recurved or reflected from the middle or almost from the base 84. *Erythronium.*

16. Medeola, or Cucumber-Root Tribe.

A. Foliage at base of st, lvs few, stalked or contracted into a sheath fls in a long-peduncled umbel, rarely solitary 85 *Clintonia.*
AA. Foliage whorled at top of st
B. Lvs 3; fl solitary, 3-merous 86 *Trillium.*
BB Lvs 4–∞ fls solitary, 4–∞-merous 87. *Paris*
AAA. Foliage whorled at middle of st with 3 smaller lvs. at the top surrounding the umbel. . 88. *Medeola.*

17. Colchicum, or Autumn-Crocus Tribe.

A. Perianth-tube entire, styles 3, distinct from the base . 89. *Colchicum.*
AA. Perianth-segms with distinct claws, connivent into a tube
B Styles 3, distinct from base . . 90. *Merendera.*
BB Style entire inside the tube, 3-fid at apex .. 91. *Bulbocodium.*

18. Narthecium Tribe.

A. Caps loculicidally dehiscent.
B Style undivided . . 92 *Narthecium.*
BB Styles 3 93 *Zerophyllum.*
AA. Caps septicidally dehiscent or parted.
B Fls few at apex of scape, style undivided . 94. *Helonopsis.*
BB. Fls in a dense raceme, styles 3, very short . 95. *Helonias.*

19. Bellwort, or Uvularia Tribe.

A Fr an indehiscent berry 96 *Disporum.*
AA Fr a septicidal caps 97 *Tricyrtis.*
AAA Fr (when known) a loculicidal caps.
B Fls terminal, pendulous.
C Lvs perfoliate seeds covered by a thin white aril 98 *Uvularia.*
CC Lvs sessile seeds have a swollen, spongy, brown ridge 99 *Oakesia.*
BB Fls axillary, or long-pedicelled in the axils
C Plants are climbers
D Perianth-segms spreading, usually wavy or crisped 100 *Gloriosa.*
DD Perianth-segms distinct, suberect, more or less connivent and bell-shaped 101 *Littonia.*
CC Plants not climbers perianth urn-shaped, lobes very short 102 *Sandersonia.*

20. False Hellebore or Veratrum Tribe.

A. Seeds membranous-winged nearly all the way around sts leafy
B Lvs narrow or long-stalked perianth-segms distinctly clawed 103 *Melanthium.*
BB Lvs usually broad, plaited, veiny, contracted into a sheath, not distinctly stalked perianth-segms a trifle contracted at the base 104 *Veratrum.*
AA Seeds narrow, angled, hardly winged lvs radical or crowded at base of st, linear or rarely sublanceolate
B Stamens much shorter than perianth, perianth more or less bell-shaped 105 *Stenanthium.*
BB Stamens a little shorter than perianth, perianth flattened out 106 *Zygadenus*

Other genera described are Acrospira, Alectorurus, Androcymbium, Arthropodium, Astelia, Chamælirium, Dipidax, Drimia, Leucocoryne, Massonia, Oligobotrya, Pehosanthes, Thysanotus, Toneldia, Tupistra, and Tulbaghia

195. PONTEDERIACEÆ.

A Perianth funnel-shaped
B Ovary by abortion 1-celled, 1-ovuled 1 *Pontederia*
BB Ovary 3-celled, many-ovuled 2 *Eichhornia*
AA Perianth salver-shaped 3 *Heteranthera.*

196. COMMELINACEÆ.

A Fr indehiscent
B Pericarp hard and brittle 1 *Pollia*
BB Pericarp succulent or fleshy 2 *Palisota.*
AA Frs loculicidally dehiscent
B Fls with 3 perfect stamens, and 3 or fewer staminodes
C Anther-cells parallel and contiguous
D Ovary 3-celled, 2 anterior cells 1-2-ovuled, posterior 1-ovuled, empty or wanting 3 *Commelina.*
DD Ovary 2–3-celled, cells usually 2–∞-ovuled 4 *Aneilema.*
CC. Anthers, with variously petaloid connective cells spirally twisted into numerous gyres 5. *Cochliostema.*
BB. Fls with 6 stamens, rarely 5, all perfect, no staminodes 6 *Dichorisandra.*
C. Anther-cells dehiscing by a terminal pore
CC Anthers otherwise dehiscent
D Connective transversely or divaricately 2-lobed 7. *Zebrina.*
DD. Connective not 2-lobed as in D.
E. Ovary-cells 2–5-ovuled.

FF. Cymes fascicle-formed, with the very short rachis contracted into a receptacle, sessile inside the base of the complicate floral lvs or variously paniculate 8. *Tradescantia.*
FF. Cyme terminal, pedunculate with 2–3 longish branches secund-fid from base .... 9. *Tinantia.*
EE. Ovary cells 1-ovuled .....10. *Rhoeo.*

197. JUNCACEÆ.

A. Ovary 1-celled, or more or less perfectly 3-celled, placentæ or cells ∞-ovuled . . . . . 1. *Juncus.*
AA. Ovary 3-celled, cells 2- or few-ovuled..... 2. *Prionium.*

198. PALMACEÆ.

A. Lf-segms unfolded in vernation: spadices interfoliaceous.
B. Fls dioecious
C. Lvs pinnatisect, segms acuminate spathe solitary, ovary of 3 distinct carpels, only 1 maturing seed deeply grooved ventrally umbilicate, embryo dorsal 1 PHŒNIX TRIBE.
CC Lvs plaited in a fan-shaped fashion, roundish, semi-orbicular or wedge-shaped, split spathes numerous, ovary entire or 3-lobed, 3-celled, with erect ovules seeds with a mere dot of a hilum raphe ventral 2 CORYPHA TRIBE
BB. Fls usually hermaphrodite lvs much like those of Corypha Tribe spathes numerous, ovary entire, 3-lobed, with ascending ovules seeds with diffused hilum 3 BORASSUS TRIBE.
AA. Lf-segms folded back in vernation
B. Seeds adherent to the endocarp, hilum diffused, embryo opposite pore spadices interfoliaceous, fls usually monœcious in the same spadix, the lower ones in 3's with the middle one pistillate 4 COCOS TRIBE.
BB Seed umbilicate
C. Raphe dorsal, embryo ventral spadices terminal or axillary, fls polygamo-monœcious 5 LEPIDOCARYA TRIBE.
CC. Raphe ventral, embryo dorsal 6 ARECA TRIBE

1. Phœnix Tribe.

The only genus . . . . 1 *Phœnix.*

2. Corypha Tribe.

A. Style or stigma basilar in fr: endosperm equable
B. The style short, embryo terminal. Palms fruit once and die . . . . . 2 *Corypha.*
BB. The style elongated
C. Embryo dorsal .... 3. *Sabal* (*Inodes*).
CC Embryo sub-basilar . 4. *Washingtonia*
AA. Style or stigma terminal in fruit.
B. Perianth of imbricate petals or corolla-segms
C. Fls polygamo-dioecious, stigmas sessile, distinct, embryo dorsal
D Endosperm ruminate . . . . 5 *Chamærops.*
DD Endosperm equable 6 *Rhapidophyllum.*
CC Fls hermaphrodite, styles long, distinct
D Filaments free 7 *Acanthorhiza.*
DD Filaments connate into a tube 8 *Trithrinax.*
BB. Perianth of valvate petals or corolla-lobes (see also BBB)
C. Fls dioecious, corolla 3-toothed, anthers extrorsely dehiscent 9. *Rhapis.*
CC. Fls polygamo-monœcious, carpels distinct, stigmas distinct, sessile endosperm equable, ventrally grooved, embryo dorsal . 10 *Trachycarpus.*
CCC. Fls hermaphrodite
D. Embryo dorsal, endosperm equable: carpels slightly cohering or in Livistona sometimes distinct
E Spadix-branches not sheathed style single, short, 3-cornered 11. *Brahea.*
EE. Spadix rachis sheathed, carpels 3-cornered, style single, thread-like 12. *Licuala.*
EEE. Spadix-branches naked or lower ones bracted, carpels globose, styles short, distinct or cohering 13 *Livistona.*
DD. Embryo, sub-basilar. rachis of spadix sheathed.
E. Endosperm ruminate carpels 3, distinct at base, style single, short, 3-grooved .14. *Copernicia.*
EE. Endosperm equable
F. Corolla-tube persistent, segms. deciduous, ovary 3-cornered or 3 lobed, narrowed into a style 15 *Pritchardia.*
FF. Corolla otherwise
G. Carpels free at base; style single, slender, elongated . 16 *Serenæa.*
GG. Carpels slightly cohering, style single, short, 3-grooved... . 17 *Erythea*
BBB. Perianth minute 6-fid or obsolete .....18 *Thrinax* (and *Coccothrinax*).

3. Borassus Tribe.

A. Stamens 6
B. Fls numerous in the cavities of the spadix...19. *Borassus.*
BB Fls solitary in the cavities . ..... 20 *Hyphæne.*
AA. Stamens numerous
B Fls numerous in cavities .... 21 *Lodoicea.*
BB. Fls. solitary in cavities ... .22. *Latania.*

4. Cocos Tribe.

A. Palms armed with prickles fr 1-seeded; endocarp 3-porous at or above the middle
B. Pistillate fls with petals united for a considerable distance, staminate fls smaller: endocarp bony
C. Staminate fls not immersed in spadix. lf-segms acuminate 23 *Bactris.*
CC Staminate fls immersed in cavities of spadix lf-segms premorse 24 *Astrocaryum.*
BB Pistillate fls with petals connate only at base
C Staminate fls immersed, anthers large, inserted lf-segms acuminate 25 *Acrocomia.*
CC Staminate fls not immersed, anthers included lf-segms wedge-shaped, premorse 26 *Martinezia.*
AA Palms unarmed
B Endocarp 3-porous above middle fr 1–3-seeded 27. *Elæis.*
BB Endocarp bony and, except in Jubæa, 3–6-porous toward base fr 1-∞-seeded
C Spadix simple . 28. *Diplothemium.*
CC Spadix simply branched
D Number of stamens 6 fr 1-seeded (in Scheelea sometimes 2–3-seeded)
E Petals minute, much smaller than exserted stamens of staminate fls 29 *Maximiliana.*
EE Petals lanceolate stamens included 30 *Cocos*
EEE Petals shaped like a long club, or cylindrical, stamens shorter 31 *Scheelea.*
DD Number of stamens 10–24 or more, petals of staminate fls lanceolate, stamens included, anther-cells connate
E Fr 2–6-seeded 32. *Attalea.*
EE Fr 1-seeded, the endocarp 3-porous at the middle or a little lower 33. *Jubæa.*

5. Lepidocarya Tribe.

A Lvs fan-shaped ovary perfectly 3-celled 34. *Maurisia.*
AA Lvs equally pinnatisect ovary imperfectly 3-celled spadices axillary
B Palms fruit once and die 35 *Plectocomia.*
BB Palms fruit more than once, usually climbers
C Spathes solitary, deciduous lf-segms rhombic, nerves fan-shaped 36 *Ceratolobus.*
CC Spathes numerous, persistent lf-segms acuminate, nerves parallel
D Spadices contracted, spathes cymbiform, beaked, long-persistent, the 2 lower ones forming an involucre for the others 37 *Dæmonorops*
DD Spadix diffused, or, if contracted, the spathes are flat and persistent only during anthesis . . . ...38. *Calamus.*

6. Areca Tribe.

Key to Subtribes;

A. Petals of the pistillate fls valvate throughout nearly their whole length, spadices interfoliaceous, spathes 2 or more, ovary entire, 3-celled 1. CARYOTIDEÆ.
AA. Petals of the pistillate fls overlapping or valvate only at apex, very rarely valvate throughout
B. Spadices infrafoliaceous.
C. Stigmas terminal in fr; ovary entire, 1-celled
D. Staminate fls unsymmetrical; sepals usually small and not imbricate..... . 2. EUARECEÆ.

DD. Staminate fls symmetrical; sepals usually roundish and widely overlapping . . . 3. PTYCHOSPERMEÆ.
CC. Stigmas usually excentric or lateral on ovary, entire or 3-lobed. lf.-segms acuminate
D Spathes 2, ovary entire . . 4. ONCOSPERMEÆ.
DD. Spathes numerous. lf -segms. wedge-shaped
E. Ovary entire, younger spadices horn-shaped . . 5. IRIARTEEÆ.
EE. Ovary deeply 3-lobed, with large stigmas, spadices club-shaped . . 6. WETTINIEÆ.
BB. Spadices nearly always interfoliaceous
C. Stigmas terminal on fr, rarely basal
D. Ovary 1-celled, spadix simple, with monœcious fls immersed in cavities . . 7. LINOSPADICEÆ.
DD. Ovary 3-celled, imperfectly so in Subtribe 8
E. Fr globose spadix paniculately branched, the fls dicœcious and pedicelled . . 8 CEROXYLEÆ.
EE. Fr elongated spadix subdigitately branched, the fls. monœcious and not immersed . . 9 MALORTIEÆ.
CC. Stigmas lateral or basal on fr, rarely terminal, ovary entire
D. Fls not immersed in cavities
E Spathes 2, all the fls or the lower ones in 3's, ovary 1–3-celled . . 10 IGUANUREÆ.
EE. Spathes numerous, ovary 3-celled, spadices inter- and infrafoliaceous, fls usually dicœcious, without bracts or bractlets, perianth rather fleshy or leathery . . 11 CHAMÆDOREÆ.
DD. Fls immersed in cavities, monœcious or dicœcious, compressed, perianth glumaceous; style often elongated, terminal or lateral. . . . . 12 GEONOMEÆ.

Subtribe 1. Caryotideæ.

A. Lvs bipinnatisect endosperm ruminate staminate fls with 3 sepals and stamens . . 39 *Caryota.*
AA. Lvs pinnatisect endosperm equable
B. Stamens 6, calyx of staminate fls tubular, truncate . . 40 *Wallichia.*
BB. Stamens ∞
C. Calyx of staminate fls cup-shaped, 3-lobed . . 41 *Didymosperma.*
CC. Calyx of staminate fls of 3 sepals . . 42 *Arenga.*

Subtribe 2. Euarecеæ.

A. Ovule basal, erect
B. Endosperm ruminate
C. Stamens 3 or 6, staminate fls minute, numerous, solitary or in pairs, on branches of spadix, pistillate fls much larger, solitary toward base of branches . . 43 *Areca.*
CC. Stamens numerous, fls in 3's, the middle one pistillate, arranged in 2, 4 or 6 ranks . . 44 *Pinanga.*
BB. Endosperm equable stamens 6, fls in 3's, the middle one pistillate, arranged in 4 ranks . . 45 *Kentia*
AA. Ovule parietal, more or less pendulous
B Fls arranged in 4 ranks on branches of spadix . . 46 *Hydriastele.*
BB. Fls arranged spirally on branches of spadix (All "sepals" mentioned under BB refer to sepals of staminate fls except when otherwise stated)
C. Pistillate fls much larger than staminate, sepals papery, connate at base . . 47 *Veitchia.*
CC. Pistillate fls not larger than staminate
D Length of sepals far surpassing petals, sepals narrow . . 48 *Nenga.*
DD Length of sepals not exceeding petals
E The sepals overlapping
F Sepals triangular-orbicular, stamens numerous, filaments short . . 49. *Kentiopsis.*
FF. Sepals small, keeled, stamens 9–24, filaments inflexed at apex . . 50 *Archontophœnix.*
EE. The sepals not overlapping
F. Filaments inflexed at apex
G. Sepals awl-shaped or lanceolate, stamens 6–12, pistillate fls with short petals valvate at apex . . 51. *Rhopalostylis.*
GG. Sepals small, acute, stamens 6; pistillate fls with petals a little longer than the sepals. . . . 52. *Dictyosperma.*
FF. Filaments normal, sepals narrowly lanceolate, stamens 9–12, pistillate fls with petals like the sepals . . 53 *Hedyscepe.*

Subtribe 3. Ptychospermeæ.

A. Endosperm ruminate
B Stamens 20–30 . . . . . 54 *Ptychosperma.*
BB Stamens 6 . . . . . 55 *Rhopalostylis.*
AA. Endosperm equable
B Lf -segms obliquely premorse stamens numerous . . 56 *Drymophlœus.*
BB. Lf -segms narrowed at apex, or in Cyrtostachys entire or sometimes obliquely 2-toothed
C. Stamens 6–15, pericarp slightly fibrous, smooth inside . . 57 *Cyrtostachys.*
CC. Stamens 6, pericarp thick, granular, fibrous inside . . 58 *Cyphophœnix.*

Subtribe 4 Oncospermeæ.

A. Staminate fls symmetrical, sepals broad and much overlapping, stigmas on fr excentric or lateral, or in Cyphosperma subterminal
B. Perianth of pistillate fls enlarged after anthesis
C Pericarp grumose and fibrous . . 59 *Clinostigma.*
CC Pericarp thin, leathery or bony . . 60 *Cyphosperma.*
BB Perianth not changed after anthesis . . 61 *Microkentia.*
AA. Staminate fls unsymmetrical, sepals small or narrow, not imbricate or only slightly so, stigmas lateral on fr or basal
B. Petals of pistillate fls connate at base, valvate above
C. Calyx of staminate fls united at base . . 62 *Oreodoxa* (Incl Roystonea)
CC Calyx with 3 distinct sepals . . 63 *Icrista*
BB Petals free
C Anthers erect . . 64 *Oncosperma.*
CC Anthers versatile
D Fr globose palms unarmed . . 65 *Euterpe*
DD Fr minute palms spiny . . 66 *Acanthophœnix.*

Subtribe 5 Iriarteæ.

Stamens 9–15 stigmas terminal or nearly so in fr lf -segms turned in every direction . . 67 *Iriartea.*

Subtribe 6 Wettinieæ

No representatives known to be cultivated in America.

Subtribe 7. Linospadiceæ.

A. Anthers basifixed, erect
B Stamens 6, 10, or 12, pistillate fls have ∞ staminodes lf -segms premorse . . 68 *Bacularia.*
BB Stamens very numerous, pistillate fls have no staminodes lf -segms acuminate . . 69 *Howea*
AA. Anthers dorsifixed, versatile staminodes in pistillate fls 6–9 lf -segms acuminate . . 70 *Linospadix.*

Subtribe 8 Ceroxyleæ

Stamens 9–15 fr with basal stigmas . . 71 *Ceroxylon.*

Subtribe 9. Malortieæ.

Not cultivated in America

Subtribe 10. Iguanureæ

A. Stigmas excentric or lateral on fr . . 72 *Heterospathe.*
AA Stigmas basal or nearly so on fr
B Stamens 15–20, ovary 1-celled palm armed . . 73 *Stevensonia.*
BB Stamens 6, with didymous anthers
C Ovary 1-celled palm armed . . 74 *Verschaffeltia.*
CC. Ovary 3-celled palm unarmed . . 75. *Dypsis.*

Subtribe 11 Chamædoreæ.

A. Fls. dicœcious or monœcious in different spadices, spirally arranged . . 76. *Chamædorea.*
AA. Fls monœcious in the same spadix
B. The fls arranged in elongated heaps or clusters
C Infl from among the lvs . . 77 *Gaussia.*
CC Infl from below the lvs . . 78. *Hyophorbe.*
BB. The fls. sparse, solitary or in pairs. . . . . 79. *Roscheria.*

Subtribe 12. Geonomeæ.

A. Base of the ovary included in the disk
B Anthers arrow-shaped . 80. *Calyptro-*[*gyne.*
BB Anthers with long separate pendulous cells 81 *Geonoma*
AA Disk 0 many-stemmed palms of India 82 *Bentinckia.*

Imperfectly Known Genera of Palms.

83 *Balaka* is a member of the Areca Tribe and probably belongs between Ptychosperma and Drymophlœus, differing from those genera as indicated in the article Balaka

84 *Bismarckia* is a member of the Borassus Tribe

85 *Chrysalidocarpus* is a well-known member of the Areca Tribe of doubtful affinity

86 *Exorrhiza* is a member of the Areca Tribe, Subtribe Euarecæ

87 *Nipa* is a member of the Areca Tribe but of uncertain affinity Its nearest horticultural relative is Phœnix

88 *Phytelephas* is a well-known member of the Areca Tribe but of doubtful affinity

89 *Pseudophœnix* is a member of the Areca Tribe which probably belongs in the Subtribe Chamædoreæ, near Hyophorbe

90 *Ptychoraphis* is a member of the Areca Tribe which probably comes after Ptychosperma

91 *Ranesea* is known only in the juvenile state and is conjectured to be near to Hyophorbe

The following genera are also treated Acoelorraphe, Cyphokentia, Desmoncus, Eremospatha, Hyospathe, Manicaria, Metroxylon, Microphœnix, Neonicholsonia, Œnocarpus, Pigafetta, Ptychococcus, Synechanthus, Treubmannia, Welfia and Zalacca

199. LEMNACEÆ.

Floating plants with roots fls inserted on marginal cracks of the frond, stamens 1–2, anthers 2-celled *Lemna.*

200. PANDANACEÆ.

A Ovules solitary in carpels 1 *Pandanus*
AA Ovules many in the locules 2 *Freycinetia*

201. CYCLANTHACEÆ.

A Plants with watery juice . 1 *Carludovica.*
AA Plants with milky juice 2 *Cyclanthus*

202. TYPHACEÆ.

The only genus *Typha.*

203. ARACEÆ.

A. Perianth 0 (except female fls of Peltandra)
B Fls monœcious (in Arisæma sometimes dœcious)
C Spadix appendaged (except in Pistea)
D The male and female infl contiguous with no neutral organs between ovules anatropous or semi-anatropous 1 *Amorpho-*[*phallus*
DD The upper fls males, lower ones females ovules orthotropous
E. The spadix free from the spathe or adnate at the base
F. Male fls sparse lvs and fls appear together
G Tube of spathe with connate margins, male fls with 1 stamen, anthers horseshoe-shaped 2 *Arisarum*
GG. Tube of spathe convolute, fls usually dœcious, males with 2–5 stamens 3 *Arisæma*
FF. Male fls dense lvs often appear before fls
G. Tube of spathe with connate margins
H Ovule solitary lvs entire 4 *Biarum*
HH Ovules 2–4 lvs pedatisect 5 *Sauroma-*
GG. Tube of spathe convolute [*tum.*
H Ovules ∞, parietal, in 2 series 6 *Arum.*
HH Ovules few, inserted at base and apex of cell
I. Male and female fls remote, appendix of spadix hairy 7 *Helicodic-*
II. Male and female fls contiguous [*eros.*
8. *Dracunculus.*
EE. The spadix not appendaged, adnate to spathe on back. aquatic plant . 9. *Pistia.*
EEE. The tube of spathe closed at mouth by dilation of spadix or else divided into 2 cells
F Tube closed at throat . 10 *Pinellia.*
FF Tube 2-celled 11. *Ambrosinia.*
CC. Spadix not appendaged (rarely with a naked appendage or endowed with neutral organs), upper fls. males, lower ones females
D. Stamens connate in a prismatic or peltate body
E. Plants are climbing shrubs
F Ovaries distinct, 2–10-celled .. 12. *Philoden-*[*dron.*
FF Ovaries coherent, 1–2-celled ... 13 *Syngonium.*
EE. Plants are herbs, not climbing
F. The ovules orthotropous or nearly so, micropyle superior
G. Ovules numerous in 2 series on 3-5 parietal placentæ 14 *Colocasia.*
GG Ovules few, basal 15 *Alocasia.*
GGG. Ovules 1 or few, subparietal distinguished by ovary immersed in a carp and embryo not albuminous 16 *Peltandra.*
FF. The ovules anatropous or semi-anatropous, micropyle inferior
G Ovaries distinct or slightly coherent 17 *Caladium.*
GG. Ovaries distinct below, above thick, dilated and grown together 18 *Xanthosoma.*
GGG Ovary 2-5-celled 19 *Dieffen-*[*bachia.*
DD. Stamens distinct
E. Fr not included by tube of spathe the whole spathe deciduous, marcescent
F. Ovule affixed to intruded placentæ lvs ovate 20 *Aglaonema.*
FF Ovule affixed near top of cell lvs broadly arrow-shaped 21 *Nephthytis.*
EE. Fr included by accrescent tube of spathe blade of spathe marcescent, deciduous 22 *Zantedes-*[*chia.*
EEE. Fr included by spathe, blade of which is persistent 23 *Homalo-*[*mena.*
EEEE Fr girt by the top-shaped tube of spathe, which has a circumscissile, deciduous blade 24 *Schizmato-*[*glottis.*
BB Fls hermaphrodite 25 *Calla*
C Plants marsh herbs
CC Plants are scandent shrubs
D Ovules 2 in a cell, affixed to base of septum 26 *Monstera*
DD Ovules solitary, basal 27 *Scindapsus.*
DDD Ovules numerous 28 *Rhaphid-*[*ophora.*
DDDD Ovules 3 or 4 in a cell 29 *Stenosper-*[*matium*
AA Perianth of 4–8 distinct segms, fls. all hermaphrodite
B. Spadix flowering downward, spathe long, often twisted, long-persistent 30 *Cyrtosperma.*
BB. Spadix flowering upward
C. Spathe sheathing the very long peduncuhform stipe of the spadix, with blade incomplete or 0
D Ovary 1-celled, ovules solitary, semi-anatropous 31 *Orontium*
DD. Ovary 2-celled, ovules 1–2 in a cell, orthotropous 32 *Lysichitum.*
DDD. Ovary 1-2-celled, ovule 1 in each cell, suspended 33 *Symplo-*[*carpus.*
DDDD Ovary imperfectly 1-2-celled, ovule solitary, affixed to interior angle of cell 34 *Dracontium.*
CC Spathe provided with scale-like appendages in the tube, long-persistent ovules semi-anatropous or campylotropous 35 *Spathyema.*
CCC Spathe leafy, accrescent, persistent, quite flattened out ovules anatropous 36 *Spathiphyl-*
CCCC Spathe open, recurved or reflexed, accrescent, persistent ovules various [*lum.*
37 *Anthurium.*
CCCCC Spathe accrescent, persistent or obsolete ovules anatropous 38 *Pothos*
CCCCCC Spathe obsolete or obscure ovules orthotropous 39 *Acorus*

Additional Key to the Araceæ.

The Araceæ are likely to be so difficult for the gardener that an additional key, based on other contrasts, is here inserted for his convenience

A Plants free-swimming, aquatic *Pistia.*
AA Plants not free-swimming aquatics, terrestrial or marsh plants
B Lvs parallel-veined (see also Calla and Acorus)
C Plant shrub-like or climbing· st more or less aërial stamens of staminate fl. separate

D. Blade of spathe deciduous, spathe constricted in middle, leaving a long tube when blade falls — *Schismatoglottis.*
DD. Blade of spathe persistent, at least until ripening of spadix.
E Seeds anatropous . ..... — *Homalomena.*
EE Seeds orthotropous .. . — *Philodendron.*
CC. Plant with st upright, aerial: stamens united into a synandrium
D. Pistillate fls crowded, without staminodia, staminate fls. with only 2–3 separate stamens — *Aglaonema.*
DD. Pistillate fls with staminodia interspersed, staminate fls with 3–4 united stamens — *Dieffenbachia.*
CCC. Plant with st subterranean
D. Seeds orthotropous or nearly so the connate staminodia of the pistillate fl forming an involucre around the gynœcium — *Peltandra*
DD Seeds anatropous staminodia of pistillate fls separate — *Zantedeschia.*
BB. Lvs. netted-veined (i e veins of 2nd, 3rd, and 4th order netted)
C. Milk-tubes absent
D Raphides absent (raphides are acicular crystals found in bundles in the plant-cell)
E Lvs differentiated into petiole and blade seeds anatropous
F Seeds without endosperm — *Pothos*
FF Seeds with endosperm — *Anthurium.*
EE. Lvs without distinction into petiole and blade seeds orthotropous — *Acorus*
DD. Raphides present in ground tissue of st and lvs
E Fls without perianth, spathe deciduous before ripening of spadix plants mostly climbing
F. Seeds with endosperm and axial embryo
G Foliage-lvs many on each shoot — *Stenospermation.*
GG Foliage-lvs 1 on each shoot in addition to several bracts — *Raphidophora.*
FF Seeds without endosperm
G Ovary 2-celled . — *Monstera*
GG Ovary 1-celled — *Scindapsus*
EE. Fls with perianth, spathe not deciduous sub-shrubs — *Spathiphyllum.*
CC. Milk-tubes present in fibro-vascular bundles
D. The milk-tubes branched, veins of 2nd grade fusing into a collective vein between veins of 1st grade
E. Seeds with endosperm. st. not climbing
F. Ovary with basal placenta — *Alocasia*
FF. Ovary with parietal placentæ — *Colocasia.*
FFF. Ovary with broad, nearly central placentæ
G Style small — *Caladium*
GG Style disk-like, projecting beyond ovary — *Xanthosoma*
EE Seeds without endosperm st climbing — *Syngonium*
DD. The milk-tubes simple, straight, veins not as above
E. Perianth present, fls bisexual
F. Lvs not arrow-shaped
G Ovary 2-celled, 2 ovules in each cell, suspended from middle of partition — *Lysichitum.*
GG. Ovary 1-celled, 1-ovuled
H Ovule from apex of cell spadix short, nearly globular — *Symplocarpus.*
HH Ovule basal: spadix cylindrical — *Orontium.*
FF. Lvs arrow-shaped
G Plants are shrubs with climbing or creeping sts · petioles and sts usually prickly or warty ... — *Cyrtosperma.*
GG Plants tuberous — *Dracontium*
EE Perianth absent, fls unisexual (bisexual in Calla)
F. Fls bisexual lvs not arrow-shaped. — *Calla.*
FF. Fls unisexual lvs various.
G. Spadix with a sterile terminal appendage, or with sterile wings sts various
H. Seeds without endosperm — *Amorphophallus.*
HH Seeds with endosperm
I. Appendage of spadix projecting much beyond the spathe, or included and free.
J. Spadix with rudimentary fls between the fertile staminate and fertile pistillate fls, or staminate infl bordering immediately on the pistillate infl
K. Placenta parietal lvs. arrow-shaped or lanceolate — *Arum.*
KK. Placentæ apical and basal lvs. pedately divided
L. Fertile staminate infl bordering immediately on the pistillate infl — *Dracunculus.*
LL. Fertile staminate infl separated from pistillate infl by many rudimentary fls — *Helicodiceros.*
KKK. Placenta basal
L. Lvs pedately divided seeds 2 or more — *Sauromatum.*
LL. Lvs ovate, lanceolate or linear seeds mostly 1 — *Biarum.*
JJ. Spadix without rudimentary fls, but a space between the staminate and pistillate fls, or unisexual
K. Ovary with many ovules
L. Staminate fls of 1 stamen lvs ovate or arrow-shaped spadix bisexual — *Arisarum.*
LL. Staminate fls of 2–5 stamens lvs 3- or many-parted spadix unisexual — *Arisæma.*
KK Ovary 1-ovuled staminate and pistillate portions of spadix separated by a partition which reaches out from wall of spathe — *Pinellia.*
II. Appendages of the spadix wing-like on the 2 sides, thus dividing the bilabiate spathe into 2 chambers, the anterior of which contains a staminate fl, the posterior a pistillate fl — *Ambrosinia.*
GG. Spadix without such appendage or wings sts subterranean, creeping — *Nephthytis*

Other genera described are Callopsis, Cryptocoryne, Epipremnum, Gamogyne, Gymnostachys, Staurostigma, Typhonium and Typhonodorum.

204. ALISMACEÆ.

A. Carpels inserted in a whorl on a small receptacle ... — 1. *Alisma.*
AA. Carpels densely crowded in many series on a large oblong or globose receptacle . . — 2 *Sagittaria*

205. BUTOMACEÆ.

A. Petals marcescent, stamens 9, carpels 6 . — 1. *Butomus.*
AA. Petals deciduous, stamens numerous, carpels 15–20 .... — 2 *Limnocharis*

206. NAIADACEÆ.

A. Fls. hermaphrodite, spicate; perianth 4-divided, stamens 2 or 4 — 1 *Potamogeton.*
AA. Fls. unisexual, axillary, perianth 0, stamens 1 — 2 *Zannichellia*

207. APONOGETONACEÆ.

The only genus..... *Aponogeton.*

208. CYPERACEÆ.

A. Fls. strictly unisexual, female inclosed in a flask-shaped or bag-shaped scale or glume (perigynium) . . . . . 1. *Carex.*
AA. Fls bisexual, rarely unisexual, not inclosed as above
B. With several (2 to many) of the lower scales empty
C. Spikelets few-fld (usually 1-2-, rarely, 3-6-fld) . . . . . 2 *Rhynchospora.*
CC. Spikelets many-fld
D St leafy . . . . . 3 *Hypolytrum.*
DD St not leafy or only at base . . . . 4 *Mapania*
BB With only 1 or 2 of the lower scales empty
C Scales 2-ranked
D Perianth 0 . . . . . 5 *Cyperus*
DD Perianth of 8 setæ . . . . . 6 *Dulichium.*
CC Scales many-ranked, overlapping
D Perianth of 4-8, rarely 0, setæ
E Style persistent, thickened and bulb-like at base . . . . . 7 *Eleocharis.*
EE Style not or hardly thickened at base 8 *Scirpus*
DD. Perianth of many setæ, very long-excrescent after anthesis, becoming wavy or cottony . . . . . 9. *Eriophorum.*

209. GRAMINEÆ.

I. Summary of the Tribes.

Subfamily I. PANICOIDEÆ

Spikelets 1-, rarely 2-fld, the terminal fl perfect, the lower staminate or neuter, rachilla articulated below the glumes, the more or less dorsally compressed spikelets falling from the pedicels entire, singly, in groups, or together with joints of an articulate rachis

A Spikelets unisexual, the male and female spikelets in different infl on the same plant or in different parts of the same infl, awnless . . . 1 INDIAN CORN
AA. Spikelets perfect, sometimes with male or neutral ones intermixed [TRIBE, OR MAYDEÆ.
B. Lemma and palea hyaline, the glumes more or less indurated, spikelets in 2's or 3's on the usually articulate axis of a spike-like raceme, 1 sessile and perfect, usually awned, the other pedicled and perfect, staminate or rudimentary . . . . . 2 SORGHUM TRIBE, OR ANDROPOGONEÆ
BB. Lemma and palea more or less indurated, firmer in texture than the glumes, spikelets all perfect, first glume sometimes obsolete . . . 3 MILLET TRIBE, OR [PANICEÆ

Subfamily II. POACOIDEÆ

Spikelets 1- to many-fld, the imperfect or rudimentary floret, if any, usually uppermost, rachilla usually articulated above the glumes which are persistent on the pedicel or rachis after the fall of the florets, when 2- to many-fld, a manifest internode of the rachilla separating the florets, and articulated below them, spikelets more or less laterally compressed

A. Culms not woody and perennial
B. Infl paniculate, the spikelets pedicelled, not sessile on opposite sides of a jointed flattened axis, forming spikes, nor sessile along one side of a slender continuous axis
C. Spikelets 1-fld, the rachilla sometimes continued as a minute bristle behind the palea (or in Phalarideæ a pair of rudimentary or male florets below the perfect one)
D. Spikelets falling entire, glumes usually obsolete or nearly so . . 4 RICE TRIBE, OR [ORYZEÆ.
DD. Spikelets persistent, glumes present
E. Floret with 2 minute scales (rudimentary lemmas) or 2 small male florets attached at the base and falling with it . . . . . 5. CANARY-GRASS
EE. Floret with no scales attached below, glumes usually subequal, lemma awned or awnless [TRIBE, OR PHALARIDEÆ.
CC. Spikelets 2- to many-fld 6. RED-TOP TRIBE, OR [AGROSTIDEÆ.
D. Glumes longer than the first floret, spikelets 2- to several-fld, 1 or more of the florets usually awned from the back or from between the teeth of a bifid apex [AVENEÆ. 7. OAT TRIBE, OR
DD. Glumes shorter than the first floret, spikelets 2- to many-fld, awns when present terminal or nearly so . . . 8. FESCUE TRIBE, OR
BB. Infl spicate [FESTUCEÆ.
C. Spikelets sessile or subsessile in 1-sided spikes, 1- to few-fld, spikes solitary, or digitately or racemosely arranged . . . 9. CHLORIS TRIBE, OR
CC. Spikelets sessile on opposite sides of a zigzag jointed channeled axis forming a spike, 1- to several-fld [CHLORIDEÆ
AA. Culms woody, tree-like lf-blades articulated with the sheaths . . . 10 BARLEY TRIBE, OR [HORDEÆ
11. BAMBOO TRIBE, OR [BAMBUSEÆ.

II. Key to the Tribes.

1. Indian Corn Tribe, or Maydeæ.

A. Male spikelets in a terminal panicle, female spikelets in spikes or ears in the axils of the lvs
B. Female spikelets sunken in cavities of a jointed readily disarticulating axis . . 1 *Euchlæna.*
BB Female spikelets crowded in rows on a thickened continuous axis (the cob) . . 2 *Zea.*
AA. Male and female spikelets in the same infl, the male at the end of the spikes
B. Spikes digitate, the axis of the female portion bony indurated, disarticulating with spikelets attached . . . . . 3 *Tripsacum.*
BB. Spikes paniculate, the female spikelets inclosed in ovoid pearly or grayish beadlike bodies, the male portion protruding from a small orifice of the bead . . . 4 *Coix.*

2. Sorghum Tribe, or Andropogoneæ.

A. Spikelets all alike, perfect
B. Axis of racemes continuous, the spikelets deciduous, panicle fan-shaped . . . 5 *Miscanthus.*
BB Axis of racemes jointed, readily disarticulating with the spikelets attached
C The spikelets awnless . . . . . 6 *Saccharum.*
CC The spikelets awned . . . . . 7 *Erianthus.*
AA Spikelets not all alike the sessile perfect, the pedicelled male or neuter
B Lower 1 or 2 pairs of spikelets unlike the upper pairs, racemes in pairs from boat-shaped sheaths on the ultimate branches of an elongated infl . . . . . 8 *Cymbopogon.*
BB Lower pairs of spikelets like the upper
C Infl consisting of 1 to many racemes, these digitate or racemose along a short axis . . . . . 9 *Andropogon.*
CC Infl compound, paniculate
D Racemes many-fld, linear, naked at base, numerous, arranged in whorls on an elongated axis . . . . . 10 *Vetiveria.*
DD Racemes reduced to 2 or 3 spikelets, arranged in a compound panicle . . . 11 *Holcus.*

3. Millet Tribe, or Paniceæ.

A. Axis broad and corky, the spikelets sunken in its cavities . . . . . 12 *Stenotaphrum.*
AA. Axis not broad and corky, spikelets not sunken in its cavities
B. Spikelets not subtended or surrounded by bristles
C. Glumes and lemmas awnless, the apex of the palea inclosed in the enfolding lemma . . . . . 13 *Panicum.*
CC. Glumes or lemmas, or both, awned or awn-tipped
D. Second glume and sterile lemma tapering into an awn or point, coarsely 4-spd, palea free at the summit, spikelets crowded . . . . . 14 *Echinochloa.*
DD. Second glume and sterile lemma awned from a 2-lobed apex
E Infl of 1-sided racemes along a common axis, spikelets pubescent but not silky, palea inclosed at summit 15 *Oplismenus.*
EE Infl paniculate, spikelets covered with long silky hairs . . . 16 *Tricholæna.*
BB. Spikelets subtended or surrounded by bristles
C. Bristles persistent, not falling with the spikelets at maturity . . . 17 *Setaria.*
CC. Bristles falling attached to the spikelet 18 *Pennisetum.*

4. Rice Tribe, or Oryzeæ.

A. Spikelets unisexual, the female awned, erect at the summit of the panicle, the male awnless, nodding on the lower branches . . . 19 *Zizania.*
AA. Spikelets perfect, strongly flattened . . 20 *Oryza.*

5. Canary-Grass Tribe, or Phalarideæ.

A. Glumes strongly compressed, sterile lemmas rudimentary . . 21. *Phalaris.*
AA. Glumes not strongly compressed, sterile lemmas not rudimentary
B. Sterile lemmas awned, glumes very unequal. 22. *Anthoxanthum.*
BB. Sterile lemmas awnless, glumes nearly equal. 23. *Hierochloë.*

6. Red-Top Tribe, or Agrostideæ.

A. Lemma indurated, or at least firmer than the glumes
B. Panicle spike-like, spikelets flattened, awnless 24 *Ammophila.*
BB. Panicle not spike-like, spikelets not flattened, awned
c Floret oblong and with a sharp callus at base, awn stout, geniculate, twisted, persistent 25. *Stipa.*
cc Floret ovate, the callus blunt, awn slender, more or less deciduous 26 *Oryzopsis.*
AA. Lemma of about the same texture as the glumes or more delicate
B Spikelets crowded in dense spike-like panicles or heads
c Heads oval, very woolly 27. *Lagurus.*
cc Heads cylindrical, not woolly 28 *Phleum.*
BB Spikelets not crowded in dense heads or spikes
C. Lemma and palea much more delicate and shorter than the glumes, the palea shorter than the lemma, often wanting 29 *Agrostis.*
cc. Lemma and palea of about the same texture as the glumes and as long or longer
D. Rachilla not continued beyond the base of the floret, lemma awned from the tip or awnless
E The lemma awned or sharp-pointed, longer than the body of the awned or awnless glumes 30 *Muehlenbergia.*
EE. The lemma not awned or sharp-pointed
F Nerves of lemma 1 31 *Sporobolus*
FF Nerves of lemma 3-5 32 *Calamovilfa.*
DD. Rachilla prolonged beyond the floret as a plumose bristle, lemmas awned on the back and silky hairy at base 33 *Calamagrostis.*

7. Oat Tribe, or Aveneæ.

A. Plants low, delicate, spikelets minute 34. *Aira*
AA. Plants 1 ft or more high
B Articulation below the glumes, the spikelets falling entire from the pedicels
C Glumes much exceeding the 2 florets, the upper floret with a hook-like awn 35. *Notholcus*
cc Glumes exceeded by the upper floret, both florets awnless 36 *Sphenopholis.*
BB Articulation above the glumes, these persistent after the fall of the florets
c Spikelets 1 in or more long, nodding, in an open panicle, florets all alike 37 *Avena*
cc Spikelets about ¼in long, erect in a narrow panicle, lower floret staminate 38. *Arrhenatherum.*

8. Fescue Tribe, or Festuceæ.

A. Rachilla or lemma bearing long hairs as long as the lemma tall reeds
B. Spikelets unisexual, male and female spikelets on separate plants
C. Lemmas much shorter than the glumes sts leafy throughout 39 *Gynerium.*
cc Lemmas with elongated delicate tips lvs crowded at the base 40 *Cortaderia.*
BB Spikelets perfect
c Lemmas hairy rachilla naked 41 *Arundo*
cc Lemmas naked, rachilla hairy 42 *Phragmites*
AA. Rachilla or lemma glabrous or hairy, but the hairs shorter than the lemmas
B. Spikelets of 2 kinds, perfect and sterile, in the same panicle
C. Fertile spikelets awnless, the sterile awned, panicle spike-like 43. *Cynosurus.*
CC. Fertile spikelets awned, the sterile awnless, panicle 1-sided, the fascicled spikelets nodding 44. *Lamarckia.*
BB. Spikelets all alike in the same infl
C. Lemmas 1-3-nerved
D The spikelets subterete, loosely 2-4-fld 45 *Molinia.*
DD. The spikelets compressed, densely, usually many-fld
E. Florets membranaceous; spikelets in open panicles 46 *Eragrostis.*
EE. Florets coriaceous; spikelets in rigid spike-like panicles . . 47. *Desmeseria.*
CC. Lemmas 5- to many-nerved.
D. The spikelets with several sterile lemmas at the base, strongly flattened, in a large drooping panicle 48. *Uniola.*
DD. The spikelets without sterile lemmas at the base
E. Florets crowded, nearly horizontal, spikelets broad, cordate 49. *Briza.*
EE. Florets not crowded, spikelets not broad and cordate
F. Spikelets flattened, nearly sessile in dense clusters at the ends of the few panicle branches 50. *Dactylis.*
FF. Spikelets not flattened
G. Lemmas keeled, often bearing white cobwebby hairs at base 51. *Poa.*
GG. Lemmas convex or keeled at the summit only, not hairy at base.
H. Nerves of lemma prominent, parallel, lemmas scarious at the summit 52 *Glyceria.*
HH. Nerves of lemma not prominent, approaching each other at the apex, lemmas acute
I. The lemmas entire, often awn-tipped 53. *Festuca.*
II. The lemmas 2-toothed, usually awned just below the apex 54. *Bromus.*

9. Chloris Tribe, or Chlorideæ.

A. Spikes racemose along a common axis, spikelets falling entire 55 *Spartina.*
AA Spikes digitate at the summit of the culm.
B Spikelets awnless
c The spikes slender, spikelets 1-fld 56 *Cynodon.*
cc The spikes stout, spikelets several-fld 57 *Eleusine.*
BB Spikelets awned
c Fertile lemma 1-awned 58 *Chloris*
cc Fertile lemma 3-awned 59. *Trichloris.*

10. Barley Tribe, or Hordeæ.

A Spikelets solitary at each joint of the axis
B Glume 1, except in terminal spikelet, spikelets placed with 1 edge to the axis 60 *Lolium.*
BB Glumes 2, spikelets placed with side to the axis
c Palea adherent to the grain, rachilla disarticulating, the florets separating 61. *Agropyron.*
cc. Palea free from the grain, rachilla not disarticulating
D Shape of glumes very narrow, 1-nerved 62 *Secale.*
DD Shape of glumes ovate, 3- to many-nerved 63 *Triticum.*
AA. Spikelets in clusters of 2 or 3 at each joint of the axis
B. Lateral pair of each cluster pediceled, usually aborted, appearing like a cluster of awns 64 *Hordeum.*
BB. Lateral spikelets sessile, usually but 2 spikelets at a joint 65 *Elymus.*

11. Bamboo Tribe, or Bambuseæ.

A. Stamens 3 fr a true caryopsis
B Spikelets 2- to many-fld
C. Infl fasciculate 66 *Oxytenanthera.*
cc. Infl racemose or paniculate, not leafy. sts cylindrical sheaths persistent 67 *Arundinaria.*
ccc Infl spicate, leafy sts flattened on one side sheaths early deciduous 68 *Phyllostachys.*
BB Spikelets 1-fld 69 *Chusquea*
AA Stamens 6
B. Pericarp thin, adnate to the seed, the fr a true caryopsis 70 *Bambusa.*
BB. Pericarp, crustaceous, separable from the seed, the fr nut-like .71. *Dendrocalamus.*

Other genera mentioned are Cenchrus, Cephalostachyum, Cinna, Dactyloctenium, Deschampsea, Diandrolyra, Distichlis, Imperata, Leptochloa, Melica, Melinis, Paspalum, Rottboellia and Trisetum.

210. LYCOPODIACEÆ.

One genus in cultivation . . . . *Lycopodium.*

211. SELAGINELLACEÆ.

One genus only..... ... . *Selaginella.*

212. EQUISETACEÆ.

One genus only ..... *Equisetum.*

213. OPHIOGLOSSACEÆ.

A. Sporangia coherent, in 2 ranks, forming spikes veins anastomosing — 1. *Ophioglossum.*
AA. Sporangia free in compound spikes or panicles veins free lvs. mostly compound — 2. *Botrychium.*

214. MARATTIACEÆ.

A. Sori in double lines along the veins, not united — 1. *Angiopteris.*
AA. Sori united in synangia
B Synangia oval, opening by a fissure — 2 *Marattia.*
BB Synangia elongate, each compartment opening by a terminal pore — 3 *Danæa*

215. HYMENOPHYLLACEÆ.

A. Involucre 2-valved — 1 *Hymenophyllum.*
AA. Involucre tubular or funnel-shaped — 2 *Trichomanes*

216. OSMUNDACEÆ.

A. Sporangia borne in panicles formed either from certain pinnæ or from whole lvs — 1 *Osmunda*
AA Sporangia borne on the under surface of foliage lvs
B Ferns coarse with broad segms — 2 *Todea*
BB. Ferns finely cut, membranous — 3 *Leptopteris*

217. SCHIZÆACEÆ.

A. Sporangia borne on under side of normal or altered lvs
B Lvs twining, lfts palmate or pinnate sporangia borne singly under side — 1 *Lygodium.*
BB Lvs not twining
C Sporangia in sori on the under surface — 2 *Mohria*
CC Sporangia in 2 ranks forming spikes — 3 *Schizæa*
AA. Sporangia borne in erect panicles formed on the elongate lowermost pinna — 4 *Anemia*

218. POLYPODIACEÆ.

I. Summary of Tribes.

A. Indusium wanting or rudimentary (rarely developed in Monogramma)
B. Sporangium scattered in a stratum over the under surface of the lvs coarse ferns — 1 ACROSTICHUM [TRIBE.
BB Sporangium collected in round or linear sori
C Lvs not jointed to the rootstock sporangia in long lines following the veins — 2 VITTARIA TRIBE
CC Lvs not jointed to the rootstock sori round (See Phegopteris in Dryopteris Tribe)
CCC Lvs jointed to the rootstock sori mostly roundish — 3 POLYPODIUM [TRIBE.
AA. Indusium present (exceptionally wanting in Phegopteris, Meniscium, Notholæna and Ceropteris)
B Sori oblong or linear, at least twice as long as broad
C. The sori marginal, covered with an indusium formed of the reflexed edge of the lf (naked in Notholæna, or naked and distributed along the veins in Ceropteris) — 4 PTERIS TRIBE.
CC The sori dorsal, covered with a flap-like indusium — 5 ASPLENIUM TRIBE.
BB. Sori roundish or at least less than twice as long as broad
C. Indusia superior, attached by a central stalk or by a sinus (sori naked in Phegopteris and Meniscium), normally dorsal lvs not jointed to the rootstock — 6 DRYOPTERIS [TRIBE.
CC. Indusia extrorse or cup-shaped, normally marginal lvs jointed to the rootstock in most genera — 7. DAVALLIA TRIBE.
CCC. Indusia inferior, attached under the sorus and opening laterally or by splitting radially into lobes. 8. WOODSIA TRIBE.

II. Key to the Tribes.

1. Acrostichum Tribe.

A. Sporangia localized on definite areas of the lvs: lvs dimorphous, the sterile basal ones shield-like — 1 *Platycerium.*
AA Sporangia covering entire lvs or entire pinnæ.
B Lvs. simple — 2 *Elaphoglossum.*
BB Lvs pinnate — 3 *Acrostichum.*
BBB Lvs. (sterile), dichotomously forked — 4. *Rhipidopteris.*

2. Vittaria Tribe.

A Sori forming 1 or 2 continuous lines parallel to the midrib
B Sorus 1 or 2 lines — 5 *Monogramma.*
BB Sorus always 2 lines — 6 *Vittaria.*
AA Sori on lateral veins forming more or less interrupted lines — 7. *Antrophyum.*

3. Polypodium Tribe.

A. Lvs distinctly dimorphous, compound, the sterile based ones oak-like plants large — 8 *Drynaria.*
AA Lvs dimorphous, simple plants very small — 9. *Drymoglossum.*
AAA Lvs uniform
B Foliage covered underneath with stellate hairs — 10 *Cyclophorus.*
BB Foliage smooth or scaly, not stellate hairy.
C Veins free — 11. *Polypodium.*
CC Veins anastomosing
D Corresponding veinlets from principal veins uniting and bearing a sorus at the end — 12 *Goniophlebium.*
DD Areole bearing 2 or more free veinlets extending outward, which bear a free sorus — 13 *Phlebodium.*
DDD. Areoles containing free veinlets irregularly directed — 14 *Phymatodes.*

4. Pteris Tribe.

A Sori dorsal, extending along all the veins, naked
B Veins copiously anastomosing
C Lvs large, pinnate — 15 *Coniogramma.*
CC Lvs smaller, palmate — 16 *Hemionitis.*
BB Veins free or only casually uniting
C Lvs naked — 17 *Anogramma.*
CC Lvs hairy — 18 *Ceropteris.*
AA Sori marginal, nominally covered with edge of lf
B The sori at the ends of veins unconnected at their apices
C Lvs dimorphous
D Sori at the ends of veins only — 19 *Cryptogramma.*
DD Sori scattered the length of the veins — 20 *Onychium.*
CC Lvs uniform, smooth, on dark-colored stalks
D Veins free lvs pinnate — 21 *Pellæa*
DD Veins usually anastomosing lvs palmate — 22 *Doryopteris.*
CCC Lvs uniform, hairy, scaly or powdery
D Margins scarcely recurved — 23 *Notholæna.*
DD Margins recurved to form a distinct indusium
E Indusia more or less continuous around the segm
F The lvs pinnately divided — 24 *Cheilanthes.*
FF The lvs palmately divided — 25 *Adiantopsis.*
EE Indusia in the form of more or less distant marginal lobes — 26 *Hypolepis.*
BB The sori inserted beneath the marginal indusium stalks black or blackish — 27 *Adiantum.*
BBB The sori rising in a continuous line-like receptacle which joins the ends of the veins
C With an inner membranous indusium — 28 *Pteridium.*
CC With no inner indusium present
D Lvs small, radiate-dichotomous — 29 *Actinopteris.*
DD Lvs small, palmate stalk black — 30 *Cassebeera.*
DDD. Lvs larger, pinnate — 31 *Pteris*

5. Asplenium Tribe.

A Sori parallel to the midrib
B. Sterile lvs. with free veins sori continuous — 32. *Blechnum.*

BB. Sterile lvs. with anastomosing veins: sori interrupted
c. The sori sunken in the lvs. . 33 *Woodwardia.*
cc The sori superficial in 1 or more rows 34. *Doodia.*
AA. Sori partly parallel and partly oblique to the midrib veins anastomosing 35. *Camptosorus.*
AAA. Sori oblique to the midrib
B. Veins free, united at the margins.
c. The sori double, extending along both sides of the vein 36 *Diplazium.*
cc The sori single on the veins
D Indusia opening toward each other, in pairs 37. *Phyllitis.*
DD Indusia all opening toward the end of pinnæ or segms 38 *Asplenium.*
BB. Veins of lower (inner) series uniting indusium extending both sides of veins 39. *Callipteris.*

6. Dryopteris Tribe.

A. Indusium present
B. Veins free, or with a single row of areoles along the mid-veins
c. Indusia on the ends of veins which project beyond the margin of the lf 40. *Deparia.*
cc Indusia dorsal
D The indusium cordate or reniform, attached by the sinus, sometimes wanting 41 *Dryopteris.*
DD The indusium orbicular, peltate, attached by a central stalk 42 *Polystichum.*
DDD. The indusium oval, fixed to a central elongate receptacle 43 *Didymochlæna.*
BB. Veins anastomosing
c The indusium cordate or reniform, attached by the sinus 44 *Tectaria.*
cc. The indusium peltate, attached by a central stalk veins forming small areoles 45. *Cyrtomium.*
AA. Indusium wanting
B. Veins free . . 46 *Phegopteris.*
BB. Veins anastomosing
c The main veins joined by arches which bear the curved sori 47 *Gymnopteris.*
cc The sori round, attached dorsally
D Sori distinct at maturity 48 *Meniscium.*
DD. Sori confluent at maturity . 49. *Leptochilus.*

7. Davallia Tribe.

A. Indusium attached at base only
B Pinnæ jointed to the rachis, lvs simply pinnate indusium circular or reniform 50 *Nephrolepis.*
BB. Pinnæ not jointed to the rachis, lvs jointed to the rootstock
c The indusium thick, coriaceous 51 *Humata*
cc The indusium membranous 52 *Leucostegia.*
AA Indusium attached at both base and sides
B Lvs jointed to the scaly rootstocks
c Shape of indusium tubular 53 *Davallia.*
cc Shape of indusium broader than long, forming a boat-shaped cavity on the edge of the segm 54 *Lozoscaphe.*
BB. Lvs not jointed to the rootstocks
c Indusia near the end of unmodified lf-lobes
D Sorus formed on receptacles containing vascular tissues 55 *Microlepia.*
DD Sorus not formed on a special receptacle 56 *Odontosoria.*
cc. Indusium united with the modified lf-lobe to form a complete cup. .....57. *Dennstædtia.*

8. Woodsia Tribe.

A. Lvs uniform, plane, veins free.
B Indusium beneath the sorus, breaking up into linear lobes . 58. *Woodsia.*
BB. Indusium extrorse, opening laterally with a hood-like lobe. . 59. *Cystopteris.*
AA. Lvs. dimorphous, the sporophylls closely rolled together
B. Veins free lvs in crowns . 60 *Matteuccia.*
BB. Veins anastomosing lvs scattered 61 *Onoclea.*

Brainea, Compteris, and Lonchitis are briefly described.

219. GLEICHENIACEÆ.

Single genus in cultivation . . . . . *Gleichenia.*

220. CYATHEACEÆ.

A. Sori borne on the apex of the veins indusium extrorse, formed of a more or less modified marginal tooth and an inner lid-like scale 1 DICKSONIA TRIBE.
AA. Sori borne dorsally on the veins or at the fork indusium inferior, or wholly wanting 2 CYATHEA TRIBE.

1. Dicksonia Tribe.

A. Tooth of spore-bearing segm scarcely modified, about the size of the inner scale 1 *Dicksonia.*
AA Tooth of the spore-bearing segm strongly modified, coriaceous like the inner scale and usually larger . 2 *Cibotium.*

2. Cyathea Tribe.

A. Indusium present, inferior
B The indusium at first inclosing the globular sorus, remaining cup-shaped or irregularly splitting at maturity 3 *Cyathea*
BB. The indusium membranous, semi-circular, more fully inclosing the sorus 4 *Hemitelia.*
AA. Indusium wanting 5 *Alsophila.*

Thyrsopteris, of another tribe, may be expected in cultivation and is briefly accounted for in this work

221. CERATOPTERIDACEÆ.

Habit aquatic: single genus . . . . *Ceratopteris.*

222. SALVINIACEÆ.

A. Lvs minute, numerous, closely imbricated sporocarps of 2 kinds, the larger globose, the smaller ovoid 1 *Azolla.*
AA. Lvs larger, fewer, distinct. sporocarps uniform, globose . 2 *Salvinia.*

223. MARSILEACEÆ.

In cultivation ..... *Marsilea.*

INDEX TO KEY OF FAMILIES AND GENERA

Abelia, 102.
Aberia, 88
Abies, 120
Abobra, 100
Abroma, 90.
Abronia, 116.
Abrophyllum, 98.
Abrus, 94
Abuta, 86
Abutilon, 89.
Acacia, 93
Acæna, 97
Acalypha, 119.
Acampe, 123
ACANTHACEÆ, 83, 114.
Acanthocereus, 101.
Acantholimon, 109
Acanthomintha, 116.
Acanthonema, 114
Acanthopanax, 102.
Acanthophippium, 122.
Acanthophœnix, 130.
Acanthorhiza, 129.
Acanthus, 114.
Acer, 92
ACERACEÆ, 81, 92.
Aceranthus, 87.
Achillea, 107
Achimenes, 113.
Achlys, 87
Acidanthera, 124.
Acineta, 123
Aciphylla, 101
Acoelorraphe, 131.
Acokanthera, 110.
Aconitum, 86
Acorus, 131
Acriopsis, 123.
Acrista, 130
Acrocomia, 129
Acrophyllum, 98.
Acrospira, 128
Acrostichum, 135.
Actæa, 86
Actinella, 106.
Actinidia, 86
Actinolepis, 106.
Actinomeris, 106
Actinopteris, 135.
Actinostemma, 100.
Ada, 123
Adansonia, 90.
Adelia, 118
Adenandra, 91.
Adenanthera, 93.
Adenocalymma, 113.
Adenocarpus, 94
Adenophora, 108.
Adenostoma, 97.
Adenostyles, 105.
Adesmia, 94
Adhatoda, 114.
Adiantopsis, 135.
Adiantum, 135.
Adlumia, 87.
Adonis, 86.
Adoxa, 85
ADOXACEÆ, 85.
Æchmea, 126
Ægle, 91
Æglopsis, 91
Ægopodium, 101.
Aerides, 123
Ærva, 116.
Æsculus, 92
Æthionema, 87.
Ætoxicon, 118.
Afzelia, 95
Agalmyla, 114.
Aganisia, 123
Agapanthus, 127.
Agapetes, 108
Agathis, 120.
Agave, 125
Agdestis, 116
Ageratum, 105.
Aglaia, 91
Aglaonema, 131.
Agrimonia, 97.
Agropyron, 134.
Agrostis, 134
Ailanthus, 91.
Aira, 134
AIZOACEÆ, 82, 101
Ajuga, 115
Akebia, 87
ALANGIACEÆ, 82, 102.
Alangium, 102
Alberta, 103
Albizzia, 93
Albuca, 128
Alchemilla, 97.
Alchornea, 118
Alectorurus, 128.
Alectryon, 92
Aletris, 127
Aleurites, 119
Alhagi, 94
Alisma, 132
ALISMACEÆ, 85, 132.
Allamanda, 110
Allium, 128
Alloplectus, 114.
Alnus, 119
Alocasia, 131.
Aloe, 127
Alonsoa, 112.
Alpinia, 125
Alsine, 89
Alsophila, 136.
Alstonia, 110
Alstrœmeria, 125.
Altamiranoa, 98.
Althæa, 89
Alyssum, 88
AMARANTACEÆ, 83, 116.
Amarantus, 116
AMARYLLIDACEÆ, 84, 124
Amaryllis, 125.
Amasonia, 114.
Ambrosia, 106
Ambrosinia, 131.
Amelanchier, 97.
Amellus, 107
Amherstia, 95.
Amicia, 95.
Ammobium, 105.
Ammocharis, 125
Ammophila, 134.
Amomum, 125
Amorpha, 95
Amorphophallus, 131.
Ampelopsis, 92
Amphicarpæa, 95
Amphicome, 113
Amsonia, 110.
Amyris, 91
Anacampseros, 89
ANACARDIACEÆ, 81, 92
Anacardium, 92
Anagallis, 109
Anamirta, 86.
Ananas, 126
Anaphalis, 105
Anarrhinum, 112
Anastatica, 88
Anchusa, 111
Andira, 94
Andrachne, 118
Androcymbium, 128
Andromeda, 108
Andropogon, 133
Androsace, 109
Androstephium, 127.
Aneilema, 128
Anemia, 135
Anemone, 86.
Anemonopsis, 86.
Anemopsis, 117.
Anethum, 101.
Angelica, 101
Angelonia, 112.
Angiopteris, 135.
Angophora, 98
Angræcum, 123.
Anguloa, 122
Anigozanthos, 125.
Anisacanthus, 114.
Anisostichus, 113
Anisotes, 114
Annona, 86
ANNONACEÆ, 80, 86.
Anœctochilus, 122
Anogramma, 135
Anoiganthus, 125.
Anopterus, 98.
Anredera, 85.
Anselia, 122
Antennaria, 105.
Anthemis, 107
Anthericum, 127.
Antholyza, 124.
Anthoxanthum, 134.
Anthurium, 131.
Anthyllis, 94.
Antiaris, 118
Antidesma, 118.
Antigonon, 117
Antirrhinum, 112.
Antrophyum, 135.
Aotus, 95
Aphananthe, 118.
Aphelandra, 114.
Aphyllon, 85
Apiera, 127.
Apios, 95
Apium, 101
Aplectrum, 122
Aplopappus, 105
APOCYNACEÆ, 83, 110.
Apocynum, 111
Aponogeton, 132
APONOGETONACEÆ, 85, 132.
Aporocactus, 101
AQUIFOLIACEÆ, 81, 91.
Aquilegia, 86
Arabis, 88
ARACEÆ, 85, 131
Arachis, 94
Arachnanthe, 123.
Aralia, 101
ARALIACEÆ, 82, 101.
Araucaria, 120
Arbutus, 108
Archangelica, 101
Archontophœnix, 130.
Arctium, 105
Arctostaphylos, 108.
Arctotis, 107
Arctous, 108.
Ardisia, 109.
Areca, 130
Aregelia, 126
Arenaria, 89
Arenga, 130
Arethusa, 123
Argemone, 87
Argyreia, 111
Ariocarpus, 100
Arisæma, 131
Arisarum, 131
Aristea, 124
Aristolochia, 117
ARISTOLOCHIACEÆ, 84, 117.
Aristotelia, 90
Armeria, 109
Arnebia, 111
Arnica, 107
Aroma, 96
Arpophyllum, 122
Arracacia, 101
Arrhenatherum, 134
Artabotrys, 86
Artemisia, 107
Artocarpus, 118
Arthropodium, 128
Arum, 131
Aruncus, 96
Arundinaria, 134
Arundo, 134
Asarum, 117
ASCLEPIADACEÆ, 83, 110.
Asclepias, 110
Ascyrum, 89
Asimina, 86
Asparagus, 126
Aspasia, 123
Asperula, 103
Asphodeline, 127
Asphodelus, 127.
Aspidistra, 127
Asplenium, 136.

Astelia, 128
Aster, 105
Asterlinosyris, 107
Astilbe, 98
Astragalus, 95
Astrantia, 101
Astrocaryum, 129.
Asystasia, 114
Atalantia, 91
Athrotaxis, 120
Atraphaxis, 117
Atriplex, 116
Atropa, 112
Attalea, 129
Aubrietia, 88
Aucuba, 102
Audibertia, 115.
Audouinia, 98.
Avena, 134.
Averrhoa, 90.
Avicennia, 115.
Azara, 88.
Azolla, 136.

Babiana, 124.
Baccaurea, 118.
Baccharis, 105.
Backhousia, 99.
Bactris, 129.
Bacularia, 130.
Bæria, 106.
Bahia, 106
Baikiæa, 95.
Balaka, 131
Balsaminaceæ, 81, 90.
Balsamocitrus, 91.
Balsamorrhiza, 106.
Bamburanta, 125.
Bambusa, 134.
Banksia, 117.
Baphia, 95
Baptisia, 94.
Barbacenia, 125.
Barbarea, 88
Barbieria, 95
Barleria, 114.
Barosma, 91.
Barringtonia, 99.
Basella, 116
Basellaceæ, 85.
Batemannia, 123.
Bauera, 98
Bauhinia, 95
Beaufortia, 99
Beaumontia, 111.
Begonia, 100.
Begoniaceæ, 82, 100.
Belemcanda, 124.
Bellis, 105
Bellium, 107
Beloperone, 114.
Benincasa, 100.
Bentinckia, 131.
Benzoin, 117.
Berberidaceæ, 80, 87.
Berberidopsis, 88.
Berberis, 87.
Berchemia, 92.
Bergerocactus, 101.
Berria, 90.
Bersama, 92.
Bertholletia, 99.
Bertolonia, 99
Beschorneria, 125.
Besleria, 114.
Bessera, 127.
Beta, 116
Betula, 119.
Betulaceæ, 84, 119.
Biarum, 131.
Bidens, 106
Bifrenaria, 123.
Bigelovia, 105
Bignonia, 113.
Bignoniaceæ, 83, 113.
Billardiera, 88.
Billbergia, 126
Biophytum, 90.
Bischofia, 118
Bismarckia, 131.
Bixa, 88
Bixaceæ, 80, 88.
Blakea, 99
Blandfordia, 127.
Blechnum, 135
Blepharis, 114.
Blepharocalyx, 99.
Bletia, 122
Bletilla, 122
Blighia, 92
Bloomeria, 128
Blumenbachia, 100.
Bocconia, 87
Boea, 114
Boehmeria, 118.
Bolandra, 98
Bollea, 123
Boltonia, 105.
Bomarea, 125
Bombacaceæ, 81, 90.
Bombax, 90
Bongardia, 87
Boraginaceæ, 83, 111
Borago, 111
Borassus, 129
Boronia, 91.
Bosea, 116
Botrychium, 135
Bougainvillea, 116
Boussingaultia, 116.
Bouvardia, 103
Bowenia, 120
Bowiea, 127
Bowkeria, 113
Boykinia, 98
Brachychæta, 105.
Brachychilus, 125.
Brachychiton, 90.
Brachycome, 105.
Brachysema, 95.
Brahea, 129.
Brainea, 136.
Brasenia, 87
Brassavola, 122.
Brassia, 123
Brassica, 87.
Bravoa, 125.
Braya, 88
Brevoortia, 127.
Breweria, 111.
Brcynia, 118
Brickellia, 105.
Briza, 134
Brodiæa, 127.
Bromelia, 125
Bromeliaceæ, 85, 125.
Bromheadia, 123.
Bromus, 134
Brosimum, 118
Broughtonia, 122.
Broussonetia, 118.
Browallia, 112.
Brownea, 95.
Bruckenthalia, 108.
Brunella, 115.
Brunfelsia, 112.
Bruniaceæ, 82, 98.
Brunsvigia, 125
Bryanthus, 108
Bryonia, 100
Bryonopsis, 100
Bryophyllum, 98
Buckleya, 117
Buddleia, 110
Bulbine, 127
Bulbinella, 127
Bulbocodium, 128
Bulbophyllum, 123
Bumelia, 109
Buphane, 125
Buphthalmum, 105.
Bupleurum, 101
Burbidgea, 125
Burchellia, 103
Bursaria, 88
Bursera, 91
Burseraceæ, 81, 91
Butea, 95
Butomaceæ, 85, 132.
Butomus, 132
Buxaceæ, 84, 119
Buxus, 119
Byrsonima, 90

Cabomba, 87.
Cacalia, 107
Cacaliopsis, 107
Cactaceæ, 82, 100.
Cactus, 100
Cadia, 94
Cæsalpinia, 95.
Cajanus, 95
Caladium, 131
Calamagrostis, 134.
Calamintha, 116
Calamovilfa, 134.
Calamus, 129
Calandrinia, 89.
Calanthe, 122
Calathea, 125
Calceolaria, 112
Calendula, 107
Calimeris, 107.
Calla, 131
Callandra, 93.
Callianthemum, 86.
Callicarpa, 114
Calliphruria, 125.
Callipsyche, 125.
Callipteris, 136.
Callirhoe, 89
Callistemon, 98
Callistephus, 105.
Callitris, 120
Callopsis, 132.
Calluna, 108
Calochortus, 128
Calodendrum, 91.
Calonyction, 111.
Calophaca, 95
Calophyllum, 89.
Calopogon, 122
Calothamnus, 98
Calotropis, 110
Calpurnia, 94
Caltha, 86
Calvoa, 99
Calycanthaceæ, 80, 86.
Calycanthus, 86.
Calycotome, 94.
Calyocarpum, 86.
Calypso, 122
Calyptrogyne, 131.
Camarotis, 123
Camassia, 128.
Camellia, 89.
Camœnsia, 95
Campanula, 108
Campanulaceæ, 82, 107.
Campanumœa, 107
Camphora, 117.
Campsidium, 113.
Campsis, 113
Camptosorus, 136.
Canangium, 86
Canarium, 107
Canavalia, 95
Candollea, 85
Candolleaceæ, 85.
Canistrum, 126
Canna, 125
Cannabis, 118
Cannaceæ, 85, 125.
Cantua, 111
Capparidaceæ, 80, 88
Capparis, 88
Caprifoliaceæ, 82, 102.
Capsicum, 112
Caragana, 95
Caralluma, 110
Cardamine, 88
Cardiandra, 97
Cardiospermum, 92.
Carduus, 105
Carex, 133
Carica, 100
Caricaceæ, 82, 100.
Carissa, 110
Carlina, 105
Carludovica, 131.
Carmichælia, 95
Carnegiea, 101
Carpenteria, 97
Carpinus, 119.
Carrierea, 88
Carthamus, 105
Carum, 101
Carya, 118
Caryocar, 85
Caryocaraceæ, 85.
Caryophyllaceæ, 81, 89
Caryopteris, 115
Caryota, 130
Casimiroa, 91
Cassebeera, 135
Cassia, 95
Cassine, 92
Cassiope, 108
Cassipourea, 98
Castanea, 119
Castanopsis, 119
Castanospermum, 94.
Castilleia, 113
Casuarina, 118
Casuarinaceæ, 84, 118.
Catalpa, 113
Catananche, 107.
Catasetum, 122.
Catesbæa, 103.
Catha, 92
Catopsis, 126
Cattleya, 122.
Caulophyllum, 87.
Cautlea, 125.

Ceanothus, 92.
Cedrela, 91.
Cedronella, 115.
Cedrus, 120.
Ceiba, 90.
CELASTRACEÆ, 81, 92.
Celastrus, 92.
Celmisia, 107.
Celosia, 116.
Celsia, 112.
Celtis, 118
Cenchrus, 134.
Cenia, 107.
Centaurea, 105
Centradenia, 99.
Centranthus, 103.
Centropogon, 107.
Centrosema, 95
Cephaelis, 103
Cephalanthera, 122.
Cephalanthus, 103
Cephalaria, 103
Cephalocereus, 101
Cephalostachyum, 134.
CEPHALOTACEÆ, 82, 98.
Cephalotaxus, 120
Cephalotus, 98
Cerastium, 89
Ceratiola, 119
Ceratolobus, 129
Ceratonia, 95
Ceratopetalum, 98
CERATOPTERIDACEÆ, 85, 136
Ceratopteris, 136
Ceratostigma, 109.
Ceratotheca, 114.
Ceratozamia, 120
CERCIDIPHYLLACEÆ, 80, 86.
Cercidiphyllum, 86
Cereus, 95
Cercocarpus, 97.
Cereus, 101.
Cerinthe, 111.
Ceropegia, 110.
Ceropteris, 135.
Ceroxylon, 130.
Cespedesia, 91.
Cestrum, 112
Chænactis, 106.
Chænomeles, 96.
Chænostoma, 112
Chærophyllum, 101.
Chætospermum, 91.
Chalcas, 90
Chamæbatia, 97.
Chamæbatiaria, 96.
Chamæcyparis, 120.
Chamædaphne, 108.
Chamædorea, 130
Chamælirium, 128.
Chamæmelum, 107.
Chamæranthemum, 114.
Chamærops, 129.
Chaptalia, 107.
Charieis, 105
Cheilanthes, 135.
Cheiranthus, 88.
Chelidonium, 87.
Chelone, 112.
CHENOPODIACEÆ, 83, 116.
Chenopodium, 116.
Chihanthus, 110.
Chilopsis, 113.
Chimaphila, 108.
Chiococca, 103.
Chiogenes, 108.
Chionanthus, 109.
Chionodoxa, 128.
Chiranthodendron, 90.
Chirita, 114.
Chironia, 110.
Chlidanthus, 124.
CHLORANTHACEÆ, 84, 117.
Chloranthus, 117.
Chloris, 134
Chlorocodon, 110.
Chlorogalum, 127.
Chlorophytum, 127.
Chloroxylon, 91.
Choisya, 91
Chondrorycha, 123.
Chorisia, 90
Chorizema, 94
Chrozophora, 118.
Chrysalidocarpus, 131.
Chrysanthemum, 107
Chrysobactron, 127
Chrysobalanus, 97
Chrysogonum, 106
Chrysophyllum, 109.
Chrysopsis, 105
Chrysosplenium, 98
Chusquea, 134.
Chysis, 122
Cibotium, 136
Cicer, 95.
Cichorium, 107.
Cimicifuga, 86
Cinchona, 103.
Cineraria, 107.
Cinna, 134
Cinnamomum, 117
Cupura, 124
Circæa, 99
Cirrhopetalum, 123
Cirsium, 105
Cissampelos, 86
Cissus, 92
CISTACEÆ, 80, 88.
Cistus, 88
Citharexylum, 115.
Citropsis, 91
Citrullus, 100
Citrus, 91
Cladanthus, 107.
Cladothamnus, 108.
Cladrastis, 94
Clarkia, 99
Claucena, 90
Clavija, 109
Claytonia, 89
Cleisostoma, 123.
Cleistocactus, 101.
Clematis, 86
Clemato-clethra, 86.
Cleome, 88
Clerodendron, 115.
Clethra, 108
CLETHRACEÆ, 83, 108.
Cleyera, 89
Chanthus, 95.
Clidemia, 99.
Cliftonia, 91.
Clinostigma, 130.
Clintonia, 128.
Clitoria, 94.
Clivia, 125.
Cluytia, 119.
Clytostoma, 113.
Cnicus, 105.
Cobæa, 111.
Coccinea, 100.
Coccoloba, 116.
Coccothrinax, 129.
Cocculus, 86
Cochlearia, 88.
Cochlioda, 123
Cochlostema, 128.
Cocos, 129
Codiæum, 119.
Codonanthe, 114.
Codonopsis, 107.
Cœlia, 122
Cœlogyne, 122.
Coffea, 103.
Coix, 133
Cola, 90
Colax, 123
Colchicum, 128.
Colea, 113
Coleus, 115
Collabium, 123.
Colletia, 92
Colliguaya, 119.
Collinsia, 112
Collinsonia, 116.
Colloma, 111
Colocasia, 131
Colquhounia, 116
Columnea, 114.
Colutea, 95
Colvillea, 95.
Comandra, 117
Comarum, 97
COMBRETACEÆ, 82, 98
Combretum, 98
Commelina, 128
COMMELINACEÆ, 85, 128
Comparettia, 123
COMPOSITÆ, 82, 103
Comptonia, 118
Conandron, 114
Congea, 115
Conogramma, 135
Conium, 101
Conochinium, 105
Convallaria, 127
CONVOLVULACEÆ, 83, 111
Convolvulus, 111
Copaifera, 95
Copernica, 129.
Coprosma, 103.
Coptis, 86
Corallorhiza, 122.
Corchorus, 90.
Cordia, 111
Cordyline, 127
Corema, 119
Coreopsis, 106
Coriandrum, 101.
Coriaria, 93
CORIARIACEÆ, 82, 93
CORNACEÆ, 82, 102
Cornus, 102
Coronilla, 94
Correa, 91
Cortaderia, 134.
Cortusa, 109
Coryanthes, 123.
Corydalis, 87
Corylopsis, 98.
Corylus, 119.
Corynocarpus, 93.
Corynostylis, 88.
Corypha, 129
Corysanthes, 123.
Corytholoma, 114.
Cosmos, 106.
Costus, 125.
Cotinus, 93.
Cotoneaster, 96.
Cotula, 107.
Cotyledon, 98.
Couroupita, 99.
Coussapoa, 118.
Cowania, 97.
Crambe, 87.
Cramolaria, 114.
Crassula, 98
CRASSULACEÆ, 82, 98.
Crataegus, 96
Crateæva, 88.
Craterostigma, 113.
Crepis, 107
Crescentia, 113.
Crinum, 125
Crithmum, 101.
Crocosmia, 124.
Crocus, 124
Crossandra, 114.
Crotalaria, 94
Croton, 118
Crucianella, 103
CRUCIFERÆ, 80, 87.
Cryptanthe, 111
Cryptanthus, 125
Cryptocoryne, 132
Cryptogramma, 135.
Cryptolepis, 110
Cryptomeria, 120
Cryptophoranthus, 123.
Cryptostegia, 110
Cryptostemma, 107
Cryptostylis, 123.
Ctenanthe, 125
Cucumis, 100
Cucurbita, 100
CUCURBITACEÆ, 82, 100.
Cudrania, 118
Cuminum, 101.
Cunninghamia, 125.
Cunila, 116
Cunninghamia, 120.
Cunonia, 98
CUNONIACEÆ, 82, 98.
Cuphea, 99
Cupressus, 120.
Curculigo, 125.
Curcuma, 125
Cuscuta, 111
Cyananthus, 107.
Cyanella, 125
Cyathea, 136
CYATHEACEÆ, 85, 136.
CYCADACEÆ, 84, 120.
Cycas, 120
Cyclamen, 109
CYCLANTHACEÆ, 85, 131.
Cyclanthera, 100
Cyclanthus, 131
Cyclobothra, 128
Cycloloma, 116.
Cyclophorus, 135.
Cycnoches, 122.
Cydista, 113
Cydonia, 96
Cymbidium, 123
Cymbopetalum, 86.
Cymbopogon, 133.
Cynanchum, 110.
Cynara, 105.
Cynodon, 134.

Cynoglossum, 111.
Cynorchis, 121
Cynosurus, 134.
Cypella, 124
CYPERACEÆ, 85, 133.
Cyperorchis, 123.
Cyperus, 133
Cyphomandra, 112.
Cyphokentia, 131.
Cyphophœnix, 130.
Cyphosperma, 130.
Cypripedium, 121.
Cyrilla, 91
CYRILLACEÆ, 81, 91.
Cyrtandra, 114.
Cyrtanthus, 124
Cyrtocarpa, 92.
Cyrtomium, 136
Cyrtopodium, 122.
Cyrtosperma, 131
Cyrtostachys, 130.
Cystopteris, 136
Cytisus, 94.

Dabœcia, 108.
Dactylis, 134.
Dactyloctenium, 134.
Dædalacanthus, 114.
Dæmonorops, 129.
Dahlia, 106
Dais, 117
Dalbergia, 94.
Dalea, 95
Dalechampia, 119.
Dalibarda, 97.
Damnacanthus, 103.
Danae, 126
Danæa, 135
Daphne, 117
Daphniphyllum, 118.
Darlingtonia, 87.
Dasylirion, 127.
Datisca, 85
DATISCACEÆ, 85.
Datura, 112
Daucus, 101
Davallia, 136.
Davidia, 102
Debregeasia, 118
Decaisnea, 87.
Decodon, 99
Decumaria, 97.
Deeringia, 116.
Demanthe, 98
Delarbrea, 101
Delavaya, 92
Delphinium, 86.
Dendrobium, 123.
Dendrocalamus, 134.
Dendromecon, 87.
Dennstædtia, 136.
Dentaria, 88
Deparia, 136.
Derris, 94.
Deschampsia, 134.
Desmanthus, 95
Desmazeria, 134.
Desmodium, 94
Desmoncus, 131.
Deutzia, 97
Diacrium, 122
Diandrolyra, 134.
Dianella, 127
Dianthera, 114.
Dianthus, 89.
Diapensia, 109.
DIAPENSIACEÆ, 83, 109
Diascia, 112.
Dicentra, 87
Dichorisandra, 128
Dichroa, 97
Dichrostachys, 95
Dicksonia, 136.
Dichptera, 114
Dictamnus, 91
Dictyosperma, 130
Dicyrta, 113
Didymochlæna, 136
Didymosperma, 130.
Dieffenbachia, 131.
Dieraina, 124
Diervilla, 102
Digitalis, 113.
Dillenia, 86
DILLENIACEÆ, 80, 86.
Dimorphotheca, 107.
Dioclea, 94
Dionæa, 98.
Dioon, 120
Dioscorea, 123.
DIOSCOREACEÆ, 84, 123.
Diosma, 91
Diospyros, 109
Diostea, 115
Dipcadi, 128.
Dipelta, 102
Diphylleia, 87.
Diphysa, 95
Dipidax, 128
Dipladenia, 111
Diplarrhena, 124
Diplazium, 136
Diploglottis, 92.
Diplolæna, 91
Diplothemium, 129.
DIPSACACEÆ, 82, 103.
Dipsacus, 103
Dipteronia, 92
Dirca, 117
Disa, 121
Disanthus, 98
Disocactus, 100.
Disporum, 128
Dissotis, 99
Distichlis, 134
Distictis, 113
Distylium, 98.
Diuris, 123
Dizygotheca, 102.
Docynia, 96
Dodecatheon, 109.
Dodonæa, 92
Dolichos, 94
Dombeya, 90.
Doodia, 136
Dorema, 101
Doronicum, 107.
Dorstenia, 118.
Doryalis, 88
Doryanthes, 125
Doryopteris, 135.
Dossinia, 122
Douglasia, 109
Downingia, 107.
Draba, 88
Dracæna, 127.
Dracocephalum, 115.
Dracontium, 131.
Dracunculus, 131.
Drimia, 128
Drimys, 86
Drosera, 98.
DROSERACEÆ, 82, 98.
Drosophyllum, 98.
Dryas, 97
Drymoglossum, 135.
Drymophlœus, 130.
Drynaria, 135.
Dryopteris, 136.
Drypetes, 118
Duchesnea, 97.
Dudleya, 98
Duguetia, 86.
Duhamhum, 133.
Duranta, 114.
Durio, 90
Duvalia, 110
Duvernoia, 114
Dyckia, 126.
Dypsis, 130
Dyschoriste, 114.

EBENACEÆ, 83, 109.
Ebenus, 95
Ecballium, 100
Eccremocarpus, 113.
Echeveria, 98
Echidnopsis, 110.
Echinacea, 106
Echinocactus, 100
Echinocereus, 101
Echinochloa, 133
Echinocystis, 100
Echinopanax, 102.
Echinops, 105
Echinopsis, 101
Echinostachys, 126
Echites, 111
Echium, 111
Edgeworthia, 117
Ehretia, 111
Eichhornia, 128
ELÆAGNACEÆ, 84, 117.
Elæagnus, 117
Elæis, 129
ELÆOCARPACEÆ, 81, 90
Elæocarpus, 90
Elæodendron, 92
Elaphoglossum, 135
Eleocharis, 133
Elettaria, 125
Eleusine, 134
Eleutherine, 124.
Elliottia, 108
Elodea, 120
Elsholtzia, 116.
Elymus, 134
Emilia, 107
Emmenanthe, 111
Emmenopterys, 103
EMPETRACEÆ, 84, 119.
Empetrum, 119
Encelia, 106
Encephalartos, 120.
Enkianthus, 108
Ennealophus, 124.
Entada, 94
Entelea, 90
Enterolobium, 93.
Eomecon, 87
EPACRIDACEÆ, 83, 108.
Epacris, 108
Ephedra, 120
Epidendrum, 122.
Epigæa, 108
Epilobium, 99
Epimedium, 87.
Epipactis, 122.
Epiphyllanthus, 101.
Epiphyllum, 100.
Epipremnum, 132.
Episcia, 114
EQUISETACEÆ, 85, 135.
Equisetum, 135.
Eragrostis, 134.
Eranthemum, 114.
Eranthis, 86
Eremocitrus, 91
Eremospatha, 131.
Eremostachys, 116.
Eremurus, 127.
Eria, 123.
Erianthus, 133.
Erica, 108
ERICACEÆ, 83, 108.
Erigenia, 101.
Erigeron, 105.
Erinacea, 94.
Erinus, 113
Eriobotrya, 96
Eriocephalus, 106.
Eriochilus, 123
Eriogonum, 117.
Eriophorum, 133.
Eriophyllum, 106.
Eriopsis, 123
Eriostemon, 91.
Erlangea, 107.
Erodium, 90.
Eruca, 87
Eryngium, 101.
Erysimum, 88.
Erythea, 129
Erythræa, 110.
Erythrina, 95
Erythronium, 128
ERYTHROXYLACEÆ, 81, 90.
Erythroxylon, 90
Escallonia, 97
Eschscholtzia, 87.
Escontria, 101
Eucalyptus, 98
Eucharidium, 99
Eucharis, 125
Euchlæna, 133
Eucnide, 100
Eucomis, 128
Eucommia, 86
EUCOMMIACEÆ, 80, 86
Eucryphia, 89
EUCRYPHIACEÆ, 81, 89.
Eugenia, 99
Eulophia, 122
Eulophiella, 122
Eupatorium, 105
Euphorbia, 119
EUPHORBIACEÆ, 84, 118.
Euphoria, 92
Euptelea, 86.
Eurya, 89
Euryale, 87.
Eurycles, 125
Euryops, 107
Euscaphis, 92
Eustrephus, 126.
Eutaxia, 95
Euterpe, 130.
Evodia, 91.
Evonymus, 92.
Exacum, 110.
Excœcaria, 119.
Exochorda, 96.
Exorrhiza, 131
Exostemma, 103.

Fabiana, 112.
FAGACEÆ, 84, 119.
Fagelia, 95.
Fagopyrum, 117.
Fagus, 119.
Fallugia, 97.
Faradaya, 115.
Fatsia, 102
Fedia, 103.
Feijoa, 98
Felicia, 105
Fendlera, 97.
Fernelia, 103.
Feroma, 90
Feronella, 90.
Ferraria, 124.
Ferula, 101.
Festuca, 134.
Ficus, 118
Filipendula, 97.
Fittonia, 114
Fitzroya, 120
Flacourtia, 88
FLACOURTIACEÆ, 80, 88.
Flemingia, 95
Fluggea, 118
Foeniculum, 101
Fokienia, 120
Fontanesia, 109
Forsythia, 109
Fortunearia, 98
Fortunella, 91
Fothergilla, 98
Fouquieria, 89
FOUQUIERIACEÆ, 81, 89
Fragaria, 97
Francoa, 97
Frankenia, 85
FRANKENIACEÆ, 85.
Frasera, 110
Fraxinus, 109
Freesia, 124
Fremontia, 90
Freycinetia, 131
Fritillaria, 128
Fuchsia, 116.
Fuchsia, 99
Fumaria, 87.
FUMARIACEÆ, 80, 87.
Funkia, 127
Furcræa, 125
Fusæa, 86

Gaillardia, 106.
Galactia, 95.
Galanthus, 124.
Galax, 109.
Galeandra, 122.
Galedupa, 95.
Galega, 95
Galeopsis, 116.
Galeorchis, 121.
Ganium, 103
Galphimia, 90
Galtonia, 128
Gamogyne, 132
Gamolepis, 107.
Garcinia, 89.
Gardenia, 103.
Garrya, 102.
GARRYACEÆ, 82, 102.
Garuga, 91.
Gasteria, 127.
Gaultheria, 108.
Gaura, 99
Gaussia, 130
Gaylussacia, 108.
Gazania, 107.
Geissorhiza, 124.
Geitonoplesium, 126.
Gelsemium, 110
Genipa, 103
Genista, 94
Gentiana, 110.
GENTIANACEÆ, 83, 110
Geodorum, 123.
Geonoma, 131
GERANIACEÆ, 81, 90.
Geranium, 90
Gerardia, 113.
Gerbera, 107
Gesneria, 113
GESNERIACEÆ, 83, 113.
Gethyllis, 125
Geum, 97
Gilia, 111
Gilibertia, 102
Gillenia, 96
Ginkgo, 119
GINKGOACEÆ, 84, 119.
Githopsis, 108
Gladiolus, 124
Glaucium, 87
Glaux, 109
Gleditsia, 95
Gleichenia, 136
GLEICHENIACEÆ, 85, 136
Ghriedia, 95
Globba, 125
Globularia, 114
GLOBULARIACEÆ, 83, 114
Gloeoidion, 118
Gloriosa, 128
Gloxinia, 113
Glycena, 134.
Glycine, 95
Glycosmis, 90
Glycyrrhiza, 95
Gmelina, 115
GNETACEÆ, 84, 120
Gnidia, 117
Gothica, 89
Gomeza, 123
Gomphocarpus, 110
Gomphrena, 116.
Gongora, 123
Gonioma, 110
Gonolobus, 110
Goodenia, 85
GOODENIACEÆ, 85.
Goodia, 94
Goodyera, 122
Gordonia, 89
Gossypium, 89.
Gouania, 92
Govenia, 123.
Grabowskia, 112.
GRAMINEÆ, 85, 133.
Grammangis, 123.
Grammanthes, 98
Grammatophyllum, 123.
Graptophyllum, 114.
Gratiola, 113.
Gravesia, 99.
Grevillea, 117.
Grewia, 90.
Greyia, 92.
Grias, 99.
Griffinia, 125.
Grindelia, 105.
Grischnia, 102
Guaiacum, 90.
Guazuma, 90.
Guettarda, 103.
Guevina, 117.
Guizotia, 106.
Gunnera, 98.
Gurania, 100.
Gutierrezia, 105.
GUTTIFERÆ, 81, 89.
Guzmania, 126.
Gymnocladus, 95.
Gymnolomia, 107.
Gymnopetalum, 100.
Gymnopteris, 136.
Gymnospora, 92
Gymnostachys, 132.
Gynandropsis, 88.
Gynerium, 134.
Gynura, 107.
Gypsophila, 89.

Habenaria, 121.
Haberlæa, 114.
Hacquetia, 101.
HÆMODORACEÆ, 85.
Hæmanthus, 125.
Hæmaria, 122.
Hæmatoxylon, 95.
Hakea, 117.
Halesia, 109.
Halimodendron, 95
Halleria, 112
HALORAGIDACEÆ, 82, 98
HAMAMELIDACEÆ, 82, 98.
Hamamelis, 98
Hamelia, 103.
Haplocarpha, 107.
Hardenbergia, 95.
Hariota, 100
Harpephyllum, 93.
Harrisia, 101
Hartwegia, 122
Hastingsia, 127.
Haworthia, 127.
Hazardia, 105
Hebenstretia, 114
Hechtia, 126
Hedeoma, 116.
Hedera, 102.
Hedychium, 125.
Hedysarum, 94.
Hedyscepe, 130
Heeria, 99
Helenium, 106.
Helianphora, 87.
Helianthella, 106.
Helianthemum, 88
Helianthus, 106
Helichrysum, 105
Helicodiceros, 131.
Heliconia, 125
Heliocereus, 101.
Heliophila, 88.
Heliopsis, 106.
Heliotropium, 111.
Helipterum, 105.
Helleborus, 86.
Helonias, 128.
Heloniopsis, 128.
Helwingia, 102
Helxine, 118.
Hemerocallis, 127.
Hemicycha, 118.
Hemigraphis, 114.
Hemiontis, 135.
Hemiteia, 136.
Hepatica, 86.
Heracleum, 101.
Herbertia, 124.
Heritiera, 90
Hermodactylus, 124.
Hernandia, 117
Herniaria, 89
Herpestis, 113.
Herpetospermum, 100.
Hesperantha, 124.
Hesperethusa, 91
Hesperis, 88
Hesperocallis, 127.
Hesperochiron, 111.
Heteranthera, 128.
Heteropappus, 105.
Heterophragma, 113.
Heterosmilax, 126.
Heterospathe, 130
Heuchera, 97.
Hevea, 119
Hexisea, 122.
Hibbertia, 86.
Hibiscus, 89.
Hidalgoa, 106.
Hieracium, 107.
Hierochloe, 134.
Hillebrandia, 100
Hippeastrum, 124
HIPPOCASTANACEÆ, 81, 92.
Hippocrepis, 95
Hippomane, 119
Hippophaë, 117
Hippuris, 98
Hodgsonia, 100
Hoffmannia, 103
Hoffmanseggia, 95.
Hohenbergia, 126.
Hoheria, 90
Holboellia, 87.
Holcus, 133
Holodiscus, 96.
Holothrix, 123
Homalanthus, 119.
Homalomena, 131.
Homeria, 124
Homogyne, 107.
Hoodia, 110
Hordeum, 134.
Hosackia, 94
Hottonia, 109.
Houlletia, 123.
Houstonia, 103.
Houttuynia, 117.
Hovea, 95.
Hovenia, 92.
Howea, 130.
Hoya, 110.
Hudsonia, 88.
Huernia, 110.
Hulsea, 106.
Humata, 136.
Humea, 105.
Humulus, 118.
Hunnemannia, 87.
Hunteria, 111
Huntleya, 123.
Hura, 119.
Hutchinsia, 87.
Hyacinthus, 128.
Hyænanche, 118.
Hydrangea, 97.
Hydrastis, 86.
Hydriastele, 130.
HYDROCHARITACEÆ, 84, 120
Hydrocharis 121

Hydrocotyle, 101.
HYDROPHYLLACEÆ, 83, 111
Hydrophyllum, 111.
Hydrotænia, 124.
Hylocereus, 100.
Hymenæa, 95.
Hymenanthera, 88.
Hymenocallis, 125
HYMENOPHYLLACEÆ, 85, 135
Hymenophyllum, 135.
Hymenosporum, 88.
Hyophorbe, 130.
Hyoscyamus, 112.
Hyospathe, 131.
Hypecoum, 87
HYPERICACEÆ, 81, 89.
Hypericum, 89
Hyphæne, 129
Hypochœris, 107.
Hypolepis, 135.
Hypolytrum, 133.
Hypoxis, 125
Hyssopus, 116.

Iberis, 87
ICACINACEÆ, 85.
Idesia, 88
Ilex, 91
ILLECEBRACEÆ, 83.
Illicium, 86
Impatiens, 90.
Imperata, 134
Incarvillea, 113.
Indigofera, 95.
Inga, 93
Ingenhousia, 90.
Inobulbon, 123.
Inula, 105
Iochroma, 112
Ione, 123
Ionopsidium, 87.
Ionopsis, 123.
Ipomœa, 111.
Iresine, 116.
Iriartea, 130.
IRIDACEÆ, 84, 124.
Iris, 124
Isatis, 87
Isochilus, 122.
Isoloma, 113
Isonandra, 109
Isopyrum, 86
Isotoma, 107.
Isotria, 122.
Itea, 97.
Iva, 106.
Ixia, 124
Ixiolirion, 125.
Ixora, 103

Jacaranda, 113.
Jacksonia, 95
Jacobinia, 114.
Jacquemontia, 111.
Jacquinia, 109
Jamesia, 97
Janusia, 90
Japarandiba, 99.
Jasione, 107.
Jasminum, 109.
Jatropha, 119
Jatrorrhiza, 86.
Jeffersonia, 87.
Joannesia, 119
Jubæa, 129.
JUGLANDACEÆ, 84, 118.
Juglans, 118.
JUNCACEÆ, 85, 129.
Juncus, 129.
Juniperus, 120.
Jussieua, 99.
Justicia, 114.

Kadsura, 86.
Kæmpferia, 125.
Kageneckia, 96.
Kalanchoe, 98.
Kalmia, 108.
Kendrickia, 99.
Kennedya, 95
Kentia, 130
Kentiopsis, 130
Kernera, 88
Kerria, 97
Keysingiella, 95.
Keteleeria, 120
Kigelia, 113
Kitaibelia, 90
Kitchingia, 98.
Klugia, 114
Kniphofia, 127.
Kochia, 116
Kœlreuteria, 92.
Kolkwitzia, 102.
Kopsia, 110
Kostelelzkya, 90.
Krameria, 95
Kraussia, 103.
Krigia, 107.
Kuhnia, 107.
Kunzea, 99.
Kydia, 89.

LABIATÆ, 83, 115.
Laburnum, 94
Lacæna, 123
Lachenalia, 128
Lactuca, 107
Lælia, 122
Læliocattleya, 122.
Lagenaria, 100
Lagerstrœmia, 99.
Lagetta, 117
Lagunaria, 89.
Lagurus, 134
Lamarckia, 134
Lamium, 116
Landolphia, 111
Lantana, 114
Lapageria, 126
Lapeyrousia, 124.
Lardizabala, 87
LARDIZABALACEÆ, 80, 87
Larix, 120
Lasthenia, 106
Latania, 129.
Lathyrus, 94
LAURACEÆ, 84, 117.
Laurelia, 117
Laurus, 117.
Lavandula, 115.
Lavanga, 91.
Lavatera, 89
Lawsonia, 99.
Layia, 106
Lebidieropsis, 118
LECYTHIDACEÆ, 82, 99
Lecythis, 99.
Ledum, 108.
Leea, 92
LEEACEÆ, 81.
LEGUMINOSÆ, 82, 93.
Leiophyllum, 108
Leitneria, 118
LILIINFLORÆ, 84, 118.
Lemairocereus, 101
Lemna, 131
LEMNACEÆ, 85, 131
Lenophyllum, 98
Lens, 94
LENTIBULARACEÆ, 83, 113.
Leonotis, 116
Leontice, 87
Leontodon, 107
Leontopodium, 105.
Lepachys, 106
Lepanthes, 123
Lepidagathis, 114.
Lepidium, 87
Leptactina, 103.
Leptarrhena, 98
Leptocarpha, 107.
Leptochilus, 136.
Leptochloa, 134
Leptocodon, 108
Leptodermis, 103.
Leptopteris, 135
Leptospermum, 98.
Leptosyne, 106
Leptotes, 122
Lespedeza, 94
Lettsomia, 111
Leucadendron, 117
Leucæna, 94
Leuchtenbergia, 100
Leucocoryne, 128
Leucocrinum, 127
Leucojum, 124
Leucophyllum, 112
Leucostegia, 136
Leucothoe, 108
Levisticum, 101.
Lewisia, 89
Leycesteria, 102
Liatris, 105
Libertia, 124
Libocedrus, 120.
Licuala, 129
Lightfootia, 108.
Ligusticum, 101.
Ligustrum, 110.
LILIACEÆ, 85, 126.
Lilium, 128
Limatodes, 122
LIMNANTHACEÆ, 81, 90.
Limnanthes, 90
Limnobium, 121
Limnocharis, 132.
Limonia, 91
LINACEÆ, 81, 90.
Linaria, 112.
Lindelofia, 111
Lindenbergia, 113.
Linnæa, 102.
Linospadix, 130.
Linosyris, 105.
Linum, 90.
Liparis, 122.
Lippia, 114.
Liquidambar, 98.
Liriodendron, 86.
Liriope, 127.
Lisianthus, 110.
Lissochilus, 122.
Listera, 122
Listrostachys, 123
Litchi, 92
Lithospermum, 111.
Lithræa, 93
Litsea, 117
Littonia, 128
Livistona, 129.
Loasa, 100.
LOASACEÆ, 82, 100.
Lobelia, 107.
LOBELIACEÆ, 82
Lodoicea, 129.
Lœselia, 111
Logania, 110
LOGANIACEÆ, 83, 110.
Loiseleuria, 108
Lolium, 134
Lomatia, 117
Lomatium, 101
Lomatophyllum, 127.
Lonas, 106
Lonchitis, 136.
Lonchocarpus, 95
Lonicera, 102
Lopezia, 99
Lophanthus, 115
Lophocereus, 100
Lophophora, 100
LORANTHACEÆ, 84, 117.
Loranthus, 117
Loropetalum, 98
Lotus, 94
Loxoscaphe, 136.
Luculia, 103
Lucuma, 109
Ludwigia, 99
Lueddemannia, 123.
Luehea, 90
Luetkea, 96
Luffa, 100
Luisia, 123
Lunaria, 88
Lupinus, 94
Lycaste, 122
Lychnis, 89
Lycium, 112
Lycopersicum, 112.
LYCOPODIACEÆ, 85, 134.
Lycopodium, 134
Lycoris, 124
Lygodium, 135
Lyonia, 108
Lyonothamnus, 97.
Lysichitum, 131.
Lysiloma, 93
Lysimachia, 109.
Lysionotus, 114.
LYTHRACEÆ, 82, 99.
Lythrum, 99.

Maackia, 94
Maba, 109
Mabea, 119
Macadamia, 117.
Macaranga, 119
Macfadyena, 113.
Macleania, 108
Maclura, 118
Macodes, 122
Macroplectrum, 123.
Macroscepis, 110
Macrozamia, 120.
Maddenia, 97.
Madia, 106.
Maesa, 109
Magnolia, 86.
MAGNOLIACEÆ, 80, 86.

Mahernia, 90.
Mahonia, 87
Maianthemum 127.
Malacocarpus, 100.
Malcomia, 88.
Mallotus, 119.
Malope, 89
Malpighia, 90
MALPIGHIACEÆ, 81, 90
Malva, 90
MALVACEÆ, 81, 89.
Malvastrum, 90.
Malvaviscus, 89
Mammea, 89
Mammillaria, 100.
Mandevilla, 111
Mandragora, 112
Manettia, 103
Mangifera, 92.
Manicaria, 131.
Manihot, 119
Mapania, 133
Maprounia, 119
Maranta, 125
MARANTACEÆ, 85, 125
Marattia, 135
MARATTIACEÆ, 85, 135
Margyricarpus, 97
Marica, 124
Marrubium, 115
Marsdenia, 110.
Marshallia, 106
Marsilea, 136
MARSILEACEÆ, 85, 136
Martinezia, 129
Martynia, 114
MARTYNIACEÆ, 83, 114
Masdevallia, 122
Massangea, 126
Massonia, 128
Matricaria, 107
Matteuccia, 136
Matthiola, 88
Maurandia, 112
Mauritia, 129
Maxillaria, 123
Maximiliana, 129
Maximilianea, 88
Maytenus, 92.
Mazus, 113
Meconopsis, 87.
Medeola, 128
Medicago, 95
Medinilla, 99.
Megachilium, 123.
Megarrhiza, 100.
Melaleuca, 98
Melanthium, 128
Melasphærula, 124.
Melastoma, 99
MELASTOMACEÆ, 82, 99.
Melia, 91
MELIACEÆ, 81, 91
MELIANTHACEÆ 81, 92.
Melianthus, 92
Melica, 134.
Melicocca, 92
Melilotus, 95.
Melinis, 134.
Melosma, 92.
Melissa, 116
Melittis, 115.
Melothria, 100.
Meniscium, 136
MENISPERMACEÆ, 80, 86
Menispermum, 86.
Mentha, 116
Mentzelia, 100
Menyanthes 110
Menziesia, 108.
Meratia, 86
Mercurialis, 118.
Merendera, 128.
Merope, 91
Mertensia, 111.
Mertya, 102.
Mesembryanthemum, 101.
Mesospinidium, 123
Mespilus, 96
Metrosideros, 98
Metroxylon, 131.
Meum, 101
Michauxia, 108.
Michelia, 86
Micholitzia, 110.
Micranthus, 114.
Microcitrus, 91.
Microcycas, 120.
Microlentia, 130.
Microlepia, 136
Micromeles, 96.
Micromelum, 90
Micromeria, 116
Microphœnix, 131.
Microstylis, 122.
Mikania, 105.
Milla, 127
Millettia, 95.
Miltonia, 123.
Mimosa, 94
MIMOSEÆ, 81.
Mimulus, 113.
Mimusops, 109.
Minkelersia, 95.
Mirabilis, 116
Miscanthus, 133.
Mitchella, 103.
Mitella, 97
Mitraria, 114.
Mitriostigma, 103
Modecca, 100.
Mohria, 135.
Molinia, 134
Molopospermum, 101
Moluccella, 116
Momordica, 100
Monarda, 115
Monardella, 116
Moneses, 108
MONIMIACEÆ, 84, 117.
Monogramma, 135
Monolena, 99
Monomeria, 123
MONOTROPACEÆ, 83, 108.
Monsonia, 90
Monstera, 131
Montanoa, 107.
Montia, 89
Moorea, 123.
MORACEÆ, 84, 118.
Moræa, 124
Morina, 103.
Morinda, 103.
Moringa, 93
MORINGACEÆ, 82, 93
Morisia, 87
Mormodes, 122.
Morrenia, 110.
Morus, 118
Moschosma, 115
Mucuna, 95
Muehlenbeckia, 116.
Muehlenbergia, 134.
Mulla, 128
Musa, 125
MUSACEÆ, 85, 125.
Muscari, 128
Musineon, 101.
Mussænda, 103.
MYOPORACEÆ, 83, 114.
Myoporum, 114.
Myosotidium, 111.
Myosotis, 111
Myrica, 118
MYRICACEÆ, 84, 118.
Myricaria, 89
Myriocephalus, 105.
Myriophyllum, 98
Myristica, 117
MYRISTICACEÆ, 84, 117.
Myrrhis, 101
MYRSINACEÆ, 83, 109.
Myrsine, 109
MYRTACEÆ, 82, 98
Myrtillocactus, 101.
Myrtus, 99
Mystacidium, 123.

Nægelia, 113
NAIADACEÆ, 85, 132.
Nandina, 87.
Napæa, 89
Napoleona, 99.
Narcissus, 124
Narthecium, 128.
Nathusia, 109
Naumbergia, 109.
Nellia, 96
Nelumbo, 87
Nemastylis, 124.
Nemesia, 112
Nemopanthus, 91.
Nemophila, 111.
Nenga, 130
Neobenthamia, 122.
Neoglaziovia, 126.
Neogyne, 122
Neolauchea, 123
Neomicholsonia, 131.
Neottia, 123
NEPENTHACEÆ, 84, 117.
Nepenthes, 117
Nepeta, 115
Nephroleps, 136
Nephthytis, 131.
Neptunia, 94
Nerine, 125
Nerium, 110
Nertera, 103
Nervilia, 123
Neuwiedia, 123
Nevrusa, 97
Nicandra, 112
Nicotiana, 112
Nidularium, 126
Nierembergia, 112.
Nigella, 86
Nipa, 131
Niphæa, 113
Nolana, 112
NOLANACEÆ, 83, 112.
Nolina, 127
Nopalea, 100
Nothofagus, 119.
Notholæna, 135
Notholcus, 134
Nothoscordum, 128.
Notylia, 123.
Nuphar, 87.
NYCTAGINACEÆ, 83, 116
Nyctocereus, 101.
Nymphæa, 87
NYMPHÆACEÆ, 80, 87
Nymphoides, 110.
Nyssa, 102
NYSSACEÆ, 82, 102.

Oakesia, 128
Oberonia, 123.
Ochna, 91
OCHNACEÆ, 81, 91.
Ochrocarpus, 89.
Ocimum, 115
Octomeria, 123.
Odontadenia, 111.
Odontoglossum, 123.
Odontosoria, 136.
Œnocarpus, 131.
Œnothera, 99
OLACACEÆ, 81, 91.
Olax, 91
Oldenburgia, 107.
Oldenlandia, 103.
Oldfieldia, 118.
Olea, 110
OLEACEÆ, 83, 109.
Olearia, 105.
Oligobotrya, 128.
Oliveranthus, 98.
Omphalia, 119
Omphalodes, 111
ONAGRACEÆ, 82, 99.
Oncidium, 123
Oncoba, 88
Oncosperma, 130.
Onobrychis, 94.
Onoclea, 136.
Ononis, 95
Onopordon, 105.
Onosma, 111
Onosmodium, 111.
Onychium, 135
OPHIOGLOSSACEÆ, 85, 135.
Ophioglossum, 135.
Ophiopogon, 127
Ophrys, 121
Ophthalmoblapton, 119
Ophismenus, 133
Opuntia, 100.
ORCHIDACEÆ, 84, 121.
Orchis, 121.
Oreocarya, 111
Oreocereus, 101.
Oreodoxa, 130.
Oreopanax, 102.
Origanum, 116
Orixa, 91
Ornithidium, 123.
Ornithocephalus, 123.
Ornithochilus, 123
Ornithogalum, 128.
Ornithopus, 94.
OROBANCHACEÆ, 85.
Orontium, 131
Oroxylon, 113
Orthocarpus, 113.
Orthosanthus, 124.
Oryza, 133.
Oryzopsis, 134.
Osbeckia, 99
Osmanthus, 109.
Osmaronia, 97.
Osmorhiza, 101.

Osmunda, 135.
OSMUNDACEÆ, 85, 135.
Osteomeles, 96.
Osteospermum, 107.
Ostrowskia 108.
Ostrya, 119.
Othonna, 107.
Ouratea, 91.
Ourisia, 113
OXALIDACEÆ, 81, 90.
Oxalis, 90
Oxera, 115
Oxyanthus, 103.
Oxydendrum, 108.
Oxylobium, 94.
Oxypetalum, 110.
Oxypolis, 101.
Oxytenanthera, 134.
Oxytropis, 95.

Pachira, 90
Pachycereus, 101.
Pachyphytum, 98.
Pachypodium, 111.
Pachyrhizus, 94
Pachysandra, 119
Pachystima, 92
Pachystroma, 119.
Pæderia, 103
Pæonia, 86
Palava, 89.
Palisota, 128.
Paliurus, 92
PALMACEÆ, 85, 129.
Palmeretia, 107.
Palumbina, 123.
Pamburus, 91.
Panax, 101
Pancratium, 125
PANDANACEÆ, 85, 131.
Pandanus, 131.
Pandorea, 113.
Panicum, 133
Panisea, 123
Papaver, 87.
PAPAVERACEÆ, 80, 87.
Papeda, 91
Paphinia, 123
Paphiopedilum, 121.
Paradisea, 127.
Paramignya, 91.
Parietaria, 118.
Paris, 128
Parkinsonia, 95
Parmentiera, 113.
Parnassia, 97
Parochetus, 95
Paronychia, 89.
Parrotia, 98.
Parrya, 88.
Parsonsia, 111.
Parthenium, 106
Parthenocissus, 92.
Pascalia, 106.
Paspalum, 134
Passiflora, 100
PASSIFLORACEÆ, 82, 100
Pastinaca, 101.
Patrinia, 103.
Paullinia, 92
Paulownia, 112.
Pavetta, 103.
Pavonia, 89.
Pectinaria, 110.
PEDALIACEÆ, 83, 114.
Pedicularis, 113
Pedilanthus, 119.
Pelargonium, 90.
Pelecyphora, 100.
Peliosanthes, 128.
Pellæa, 135
Pellionia, 118.
Peltandra, 131.
Peltaria, 87.
Peltophorum, 95.
Pennisetum, 133.
Pentachæta, 105.
Pentapetes, 90.
Pentapterygium, 108.
Pentas, 103
Pentstemon, 112.
Peperomia, 117.
Peponia, 100
Peraphyllum, 97.
Pereskia, 100
Pereskiopsis, 100.
Perisome, 106
Perilla, 116
Periploca, 110
Peristeria, 123
Peristrophe, 114.
Pernettya, 108
Perowskia, 115
Persea, 117.
Pertya, 107.
Pescatorea, 123
Petalostemon, 95.
Petasites, 107
Petiveria, 116.
Petræa, 114
Petrophytum, 96.
Petroselinum, 101.
Petteria, 94
Petunia, 112.
Peucedanum, 101.
Peumus, 117.
Pfaffia, 116
Phacelia, 111.
Phædranassa, 125.
Phædranthus, 113.
Phajus, 122
Phalænopsis, 123.
Phalaris, 134
Phalocallis, 124.
Phaseolus, 94
Phegopteris, 136
Phellodendron, 91
Philadelphus, 97
Philesia, 126
Philibertia, 110
Phillyrea, 109
Philodendron, 131.
Phlebodium, 135
Phleum, 134
Phlogacanthus, 114.
Phlomis, 116
Phlox, 111
Phœnix, 129
Pholidota, 122.
Phoradendron, 117.
Phormium, 127.
Photinia, 96.
Phragmites, 134.
Phragmopedilum, 121.
Phryma, 114.
PHRYMACEÆ, 83, 114.
Phrynium, 125
Phygelius, 112
Phyllagathis, 99.
Phyllanthus, 118.
Phyllitis, 136.
Phyllocladus, 120.
Phyllodoce, 108
Phyllostachys, 134.
Phymatodes, 135.
Physalis, 112.
Physaria, 88
Physianthus, 110.
Physocarpus, 96.
Physoptychis, 88.
Physosiphon, 123.
Physostegia, 115.
Physurus, 122
Phytelephas, 131
Phyteuma, 108
Phytolacca, 116
PHYTOLACCACEÆ, 84, 116.
Piaranthus, 110.
Picea, 120
Pierasma, 91.
Pieris, 108
Pigafetta, 131.
Pilea, 118
Pilocarpus, 91.
Pimelea, 117.
Pimenta, 99.
PINACEÆ, 84, 120.
Pinanga, 130
Pinckneya, 103.
Pinellia, 131.
Pinguicula, 113.
Pinus, 120
Piper, 117
PIPERACEÆ, 84, 117
Piptadenia, 94
Piptanthus, 95
Pipturus, 118
Piqueria, 105
Piscidia, 94
Pisonia, 116
Pistacia, 92.
Pistia, 131
Pisum, 94.
Pitcairnia, 126.
Pithecoctenium, 113
Pithecolobium, 93
PITTOSPORACEÆ, 81, 88
Pittosporum, 88
Placea, 124
Plagianthus, 90
Plagiobothrys, 111.
Plagiospermum, 97
Planera, 118
PLANTAGINACEÆ, 83, 116
Plantago, 116
PLATANACEÆ, 84, 118
Platanus, 118
Platonia, 89.
Platycarya, 118
Platycerium, 135.
Platyclinis, 122
Platycodon, 107.
Platycrater, 97
Platylepis, 123
Platystemon, 87
Platystigma, 87.
Platytheca, 88
Plectocomia, 129.
Plectranthus, 115
Plectronia, 103.
Pleione, 122.
Pleiocarpa, 111.
Pleiospermum, 91.
Pleurothallis, 122
Plocama, 103
Plukenetia, 119
PLUMBAGINACEÆ, 83, 109
Plumbago, 109
Plumeria, 110.
Poa, 134
Podachænium, 106.
Podalyria, 95
Podocarpus, 120.
Podolepis, 105.
Podophyllum, 87.
Podostigma, 110.
Pogonia, 122.
Pogostemon, 116.
Poinciana, 95
Poivrea, 98
Polanisia, 88
POLEMONIACEÆ, 83, 111.
Polemonium, 111.
Polianthes, 125
Poliothyrsis, 88.
Pollia, 128
Polycycnis, 123.
Polygala, 88.
POLYGALACEÆ, 81, 88
POLYGONACEÆ, 84, 116
Polygonatum, 127.
Polygonum, 117
Polymnia, 106
POLYPODIACEÆ, 85, 135
Polypodium, 135
Polypteris, 106
Polyrrhiza, 123
Polyscias, 102
Polystachya, 122
Polystichum, 136
Pomaderris, 92
Poncirus, 91
Pontederia, 128
PONTEDERIACEÆ, 85, 128
Ponthieva, 122
Populus, 119
Porana, 111
Poranthera, 118
Portenschlagia, 101.
Portulaca, 89
PORTULACACEÆ, 81, 89.
Posoqueria, 103.
Potamogeton, 132
Potentilla, 97.
Poterium, 97
Pothos, 131
Pouteria, 109
Premna, 115.
Prenanthes, 107.
Prestonia, 110.
Primula, 109
PRIMULACACEÆ, 83, 109
Prinsepia, 97
Prionium, 129.
Pritchardia, 129.
Prochnyanthes, 125.
Promenæa, 123.
Prosopis, 94.
Prostanthera, 115.
Protea, 117.
PROTEACEÆ, 84, 117.
Prunus, 97.
Pseuderanthemum, 114.
Pseudolarix, 120
Pseudopanax, 102
Pseudophœnix, 131.
Pseudotsuga, 120.
Psidium, 98.
Psilostrophe, 107.
Psoralea, 95.
Psychotria, 103.
Ptæroxylon, 91.
Ptelea, 91.
Pteridium, 135.

Pteris, 135.
Pterocactus, 101
Pterocarpus, 95.
Pterocarya, 118.
Pteroceltis, 118.
Pterolobium, 95.
Pteronia, 107
Pterospermum, 90.
Pterostylis, 123
Pterostyrax, 109
Ptychococcus, 131.
Ptychoraphis, 131
Ptychosperma, 130.
Pueraria, 94.
Pulmonaria, 111
Pultenæa, 94
Punica, 99
PUNICACEÆ, 82, 99.
Purshia, 97
Puschkinia, 128
Putranjiva, 118
Puya, 126
Pycnanthemum, 116
Pycnostachys, 116
Pyracantha, 96
Pyrenacantha, 85
Pyrethrum, 107
Pyrola, 108
PYROLACEÆ, 83, 108.
Pyrostegia, 113
Pyrularia, 117.
Pyrus, 97
Pyxidanthera, 109

Quamoclit, 111
Quassia, 91
Quekettia, 123
Quercus, 119
Quesnelia, 126.
Quillaja, 96
Quisqualis, 98.

Rademachera, 113
Radicula, 88
Rajania, 123
Ramonda, 114
Randia, 103
Ranevea, 131
RANUNCULACEÆ, 80, 86.
Ranunculus, 86
Raphanus, 87
Raphiolepis, 97
Raphionacme, 110
Rathbunia, 101.
Rauwolfia, 110.
Ravenala, 125.
Ravenia, 91
Reevesia, 90
Rehmannia, 113.
Reineckia, 127.
Reinwardtia, 90.
Renanthera, 123.
Renealmia, 125.
Reseda, 88
RESEDACEÆ, 80, 88.
RESTIACEÆ, 85.
Restio, 85
Restrepia, 122.
Reynosia, 92.
Rhabdothamnus, 114.
RHAMNACEÆ, 81, 92.
Rhamnella, 92.
Rhamnus, 92.
Rhaphidophora, 131
Rhapidophyllum, 129
Rhapis, 129.
Rheedia, 89.
Rheum, 117.
Rhexia, 99.
Rhipidopteris, 135
Rhipsalis, 100
Rhizophora, 98.
RHIZOPHORACEÆ, 82, 98
Rhodochiton, 112.
Rhododendron, 108
Rhodoleia, 98
Rhodomyrtus, 99.
Rhodorhiza, 111
Rhodothamnus, 108
Rhodotypus, 97.
Rhoeo, 129
Rhopaloblaste, 130
Rhopalostylis, 130.
Rhus, 93
Rhynchanthus, 125.
Rhynchosia, 95.
Rhynchospora, 133
Rhynchostylis, 123
Ribes, 97
Ricinodendron, 119
Ricinus, 118
Rigidella, 124.
Rivina, 116.
Robinia, 95
Rochea, 98
Rodgersia, 98.
Rodriguezia, 123.
Roettlera, 114.
Rohdea, 127
Rollinia, 86
Romneya, 87.
Romulea, 124.
Rondeletia, 103.
Rosa, 97.
ROSACEÆ, 82, 96.
Roscheria, 130
Roscoea, 125
Rosmarinus, 115
Rothrockia, 110
Rottboellia, 134.
Roupala, 117
Royena, 109
Roystonea, 130
Rubia, 103
RUBIACEÆ, 82, 102.
Rubus, 97
Rudbeckia, 106.
Ruellia, 114
Ruhmgia, 90
Rumex, 117
Rungia, 114
Rupicola, 108.
Ruscus, 126
Russelia, 112.
Ruta, 91
RUTACEÆ, 81, 90.

Sabal, 129.
Sabbatia, 110.
SABIACEÆ, 81, 92.
Saccharum, 133.
Saccolabium, 123.
Sagina, 89.
Sagittaria, 132
Saintpaulia, 114.
SALICACEÆ, 84, 119.
Salicornia, 116.
Salix, 119
Salpichroa, 112.
Salpiglossis, 112.
Salpinga, 89.
Salsola, 116.
Salvia, 115
Salvinia, 136
SALVINIACEÆ, 85, 136
Sambucus, 102.
Sanchezia, 114
Sandersonia, 128.
Sanguinaria, 87.
Sanguisorba, 97.
Sanicula, 101
Sansevieria, 127
SANTALACEÆ, 84, 117.
Santalum, 117
Santolina, 106
Sanvitalia, 106
SAPINDACEÆ, 81, 92.
Sapindus, 92.
Sapium, 119
Saponaria, 89.
SAPOTACEÆ, 83, 109.
Saraca, 95
Sarcanthus, 123
Sarcocephalus, 103.
Sarcochilus, 123.
Sarcococca, 119
Sarcodes, 108
Sarcopodium, 123
Sargentodoxa, 87
Sarracenia, 87
SARRACENIACEÆ, 80, 87.
Sassafras, 117
Satureia, 116
Satyrium, 123
Sauromatum, 131
Sauropus, 118
SAURURACEÆ, 84, 117
Saururus, 117
Saussurea, 107.
Saxifraga, 98
SAXIFRAGACEÆ, 82, 97.
Scabiosa, 103
Scævola, 85
Scandix, 101
Scaphosepalum, 122.
Scaphyglottis, 123.
Schaueria, 114.
Scheelea, 129
Scheeria, 113
Schefflera, 102.
Schima, 89
Schinus, 92
Schismatoglottis, 131.
Schizæa, 135
SCHIZÆACEÆ, 85, 135
Schizandra, 86
Schizanthus, 112
Schizocodon, 109.
Schizolobium, 95
Schizopetalon, 88
Schizophragma, 97.
Schizostylis, 124.
Schlimmia, 123
Schlumbergera, 100
Schomburgkia, 122
Schotia, 95
Schrankia, 94
Sciadopitys, 120
Scilla, 128
Scindapsus, 131.
Scirpus, 133
Sclerocarpus, 106.
Scolymus, 107
Scopolia, 112
Scorpiurus, 95
Scorzonera, 107
Scrophularia, 112
SCROPHULARIACEÆ, 83, 112
Scutellaria, 115.
Scuticaria, 123
Scyphanthus, 100
Sebastiana, 119
Secale, 134
Sechium, 100.
Securinega, 118.
Sedum, 98
SELAGINACEÆ, 114.
Selaginella, 134
SELAGINELLACEÆ, 85, 134.
Selenia, 88.
Selenicereus, 101.
Selinum, 101.
Semecarpus, 92.
Semele, 126.
Sempervivum, 98.
Senebiera, 87.
Senecio, 107.
Sequoia, 120.
Serapias, 121.
Serenæa, 129
Sericocarpus, 105.
Serissa, 103
Serjania, 92
Serratula, 105.
Sesamum, 114.
Sesbania, 95.
Seseli, 101,
Sesuvium, 101.
Setaria, 133
Severinia, 91
Seymeria, 113
Shepherdia, 117.
Shortia, 109
Sibbaldia, 97.
Sibiræa, 96
Sibthorpia, 113.
Sicana, 100
Sicyos, 100
Sida, 90
Sidalcea, 89
Sideritis, 116.
Sideroxylon, 109.
Sievekingia, 123
Sigmatostalix, 123.
Silene, 89
Silphium, 106
SIMARUBACEÆ, 81, 91.
Simmondsia, 119
Sinningia, 113
Sinofranchetia, 87.
Sinomenium, 86
Sinowilsonia, 98
Siphocampylus, 107.
Sisyrinchium, 124.
Sium, 101
Skimmia, 91.
Smelowskia, 88.
Smilacina, 127.
Smilax, 126
Smodingium, 93.
Sobolewskia, 87.
Sobralia, 122
SOLANACEÆ, 83, 112.
Solandra, 112.
Solanum, 112
Soldanella, 109.
Solea, 88
Solenanthus, 111.
Solenidium, 123.
Solidago, 105.
Sollya, 88
Sonchus, 107.
Sonerila, 99
Sophora, 94

Sophronitis, 122.
Sorbaria, 96.
Sorbus, 96.
Sorindeia, 93.
Sparaxis, 124.
Sparmannia, 90.
Spartina, 134.
Spartium, 94
Spathelia, 91.
Spathiphyllum, 131
Spathodea, 113
Spathoglottis, 122.
Spathyema, 131
Specularia, 107.
Spergula, 89
Sphæralcea, 89.
Sphærocodon, 110.
Sphedamnocarpus, 90.
Sphenopholis, 134.
Spigelia, 110
Spilanthes, 106.
Spinacia, 116.
Spiræa, 96.
Spiranthes, 122.
Spondias, 93
Sporobolus, 134
Spraguea, 89
Sprekelia, 124
Stachys, 116
Stachytarpheta, 114
STACHYURACEÆ, 81, 89.
Stachyurus, 89
Stackhousia, 92.
STACKHOUSIACEÆ, 81, 92
Stadmannia, 92
Stangeria, 120
Stanhopea, 123
Stanleya, 88
Stapelia, 110
Staphylea, 92
STAPHYLEACEÆ, 81, 92.
Statice, 109
Stauntonia, 87.
Stauropsis, 123.
Staurostigma, 132.
Steironema, 109
Stelis, 123
Stellaria, 89
Stenandrium, 114.
Stenanthium, 128.
Stenia, 123
Stenocarpus, 117.
Stenomesson, 125
Stenorrhynchus, 122.
Stenospermatium 131
Stenotaphrum, 133.
Stephanandra, 96.
Stephanotis, 110.
Sterculia, 90.
STERCULIACEÆ, 81, 90.
Stereospermum, 113.
Sternbergia, 124.
Stevensonia, 130.
Stigmaphyllon, 90.
Stillingia, 119.
Stipa, 134
Stokesia, 105.
Stranvæsia, 96.
Stratiotes, 121.
Strelitzia, 125
Streptocalyx, 126.
Streptocarpus, 114.
Streptopus, 127.
Streptosolen, 112.
Strobilanthes, 114.
Stromanthe, 125.
Strophanthus, 111.
Strophoiirion, 127.
Strychnos, 110.
Stryphnodendron, 94.
Stuartia, 89
Stylophorum, 87.
Stylophyllum, 98
STYRACACEÆ, 83, 109.
Styrax, 109
Suksdorfia, 98
Sullivantia, 98.
Sutherlandia, 95.
Swainsona, 95.
Swertia, 110
Swietenia, 91.
Sycopsis, 98
Symbegonia, 100
Symphoricarpos, 102.
Symphyandra, 108
Symphytum, 111.
SYMPLOCACEÆ, 83, 109.
Symplocarpus, 131.
Symploros, 109.
Synadenium, 119.
Synandra, 116.
Syncarpia, 98
Syndesmon, 86.
Synechanthus, 131.
Syngonium, 131.
Synthyris, 113.
Syringa, 109.

Tabebuia, 113.
Tabernæmontana, 110.
Tacca, 124
TACCACEÆ, 84, 124.
Tacsonia, 100.
Tænidia, 101.
Tagetes, 106.
Tainia, 123
Talauma, 86
Talinum, 89
TAMARICACEÆ, 81, 89.
Tamarindus, 95.
Tamarix, 89.
Tamonea, 99
Tamus, 123.
Tanacetum, 107.
Tanakæa, 98.
Tapiria, 92
Tapiscia, 92.
Taraxacum, 107.
TAXACEÆ, 84, 120.
Taxodium, 120.
Taxus, 120
Tecoma, 113.
Tecomaria, 113.
Tecophilæa, 125.
Tectaria, 136.
Teedia, 112
Telanthera, 116.
Telfairea, 100.
Tellima, 98
Telopea, 117.
Templetonia, 94.
Tephrosia, 95
Terminalia, 98.
Ternstrœmia, 89.
TERNSTRŒMIACEÆ, 81, 89.
Testudinaria, 123.
Tetracentron, 86.
Tetradymia, 107.
Tetragonia, 101.
Tetranema, 112.
Tetrapanax, 102.
Tetrastigma, 92
Tetratheca, 88.
Teucrium, 115.
Teysmannia, 131.
Thalia, 125.
Thalictrum, 86.
Thaspium, 101.
Thea, 89.
Thecostele, 123
Thelesperma, 106
Thelymitra, 123
Theobroma, 90
Theophrasta, 109.
Thermopsis, 94.
Thespesia, 89.
Thevetia, 110.
Thibaudia, 108.
Thladiantha, 100.
Thrinax, 129
Thryptomene, 98.
Thuja, 120.
Thujopsis, 120.
Thunbergia, 114.
Thunia, 122
Thymelæa, 117.
THYMELÆACEÆ, 84, 117.
Thymus, 116
Thyrsacanthus, 114.
Thyrsopteris, 136.
Thysanotus, 128.
Tiarella, 97
Tibouchina, 99.
Tigridia, 124
Tilia, 90
TILIACEÆ, 81, 90.
Tillæa, 98
Tillandsia, 126.
Tinantia, 129.
Tinnea, 116
Tipuana, 94
Tipularia, 122.
Tithonia, 107.
Tococa, 99
Toddalia, 91.
Todea, 135
Tofieldia, 128.
Tolmiea, 97.
Tolpis, 107.
Tolufera, 95
Torenia, 113
Torreya, 120
Tournefortia, 111.
Townsendia, 105.
Trachelium, 108
Trachelospermum, 111.
Trachycarpus, 129
Tradescantia, 129.
Tragia, 119
Tragopogon, 107.
Trapa, 99
TRAPACEÆ, 82, 99
Trautvetteria, 86
Trema, 118
TREMANDRACEÆ, 81, 88.
Trevesia, 102.
Trewia, 118
Tricalysia, 103.
Trichilia, 91
Trichinium, 116
Trichloris, 134
Trichocaulon, 110
Trichocentrum, 123.
Trichoglottis, 123.
Tricholæna, 133
Tricholepis, 107.
Trichomanes, 135.
Trichopilia, 123.
Trichosanthes, 100.
Trichosma, 122.
Trichosporum, 114.
Trichostema, 115
Tricuspidaria, 90.
Tricyrtis, 128
Trientalis, 109.
Trifolium, 95.
Trigonella, 95.
Trigonidium, 123.
Trilisa, 105
Trillium, 128.
Triosteum, 102
Tripetaleia, 108.
Triphasia, 91
Triphora, 122
Triplaris, 117
Tripsacum, 133.
Tripterygium, 92.
Trisetum, 134
Tristagma, 127.
Tristania, 98
Tristellateia, 90.
Triteleia, 128
Trithrinax, 129.
Triticum, 134
Tritonia, 124
Triumfetta, 90
TROCHODENDRACEÆ, 80, 86.
Trochodendron, 86
Trollius, 86
TROPÆOLACEÆ, 81, 90.
Tropæolum, 90
Troximon, 107
Tsuga, 120
Tulbaghia, 128.
Tulipa, 128
Tunica, 89
Tupidanthus, 102.
Tupistra, 123
Turnera, 85
TURNERACEÆ, 85.
Turpinia, 92
Turræa, 91
Tussilago, 107.
Typha, 131.
TYPHACEÆ, 85, 131.
Typhonium, 132
Typhonodorum, 132.

Ulex, 94
Ullucus, 116
ULMACEÆ, 84, 118
Ulmus, 118
UMBELLIFERÆ, 82, 101.
Umbellularia, 117.
Ungnadia, 92.
Uniola, 134.
Unona, 86.
Uraria, 94
Urbinia, 98
Urceocharis, 125.
Urceolina, 125.
Urera, 118
Urginea, 128.
Ursinia, 107.
Urtica, 118
URTICACEÆ, 84, 118.
Utricularia, 113.
Uvaria, 86.
Uvularia, 128.

Vaccinium, 108.
Vagaria, 125
Valeriana, 103.
VALERIANACEÆ, 82 103.

Valerianella, 103.
Vallaris, 110.
Vallisneria, 120.
Vallota, 124
Vancouveria, 87.
Vanda, 123.
Vandopsis, 123.
Vangueria, 103.
Vanilla, 122.
Veitchia, 130.
Vellozia, 125
VELLOZIACEÆ, 85, 125.
Veltheimia, 128.
Venidium, 107.
Veratrum, 128
Verbascum, 112.
Verbena, 114
VERBENACEÆ, 83, 114.
Verbesina, 106
Vernonia, 105
Veronica, 113
Verschaffeltia, 130.
Vesicaria, 88
Vetiveria, 133.
Viburnum, 102.
Vicia, 94
Victoria, 87.
Vigna, 94
Viguiera, 106.
Villarsia, 110
Viminaria, 94
Vinca, 110
Vincetoxicum, 110.
Viola, 88.
VIOLACEÆ, 80, 88.
Viscum, 117.
Visnea, 89
VITACEÆ, 81, 92.
Vitex, 114.
Vitis, 92
Vittadinia, 105.
Vittaria, 135.
Vochysia, 85.
VOCHYSIACEÆ, 85.
Vouapa, 95
Vriesia, 126

Waitzia, 105
Waldsteinia, 97.
Wallichia, 130
Warpuria, 114.
Warrea, 122
Warscewiczella, 123.
Washingtonia, 129.
Watsonia, 124.
Wedelea, 107.
Welfia, 131
Welwitschia, 120.
Westringia, 115.
Whipplea, 97
Whitfieldia, 114.
Wigandia, 111
Wikstræmia, 117.
Wilcoxia, 101.
Wistaria, 95.
Wiltia, 100
Woodsia, 136.
Woodwardia, 136
Wulfenia, 113

Xanthisma, 105.
Xanthoceras, 92
Xanthorrhiza, 86
Xanthorrhœa, 127.
Xanthosoma, 131.
Xanthoxylum, 91.
Xeranthemum, 105.
Xerophyllum, 128.
Ximenia, 91
Xylobium, 123.
Xylopia, 86
Xylosma, 88.

Yucca, 127.

Zalacca, 131
Zaluzania, 107
Zaluzianskya, 112.
Zamia, 120
Zannichellia, 132
Zantedeschia, 131
Zauschneria, 99
Zea, 133
Zebrina, 128
Zelkova, 118
Zenobia, 108
Zephyranthes, 124
Zingiber, 125
ZINGIBERACEÆ, 85, 125
Zinnia, 106
Zizania, 133
Zizia, 101
Zizyphus, 92
Zygadenus, 128
Zygocactus, 100
Zygopetalum, 123
ZYGOPHYLLACEÆ, 81, 90.
Zygophyllum, 90.

NOTE

The foregoing index comprises only the names in the Key, not all those in the Cyclopedia It is not intended that the Key shall include every small or incidental generic entry or paragraph in the volumes, for that would make it more involved and complicated (See page 79) At the end of some of the families the names of other genera are sometimes given, so far as these small entries were positively determined when the Key was made, for the purpose of aiding the student to a completer knowledge of the family or of advising him of entries that he might overlook In the progress of the work, other minor or outlying or very recently introduced genera will undoubtedly be inserted, and such new definitions of genera may be made as will necessitate some shifting of names All such additional entries will be accounted for, under their proper families, in the General Index at the close of Vol. VI

NAME-LIST

ENGLISH EQUIVALENTS OF LATIN NAMES OF SPECIES

The technical or botanical name of a plant is a combination of two words,—the generic word, common to the entire group or genus; the specific or particular word, designating the given species: as *Briza maxima*, the large briza, *B minor*, the small briza, and *B media*, the intermediate briza The second or species-word usually is an adjective descriptive of some feature of the plant, although it is sometimes geographical, as *Abies sibirica*, the Siberian abies, or commemorative, as *A Fraseri*, Fraser's abies Although the species-word is not always designative and is sometimes even inapplicable, nevertheless the student is aided if he knows what the word means in English translation, and the following list is inserted to supply this knowledge for characteristic Latin or Latinized descriptive adjectives (in some cases nouns in the genitive or in apposition) applied to the species of plants. These words are likely to be used in differing meanings in different genera and as applied by different authors, in many cases, they do not follow the usages of classical Latin: therefore a list of this kind cannot be exact or give all the meanings in which the words may be applied as specific names. The generic names (the first word in the combination) need not be listed here, for they are not adjectives of description but made-up substantives, and, moreover, their origins are explained at the entries in the text.

The species-adjective is made to agree with its genus in gender thus the Latin adjective *aureus* (golden) takes the regular masculine termination in *Calochortus aureus*, because Calochortus is masculine, the feminine termination in *Albuca aurea*, the neuter in *Acrostichum aureum;* in Sorbus it is feminine (*S aurea*) even though the generic name is masculine in form, because most trees are feminine whatever the termination of the name In the following list, for convenience most of the adjectives are printed in the masculine form. The leading exceptions are those that terminate in *-fer* and *-ger*, meaning "bearing," these being given in the feminine form.

The above examples illustrate prevailing terminations of species-words. Other adjectives have other forms, as *niger, nigra, nigrum* (black); *asper, aspera, asperum* (rough); *acaulis, acaule* (stemless), the termination *-ensis* (belonging to, citizen of), as in *canadensis, canadense* (not *-um*) Commemorative personal species-names may be in the genitive or in the form of an adjective; as *Stanhopea Lindleyi* Lindley's stanhopea; *Selenipedium Lindleyanum*, Lindleyan selenipedium If the person's name ends in a hard consonant, the termination (under the recent Vienna code) is in double n, as *Canna Lambertii*. If for a woman, the termination is feminine, as *Acacia Wayæ* Substantive names in apposition hold their own termination, and the word in such cases should begin with a capital letter, if it is a proper name or an old generic name, as *Hibiscus Sabdariffa, Artemisia Absinthium, Begonia Rex* Such words are usually old generic names or prominent vernacular substantives, and they commonly record some historical connection of the plant.

In all the regular entries in the Cyclopedia the pronunciation is indicated (see explanation p xii), but it is also indicated again in the following lists: when the emphatic syllable is indicated as ending in a vowel and with a grave accent, the vowel is pronounced long, as *acutifò lius, pù milus*, when it ends in a consonant and is marked with an acute accent, the vowel is short, as *máx imus, arvén sis* There are differences of practice in the pronouncing of many of the names in this list, but the list represents the method in this Cyclopedia, and if it should so happen that there are any inconsistencies between the list and the text, it is desired that the list shall hold

Very many names are compounded from generic or subgeneric names, representing similarity or likeness to These the reader will be able to recognize at once, and they need not be entered in this list Examples are. *achilleæfolius*, achillea-leaved, *achilleoides*, achillea-like, *acrostichoides*, acrostichum-like, *bellidiflorus*, bellis-flowered; *lamiifolius*, lamium-leaved, *xiphioides*, xiphium-like; *tremuliformis*, tremula-formed or -shaped; *cacaliopsis*, cacalia-like, *atriplicis*, atriplex-like; *scillaris*, scilla-like.

The glossary, beginning page 160, will be helpful in giving other botanical equivalents and in accounting for other words that are sometimes applied as species-names.

abbreviā tus: abbreviated, shortened.
aborti vus: aborted, parts failing
abrúp tus: abrupt, suddenly changing in shape or character.
abyssín icus: Abyssinian.
acaù lis: stemless
acéph alus: headless
acér bus: acerb, harsh or sour (taste).
aceroī des: acer-like, maple-like.
acerò sus: needle-shaped.
aciculā ris: needle-like.
acidís simus: exceedingly sour.
ác idus: acid, sour
acinā ceus: scimetar- or saber-shaped.
à cris: acrid, sharp
aculeā tus: prickly
acuminā tus: acuminate, long-pointed, tapering.
acután gulus: acutely or sharply angled
acutíf idus: acutely or sharply cut.
acutifò lius: acutely leaved, sharp-leaved.
acutíl obus: acutely lobed.
acutipét alus: petals acute or sharp (pointed)
acù tus: acute, sharp-pointed.
admirāb ilis: admirable, noteworthy.
adnā tus: adnate, joined to
adprés sus: pressed against.
adscén dens: ascending
adsúr gens: rising to an erect position, ascending
adún cus: hooked
ād venus: newly arrived, adventive.
ægyptī acus: Egyptian
æm ulus: emulative, imitating.
aē neus: brazen, bronze-colored
æquinoctiā lis: pertaining to the equinox
æquipét alus: equal-petaled.
æruginò sus: rusty, rust-colored.
æstivā lis: summer.
æstī vus: summer.
æthiōp icus: Ethiopian, African.
affī nis: related (to another species).
africā nus: African.
agavoī des: Agave-like.
ageratoī des: ageratum-like.
aggregā tus: aggregate, clustered.
agrā rius: of the fields.
agrés tis: of or pertaining to the fields
aizoī des: aizoon-like (Aizò on, an evergreen or tenacious plant).
alā tus: winged
albés cens: whitish, becoming white.
āl bicans: whitish.
albicaū lis: white-stemmed.
āl bidus: white.
albifiō rus: white-flowered.
āl bifrons: white-fronded, white-herbaged.
albispī nus: white-spined
albocínc tus: white-girdled, white-crowned.
albospī cus: white-spiked.
āl bus: white.
alcicór nis: elk-horned.

alép picus: of Aleppo (in Syria).
allià ceus: of the alliums, garlic-like.
aloî des: aloe-like.
alpés tris: alpine.
alpî nus: alpine.
altà icus: of the Altai Mts. (S Siberia).
altér nans: alternating.
altér nus: alternating, alternate.
âl tifrons: tall-fronded or -herbaged.
altís simus: very tall, tallest.
âl tus: tall
amâb ilis: lovely.
amà rus: bitter
ambíg uus: ambiguous, doubtful.
amelloî des: amellus-like.
americà nus: American.
amethýs tinus: amethystine, violet-colored
amœ nus: charming, pleasing.
amphíb ius· amphibious, growing both in water and on land
amplexicaû lis: stem-clasping
amplís simus: most or very ample.
âm plus: ample, large, extended
amurén sis· of the Amur River region (E Siberia)
amygdâl inus: pertaining to or like amygdalus
anacân thus: without spines
anatôl icus. of Anatolia (Asia Minor).
ân ceps· two-headed, two-edged
andíc olus: native of the Andes
andî nus: Andine, Andian, pertaining to the Andes
andróg ynus: with both staminate and pistillate flowers in one cluster
anfractuô sus: twisted
ân glicus: English, pertaining to England
anguî nus: snaky, pertaining to serpents
angulà ris: angular, angled.
angulà tus: angular, angled.
anguld sus: angular, angled.
angús tus. narrow
annôt inus· year-old.
annulà ris: annular, ringed.
annulà tus· annular
ân nuus annual, living but one year.
anôm alus. anomalous, out of the ordinary or usual
antillà ris· of the Antilles (W. Indies).
antíp odum: of the antipodes.
antiquô rum· of the ancients
antî quus: ancient
apenni nus: pertaining to the Apennines (Italy)
apér tus: uncovered, bare.
apét alus: without petals.
aphýl lus: leafless.
apiculà tus: apiculate, tipped with a point
appendiculà tus: appendaged, bearing an extension or additional part or process.
applanà tus: flattened.
applicâ tus: joined, attached.
âp terus: wingless
aquât icus, aquât ilis: aquatic.
à queus: aqueous, watery.
aquîl inus: aquiline, pertaining to the eagle.
arâb icus: Arabian.
arachnoî des: spider-like, cobwebby.
arborés cens: becoming tree-like, woody.
arbô reus: tree-like.
árc ticus: arctic.
arcuà tus: bow-like, bowed.
arenâ rius: of sand or sandy places.
areolâ tus: areolate, pitted.
argentà tus: silvery, silvered.
argén teus: silvery.
argophýl lus: silver-leaved.
argû tus. sharp-toothed
argyræ us: silvery.
âr idus: arid
arietî nus: like a ram's head.
aristà tus: aristate, bearded.
aristô sus: bearded
armà tus: armed (as with thorns).
aromât icus: aromatic
arrêct us: raised up, erect
articulà tus: articulated, jointed.
arundinâ ceus: reed-like.
arvén sis: pertaining to cultivated fields.
ascén dens: ascending.
asiât icus: Asian.
ás per: rough
asperà tus: rough
aspericaû lis: rough-stemmed.
aspér rimus: very rough
assím ilis: similar, like to.
assúr gens: assurgent, clambering
à ter: coal-black
atlânt icus: Atlantic, growing in Atlantic regions
atrà tus: blackened
atropurpû reus· dark purple.
atrór ubens: dark red
atrosanguín eus: dark blood-red.
atrôv irens. dark green
attenuà tus. attenuated, produced to a point
ât ticus: pertaining to Attica or Athens, Greek
augustís simus: very notable.
augúst us: august, notable, majestic.
aurantî acus· orange-red.
aurè olus: golden.
aû reus: golden
auriculâ tus: auricled, eared.
australién sis: belonging to Australia.
austrâ lis· southern.
austrî acus: Austrian.
autumnâ lis: autumnal.
axillâ ris· axillary, borne in the axils, pertaining to the axils.
azû reus: azure, sky-blue.

baccâ tus: berried.
baccîf era: berry-bearing.
baleár icus: Balearian, of the Balearic Islands
balsâ meus: balsamic, balsam-like, with balsam odor
balsamîf era: balsam-bearing.
bambusoî des: bambusa-like, bamboo-like
banât icus: of Banat (S. Hungary).
barbadén sis: of Barbadoes.
bâr barus: foreign, from a strange country
barbâ tus: barbed, bearded.
barbíg era: bearing barbs or beards.
basilâ ris: pertaining to the base or bottom.
bél lus: handsome.
benedíc tus: blessèd.
benghalén sis: of Bengal (E. India).
betuloî des: Betula-like, birch-like.
bicarinà tus: twice-keeled, with two keels.
bíc olor: two-colored
bicôr nis: two-horned
bicornû tus: two-horned
bidentâ tus: two-toothed
bién nis: biennial, living only two years.
bîf idus: twice cut, in two parts
bifld rus: two-flowered
bifurcâ tus: twice-forked
bigíb bus: with two swellings or projections
bigiû mis: two-glumed.
bíj ugus: yoked two together, joined, fastened together.
bîl obus: two-lobed
binâ tus: twin, double, two-and-two.
binér vis: two-nerved
binoculâ ris: binocular, two-eyed, two-spotted
bipartî tus: two-parted
bipét alus: two-petaled
bipinnatîf idus· bipinnatifid, twice pinnately cut
bipinnâ tus: bipinnate, twice pinnate.
bipunctâ tus: two-spotted
biséc tus: cut in two parts.
bispinô sus: two-spined
biternâ tus: twice ternate.
blân dus: bland, mild
bô nus: good
borbôn icus: of Bourbonne (in N. E. France)
boreâ lis. northern
botryoî des: cluster-like, grape-like
brachiâ tus brachiate, branched at right angles
brachýp odus· short-stalked
bracteâ tus: bracteate, bearing bracts.
bracteô sus: bract-bearing
brevicaû lis· short-stemmed
brév ifrons. short-fronded, short-leaved
brév ipes: short-footed, as with short pedicel or petiole
brevirôs tris: short-beaked.
brè vis· short
brevisè tus: short-bristled
brevís pathus: short-spathed
brevís simus· very short, shortest.
brilliantís simus· most brilliant, very brilliant
brún neus: deep brown
bucéph alus: ox-headed
bufô nius. pertaining to the toad.
bulbîf era· bulb-bearing
bulbô sus: bulbous
bullâ tus: inflated, swelling, puckered, bullate
byzantî nus: Byzantine (of the Constantinople region).

cærulés cens: becoming or turning dark blue
cærû leus: cerulean, dark blue.
cæ sius: bluish gray
cæspitô sus: cespitose, tufted, growing in low dense clumps.
câf fer, caffra: Kafir
calâb ricus: from Calabria (in S Italy).
calathî nus: basket-like
calcarâ tus: spurred, with spurs.
calcâ reus, of or pertaining to lime.
callô sus: thick-skinned, with callosities.

cāl vus: bald, hairless.
calȳc inus: calyx-like
calyculā tus: calyx-like, calyx-bearing, fruit inclosed in a calyx
cām bricus: Cambrian, Welsh.
campanulā tus: campanulate, bell-shaped.
campés tris: of the fields or plains.
canadēn sis: Canadian
canaliculā tus: channeled, grooved.
canariēn sis: of the Canary Isls
cān dicans: white, hoary, particularly white-hairy or white-woolly.
candidīs simus: very white-hairy or hoary
cantāb ricus: from Cantabria (in Spain)
cān didus: white, white-hairy, shining
canés cens: gray-pubescent
cā nus: ash-colored, hoary.
capēn sis: of the Cape (of Good Hope).
capillā ris: hair-like.
capreolā tus: winding, twining.
capsulā ris: capsular.
cardinā lis: cardinal.
carinā tus: keeled
cār neus: flesh-colored.
carnō sus: fleshy.
carolinia nus: Carolinian, pertaining to North or South Carolina, or indefinitely to the Carolinas
carpāth icus: of the Carpathian region (Europe)
cartilagīn eus: like cartilage
caryophyllā ceus: clove-like, perhaps also pertaining to the pink family
cashmeriā nus: of Cashmere (Asia)
cathārticus: cathartic
cathayā nus: of Cathay (China)
caucās icus: belonging to the Caucasus (mountain region between the Black and Caspian Seas).
caudā tus. caudate, tailed
caulēs cens: caulescent, having a stem or stems
cauliflō rus: stem-flowered
cenīs ius: of Mt Cenis (between France and Italy)
cephalā tus: headed, bearing heads
cerasifōr mis: cherry-formed
cerefō lius· wax-leaved
cerīf era: wax-bearing
cēr nuus: bending forward, inclined, drooping, nodding
ceylān icus: of Ceylon, same as *zeylanicus*
chalcedōn icus: of Chalcedon (on the Bosphorus)
chilēn sis: belonging to Chile
chinēn sis: belonging to China.
chlorān thus: green-flowered.
chrysān thus: golden-flowered.
chrysocār pus. golden-fruited.
chrysophȳl lus: golden-leaved
chrysōs tomus: golden-mouthed, golden-throated
ciliā ris: ciliate, fringed with hairs on the margin
ciliā tus: ciliate, hairy fringed.
cilīc icus: of Cilicia (in S. E. Asia Minor)
cinc tus: girded, girdled
cinē reus: ash-colored.
cinnabarī nus: cinnabar-red.
cinnamō meus: cinnamon-brown.
circinā tus: circinate, coiled.
cirrhō sus: tendrilled.
citrā tus: citrus-like
citrī nus: citron-colored or -like.
clandestī nus: concealed
clavā tus: clavate, club-shaped.
clematīd eus: pertaining to or like clematis
clypeā tus: with a shield.
coccīf era: berry-bearing.
coccīn eus· scarlet.
cochleā ris: spoon-like.
cochleā tus: spoon-like.
cœlestī nus: sky-blue.
cœlēs tis: celestial, sky-blue.
collī nus. pertaining to a hill.
colorā tus: colored (other than green)
comā tus: with coma or hair.
commū nis: common, general, gregarious
commutā tus: changed or changing.
comō sus: with long hair
compāc tus: compact, dense
compléx us: circled, embraced
complicā tus: complicate, page 162
comprés sus: compressed
cŏmp tus: adorned, ornamented
cón cavus· concave, hollowed out
concīn nus: neat, well made
cón color: colored similarly
condēn sus: condensed, crowded
confēr tus: crowded
confōr mis: similar, like to
confū sus: confused, uncertain (as to characteristics)
congés tus: congested, brought together
conglomerā tus: conglomerate, crowded together
conīf eræ: cone-bearing
conjugā tus: connected, joined together
conoīd eus: conoid, cone-like
consōl idus: consolidated, solid, stable
conspīc uus: conspicuous, marked
constrīc tus: constricted
contīg uus: contiguous, near together.
contōr tus. contorted, twisted.
contrāc tus: contracted
corallifl rus: coral-flowered.
corāl linus· coral-red
cordā tus: cordate, heart-shaped.
cordifō lius: cordate-leaved, heart-leaved
coriā ceus: leathery.
cornīculā tus: horned.
cornīf era: horn-bearing.
cornū tus: horned
coronā rius: used for or belonging to garlands
coronā tus: crowned
corrugā tus: corrugated, wrinkled.
cŏr sicus: Corsican (island in the Mediterranean).
corticō sus. heavily furnished with bark.
corús cans: vibrating, glittering.
corymbīf era: corymb-bearing.
corymbō sus: corymbose.
costā tus: costate, ribbed.
crassicaū lis: thick-stemmed.
crassifō lius: thick-leaved.
crās sipes: thick-footed or -stalked
crās sus: thick, fleshy.
crenā tus: crenate, scalloped.
crenulā tus: crenulate, somewhat scalloped.
crepidā tus: sandaled, slippered.
crép itans: rattling, rustling.
cretā ceus: cretaceous, pertaining to chalk
crét icus: of Crete (island in Eastern Mediterranean)
crinī tus: hairy, provided with hair.
crīs pus. crisped, curled
cristā tus: cristate, crested
crocā tus. saffron-yellow
crō ceus: saffron-colored, yellow.
crucià tus: cruciate, cross-like.
crucīf era: cross-bearing.
cruén tus: bloody
crystāl linus: crystalline.
cubēn sis. Cuban
cucullā tus: hooded
cultrā tus. cultrate, knife-shaped.
cuneā tus: cuneate, wedge-shaped.
cuneifō lius: wedge-leaved
cuneifōr mis. wedge-formed.
cū preus: copper-like or -colored.
curvā tus. curved
cuspidā tus. cuspidate, with a cusp or sharp stiff point
cyā neus: blue
cylindrā ceus. cylindrical
cylīn dricus: cylindrical
cymbifōr mis: boat-formed.
cymō sus. cymed, having a cyme or cymes
cȳ preus: copper-like, see *cupreus*.

dactylīf era: finger-bearing
dahū ricus, davū ricus: Of Dahuria or Dauria (in Trans-Baikal Siberia, near the frontier of China)
dalmāt icus: Dalmatian (on eastern side of the Adriatic)
damascē nus: of Damascus.
dasycār pus: thick-fruited
dealbā tus: whitened, white-washed.
déb ilis. weak, frail.
decān drus. ten-stamened.
decapét alus: ten-petaled
decīd uus: deciduous, with parts falling
decīp iens: deceptive
declinā tus: declined, bent downward
decolō rans: discoloring, staining
decompós itus: decompound, more than once compound or divided.
déc orans: adorning
decō rus: elegant, comely, becoming.
decúm bens: decumbent, reclining at the base but the top or tips upright.
decúr rens: decurrent, as a leaf extending down the stem
deflēx us: deflexed, bent abruptly downward.
defōr mis: misshapen, deformed.
delēc tus: chosen.
delicatīs simus: most or very delicate.
delicā tus: delicate, tender.
delicīō sus: delicious.
deltoīd eus: deltoid, triangular.
demīs sus: low, weak.
dendroīd eus: tree-like.
densifl rus: densely flowered.
dēn sus: dense.
dentā tus: toothed.
denticulā tus: denticulate, slightly toothed.
dentō sus: toothed.
denudā tus: denuded, naked.

depauperā tus: depauperate, starved, dwarfed.
depēn dens: hanging down.
deprĕs sus: depressed.
deŭs tus: burned.
devastā tor: (feminine *devastatrix*): devastating, laying waste.
diacān thus: two-spined.
diadē ma: a diadem, crown.
diān drus: with two stamens.
diăph anus: diaphanous, very thin, transparent.
dichŏt omus: forked, two-branched equally.
dĭch rous: of two colors.
dicŏc cus: with two berries.
dĭd ymus: in a pair, as of anthers
diffŏr mis: of differing forms.
diffū sus: diffuse, spreading
digitā tus: digitate, compound in form like the fingers
dilatā tus: dilated, expanded.
dilā tus: dilated, spread out
dimidiā tus: halved, in two equal parts
dimŏr phus: dimorphous, two-formed
dī odon: with two teeth
dioī cus: dicœcious
dipĕt alus: two-petaled.
diphȳl lus: two-leaved
dipsā ceus: of the teasel or Dipsacus.
discoīd eus: discoid, rayless
dĭs color: of two or of different colors
dĭs par: dissimilar, unlike
dissĕc tus: dissected, deeply cut.
dissĭm ilis: dissimilar, unlike.
dissitiflō rus: remotely or loosely flowered
distā chyus: two-spiked
dĭs tans: distant, separate, remote
dĭs tichus: two-ranked, with leaves or flowers in ranks on opposite sides of stem.
dis tylus: two-styled
diūr nus: day-flowering.
divaricā tus: divaricate, spreading, widely divergent
divĕr gens: diverging, wide-spreading.
diversifli ō rus: diversely flowered, variable-flowered
diversifō lus: variable-leaved.
divī sus: divided, separated
dodecān drus: twelve-stamened
dolabrifŏr mis: hatchet- or ax-shaped.
dolō sus: deceitful
domĕs ticus: domestic, domesticated.
drupā ceus: drupe-like.
drupĭf era: drupe-bearing.
dū bius: dubious, doubtful.
dŭl cis: sweet.
dumetō rum: of bushes or hedges.
dumō sus: bushy.
dū plex: double.
duplicā tus: duplicate, double.
durāb ilis: durable, lasting.
durāc inus: hard-berried.
duriŭs culus: somewhat hard or rough.

ebenā ceus: ebony-like.
ebracteā tus: bractless.
ebŭr neus: ivory-white.
echinā tus: bristly, prickly.
echinocār pus: prickly-fruited.
echinosēp alus: prickly-sepaled.
ecornū tus: hornless.
edū lis: edible.
effū sus: very loose-spreading.
elās ticus: elastic.
elā tior: taller.
elā tus: tall.
ĕl egans: elegant.
elegantĭs simus: most elegant, very elegant.
elephān tum: of the elephants.
ellĭp ticus: elliptical.
elongā tus: elongated, lengthened.
emarginā tus: emarginate, with a shallow notch at the apex.
emĕt icus: emetic.
ĕm inens: eminent, prominent.
enneaphȳl lus: nine-leaved.
ensā tus: sword-shaped.
ensifō lius: sword-leaved.
ensifŏr mis: sword-formed or -shaped.
entomŏph ilus: insect-loving.
equĕs tris: pertaining to the horse.
equī nus: of horses
erĕc tus: erect, upright.
erĭān thus: woolly-flowered.
ericoī des erica-like, heath-like.
eriocār pus: woolly-fruited
eriocĕph alus: woolly-headed
erō sus: erose, jagged, as if gnawed
errā ticus: erratic, unusual, sporadic.
erubĕs cens. blushing
erythrocār pus: red-fruited
erythrocĕph alus: red-headed.
erythrŏp odus: red-footed, red-stalked
erythrŏp terus: red-winged.
esculĕn tus: esculent, edible.
estrī tus: without stripes.
etuberō sus: without tubers.
europæ us. European.
exaltā tus: exalted, very tall.
excavā tus: excavated, hollowed out.
excĕl lens: excellent, excelling.
excĕl sus: tall.
excī sus: excised, cut away.
exĭg uus: little, small, poor.
exĭm ius: distinguished, out of the ordinary.
exitiō sus: pernicious, destructive.
exolē tus: mature, fully grown, dying away
exŏt icus: exotic, from another country
expān sus: expanded
exscŭlp tus: dug out, carved out.
exsĕr tus: exserted, protruding from.
exsŭr gens: rising up, standing up.
extĕn sus: extended.
exū dans: exuding.

fabā ceus: faba-like, bean-like.
falcā tus: falcate, sickle-shaped or scythe-shaped.
falcifō lius: falcate-leaved.
falcifŏr mis: sickle-formed.
fāl lax: deceptive.
farinā ceus: containing farina or starch, or like flour; perhaps also farinose.
farinĭf era: farina-bearing.
farinō sus: farinose, mealy, powdery.
fascià tus: fasciate, abnormally flattened and broadened.
fasciculā ris: fascicled, clustered, brought together.
fasciculā tus: fascicled.
fascinā tor: fascinating, charming.
fastigiā tus: fastigiate, branches erect and close together.
fastuō sus: proud.
febrĭf ugus: febrifuge, fever-dispelling.
fenestrā lis: with window-like openings
fĕ rox: ferocious; very thorny.
fĕr reus: pertaining to iron.
ferrugĭn eus: rusty, of the color of iron rust
fĕr tilis: fertile, fruitful.
festī vus: festive, gay, bright.
fibrō sus: fibrous, bearing prominent fibers
ficoīd eus: fig-like.
filamentō sus: filamentous, composed of threads or bearing threads.
filicā tus: fern-like, ferny.
filicifō lius. fern-leaved.
filicī nus: fern-like
filicoī des: fern-like.
filĭf era: bearing filaments or threads.
filifō lius: thread-leaved, with leaves cut into thread-like divisions.
filifŏr mis: filiform, thread-like
fĭl ipes: with stalks thread-like.
fimbriā tus: fimbriated, fringed.
firmā tus: firm, made firm.
fīr mus: firm, strong.
fissifō lius: split-leaved.
fīs silis: fissile, cleft or split.
fīs sus: cleft, split
fistulō sus: fistular, hollow-cylindrical.
flabellā tus: flabellate, with fan-like parts
flabellifŏr mis: fan-formed.
flāc cidus: flaccid, soft
flagellā ris: flagellate, whip-like.
flagellā tus: whip-like
flagellifŏr mis: whip-formed
flagĕl lum: a scourge or flail.
flām meus: flame-colored
flavĕs cens: yellowish, becoming yellow or yellowish
flavĭc omus: yellow-wooled or -haired.
flāv idus: yellow, yellowish.
flavispī nus: yellow-spined.
flavĭs simus: very yellow, deep yellow.
flā vus: yellow
flĕx ilis: flexible, pliant.
flexuō sus: flexuose, tortuous, zig-zag.
floccō sus: woolly.
flō re-āl bo: with white flowers.
florentī nus: Florentine.
flō re-plē no: with full or double flowers
floribūn dus: free-flowering, blooming profusely
flŏr idus: flowering, full of flowers.
flū itans: floating.
fluviāt ilis: pertaining to a river.
fœm ina: female.
fœniculā ceus: fennel-like.
fœtidĭs simus: very fetid.
fœt idus: fetid, bad-smelling.
foliā tus: with leaves.
foliolā tus: with leaflets.
foliō sus: leafy, full of leaves.
folliculā ris: bearing follicles, follicled.
forficā tus: shear-shaped.
formicæfŏr mis: ant-shaped, ant-like.
formosĭs simus: most or very beautiful.
formō sus: beautiful, handsome.

foveà tus: pitted.
frăg ilis: fragile, brittle.
frà grans: fragrant, odorous.
fragrantís simus: very fragrant
fraxín eus: fraxinous, like Fraxinus or ash trees
frĭg idus: cold, of cold regions.
frondŏ sus: fronded, leafy.
fructíf era: fruit-bearing, fruitful.
fructĭg enus: fruitful.
frutés cens. shrubby, bushy
fruticŏ sus: fruticose, shrubby, bushy.
fucà tus: painted, dyed.
fù gax: swift
fúl gens: shining, glistening.
fúlg idus: fulgid, shining
fuliginŏ sus: black-painted or -colored, sooty
fulvés cens: fulvous or becoming fulvous
fúlvus: fulvous, tawny, orange-gray-yellow
funà lis: of a rope or cord
fù nebris: funereal
fungŏ sus: fungous, pertaining to a fungus, spongy
funiculà tus. of a slender rope or cord, with a funicle (stalk of an ovule or seed).
fúr cans: forked
furcà tus: furcate, forked
fús cus: fuscous, brown, dusky.
fusifŏr mis: spindle-shaped

galericulà tus: helmet-like.
gál licus: of Gaul or France, also pertaining to a cock or rooster
gandavén sis: belonging to Ghent, Belgium
gargán icus: belonging to Gargano (Eastern Italy).
gél idus: ice-cold
geminà tus: twin
geminiflŏ rus: twin-flowered
gemmà tus: gemmed, jewelled, also bearing buds
gemmíf era: bud-bearing.
genevén sis: belonging to Geneva.
geniculà tus: jointed, kneed.
geoí des: of the earth
geométr icus: geometrical, in a pattern
germán icus: German, of Germany.
gibberŏ sus: humped, hunchbacked
gibbiflŏ rus: gibbous-flowered.
gibbŏ sus: swollen on one side
gĭb bus: gibbous, swollen on one side.
gigantè us: gigantic, very large.
gigánt icus: gigantic
gi gas: of giants, immense.
glabél lus: smoothish.
glà ber: glabrous, smooth.
glabér rimus: most smooth, smoothest.
glabrà tus: somewhat glabrous or smooth.
glabrés cens: smoothish, or becoming so.
glacià lis: icy, frozen.
gladià tus: sword-like.
glandulíf era: gland-bearing.
glandulŏ sus: glandular.
glastifŏ lius: with leaves like the dyer's woad (Isatis, once called Glastum).
glaucés cens: glaucescent, becoming glaucous.
glaucifŏ lius: glaucous-leaved
glaucophýl lus: glaucous-leaved.
glaù cus: glaucous, with a bloom, grayish.
globŏ sus: globose, spherical, nearly or quite globular.
globulà ris: of a little ball or sphere.
globulíf era: globule-bearing, globe-bearing.
globulŏ sus: globuled, like a little ball.
glomerà tus: glomerate, clustered
gloriŏ sus: glorious, superb
glumà ceus: glumed, with glumes or glume-like structures
glutinŏ sus: glutinous, gluey, sticky.
gongylŏ des: roundish.
gracilén tus: slender.
grác ilis graceful, slender.
gracíl limus: graceful, very slender.
græ cus: of Greece, Greek
gramín eus: grassy, grass-like
graminifŏ lius: grass-leaved.
grán diceps: large-headed
grandicús pis: with large cusps or points
grandidentà tus: large- or big-toothed
grandiflŏ rus: large-flowered
grandifŏ lius: large-leaved
grandifŏr mis: on a large scale, of a big kind
grandipunctà tus: with large spots
grán dis: large, big
granulà tus. granulate, covered with minute grains
granulŏ sus: granulate, granulose
gratís simus: very pleasing or agreeable
grà tus: pleasing, agreeable.
gravè olens: heavy-scented
grœnlánd icus: of Greenland.
guianén sis: of Guiana (South America)
guineén sis: of Guinea (Africa)
gummíf era: gum-bearing
guttà tus: spotted, speckled
gymnocár pus: naked-fruited
gỳ rans. gyrating, revolving in a circle.

hæmán thus: blood-red-flowered.
hamà tus: hooked
hamŏ sus: hooked
harpophýl lus: sickle-leaved.
hastà tus: hastate, spear-shaped.
hastíf era: spear-bearing
hastĭ lis: of a javelin or spear.
hebecár pus: pubescent-fruited
hederà ceus: of the ivy (Hedera).
helián thus: sunflower.
helvét icus: Swiss, of Helvetia (Switzerland).
hél volus: pale yellow.
hemisphær icus: hemispherical.
heptaphýl lus: seven-leaved.
herbà ceus: herbaceous, dying to the ground and not woody.
herbarĭ um: of the herbaria
heteracán thus: various-spined.
heterán thus: various-flowered, variable in flowers.
heterocár pus: various-fruited.
hetér odon: various-toothed.
heteroglós sus: various-tongued.
heteromór phus: various in form.
heterophýl lus: various-leaved, with leaves of more than one shape.
hexagonŏp terus: six-angled-winged.
hexagŏ nus: hexagonal, six-angled.
hexapét alus: six-petaled.
hĭ ans open, gaping
hibernà lis: of or pertaining to winter.
hibér nicus: Hiberian, of or pertaining to Ireland.
hieroglýph icus: hieroglyphic, marked as if with signs.
himalà icus: Himalayan.
hircì nus: of a goat, with a goat's odor.
hirsutís simus: very hairy, most hairy
hirsù tulus: somewhat hirsute or hairy
hirsù tus: hirsute, hairy
hirtél lus: somewhat hairy.
hirtiflŏ rus: hairy-flowered
hír tipes: hairy-stalked or -stemmed.
hír tus. hairy
hispán icus Spanish, of Spain
hispidís simus: most or very bristly.
hispíd ulus: somewhat hispid or bristly
hís pidus hispid, bristly
histrión icus: histrionic, pertaining to the stage or to actors
holoseríc eus: woolly-silky.
horizontà lis. horizontal
hŏr ridus: provided with spines or barbs, prickly
hortén sis: belonging to the hortus or garden
hortíc olus: a little garden, of the garden
hortŏ rum: of gardens
hortulà nus: pertaining to a garden
humifù sus sprawling on the ground
hù milis low-growing, dwarf
hyacínth inus: hyacinthine, sapphire-colored
hyacínthoi des: like the hyacinth.
hyál inus: transparent, translucent
hýb ridus: hybrid, mixed, mongrel
hyemà lis: of winter, also *hiemalis*
hygromét ricus: hygrometric, taking up water
hymenán thus: membranaceous-flowered
hymenŏ des membrane-like
hyperbŏ reus: far northern
hypocrateriför mis salver-shaped, flower with a slender cylindrical tube and flat spreading limb
hypogæ us: underground, subterranean
hypoglaù cus: glaucous beneath
hypoleù cus: whitish, pale
hypophýl lus: under the leaf
hýs trix: porcupine-like, bristly.

iân thinus: violet, violet-blue.
ibér icus: of Iberia (the Spanish peninsula).
icosán drus: twenty-stamened
ignés cens: fiery.
íg neus: fiery.
ilicifŏ lius: ilex-leaved, holly-leaved.
illustrà tus: pictured
illús tris: bright, brilliant, lustrous.
illýr icus: of Illyria (Grecian Peninsula)
imbér bis: without beards or spines.
im bricans: imbricating.
imbricà tus: imbricated, lapping over, shingled.
immaculà tus: immaculate, spotless.

immér sus: immersed, under water
imperà tor: commanding, imperious.
imperià lis: imperial, kingly.
impléx us: implicated, interwoven.
imprés sus: impressed, sunken in.
inæqualifò lius: unequal-leaved.
inæquà lis: unequal.
inæquilát erus: unequal-sided.
incà nus: hoary
incarnà tus: flesh-colored.
incér tus: uncertain, doubtful.
incisifò lius: cut-leaved.
incì sus: incised, cut.
inclinà tus: inclined, bent downward.
incomparáb ilis: incomparable, excelling.
incómp tus: rude, unadorned, not attractive.
inconspíc uus: inconspicuous, not prominent
incurvà tus: incurved, bent inward.
incúr vus: incurved
indentà tus: indented, dented
ín dicus: Indian, of India or the East Indies.
indivì sus: undivided.
inér mis: unarmed, without thorns or spines.
infectò rius: used for dying, pertaining to dyes
infés tus: dangerous, unsafe.
inflà tus: inflated, swollen up.
infortunà tus: unfortunate.
infrác tus: broken
infundibulifór mis: funnel-shaped, trumpet-shaped.
infundíb ulum: a funnel.
inodò rus: without odor, scentless.
inornà tus: without ornament, not showy.
ín quinans: polluting, discoloring.
inscríp tus: inscribed, written on
insíg nis: remarkable, distinguished, marked
insitít ius: grafted.
intác tus: intact, untouched.
ín teger: entire.
integér rimus: very entire.
integrifò lius: entire-leaved.
interjéc tus: interjected, put between.
intermè dius: intermediate.
interrúp tus: interrupted.
intertéx tus: interwoven, intertwined
intricà tus: intricate, entangled.
intrór sus: introrse, turned inward
intumés cens: swollen, puffed up, tumid
intybà ceus: pertaining to chicory (Intybus).
invér sus: inverse, turned over, upside down.
invì sus: unseen, overlooked.
involucrà tus: involucred, with an involucre.
involù tus: involute, rolled inward.
ionán thus: with flowers like the violet.
ionóp terus: with wings like the violet.
iridés cens: iridescent, changing color at different angles.
iridifò rus: iris-flowered.
irregulà ris: irregular.
isán drus: with equal stamens.
isopét alus: equal-petaled.
isophýl lus: equal-leaved.
itál icus: Italian.

jamaicén sis: of Jamaica.
japón icus: Japanese, of Japan.
jasmín eus: jasmine-like.
jasminifò rus: jasmine-flowered.
javán icus: Javan, of Java.
jubà tus: crested, with a mane.
jucún dus: agreeable, pleasing.
jugò sus: joined, yoked
jún ceus: Juncus-like, rush-like.

kashmirià nus: of Cashmere or Kashmere.
kewén sis: belonging to Kew (Kew Gardens, England).
koraià nus: of Corea, also *coreanus*.

labià tus: labiate, lipped
labiò sus: lipped.
lách ryma: a tear.
lacinià tus: laciniate, torn, cut or slashed into narrow lobes.
laciniò sus: laciniose, laciniate.
lactà tus: milky
lác teus: milk-white
lactíc olor: milk-colored.
lactíf era: milk-bearing, milky-juiced.
lactifò rus: flowers milk-colored.
lacunò sus: with holes or pits.
lacús tris: pertaining to lakes.
ladaníf era: ladanum-bearing.
lætév irens: light green, vivid green.
læ tus: bright, vivid
lævicaù lis: smooth-stemmed.
lævigà tus: smooth
lév ipes: smooth-footed, smooth-stalked
lè vis: smooth
læviús culus: smoothish, somewhat smooth
lanà tus: woolly.
lanceolà tus: lanceolate.
lán ceus: lance-like
lancifò lius: lance-leaved.
lanígera: wool-bearing.
lanuginò sus: woolly, downy.
lappà ceus: pertaining to a globular hooked bur; Lappa-like
lappón icus: of Lapland
laricifò lius: larch-leaved.
larícinus: Larix-like, larch-like.
lasiocár pus: rough-fruited, rough-hairy.
lasiopét alus: with petals rough-hairy.
laterifò rus: lateral-flowered, with flowers on the side
laterít ius: brick-red
latifò lius: broad-leaved
lát ifrons: broad-fronded, broad-herbaged, broad-leaved
latimaculà tus: broad-spotted
lát ipes: broad-footed, broad-stalked.
latís simus: broadest, very broad.
là tus: broad, wide
laurifò lius: laurel-leaved.
lauri nus: laurel-like.
lavandulà ceus: lavender-like.
laxifò rus: loose-flowered.
laxifò lius: loose-leaved.
lá x us: lax, open, loose.
leián thus: smooth-flowered.
leiocár pus: smooth-fruited.
leiophýl lus: smooth-leaved.
lenticulà ris: lenticular, lens-shaped.
lén tus: pliant, tenacious, tough.
leontoglós sus: lion-tongued or -throated.

leopardì nus: leopard-spotted.
lepidophýl lus: scaly-leaved.
leprò sus: of leprosy, scurfy.
leptocaù lis: thin-stemmed, slender-stemmed.
leptóc ladus: thin-stemmed or -branched.
leptól epis: thin-scaled.
leptophýl lus: thin- or slender-leaved.
leptosép alus: thin-sepaled.
lép topus: thin- or slender-stalked.
leucán thus: white-flowered
leucób otrys: with white clusters.
leucocéph alus: white-headed.
leuconeù rus: white-nerved
leucophýl lus: white-leaved
leucorhi zus: white-rooted.
líbúr nicus: of Liburnia (west of Adriatic).
lignò sus: woody
ligulà ris: ligulate, strap-shaped.
lilác inus: lilac
liliflò rus: lily-flowered
limbà tus: bordered
limò sus: of muddy or marshy places.
linariifò lius: linaria-leaved
linearifò lius: linear-leaved
linearfl obus: linear-lobed
lineà ris: linear
lineà tus: lined, with lines or stripes.
lingulà tus: tongue-shaped
linifò lius: linum-leaved, flax-leaved.
linophýl lus: flax-leaved
lithospér mus: with seeds stone-like.
littorà lis: of the seashore
lív idus: livid, bluish.
lobà tus: lobed
lobulà ris: lobed
lolià ceus: Lolium-like (Lolium comprises the rye-grasses)
longebracteà tus: long-bracted.
longepedunculà tus: long-peduncu-late.
longicaudà tus: long-tailed.
longiflò rus: long-flowered
longifò lius: long-leaved
longihamà tus: long-hooked
longilaminà tus: with long laminæ or plates.
longfl obus: long-lobed.
longimucronà tus: long-mucronate.
lóng ipes: long-footed, long-stalked.
longipét alus: long-petaled.
longipinnà tus: long-pinnate.
longiracemò sus: long-racemed.
longiscà pus: long-scaped
longisép alus: long-sepaled.
longís pathus: long-spathed.
longispì nus: long-spined.
longís simus: longest, very long.
longís tylus: long-stalked.
lón gus: long.
lorifò lius: strap-leaved
lù cidus: lucid, bright, shining, clear.
ludovicià nus: of Louisiana.
lugdunén sis: belonging to the region of Lyons.
lunà tus: lunate, moon-shaped, moon-like, crescent-shaped.
lunulà tus: somewhat moon-shaped.
lupuli nus: Lupulus-like, hop-like.
lù ridus: lurid, wan, sallow, pale yellow.
lutè olus: yellowish.
lutes cens: yellowish, becoming yellow.

lù teus: yellow.
luxù rians: luxuriant, thrifty.
lyrà tus: lyrate, pinnatifid with large terminal lobe.

macilén tus: lean, meager.
macrán drus: with large anthers.
macrán thus: large-flowered.
macrób otrys: large-clustered.
macrocár pus: large-fruited
macrocéph alus: large-headed.
macrodác tylus: large-fingered.
macrodón tus: large-toothed.
macropét alus: with large petals.
macrophýl lus: large-leaved
macroplec tron: large-spurred.
macróp odus: large-footed or -stalked.
macróp terus: large-winged.
macrospà dix: with large spadix.
macrostà chyus: large-spiked.
macrostè gius: large-decked.
macrostè mus: with large filaments.
macrós tylus: large-styled.
macroù rus: large-tailed.
maculà tus: spotted.
maculò sus: spotted
mæsi acus: of Moesia, ancient name of Bulgaria and Servia
magellán icus: Straits of Magellan region
magnif icus: magnificent, eminent, distinguished
majà lis: of May, Maytime.
majést icus: majestic.
mà jor, mà jus: greater, larger.
malabár icus: of Malabar (in British India)
malifór mis: apple-formed.
malvà ceus: Malva-like, mallow-like
mammò sus: breasted, with breasts
manicà tus: manicate, long-sleeved, covered densely as with thick hairs so that the covering can be removed as such
marcés cens: withering but not falling
már cidus: withering but not falling off.
margarità ceus: pearly, of pearls
marginà lis: marginal, marked in some way along the margins or edges
marginà tus: margined.
marginél lus: somewhat margined
marilánd icus: of the Maryland region; also written *marylandicus*
marít imus: maritime, of the sea
marmorà tus: marbled, mottled
marmò reus: marbled
marmorophýl lus: leaves marbled.
maroccà nus: of Morocco.
más: male
masculà tus: masculine.
más culus: male, masculine.
matronà lis: pertaining to matrons.
maurităn icus: of Mauretania (N. Africa).
maxillà ris: maxillary, of the jaw.
máx imus: largest.
mediterrà neus: of the Mediterranean region.
mè dius: medium, intermediate.
medullà ris: of the marrow or center or pith.
megalán thus: large-flowered.
megaphýl lus: large-leaved.
megapotám icus: of the large river.
megarrhì zus: large-rooted
megaspér mus: large-seeded.
megastà chyus: large-spiked.
megastíg mus: with large stigma.
melanán thus: black-flowered.
melancholi icus: melancholy, hanging or drooping.
melanocaù lon: black-stemmed.
melanocóc cus: black-berried.
melanoleù cus: black-and-white.
melanóx ylon: black-wooded
meleà gris: like a guinea-fowl, speckled
mél leus: pertaining to honey.
mellíf era: honey-bearing
melofór mis: melon-shaped
membranà ceus. membranaceous, membranous, thin and more or less translucent
meniscifò lius: crescent-leaved
mesoleù cus: mixed with white
metál licus: metallic (color or luster)
mexicà nus. Mexican, of Mexico
mì cans: glittering, sparkling, mica-like
micrán thus: small-flowered.
microcár pus: small-fruited.
míc rodon: small-toothed
microglós sus. small-tongued
microl epis. small-scaled
microm eris. small-numbered, of small number of parts
micropét alus: small-petaled
microphýl lus: small-leaved
microp terus: small-winged
microsép alus: small-sepaled
microstè mus: of small filaments or stemlets.
milità ris: military
millefolià tus. thousand-leaved.
millefò lius. thousand-leaved, leaves or parts very many.
mì mus. mimic
mì nax threatening, forbidding
minià tus: cinnabar-red
mín imus. least, smallest
mì nor, mì nus. smaller
minutís simus. very or most minute
minù tus: minute, very small
marab ilis: marvellous, extraordinary, wonderful
mistassín icus: of Lake Mistassini, (Quebec)
mì tis: mild, gentle.
mitrà tus: turbaned.
míx tus: mixed
modés tus: modest.
moldáv icus: of Moldavia (in Rumania)
mól lis: soft, soft-hairy.
mollís simus: very soft-hairy.
moluccà nus: of the Moluccas (East Indies)
monadél phus: in one group or bundle.
mongól icus: of Mongolia
monilif era: bearing a necklace.
monacán thus: one-spined.
monocéph alus: single-headed.
monóg ynus: of one pistil.
monoì cus: monœcious.
monopét alus: one-petaled.
monophýl lus: one-leaved.
monóp terus: one-winged.
monopyrè nus: bearing one stone or pyrene.
monosép alus: one-sepaled.
monospér mus· one-seeded
monostà chyus. single-spiked
monspelién sis: of Montpelier
monspessulà nus· of Montpelier.
monstrò sus: monstrous, wholly abnormal or deformed, teratological
montà nus: pertaining to mountains or mountainous regions
montevidén sis· of Montevideo (Uruguay)
montíc olus. native of mountains
moschà tus· musky, musk-scented.
mucronà tus. mucronate, tipped with a short sharp point or mucro
mucronulà tus: with a small mucro or point
multibracteà tus: many-bracted
multicaù lis: many-stemmed, with numerous stems
múl ticeps. many-headed, many branched
multíc olor many-colored
multíf idus. multifid, many times parted
multifló rus. many-flowered
multifurcà tus much-forked, many times forked
multíj ugus many in a yoke, many times joined
multinér vis: many-nerved
múl tiplex many-folded
multiradià tus· many-radiate, with numerous rays
multiséc tus. many times cut, much cut or dissected
mún dulus trim, neat
munì tus· defended, fortified
murà lis· of walls, growing on walls.
muricà tus muricate, roughed by means of hard points
muscíp ula. a mouse-trap
mutáb ilis. changeable, variable, mutant
mutà tus changeable
mù ticus blunt, pointless
mutilà tus mutilated
myriacán thus. numberless spined, very many-spined
myriocár pus: very many-fruited.
myrmecóph ilus· ant-loving
myrtifò lius. myrtle-leaved.

nà nus· dwarf
napifór mis: turnip-shaped
narbonén sis· of Narbonne (ancient region or province of S France).
nà tans: floating, swimming
naviculà ris· pertaining to a ship.
neapolità nus Neapolitan
nebulò sus: nebulous, clouded, indefinite, obscure
negléc tus: neglected, overlooked
nemorà lis: of groves or woods.
nemorò sus· of groves or woods and shady places
nepalén sis: of Nepal (Himalayan region)
nerifò lius: nerium-leaved, oleander-leaved
nervò sus: nerved
nevadén sis: of the Sierra Nevadas (in Spain or N America).
níc titans: blinking, moving.
nì dus: nest
nì ger: black.

nigrā tus: blackish.
nigrēs cens: blackish, becoming black.
nĭg rĭcans: black.
nigrĭcŏr nis: black-horned.
nĭg rĭpes: black-footed or -stalked.
nilŏt ĭca: of the Nile.
nĭ tens: shining
nĭt ĭdus: shining.
nivā lis: snowy, pertaining to snow.
nĭv eus: snowy.
nivō sus: snowy, full of snow.
nobĭl ior: more noble
nŏb ĭlis: noble, famous, renowned.
nobilĭs simus: most or very noble
nodĭflō rus: with flowers at nodes
nodō sus: with nodes, jointed.
nonscrĭp tus: undescribed
nootkatēn sis: of Nootka (Nootka Sound is by Vancouver Island).
notā tus: marked
nō væ-ān gliæ. of New England.
nō væ-cæsarē æ: of New Jersey.
nō væ-zealānd iæ: of New Zealand.
noveboracēn sis: of New York
nō vi-bĕl gii: of New Belgium or New Netherlands (i e , New York)
nubĭc olus: dwelling among clouds
nucĭf era: nut-bearing
nudā tus· nude, stripped
nudĭcaū lis: naked-stemmed
nudĭflō rus: naked-flowered
nū dus· nude, naked
numĭsmā tus: pertaining to money, coin-like
nū tans: nodding
nyctĭc alus: night-blooming.

obcōn icus: inversely conical.
obcordā tus: obcordate, inversely cordate
obē sus: obese, fat
obfuscā tus: clouded, confused.
oblī quus: oblique, unequal and slanting
obliterā tus: obliterated, erased, not apparent
oblongā tus: oblong.
oblongĭfō lius: oblong-leaved.
oblŏn gus: oblong.
obovā tus: obovate, inverted ovate.
obscū rus· obscure, hidden
obsolē tus: obsolete, rudimentary
obtusā tus. obtuse, blunt
obtusĭfō lius: blunt-leaved.
obtusĭl obus: blunt-lobed
obtū sus: obtuse, blunt, rounded.
occidentā lis: occidental, western.
ocēan icus: oceanic, perhaps of Oceanica
ocellā tus: eyeleted, with small eyes.
ochreā tus: with an ochrea or boot-sheath.
ochroleū cus: yellowish white
octān drus: with eight anthers.
octopét alus: eight-petaled.
octophȳl lus: eight-leaved
oculā tus: eyed, with eye-like marks.
odontī tes: tooth.
odontochī lus: with toothed lip or margin
odoratĭs simus: most or very odorous, very fragrant.
odorā tus: odorous, fragrant.
odō rus: odorous, fragrant.
officinā lis: officinal, medicinal, recognized in the pharmacopœa.
officinā rum: of the apothecaries.
oleæfō lius: Olea- or olive-leaved.
oleĭf era: oil-bearing.
olerā ceus: oleraceous, vegetable-garden herb used in cooking.
oligān thus: few-flowered.
oligocār pus: few-fruited
oligospēr mus: few-seeded.
oltō rius: pertaining to vegetable-gardens or -gardeners.
olivā ceus: olive-like, olive-colored.
olivæfōr mis: olive-shaped
olym picus: of Olympus or Mt. Olympus (in Greece)
omnĭv orus: omnivorous, of all kinds of food.
opā cus: opaque, shaded
operculā tus: with a lid
oppositĭflō rus: opposite-flowered.
oppositĭfō lius: opposite-leaved
opulĭflō rus: flowers of Opulus (a Viburnum)
orbiculā ris: round
orbiculā tus: round
orchĭd eus: orchid-like
orchioī des: orchid-like
oregā nus: of Oregon
orgyā lis: length of the arms extended, about 6 feet
orientā lis: oriental, eastern.
ornatĭs simus: most showy or ornate.
ornā tus. ornate, adorned
ornithocĕph alus: like a bird's head.
ornithŏp odus: like a bird's foot
ornithorhȳn chus: shaped like a bird's beak
orthocār pus: straight-fruited.
orthochī lus: straight-lipped
orthŏp terus: straight-winged.
ovalĭfō lius: oval-leaved
ovā lis: oval
ovatĭfō lius: ovate-leaved.
ovā tus: ovate
ovĭf era: egg-bearing
ovĭg era: egg-bearing.
ovī nus: pertaining to sheep
oxyacān thus: sharp-thorned or -spined
oxygō nus. sharp-angled
oxyphȳl lus: sharp-leaved.
oxysēp alus: with sharp sepals.

pachyān thus: thick-flowered.
pachyneū rus: thick-nerved
pachȳp terus: thick-winged
pacĭf icus: of the Pacific, of regions bordering the Pacific Ocean.
palæstī nus: of Palestine
paleā ceus: with palea (bracts in grass flowers), or palea-like, chaffy.
pāl lens: pale
pallēs cens: palish, becoming pale.
pallĭā tus: palliated, cloaked.
pallĭdĭflō rus: pale-flowered.
pallĭdĭfō lius: pale-leaved
pallidispī nus: pale-spined.
pāl lidus: pale.
pallĭfl a vens: pale yellow.
palmatĭf idus: palmately cut.
palmā tus: palmate, divided or lobed like the hand.
paludō sus: of marshes, marsh-loving.
palūs tris: marsh-loving
pandurā tus: fiddle-shaped.
paniculā tus: paniculate
paniculĭf era: panicle-bearing.
pannōn icus: of Pannonia (Roman province on the Danube, now western Hungary)
pannō sus: ragged, tattered
papaverā ceus: Papaver-like, poppy-like.
papilionā ceus: butterfly-like, the form of the pea flower.
papillō sus: papillate, with minute nipple-like projections or protuberances
papyrā ceus: papery
papyrĭf era: paper-bearing
paradisī acus: of parks or gardens.
paradŏx us. paradoxical, strange
parasĭt icus: parasitical, of a parasite.
pardalī nus: leopard-like, spotted
pardī nus: leopard-spotted.
partī tus: parted
parvĭflō rus: small-flowered
parvĭfō lius· small-leaved
parvĭs simus: smallest, very small.
pār vulus: very small, very slight.
pār vus· small
patagōn icus: of Patagonia
patellā ris. circular, disk-shaped, like a knee-pan
pā tens: spreading
pāt ulus: spreading
pauciflō rus: few-flowered
paucifō lius: few-leaved
paupēr culus poor
pavonī nus: peacock-like
pectinā ceus: pectinate
pectinā tus: pectinate, comb-like, pinnatifid with very narrow close divisions or parts
pectinĭf era: comb-bearing
pectorā lis shaped like a breast-bone
pedā tus· footed, of the foot or feet; also pedate, like a bird's foot, being palmately divided and the side parts 2-cleft.
pedemontā nus: of Piedmont (northern Italy)
pedunculā ris· peduncled, stalked.
pedunculā tus: peduncled
pedunculō sus: with many peduncles.
pellū cidus: pellucid, with translucent dots
peltā tus: peltate
peltifō lius: peltate-leaved
pelvifōr mis: pelvis-shaped
pendulĭflō rus· pendulous-flowered
pendulī nus. somewhat pendulous
pēn dulus: pendulous, hanging
penicillā tus: hair penciled, like a little brush, pinnate
pennā tus: feathered, as the veins or lobes standing off at right angles from a midrib, pinnate
penninēr vis: feather-veined
pennsylvān icus: of Pennsylvania.
pentagō nus: five-angled
pentāg ynus: of five pistils
pentān drus: of five stamens
pentān thus: five-flowered
pentaphȳl lus: five-leaved.
perbēl lus: very beautiful
peregrī nus: exotic, foreign, from a strange country
perēn nans: perennial
perēn nis: perennial, living three or more years
perfolĭā tus: perfoliate, with leaf surrounding the stem.

perforà tus: perforated, with holes.
permíx tus: much mixed or confused.
persicæfò lius: peach-leaved.
pér sicus: of Persia, also the peach
perspíc uus: clear, transparent
pertù sus: thrust through, forced through, perforated.
peruvià nus: Peruvian, of Peru
petaloíd eus: petal-like
petiolà ris: petioled, with a leaf-stalk
petiolà tus: petioled
petræ us: rock-loving
phlogiflò rus: flame-flowered.
phœníc eus: purple-red
phrýg ius: of Phrygia (in Asia Minor)
phyllomanì acus: running wildly to leaves, leafy
picturà tus: painted-leaved, pictured, variegated
píc tus: painted
pilíf era: bearing soft hairs
pilosiús culus: somewhat or slightly pilose
pilò sus: pilose, shaggy, with soft hairs
pilulíf era: globule-bearing
pinetò rum: of pine forests.
pín eus: of the pine
pinifò lius: pine-leaved
pinnatífi idus: pinnatifid, pinnately cleft
pinnát ifrons: pinnate-fronded or -foliaged
pinnatinér vis: pinnate-nerved.
pinnà tus: pinnate, with leaflets on the sides of a main leaf axis
pisíf era: Pisum-bearing, pea-bearing
pisocár pus: pea-fruited
placà tus: quiet, calm
planiflò rus: plane-flowered, flat-flowered
planifò lius: flat-leaved
plantagín eus: plantain-like
plà nus: plane, flat
platanoì des: Platanus-like, plane-tree-like
platycán thus: broad-spined
platycár pus: broad-fruited
platýc ladus broad-branched
platyglós sus: broad-tongued.
platyphýl lus: broad-leaved
plenís simus: very full or double
plè nus: full, used to designate doubleness in flowers (as in *flore-pleno*)
pleurós tachys: side-spiked
plicà tus: plicate, plaited, folded lengthwise
plumà rius: plumed.
plumà tus: plumed
plúm beus. of lead
plumò sus: feathery.
poculifór mis: deep cup-shaped.
podocár pus: with stalked fruit.
poét icus: pertaining to poets
polifò lius: Polium-leaved, white-leaved.
polì tus: polished.
polyacán thus: many-spined.
polyán drus: of many stamens.
polyán thus: many-flowered
polycéph alus: many-headed
polydác tylus: many-fingered
polýg amus: polygamous, having both perfect and imperfect flowers.
polymór phus: of many forms, variable
polypét alus: many-petaled.
polyphýl lus: many-leaved
polyspér mus: many-seeded.
polystà chyus: many-spiked.
polystíc tus: many-dotted.
pomà ceus: pome-like, resembling the apple or pear
pomeridià nus: afternoon.
ponderò sus: ponderous, heavy, weighty
pón ticus: of Pontus (in Asia Minor)
populifò lius: populus-leaved, poplar-leaved
popúl neus: pertaining to poplars.
porcì nus: pertaining to swine
porrifò lius: Porrum- or leek-leaved
præál tus: very tall
præ cox: precocious, premature, very early
præ stans: distinguished, excelling.
prætéx tus: bordered.
prasinà tus: greenish
prasì nus: grass-green
pratén sis of meadows
precatò rius: praying, prayerful
primúl inus. primrose-like.
prín ceps. primely, first
prismát icus. prismatic, prism-shaped
proboscíd eus: proboscis-like
procè rus: tall
procúm bens: procumbent, lying on the ground
procúr rens. extended
produc tus: produced, lengthened
profù sus. profuse
prolíf era. producing offshoots, bearing abnormal supernumerary parts
prolíf icus: prolific, fruitful
propén dens. hanging down
propín quus: related, near to
prostrà tus: prostrate, lying flat.
protrù sus protruding
provincià lis: provincial, or of Provence, southern France
pruinà tus. pruinose
pruinò sus pruinose, with a hoary or frost-like bloom
prunifò lius plum-leaved
prù riens: itching
pseud- pseudo-. in combinations means *false, not genuine, not the true* or *the typical*, as Pseudotsuga, false tsuga
psittaci nus. of the parrot
pù bens: downy
pubér ulus: puberulous, somewhat pubescent
pubés cens: pubescent, downy
pudì cus: bashful, retiring, shrinking
pulchél lus: pretty, beautiful
púl cher: handsome, beautiful
pulchér rimus: very handsome.
púl lus: dark colored, dusky, almost black
pulverulén tus: powdered, dust-covered
pulvinà tus: cushioned, cushion-like.
pù milus: dwarf
punctatís simus: most spotted, very spotted
punctà tus: punctate, dotted.
pún gens: piercing, sharp-pointed
punícˈeus: reddish purple.
purpurà ceus: purple.
purpurás cens: purplish, becoming purple.
purpurà tus: purple.
purpù reus: purple
pusíl lus: very small, insignificant.
pycnacán thus. densely spined.
pycnán thus: densely flowered.
pygmæ us: pigmy
pyramidà lis: pyramidal
pyrenà icus. of the Pyrenees.
pyrifò lius: pear-leaved
pyrifór mis: Pyrus-formed, pear-shaped.

quadrangulà ris: quadrangular, four-angled
quadrangulà tus: four-angled
quadrà tus: in four or fours, squared.
quadríc olor: of four colors
quadridentà tus. four-toothed.
quadríf idus: four-cut
quadrifò lius: four-leaved
quadripárti tus: four-parted
quadrivál vis. four-valved.
quercifò lius: Quercus-leaved, oak-leaved
quercì nus: of Quercus the oak.
quinà tus: quinate, in fives
quinquéc olor five-colored
quinquefló rus. five-flowered
quinquefò lius: five-leaved
quinqueloculà ris: five-loculed, of five cells or compartments
quinquenér vis: five-nerved
quinquepunctà tus: five-spotted.

racemiflò rus: raceme-flowered.
racemò sus: racemose, flowers in racemes
radià tus: radiate, rayed.
radì cans: rooting
radicò sus: many-rooted
radì cum: of roots
radiò sus: radiate, with many rays
ramentà ceus: bearing a hair-like covering
ramiflò rus: with branching inflorescence.
ramosís simus: most- or much-branched
ramò sus. branched.
ranív era: bearing frogs
rapà ceus: pertaining to rape or turnips
rariflò rus: scattered-flowered, with flowers loose or few
rà rus: rare, uncommon
raù cus: hoarse, raw
reclinà tus: reclined, bent back
réc tus: straight, upright
recurvà tus: recurved
recurvifò lius: recurved-leaved.
recúr vus: recurved, curved back.
redivì vus: restored, brought to life.
reduplicà tus: duplicated again, doubled again, redoubled.
reflé xus: reflexed, bent back.
refrác tus: broken, broken in pieces.
refúl gens: brightly shining, reflecting light or color.
regà lis: regal, royal
Regì na: Queen
rè gius: regal, royal, kingly, pertaining to a king
religiò sus: used for religious purposes, venerated.

remò tus: remote, with parts distant.
renifór mis: reniform, kidney-shaped.
repán dus: repand, with margin wavy.
rè pens: repent, creeping.
rép tans: creeping.
reséc tus: cut off, curtailed, pruned.
resinò sus: resin-bearing, full of resin.
reticulà tus: reticulate, netted, net-veined.
retór tus: twisted back.
retrofléx us: reflexed.
retù sus: retuse, notched slightly at a rounded apex.
revér sus: reversed, end-for-end.
revolù tus: revolute, rolled backward from the margins.
Réx: king
rhamnifò lius: Rhamnus-leaved, buckthorn-leaved
rhizophýl lus: root-leaved, acaulescent
rhodán thus: rose-flowered.
rhodochî lus: rose-lipped or -margined.
rhodocínc tus: rose-girdled
rhodoneù rus: red-nerved
rhomboíd eus: rhomboidal
ricinifò lius: Ricinus-leaved, with leaves of castor-oil plant
rigíd ulus: somewhat stiff or rigid.
ríg idus: rigid, stiff.
rín gens: ringent, gaping, open-mouthed
ripà rius: of river banks
rivà lis: pertaining to brooks.
rivulà ris: brook-loving
robús tus: robust, stout.
rosà ceus: rose-like.
rosæflò rus: rose-flowered.
rò seus: rose, rosy
rostrà tus: rostrate, beaked
rosulà ris: rosulate, in rosettes.
rotà tus: rotate, wheel-shaped.
rotundifò lius. round-leaved.
rotún dus: rotund, round.
rubél lus: reddish.
rù bens: red, ruddy.
rù ber: red, ruddy.
rubér rimus: very red
rubés cens: reddish, becoming red.
rubiæfò lius: rubus- or bramble-leaved
rubicún dus: rubicund, red.
rubiginò sus: rusty.
rubricaù lis: red-stemmed.
rubrifò lius: red-leaved.
rubronér vis: red-veined.
rufés cens: reddish, becoming red.
rufinér vis: red-nerved.
rù fus: red, reddish
rugò sus: rugose, wrinkled
runcinà tus: runcinate, retrorsely or backwardly incised or toothed.
rupés tris: rock-loving.
rupíc olus: growing on cliffs or ledges
rús ticus: rustic, belonging to the country.
ruthén icus: Ruthenian, Russian.
rù tilans: red, becoming red.

saccà tus: saccate, bag-like.
saccharà tus: containing sugar, sweet.
saccharíf era: sugar-bearing
saccharì nus: saccharine.
sác charum: sugar.
saccíf era: bag-bearing.
sachalinén sis: of Saghalien Isl. (N. Japan).
sagittà lis: of the arrow, sagittate.
sagittà tus: sagittate, arrow-like.
sagittifò lius: arrow-leaved.
salicifò lius: salix-leaved, willow-leaved.
salíc inus: willow-like.
salíg nus: of the willow.
salì nus: salty.
sambù cinus: sambucus- or elder-like.
sánc tus: holy.
sandwicén sis: of the Sandwich or Hawaiian Isls
sanguín eus: bloody, blood-red.
sáp idus: savory, pleasing to taste.
sapién tum: of the wise men or authors
saponà ceus: soapy.
sarcò des: flesh-like
sarmát icus: of Sarmatia (an ancient territory in S Russia and Poland).
sarmentò sus: sarmentose, bearing runners
satì vus: cultivated
saurocéph alus: lizard-headed
saxát ilis: found among rocks.
saxíc olus: growing among rocks
saxò sus: full of rocks
scà ber. scabrous, rough
scabrél lus. somewhat scabrous.
scán dens: scandent, climbing
scapò sus: with scapes
scép trum: of a scepter
schizoneù rus: cut-nerved
schizopét alus: cut-petaled
schizophýl lus: cut-leaved
scholà ris. pertaining to a school
sclerocár pus: hard-fruited
sclerophýl lus: hard-leaved
scót ica: Scotch, of Scotland
scúlp tus: carved
scutellà ris salver- or dish-shaped
scù tum: a shield
sebíf era: tallow-bearing.
sebò sus. full of tallow or grease
sechellà rus: of the Seychelles (Indian Ocean)
secún dus: second, side-flowering
securíg era: axe-bearing.
ség etum: of cornfields
semialà tus: semi-winged, half or somewhat winged
semicaudà tus: semi- or partially tailed
semicylín dricus: semi- or somewhat cylindrical.
semipinnà tus: half or imperfectly pinnate
semperflò rens: ever flowering.
sempér virens: ever green
senì lis: senile, old, white-haired.
sensíb ilis: endowed with feeling, sensitive.
sensitì vus: sensitive
sepià rius: pertaining to hedges.
sè pium: of hedges or fences.
septangulà ris: seven-angled.
septém lobus: seven-lobed.
septempunctà tus: seven-spotted.
septentrionà lis: northern, belonging to the North
sepúl tus: sepulchered, interred
serícc eus: silky.
serót inus: late, late-flowering or late-ripening.
sér pens: creeping, crawling
serpentì nus: of snakes, serpentine, looping or waving
serratifò lius: serrate-leaved, saw-edge-leaved.
serrà tus: serrate, saw-toothed.
serrulà tus: serrulate, somewhat serrate.
sesquipedà lis: one foot and a half long or high.
sessiflò rus: sessile-flowered, without pedicel
sessifò lius: sessile-leaved, without petiole
sessilifò lius: sessile-leaved.
sés silis: sessile, stalkless, sitting
setà ceus: setaceous, bristle-like
setíg era: bristly, bristle-bearing.
setò sus: setose, full of bristles
setulò sus: full of small bristles
sibír icus: of Siberia
signà tus: marked, designated, attested
sikkimén sis: of Sikhim or Sikkim (N India)
silíc eus: pertaining to or growing in sand
siliculò sus: bearing silicles
silvát icus: pertaining to woods, sylvan, sometimes *sylvaticus*
silvés tris: pertaining to woods.
sím plex: simple, unbranched.
simplicicaù lis. simple-stemmed.
simplicifò lius: simple-leaved
simplicís simus: simplest, very unbranched
sím ulans. similar to, resembling.
sinén sis: Chinese, of China
sín icus Chinese
sinuà tus: sinuate, wavy-margined.
sinuò sus sinuate
sitchén sis: belonging to Sitka, Alaskan
smarág dinus: of emerald.
smilác inus. of smilax
sobolíf era. bearing creeping rooting stems or shoots
socià lis. sociable, companionable
socotrà nus. of the Island of Socotra (south of Arabia)
solà ris. solar, of the sun
sól idus: solid, dense, not hollow.
somnífera: sleep-producing
sór didus. dirty, unclean, foul
spadíc eus: with a spadix
sparsiflò rus: sparsely or few-flowered
sparsifò lius: sparsely or few-leaved.
spár sus: sparse, scattered, few.
spár teus: pertaining to the broom.
spathà ceus: with a spathe
spathulà tus: spatulate, spoon-shaped, narrowed toward the base from a rounded top
speciosís simus: very showy
speciò sus: showy, good-looking.
spectáb ilis: spectacular, worth seeing, remarkable, showy.
spectán dus: showy.
spéc trum: an image, apparition.
sphacelà tus: dead, withered, diseased.
sphér icus: spherical
sphærocár pus: spherical-fruited
sphærocéph alus: spherical-headed.
sphæroíd eus: sphere-like.
sphærostà chyus: spherical-spiked.

spicà tus: spicate, with spikes.
spicíg era: spike-bearing.
spinosís simus: most or very spiny.
spinò sus: full of spines
spinulíf era: bearing small spines.
spinulò sus: somewhat or weakly spiny.
spirà lis: spiral.
spirél lus: a spiral, little spiral
splén dens: splendid.
splendidís simus: very splendid.
splén didus: splendid
spumà rius: frothing, of froth or spume.
spù rius: spurious, false, bastard.
squà lens: daubed, filthy.
squál idus: squalid, filthy.
squamà tus: squamate, with squamæ or small scale-like leaves or bracts.
squamò sus: squamate, full of scales
squarrò sus: squarrose, with parts spreading or even recurved at ends
stamín eus: bearing prominent stamens.
stáns: standing, erect, upright
stauracán thus: with spines cross-shaped
stellà ris: starry
stellà tus: stellate, starry.
stellulà tus: of little stars
stenocéph alus: narrow-headed
stenóg ynus: with a narrow stigma.
stenopét alus: narrow-petaled
stenophýl lus: narrow-leaved.
stenóp terus: narrow-winged.
stér ilis: sterile, infertile
stigmát icus: marked, of stigmas.
stigmò sus: much marked, pertaining to stigmas
stipulà ceus: stipuled, with stipules.
stipulà ris: stipuled.
stipulà tus: stipuled
stoloníf era: bearing stolons or runners that take root
stramín eus: straw-colored
strangulà tus: strangled, constricted
streptocár pus: twisted-fruited
streptopét alus: with petals twisted
streptophýl lus: twisted-leaved
streptosép alus: with sepals twisted
striát ulus: somewhat or faintly striped
strià tus: striated, striped
strictifló rus: strict- or stiff-flowered.
strícˌtus. strict, upright, erect.
strigillò sus: somewhat strigose.
strigò sus: strigose, covered with sharp straight appressed hairs.
strigulò sus: beset with small or weak appressed hairs
striolà tus: striolate, somewhat or faintly striped.
strobilíf era: cone-bearing
strumà rius: of tumors or ulcers.
strumà tus: with tumors or ulcers
stylò sus: with style or styles prominent.
styracíf luus: flowing with storax or gum.
suavè olens: sweet-scented
suà vis: sweet, agreeable.
suavís simus: sweetest, very sweet-scented.
subacaù lis: somewhat stemmed, nearly stemless.
subalpì nus: subalpine, nearly alpine
subauriculà tus: somewhat or rather auricled or eared.
subcarnò sus: nearly or rather fleshy.
subcordà tus: partially or imperfectly or somewhat cordate.
subedentà tus: nearly toothless.
suberculà tus: of cork, corky.
suberéc tus: somewhat or rather erect.
suberò sus: cork-barked, full of cork.
subfalcà tus: somewhat falcate.
subglaù cus: somewhat or to some degree glaucous.
subhirtél lus: somewhat hairy.
sublunà tus: somewhat lunate or crescent-shaped
submér sus: submerged, under water.
subperén nis: imperfectly or nearly perennial
subpetiolà tus: somewhat or partially petioled
subsés silis: nearly sessile, not completely sessile
subsinuà tus: somewhat sinuate or wavy-margined
subterrà neus: subterranean, underground
subulà tus: subulate, awl-shaped
subumbellà tus: somewhat or incompletely umbellate.
subvillò sus: somewhat villose or soft-hairy.
subvolù bilis: somewhat twining.
succulén tus: succulent, fleshy.
suéc icus: Swedish, of Sweden
suffrutés cens: slightly shrubby, becoming somewhat shrubby
suffruticò sus: slightly shrubby.
sulcà tus: sulcate, furrowed
sulphù reus. sulfur-colored
sumatrà nus: of the Isl of Sumatra.
supérb ıens: superb, proud
supér bus: superb, proud
supercilià ris: eyebrow-like
supér fluus: superfluous, redundant.
surculò sus: producing suckers
surinamén sis: belonging to Surinam (Dutch Guiana)
susià nus: of the province of Susiana (Persia)
suspén sus: suspended, hung
sylvát icus: sylvan, forest-loving (also written *silvaticus*)
sylvés tris: of woods or forests.
sylvíc olus: growing in woods
syphilít icus: syphilitic.
syrì acus: Syrian, of Syria.
sýs tylus: with styles joined.

tabulà ris: pertaining to tablets.
tabulifór mis: tablet-formed.
tædíg era: torch-bearing, resin-bearing.
taraxicifò lius: Taraxicum- or dandelion-leaved.
tardifló rus: late-flowered.
tardì vus: tardy, late.
tatár icus: of Tartary (old name for Central Asia).
taù reus: of oxen.
taù ricus: Taurian, Crimean.
taurì nus: bull-like.
taxifò lius: Taxus-leaved, yew-leaved.
tectò rum: of roofs or houses.
téc tus: concealed.
temulén tus: drunken.
tenacís simus: most tenacious.
tè nax: tenacious, strong.
tenebrò sus: of dark or shaded places.
tenél lus: slender, tender, soft.
tén er: slender, tender, soft.
tentaculà tus: with tentacles or short projecting parts
tenuicaù lis: slender-stemmed.
tenuifló rus: slender-flowered.
tenuifò lius: slender-leaved.
tenuíl obus: slender-lobed.
tenù ior: more slender.
tén uis: slender, thin
tenuís simus: very slender, very thin.
terebínth inus: of turpentine.
tè res: terete, circular in cross-section.
teretifò lius: terete-leaved
terminà lis: terminal, at the end of a stem or branch
ternà tus: in threes, ternate
ternifò lius: with leaves in threes
terrés tris: of the earth, terrestrial
tessellà tus: tessellate, laid off in squares or in dice-like pattern
testà ceus: light brown, brick-colored; also testaceous, bearing a prominent testa or outer seed-coat.
testiculà tus: testiculated, testicled.
testudinà rius: like a tortoise-shell.
tetracán thus: four-spined
tetragò nus: four-angled
tetrán drus: four-anthered
tetrán thus: four-flowered
tetraphýl lus: four-leaved
tetráp terus: four-winged.
tetraquè trus: four-cornered
texà nus, texén sis: of Texas, belonging to Texas
theíf era: tea-bearing
thermà lis: warm, of warm springs.
thuyoì des: like Thuja or arbor-vitæ.
thyrsifló rus: Thyrse-flowered
thyrsoíd eus: thyrse-like
tibíc inis: of a flute player.
tigrì nus: tiger-striped
tinctò rius: belonging to dyers, of dyes.
tínc tus: dyed
tipulifór mis: of the shape of a daddy-long legs
tomentò sus: tomentose, matted-pubescent
tormìnà lis: useful against colic
torò sus: torose, cylindrical with contractions at certain places or at intervals
tór tilis: twisted.
tortuò sus: much twisted.
tór tus: twisted.
torulò sus: somewhat torose.
toxicà rius: poisonous.
tóx icus: poisonous
toxíf era: poison-producing.
transpà rens: transparent
trapezifór mis: trapezium-formed, a four-sided figure of which no two sides are alike.
trapezioì des: trapezium-like.
tremuloì des: like Tremulus, the trembling poplar.
trém ulus: quivering, trembling.
triacàn thus: three-spined
trián drus: with three anthers or stamens.

triangulà ris: three-angled.
triangulà tus: three-angled.
trián gulus: three-angular.
tricaudà tus: three-tailed
trichophýl lus: hairy-leaved.
trichosán thus: hairy-flowered.
trichospér mus: hairy-seeded.
trichôt omus: thrice branched or forked
tríc olor: three-colored
tricór nis: three-horned.
tricuspidà tus: three-cusped, three-pointed
tridác tylus: three-fingered
trí dens: with three teeth
tridentà tus: three-toothed.
trifascià tus: three-banded.
tríf idus: three-parted
triflð rus· three-flowered.
trifoliâ tus: three-leaved
trifoliolà tus. three-leafleted.
trifð lius· three-leaved
trifurcà tus: trifurcate, thrice-forked
trilineà tus: three-lined.
trilobà tus three-lobed.
trîl obus. three-lobed
trimés tris: of three months.
trinér vis: three-nerved
trinotà tus three-marked or -spotted.
tripartì tus: three-parted
tripét alus: three-petaled
triphýl lus: three-leaved
tríp teris: three-winged
tripunctà tus· three-spotted.
triquè trus: three-cornered
trís tis: sad, bitter, dull
triternâ tus. triternate, thrice in threes
triúm phans: triumphant
trivià lis: common, ordinary, very frequent, found everywhere
trôp icus of the tropics
truncát ulus: somewhat or partially truncate
truncà tus: truncate, cut off square
tuberculà tus: tuberculate, with tubercles or small tubers
tuberculð sus: tubercled, knotted.
tuberð sus. tuberous.
tubiflð rus: tube-flowered, trumpet-flowered
tubís pathus: tube-spathed
tubulð sus. tubulose, with tubes.
tulipíf era· tulip-bearing.
tù midus: swollen
turbinà tus: turbinate, top-shaped.
túr gidus: turgid, inflated, full
typhi nus: smoky or dull; perhaps pertaining to fever.
týp icus: typical, conforming to the standard or norm.

ulíc inus: like the gorse or furze (Ulex).
uliginð sus: of wet or marshy places.
ulmifð lius: Ulmus-leaved, elm-leaved
umbellà tus: with umbels.
umbellulà tus: with umbellets.
umbonà tus: bossed, bearing at center an umbo or stout projection.
umbraculíf era: umbrella-bearing, shade-producing
umbrð sus: shaded, shade-loving
uncinà tus: hooked at the point
undà tus: waved
undecimpunctà tus: eleven-spotted
undulatifð lius. undulate-leaved
undulà tus· undulated, wavy
unguiculà ris. clawed, narrowed to a petiole-like base
unguiculà tus: unguiculate, clawed.
unguipét alus: petals clawed.
unîc olor: one-colored
unicór nis: one-horned
unidentà tus. one-toothed.
unifl ð rus. one-flowered
unilaterà lis· one-sided
univittà tus: one-striped
urceolà tus urn-shaped
ù rens burning, stinging
urentís simus. very burning, very stinging
urophýl lus. tail-leaved
urostà chyus: tail-spiked
ursî nus· pertaining to bears.
urticifð lius· nettle-leaved (Urtica).
usitatís simus. most useful
ustulà tus burnt, sere
ù tilis· useful
utilís simus· most useful
utriculà tus· utriculate, with a utricle or small bladdery one-seeded fruit
utriculð sus. utricled
uvíf era. grape-bearing

và gans wandering, vagabondish
vaginà lis vaginate, sheathed
vaginà tus. sheathed
valdivià nus, valdivién sis. Valdivian, of province of Valdivia (Chile).
valentî nus· Valentian, of Valentia (in Spain)
vál idus· strong
variáb ilis· variable, of many forms.
và rians. variable
varià tus· variable
variegà tus· variegated.
varnifór mis: of variable or many forms
và rius: various, diverse.
vastà tor (feminine *vastatrix*): ravaging, devastating
vegetà tus: full of growth, vigorous.
vég etus. vigorous
velà ris: pertaining to curtains or veils
velù tinus: velvety.
venenà tus: poisonous.
venð sus: veiny.
ventricð sus: ventricose, swelling or inflated on one side or unevenly.
venús tus: handsome, charming
verecún dus: modest, blushing
vermiculà tus: worm-like, or like worm-tracks
vernà lis: vernal.
vernicíf era: varnish-bearing.
vér nus: of spring, vernal
verrucð sus: verrucose, warted.
versíc olor: variously colored.
verticillà ris: verticillate.
verticillà tus: verticillate, whorled, arranged in a circle about the stem.
vè rus: the true or genuine or **standard**
vés cus: weak, thin, feeble
vesiculð sus: with little bladders
vespertì nus: of the evening, western
vestì tus: covered, clothed, as with hairs or pubescence
véx ans: puzzling, vexatious
vexillà rius: of the standard petal (as of pea-like flowers), with a standard.
villð sus. villous, soft-hairy
viminà lis: of osiers, of basket willows.
vimín eus. of osiers or wicker-work.
vinif era wine-bearing
vinð sus· full of wine.
violà ceus. violet
violés cens. somewhat violet-colored or becoming so
vì rens. green
virés cens greenish, becoming green.
virgà tus: twiggy
virginà lis: virgin
virgín eus. virgin
virgín icus, virginién sis: Virginian, of Virginia
viridiflð rus: green-flowered.
viridifð lius. green-leaved
vír idis: green.
viridís simus: greenest, very green.
viríd ulus. greenish
viscíd ulus somewhat viscid.
vís cidus: viscid, sticky
viscosís simus: very sticky.
viscð sus: viscid
vitellì nus: dull yellow approaching red
vitifð lius· Vitis-leaved, grape-leaved.
vittà tus. striped
vittíg era. bearing stripes
vivíp arus: viviparous, producing the young alive (rather than oviparous).
volgár icus: Volgan, of the Volga river region (written also *volgaricus*)
volù bilis: twining
volúp tas: pleasure, delight.
volù tus: rolled-leaved
vulgà ris: vulgar, common.
vulgà tus: common
vulpî nus: of the fox

wolgár icus: Volgan (see *volgaricus*).

xanthacán thus: yellow-spined.
xán thi nus: yellow
xanthocár pus: yellow-fruited.
xantholeù cus: yellow-white.
xanthophýl lus: yellow-leaved.

yedoén sis: of Yedo or Yeddo (Japan).
yunnanén sis: of Province of Yun-nan, China.

zebrì nus: zebra-striped.
zeylán icus: Ceylonian, of Ceylon; Cingalese, same as *ceylanicus*.
zonà lis: zonal, zoned.
zonà tus: zoned, banded.

GLOSSARY

OF THE USUAL BOTANICAL AND HORTICULTURAL TECHNICAL WORDS

The following set of words includes many descriptive terms used in this Cyclopedia and elsewhere, with explanations of their meaning In some respects, the Name-List (pages 148 to 159) is a glossary, and the consultant should search there when he fails to find the word in the present catalogue.

Aberrant Unusual, or exceptional, a plant or structure that varies from customary structure or from the type, used mostly of variation

Abortive Defective, barren, not developed

Abrupt. Changing suddenly rather than gradually, as a leaf that is narrowed quickly to a point, or a pinnate leaf that has no terminal leaflet, not tapering

Acaulescent Stemless, or apparently stemless, sometimes the stem is subterranean or protrudes only slightly.

Accessory buds Buds more than one in an axil

Accessory fruit Fruit-like body composed of pericarp and other structure or structures seemingly a part of it, but not originally united with it, as wintergreen berry

Accrescent Increasing, becoming larger after flowering, as the calyx in some plants

Accumbent Lying against, said of cotyledons when the edges are placed against the radicle

Achene (akene) A dry indehiscent one-seeded pericarp.

Achlamydeous Lacking calyx or corolla, naked

Acinaciform Shaped like a scimitar, curved, round toward the point, being thicker on the outer side than on the convex or inner side

Acotyledonous Without cotyledons

Adnate Grown to, united with another part, as stamens with the corolla-tube or an anther in its whole length with the filament

Adventitious buds Buds appearing on occasion, rather than in regular places and order, as those arising about wounds.

Adventive Said of an introduced plant not yet established, imperfectly or only partially naturalized.

Æstivation The arrangement of floral envelopes in the bud (æstivus, *summer*, when flowers mostly appear. Vernation is leaf-arrangement in the bud)

Affinity A plant or part closely related to another or much resembling it in structure

Agglomerate Piled together, heaped up

Aggregate fruit One formed by the coherence of pistils that were distinct in the flower, as blackberry

Albumen Starchy or other nutritive material accompanying the embryo, commonly used in the sense of endosperm, for the material surrounding the embryo

Alburnum The sapwood or younger wood of a tree

Alternate Any arrangement of leaves or other parts not opposite or whorled, placed singly at different heights on the axis or stem

Alveolate Honey-combed, or pitted with angular separated depressions.

Ament Catkin

Amentiferous Bearing aments or catkins.

Amorphous Formless, of no definite or constant form

Amphigean Of both worlds, the Old and New, said of distribution of plants

Amphitropous. Said of a straight ovule or seed that is apparently turned a quarter way around, so that it is half inverted and with the scar or hilum on the side.

Ampullaceous Said of plants bearing flask-like parts, as in certain aquatics such as Utricularia.

Analogous Related in function or use, but not in origin. See *Homologous*.

Anastomosing Netted, intervened, said of leaves marked by cross-veins forming a network

Anatropous Said of a straight ovule or seed that is inverted, with the micropyle next the hilum or scar

Ander Male, occurs in combinations as, *monandrous*, having one stamen

Andrœceum The male or stamen-bearing part of a flower; the stamens spoken of collectively See *Gynœcium*

Androphore The cylinder or column formed by monadelphous filaments, as in the mallow and bombax tribes

Angiosperms Plants that bear the seeds within a pericarp, in distinction from the gymnosperms which have naked ovules and seeds, having a closed ovary

Annual Of one season's duration from seed to maturity and death

Anterior Front, on the front side, away from the axis, toward the subtending bract

Anther The pollen-bearing part of the stamen, borne at the top of the filament or sometimes sessile

Antheriferous Anther-bearing

Anthesis Flowering, strictly, the time of expansion of a flower, but often used to designate the flowering period, the act of flowering

Anthocarpous Said of a body combined of flowers and fruit united into a solid mass, as in the pineapple or the mulberry

Anthodium Flower-head of the Compositæ; in common speech this flower-head is erroneously called a "flower"

Antical Front, anterior

Apetalous. No petals, petals missing.

Apical. At the apex or top.

Apocarpous Carpels not united, see *Syncarpous*

Appendage An attached subsidiary or secondary part, as a projecting part or a hanging part or supplement

Appressed Closely and flatly pressed against, adpressed.

Arachnoid Cobwebby, by soft and slender entangled hairs, also spider-like

Areole, areola A small more or less angular space on a surface, as between network of veins

Aril An appendage or an outer covering of a seed, growing out from the hilum or funiculus; sometimes it appears as a pulpy covering

Arillate Provided with an aril

Arillode An aril-like structure, or false aril; a coating or covering of the seed arising from its own surface, and not from the funiculus

Armed Provided with any kind of strong and sharp defence, as of thorns, spines, prickles, barbs.

Articulate. Jointed, provided with nodes or joints, or places where separation may naturally take place.

Ascending Rising up, produced somewhat obliquely or indirectly upward

Asexual. Sexless, without sex.

Auricle An ear-shaped part or appendage, as the projections at the base of some leaves and petals.

Awl-shaped. Narrow and sharp-pointed, gradually tapering from base to a slender or stiff point.

Awn A bristle-like part or appendage

Axil Upper angle that a petiole or peduncle makes with the stem that bears it.

Axile. Borne in or on the axis, or relating to it.

Axillary. In an axil.

Axis The main or central line of development of any plant or organ, the main stem.

Bacca. A berry

Baccate. Berry-like, pulpy or fleshy.

Banded. Marked with cross-bars or horizontal lines of color, or with very prominent ribs or other structure

Barb A short point or bristle; usually employed to designate points with reflexed or fishhook-like rarely ascending appendages

Barbulate. With fine beards

Bark The word is often used in a general way to designate the softer outer envelope of a stem or root In this sense, it includes all that peels readily, as the bark of the hemlock and oak, used for tanning leather In a stricter sense, it is applied to the corky layers formed on the outer surface of woody plants It is formed from an active layer of tissue,—the phellogen The bark is developed in different ways on different trees. So distinct are the resulting tissues that species of trees may be readily recognized by their bark alone Cork of commerce is the bark of the cork oak, a native of southwestern Europe Inasmuch as the word covers so many structures, it is little used by botanists in technical descriptions

Bark-grafting A kind of grafting in which the cions are inserted between the bark and wood of a stub, often, but erroneously, called crown-grafting

Base. The bottom or lower end of a part or structure or organ, even though this part may be uppermost as the organ hangs on the plant

Basifixed Attached or fixed by the base, as an ovule that is affixed to its support by its bottom rather than by its side or by an angle

Basin The depression at the apex or blossom-end of an apple or other pome fruit

Basinerved All the ribs or nerves of a leaf or petal starting from its base

Bast The soft part of the fibro-vascular bundles in plants, abundant in the inner bark It increases in thickness simultaneously with the wood, but much less rapidly The fibrous elements in the bast of basswood have been used in making cordage, also in making strong paper.

Beak. A long prominent and substantial point, applied particularly to prolongations of fruits and carpels

Beard A long awn or bristle-like hair

Berry Pulpy, indehiscent, few- or many-seeded fruit, technically, the pulpy fruit resulting from a single pistil, containing one or more seeds but no true stone, as the tomato

Bi- or Bis- In Latin compounds, signifying *two* or *twice.*

Biauriculate, biaurite Having two ears.

Bicallose, bicallous Furnished with two callosities, as the lip of some orchids

Bicrural. With two tails, legs, or slender elongations.

Biennial Of two seasons' duration from seed to maturity and death

Bifarious Arranged in two rows.

Bifid Two-cleft or two-cut

Bifoliolate With two leaflets to a leaf.

Biforate With two openings, pores or apertures.

Bigener. Plant arising from a cross between two genera.

Bilabiate Two-lipped, double-lipped.

Bilamellate Bearing or consisting of two plates.

Bilobed Two-lobed, parted into two lobes.

Bilocular. Two-celled, with two locules or compartments.

Bipartite Divided into two parts, separated nearly to base.

Bipinnate. Twice-pinnate, when the primary divisions are pinnate.

Bipinnatifid. Twice-pinnatifid; when pinnatifid primary parts are pinnately cut

Biplicate Bearing two plaits or folds

Biseptate. Twice-divided, with two partitions.

Biserial In two series or sets

Biserrate. Doubly serrate; the serratures themselves serrate.

Bisexual. Two-sexed, with both stamens and pistils.

Biternate Twice-ternate, when the divisions of a ternate leaf are divided into three.

Bivalvular. Two-valved

Bivittate With two vittæ or oil-tubes

Bladdery Inflated, empty, and the walls thin like the bladder of an animal

Blade The expanded part of leaf or petal.

Blanching. A whitening or decoloring of the usually green parts of plants, as in celery or endive when it is prepared for use

Bole The trunk of a tree, particularly of a large tree.

Boss A prominent center or projection on a flat and more or less circular surface

Bottom-heat A term used to designate the condition that arises when the roots of plants, or the soil in which they grow, are exposed to a higher temperature than that of the air in which the aerial parts are growing

Brachiate Branches or parts spreading at nearly right-angles and placed alternately

Brachys In Greek compounds, signifying *short,* as brachypodus, *on a short foot* or *stalk*

Bract A much-reduced leaf, particularly the small or scale-like leaves in a flower-cluster or associated with the flowers

Bracteal Concerning or pertaining to bracts

Bracteole Bractlet

Bractlet Bract born on a secondary axis, as on the pedicel or even on a petiole

Breaking Said when buds start to grow

Bristly Bearing stiff strong hairs or bristles

Bud An incipient or nascent shoot, the rudimentary or beginning state of a stem, particularly, in common speech, a thickened and condensed resting-stage of a shoot, or a flower or leaf before expanding, in propagating, a single bud used on a cutting or cion See *Buds,* p 586

Budding The operation of applying a single bud to the surface of the growing wood of the stock, with the intention that it shall grow The bud is usually inserted underneath the bark of the cion, and is held in place by a bandage Budding is a part of the general process of grafting Called *inoculation* in old writings

Bulb A thickened part in a resting state and made up of scales or plates on a much shortened axis See *Bulb,* p 588

Bulbel A bulb arising from a mother-bulb

Bulbiferous Bulb-bearing

Bulblet Aerial bulb, a bulb borne above ground, as in the flower-cluster or a leaf-axil.

Bulbo-tuber Corm

Bulbous Bulb-like, with the structure or the characteristics of a bulb

Bullate The surface blistered or puckered, as the leaf of a Savoy cabbage

Bursicle. A little pouch-like or purse-like receptacle

Bush A low and thick shrub, without distinct trunk.

Caducous Falling off early, or prematurely, as the sepals in some plants

Calcarate Spurred

Calcariform Spur-formed, shaped like a calcar or spur.

Calceolate Slipper-like, having the form of a rounding toed shoe

Callosity A thickened and hardened part or protuberance.

Callus A hard prominence or protuberance, in a cutting or on a severed or injured part, the roll of new covering tissue

Calycine Pertaining to a calyx, or calyx-like.

Calyculate Calyx-like, bearing a part resembling a calyx; particularly, furnished with bracts against or underneath the calyx resembling a supplementary or outer calyx.

Calyptra A hood or lid, particularly the hood or cap of the capsule of a moss.

Calyptriform. Hood-formed; like a cap pulled over.

Calyx The outer circle of floral envelopes

Cambium. The growing or nascent tissue lying between the xylem and phloem of the fibro-vascular bundle, and therefore on the outside of the woody trunk between wood and bast, or in trees and shrubs between wood and "bark" Its function is to increase the stem in diameter

Campanulate. Bell-shaped.

Campylotropous. Said of an ovule or seed so curved or turned on itself as to bring the apex and base together.

Canaliculate Grooved or channeled lengthwise.

Canescent Gray-pubescent and hoary

Cap A convex removable covering of a part, as of a capsule, in the grape, the cohering petals fall off as a cap.

Capillary. Hair-like, very slender.

Capitate Headed, in heads, formed like a head, aggregated into a very dense or compact cluster

Capitulum Head, a close body of sessile flowers

Capsular. Pertaining to a capsule, formed like a capsule.

Capsule Compound pod, a dry fruit of more than one carpel, opening at maturity

Carinate Keeled, provided with a projecting central longitudinal line or ridge on the lower or under surface

Carpel. One of the foliar units of a compound pistil, a simple pistil contains one carpel

Carpophore Fruit-stalk, stem bearing the carpels, particularly, in the Umbelliferæ, the slender extended axis that supports the ripe seed-like carpels.

Cartilaginous Hard and tough, like parchment

Caruncle On a seed, a protuberance or growth at or around the hilum

Caryopsis An achene-like fruit, with the thin pericarp or covering grown fast to the seed, it is the characteristic fruit of the cereal grains and other grasses

Cataphyll An undeveloped leaf, as at the beginning of a growth

Catkin A scaly-bracted spike with declinous flowers, ament, prominent in willows and poplars

Caudex Stem, trunk, used particularly to designate the persistent base of an herbaceous stem that is otherwise annual, and also for the stem of tree-ferns and palms

Caudicle Little stem, stemlet, stalk of pollinium in orchids

Caulescent More or less stemmed or stem-bearing, having an evident stem above ground

Caulicle. Stemlet of the embryo, radicle

Cauline Pertaining or belonging to the stem

Cavity The depression at the bottom or stem-end of an apple or similar fruit

Cell One of the ultimate compartments or vesicles of which plants are composed or made up, also, a cavity or compartment or locule of an ovary or anther

Cellular Tissue made up of short thin-walled cells, rather than of fibers or tubes

Centrifugal Away from the center

Centripetal Toward the center

Centrum The central part of any structure, particularly the large central air-space in hollow stems

Cephalanthium An old name for the flower-head of composites, anthodium

Cephalium. The head-like stem-end of condensed cacti, bearing the flowers and fruits

Cernuous. Drooping, inclining somewhat from the perpendicular

Cespitose Matted, growing in tufts in little dense clumps; said of low plants that make tufts or turf of their basal growths.

Chæta. A bristle, seta

Chaff A small thin dry and membranous scale or bract; in particular, the bracts in the flower-heads of composites

Channeled. Deeply grooved lengthwise; canaliculate.

Chartaceous. Thin, hard and stiff, having the texture of writing-paper.

Chryseo. In Greek compounds, signifying *golden* or *golden yellow.*

Ciliate Fringed with hairs, bearing hairs on the margin

Ciliolate Slightly or minutely ciliate

Cinereous Ash-colored, light gray

Cinnamomeus Cinnamon-colored

Cion The bud or branch used in grafting, also spelled *scion*

Circinate Coiled downward or inward from the top, as the young frond of a fern and cycas.

Circumscissile Opening or dehiscing by a line around the fruit or anther, the valve usually coming off as a lid.

Cirrhiferous Tendril-bearing

Cirrhiform Tendril-form

Cirrhus, cirrus A tendril

Cladophyllum A flattened leaf-like branch, functioning as foliage, as in many acacias and in asparagus

Clados In Greek compounds, signifying a *branch*

Clasping Leaf partly or wholly surrounding stem

Clavate Club-shaped, said of a long body thickened toward the top

Claw The long narrow petiole-like base of the petals or sepals in some flowers

Cleistogamous flowers Small closed self-fertilized flowers, as in some violets and in many other plants

Close fertilization Fecundation by pollen from same flower, self-fertilization

Clove One of the separable parts of a composite bulb, as of the garlic

Clypeate With the form of an ancient buckler or round convex shield, shield-like

Coalescence The union of similar parts or organs, or of those in the same series as stamens with stamens and petals with petals

Coarctate Crowded together

Coccus A berry (plural *cocci*), in particular, one of the parts of a lobed fruit with one-seeded cells

Cochleariform Spoon-shaped

Coherent Two or more similar parts or organs joined

Cohesion The union of two or more organs of same kind

Collateral By the side, standing side by side

Column Body formed of union of stamens and pistil in orchids, or of stamens, as in mallows

Commissure The place of joining or meeting, as the face by which one carpel joins another

Comose Bearing a tuft or tufts of hair

Complete flower All parts present

Complete leaf Having blade, petiole, stipules.

Complicate Folded over or back on itself

Compound Of two or more similar parts in one organ.

Compound leaf A leaf with two or more separate leaflets, in some cases (as in Citrus) some of the leaflets may be obsolete and the compound leaf have only one leaflet

Compound pistil Of two or more carpels united

Compressed Flattened, especially flattened laterally

Conchiform Shell-form, like one valve of a bivalve shell

Conduplicate Two parts folded together lengthwise

Cone A dense and usually elongated collection of flowers or fruits borne beneath scales, the whole with scales and axis forming a detachable homogeneous fruit-like body, some cones are of short duration, as the staminate cones of pines, and others become dry and woody durable parts

Confluent Running together so as to form a single part or organ, blended

Conformed Of the same form or character as something else or as a related part or structure

Congested Crowded very closely together, collected into a mass or body

Conglobate. Gathered into a ball or globe.

Conglomerate. Clustered, brought together

Coniferous Cone-bearing.

Connate United or joined, in particular, like or similar structures joined as one body or organ

Connective. The filament or tissue connecting the two cells of an anther, particularly when the cells are separated

Connivent Coming together or converging, but not organically connected

Conoidal. Cone-like, nearly conical.

Convolute Said of floral envelopes in the bud when one edge overlaps the next part or petal or sepal or lobe while the other edge or margin is overlapped by a preceding part, rolled up

Cordate Heart-shaped, with a sinus and rounded lobes at the base and ovate in general outline

Cork The name applied to the outer impervious mostly not-living part of the bark Most bark develops a corky exterior, and in some cases it becomes very prominent In *Evonymous Thunbergianus*, the English maple, the corky barked elm, and other trees and shrubs, it forms wings on the branches The cork of commerce comes from the bark of *Quercus Ilex* (better known as *Q Suber*), plantations of which grow in south-western Europe The cork tree of the catalogues, *Phellodendron amurense*, is a curious tree, cultivated for ornament

Corm A solid bulb-like part, usually subterranean, as the "bulb" of crocus and gladiolus

Cormel A corm arising from a mother-corm

Cormlet Aerial corm, or one borne in the inflorescence or in the leaf axils

Cormous With corms, or pertaining to corms.

Corneous Horny, hard and very dense in texture

Corniculate Bearing or terminating in a small horn-like protuberance or process

Corolla Inner circle of floral envelopes, if the parts are separate, they are petals, if not separate, they are teeth, lobes or divisions

Corona Crown, coronet, any appendage or intrusion that stands between the corolla and stamens, or on the corolla, as the cup of a daffodil, or that is the outgrowth of the staminal part or circle, as in the milk-weeds

Coroniform Crown-formed or crown-like, corona-like

Corticate Having a cortex or hard bark, also having a rind, as the lemon and orange

Corymb Short and broad, more or less flat-topped indeterminate flower-cluster

Corymbose inflorescence Outer flowers opening first

Costa A rib, in particular a strong rib or line, as a midrib or mid-nerve

Costate Ribbed

Cotyledon Seed-leaf, the primary leaf or leaves in the embryo, in some plants the cotyledon always remains in the seed-coats and in others (as bean) it emerges on germination

Craterform Deep saucer-shaped, cup-shaped.

Creeper A trailing shoot that takes root in the ground throughout its length

Crenate Shallowly round-toothed or obtusely toothed.

Crenulate Finely or shallowly crenate

Crested With elevated and irregular or toothed ridge.

Cribrose Sieve-like, with numerous small apertures

Crop Produce of tilled, cared-for or protected plants.

Croppage The whole subject of the producing of crops

Cross The offspring of any two flowers that have been fertilized A cross-breed is a cross between varieties of the same species Synonyms are half-breed, mongrel, variety-hybrid Crossing is the operation of cross-pollinating Cross-pollination is the transfer of the pollen of one flower to the pistil of another

Cross-fertilization Fertilization or fecundation secured by pollen from another flower

Cross-pollination Transfer of pollen from flower to flower.

Crown. Corona; also that part of the stem at the surface of the ground, also a part of a rhizome with a large bud, suitable for use in propagation.

Cruciate Cross-shaped or cross-like

Crustaceous. Said of bodies or coverings that are hard and brittle.

Cryptogam. Flowerless plant, as fern, moss, fungus, seaweed, less used than formerly as a technical term.

Cryptos In Greek compounds, signifying *concealed.*

Culm The stem of sedges and grasses, and similar plants.

Cuneate. Wedge-shaped, triangular, with the narrow end at point of attachment, as of leaves or petals

Cupular. Cup-like or cup-shaped, the acorn nut sits in a cupule or little cup (whence the name Cupuliferæ).

Cuticle The external rind or skin of a plant or part; usually applied to the thin waterproof membrane overlying the epidermis

Cutting A severed vegetative or asexual part of a plant used in propagation, as a cutting of root, of stem, or of leaf.

Cyathiform Cup-shaped.

Cymbiform Boat-shaped.

Cyme A broad, more or less flat-topped determinate flower-cluster

Cymose inflorescence With central flowers opening first

Cypsela An old term for the fruit of composites, being dry, one-celled and one-seeded.

Deciduous Falling, as the leaves of non-evergreen trees.

Decompound More than once compound

Decumbent Reclining or lying on the ground, but with the end ascending

Decurrent Running down the stem, as the leaf of mullein

Decussate Opposite leaves in four rows up and down the stem, alternating in pairs at right angles

Definite Said of a constant or known number, not exceeding twenty, contrasted with indefinite, above twenty, when the parts are usually not counted in systematic descriptions

Deflexed Turned downward abruptly.

Defoliation The casting or falling of the leaves

Dehiscence The method or process of opening of a seed-pod or anther

Deliquescent Trunk or leader lost in the branches; said of tree-top without a leader

Deltoid Triangular, delta-like

Dendroid Said of tree-shaped small plants

Dendron In Greek compounds, signifying a *tree*

Dentate With sharp spreading teeth

Depauperate Applied to a plant or part that is less perfectly developed than usual or normal, also said of very small members of a genus or family

Depressed More or less flattened endwise or from above.

Descending The direction gradually downwards

Determinate Definite cessation of growth at the apex or in the main axis

Di-, Dis.- In Greek combinations, signifying *two* or *twice* as diphyllus, *two-leaved*

Diadelphous In two groups, as the stamens of some Leguminosæ, joined by their filaments.

Diandrous With two stamens

Diaphanous Transparent or translucent.

Dicarpellous Comprised of two carpels

Dichlamydeous Provided with both calyx and corolla.

Dichogamy Stamens and pistils maturing at different times

Diclinous Imperfect, having either stamens or pistils but not both, unisexual See *Monoclinous*

Dicoccous Separating into two cocci

Dicotyledonous With two cotyledons

Didynamous. With four stamens in two pairs of different length

Diffuse Loosely branching or spreading; of open growth

Digitate Hand-like, compound with the members arising from one point.

Dimerous The parts in twos.

Dioecious Staminate and pistillate flowers on different plants.

Dipterous. Two-winged.

Dipyrenous Having two stones or pyrenes.

Disciform Flattish and circular like a discus.

Discoid Disk-like, in particular, said of a head of Compositæ without ray-flowers.

Disk, disc. A more or less fleshy or elevated development of the receptacle about the pistil, receptacle in the head of Compositæ
Disk-flowers The tubular flowers in the center of heads of Compositæ, as distinguished from the ray-flowers.
Dissected Divided into many slender segments.
Dissepiment A partition, particularly in an ovary or fruit.
Distinct Separate, not united with parts in the same series
Divided Separated to the base
Division Propagation by means of separating the root system or rhizome system into parts, cutting up the plant into several root-bearing parts or pieces, as when one rhubarb plant is made into two or more.
Dorsal Back, relating to the back or outer surface of a part or organ
Dorsiferous Bearing anything on the back.
Dorsifixed Attached by the back
Dorsoventral Literally, back-front, placed with reference to the back or front or to both
Double Said of flowers that have more than the usual number of floral envelopes, particularly of petals, full
Downy Covered with very short and weak soft hairs
Drupe A fleshy one-seeded indehiscent fruit, with seed inclosed in a stony endocarp, stone-fruit
Drupelet One drupe in a fruit made up of aggregate drupes, as in the raspberry
Dumose. Low and branching, as a bush.

E- or Ex- In Latin-formed words, usually denoting, as a prefix, that parts are missing, as exstipulate, *without stipules*, estriate, *without stripes*
Ecalcarate Without calcar or spur
Ecology Study of habits and modes of life of animals and plants
Ecostate Without ribs.
Edentate Without teeth
Effuse Loosely spreading, very diffuse.
Eglandulose Without glands
Elliptic A flat part or body that is oval and narrowed to rounded ends
Elongate Lengthened, stretched out.
Embryo The plantlet in the seed
Endocarp The inner layer or part of a pericarp.
Endogen Term applied to stems having scattered bundles, as of Indian corn, not appropriate, and now little used. See *Exogen*
Endosperm Starch or other food outside or around the embryo, albumen
Ensiform, ensate Sword-shaped, long, flat, 2-edged, nearly or quite straight, with a sharp point
Entire Margin not in any way indented, whole
Environment Surroundings, conditions in which organisms live and grow
Ephemeral Persisting for one day only, as flowers of spiderwort
Epi A Greek prefix signifying *on* or *upon*
Epicarp The outer layer or surface of the pericarp.
Epichile The upper part of the jointed lip of an orchid.
Epicotyl That part of the caulicle lying above the cotyledons
Epidermis Superficial layer of cells and underneath the cuticle
Epigeal Cotyledons rising into the air in germination.
Epigeous Close upon the ground rather than underneath.
Epigynous Borne on the ovary, used of floral parts when ovary is inferior and flower not perigynous
Epipetalous On a petal
Epiphyllous On a leaf.
Epiphyte Air-plant, a plant growing on another or on some other elevated support
Equitant. Sitting astride, used for conduplicate leaves that stand inside each other in two ranks, as in Iris.
Erostrate. Without a beak.
Essential organs Stamens and pistils
Evergreen. Remaining green throughout the year.
Exalbuminous Seeds without albumen or endosperm.
Excentric. Out of or away from the center
Excurrent. The trunk or leader continuing through the top.
Exfoliating Coming off in thin layers, as the bark of birch and other plants
Exocarp The outside part of a pericarp.
Exogen, exogenous. Growing and increasing in diameter by layers on the exterior of the woody cylinder, in distinction from endogens
Exserted Sticking out, projecting beyond, as stamens from a perianth
Exsiccated Dry or dried.
Exstipulate Without stipules
Extrorse Looking or facing outward
Eye The marked center of a flower, a bud on a tuber, as on a potato, a single-bud cutting

Facies The general appearance or "looks" of a plant, or the characteristic appearance of a plant society
Farinaceous Containing starch, or starch-like materials.
Fasciated Much flattened, an abnormal or teratological widening and flattening of the stem
Fascicle A condensed or close cluster, as of flowers.
Feminine Pistillate (in higher plants)
Fertile Said of pollen-bearing stamens and seed-bearing fruits
Fertilization Impregnation of the ovule, the act of union of sperm and egg cells, in the higher plants taking place within the ovule fecundation
Fetid Having a disagreeable odor
Fibrillose With fine fibers or threads
Fibrous Fiber-like, containing fibers or thread-like parts.
Fibro-vascular Made up of both fibers and ducts, combination of fibrous and vascular structure.
Filament Stalk of the anther
Filiform Thread-like, long and very slender.
Fimbriate Fringed
Fimbrillate Minutely fringed
Fistular Cylindrical and hollow.
Flaccid Soft, lax and weak, not rigid.
Flagelliform Whip-form, long and slender like a lash
Flagging Wilting, said particularly of newly made cuttings and recently transplanted plants
Flexuous Having a more or less zigzag or wavy form, said of stems of various kinds
Floccose With tufts or flocks of soft wool or woolly hair.
Flora The plant population of a given region, also a book describing this population
Florets Individual flowers of composites and grasses, also other very small flowers that make up a very dense form of inflorescence
Floriferous Flower-bearing
Foliaceous Leaf-like, said particularly of sepals and calyx-lobes and of bracts that in texture, size or color look like small or large leaves
-foliate In combinations, -leaved, having leaves, as trifoliate, *three-leaved*
-foliolate Having leaflets, as trifoliolate, *of three leaflets*
Follicle Dry, dehiscent pericarp opening only on the front suture
Follicular With follicles, follicle-like.
Foramen An aperture or opening
Forked Branching or divided into nearly equal parts or members
Fornicate Arched.
Free Not joined to other organs, as petals free from the stamens or calyx
Frond Leaf of fern, sometimes used in the sense of foliage.
Frosted With a more or less shining or crystallized white covering
Fructification The act or process of fruiting, also the fruiting organ or organs.
Fruit. The ripened pericarp or pericarps with the adnate parts; the seed-bearing organ.
Fruticose. Shrubby or shrub-like in the sense of being woody.

Fugacious. Falling or withering away very early.
Fumose Smoke-colored.
Function What a plant or a part does, its vital activities.
Funicle The stalk or stipe of an ovule or seed.
Funnelform With tube gradually widening upward and passing insensibly into the limb, as in many flowers of Convolvulus, infundibuliform
Furrowed With longitudinal channels or grooves
Fusiform Spindle-shaped, narrowed both ways from a swollen middle, as dahlia roots

Galea. A hood or a helmet-shaped part or structure, as found in the upper lip of some corollas
Gamete One of the sex-cells, either male or female
Gamopetalous Corolla of one piece, petals united
Gamophyllous. Leaves united
Gamosepalous Calyx of one piece, sepals united
Geminate In pairs, twin
Gemma A bud, particularly a bud or bud-like structure by which a plant propagates
Gemmiparous Bud-bearing
Gemmule A little bud or bud-like structure
Generation Period from birth (impregnation) to death, the epoch from one 1-celled stage of a plant to the next 1-celled stage
Germination The unfolding of the embryo and becoming self-established of the plantlet
Gibbosity A swelling or bulging on one side or near the base.
Glabrate Nearly glabrous, or becoming glabrous with maturity or age
Glabrous Not hairy
Gladiate Sword-shaped or sword-like
Gland Properly a secreting part or prominence or appendage, but often used in the sense of gland-like
Glandular Having or bearing secreting organs, or glands.
Glandulose, glanduliferous Gland-bearing
Glaucous Covered with a "bloom" or a whitish substance that rubs off
Glochidiate Said of parts with summit barbed
Glomerate In dense or compact cluster or clusters
Glomerule Dense head-like clusters, properly a dense cyme
Glume A small chaff-like bract, in particular, one of the two empty bracts at the base of the grass spikelet
Graft A branch or bud inserted on another plant with the intention that it shall grow there, cion
Grafting The process of inserting a cion in a plant with the intention that it shall grow there See *Budding*
Granular, granulose Covered with very small grains, minutely or finely mealy
Gymnos In Greek compounds, signifying *naked* or *not covered* as gymnosperms, *with naked seeds* (not in a pericarp) See *Angiosperm*
Gynandrous With the stamens grown on the pistil, forming one organ, as in the orchids
Gynobase Stipe or stalk of an ovary, being an extension or prolongation of the receptacle, short gynophore
Gynœcum The female or pistil-bearing part of the flower See *Andrœcum*
Gynophore. Stipe of an ovary prolonged within the calyx.

Habit The looks, appearance, general style or mode of growth, as an upright, open, decumbent or strict habit.
Habitat. Particular place in which a plant grows, as a swamp, roadside, lawn, woods, ballast-heap, hillside
Hairs A general name for many kinds of small and slender outgrowths on the parts of plants, special kinds of hairiness are designated as setose, villous, comose, pubescent, hirsute, and others.
Halberd-shaped Hastate
Hamate Hooked
Hastate. Of the shape of an arrow-head but the basal lobes pointed or narrow and standing nearly or quite at right angles, halberd-shaped.
Haulm Straw-like stems, as of the cereal grains, sometimes also applied to the stems of palms, usually a collective noun
Head A short dense spike, capitulum
Heart-shaped Cordate, ovate in general outline but with two rounded basal lobes, has reference particularly to the shape of the base of a leaf or other expanded part
Heel An enlarged or more or less transverse part on the lower end of a cutting secured from the older or larger branch from which the cutting is taken
Helicoid Twisted or coiled in snail-shell form
Heliotropism The characteristic of turning toward the light.
Hemi- In Greek compounds, signifying *half*
Hepta- In Greek compounds, signifying *seven*
Herb Naturally dying to the ground, without persistent stem above ground, lacking definite woody firm structure
Herbaceous Not woody, dying down each year, said also of soft branches before they become woody.
Hermaphrodite Bearing both stamens and pistil in the same flower, two-sexed, bisexual
Hesperidium The fruit of the orange-kind
Heterocarpous Various-fruited, with more than one kind or form of fruit
Heterogamous With two or more kinds or forms of flowers.
Heteros In Greek composition, signifying *various*, or of *more than one kind* or *form*, as heterophyllous, *with more than one kind* or *form of leaf*
Hilum In the seed, the scar or mark indicating the point of attachment
Hip Fruit of the rose, being an urn-like or closed receptacle bearing the achenes inside See *Hypanthium*
Hirsute With rather rough or coarse hairs
Hirtellous Softly or minutely hirsute or hairy
Hispid Provided with stiff or bristly hairs
Hispidulous Somewhat or minutely hispid
Hoary Covered with a close white or whitish pubescence
Homo- In Greek compounds, signifying *alike* or *very similar*
Homocarpous All the fruits, as of a flower-head, alike.
Homogamous Presenting only one kind of flowers
Homologous Related in origin or morphology. See *Analogous*
Homomorphous Uniform, all the given parts alike.
Horny Hard and dense in texture, corneous
Hybrid A plant resulting from a cross between two or more parents that are more or less unlike
Hygroscopic Capable of absorbing moisture from atmosphere
Hypanthium A fruit-like body (as the rose-hip) formed by the enlargement of the torus and bearing the proper fruits on its upper or inner surface, literally "beneath the flower" Now commonly used to denote the cup-shaped receptacle on which calyx, petals and stamens are inserted in cases of perigyny, as in plum, fuchsia
Hypochil The lower or basal part of the lip in orchids
Hypocotyl That part of the caulicle lying below the cotyledons
Hypocrateriform Salver-form, that shape of the flower characterized by a cylindrical tube and a flat-spreading limb, as in phlox
Hypogeal Cotyledons remaining beneath the ground in germination
Hypogynous Borne on the torus, or under the ovary; said of the stamens or petals

Immarginate Without a rim or edge.
Immersed Entirely under water.
Imparipinnate Unequally pinnate, odd-pinnate, with a single terminal leaflet
Imperfect flower. Having either stamens or pistils, but not both.
Implexed, implexuous. Entangled, interlaced
Impregnation Fecundation or fertilization of the ovule by the pollen, also, the infiltration of substances

Impressed. Deeply nerved, furrowed or grooved as if by pressure

Inarching The grafting together of two plants with the intention that, when they are severed, part of one plant will be growing on the other

Incanescent Hoary- or gray-pubescent, canescent

Incised. Cut, slashed irregularly, more or less deeply and sharply.

Inclining. Looking or falling down from the horizontal.

Included. Not protruded, as stamens not projecting from the corolla.

Incomplete Lacking some of its parts, as a flower deficient in stamens or calyx

Incrustate Crusted, with a hard or firm covering

Incumbent (*cotyledons*) Of a seed so bent over that the back of one cotyledon lies against the radicle

Indefinite Very numerous, as above twenty, see *Definite*

Indehiscent Not regularly opening, as a seed-pod or anther

Indeterminate Growing on from the apex, particularly of the main axis

Indigenous Native to the region, not introduced from some other country

Indumentum A covering of hair

Induplicate With margins folded inward.

Indurated Hard, hardened

Indusium The little growth covering or surrounding the sorus or fruit-dot in ferns

Inferior Beneath, lower, below, as an inferior ovary, one that is below the calyx-leaves

Inflated Blown up, bladdery

Inflorescence Mode of flower-bearing, technically less correct but much more common in the sense of a flower-cluster

Infra- In combinations, signifying *below.*

Infundibuliform Funnelform

Innate Said of an anther when attached by its base to the filament

Innovation An off-shoot or departure from the axis

Inserted Attached, as a stamen growing on the corolla

Inter- In composition, signifying *between,* particularly between closely related parts or organs

Interfoliaceous Between the leaves, particularly between two leaves of a pair

Internode The part or space of stem between two nodes or joints.

Interrupted Not continuous, in particular, the interposition of small leaflets or segments between others

Intorted Twisted upon or around itself

Intramarginal. Just within the margin or edge, between the margins

Introduced Brought from another region, either intentionally or otherwise, in horticulture, used to designate the intentional bringing of plants into cultivation either from another country or from the wild

Introrse Turned or faced inward or toward the axis, as an anther looking toward the center of the flower.

Inverted Turned over, end-for-end, top-side down.

Involucel A secondary involucre, small involucre about the parts of a cluster

Involucre A whorl of small leaves or bracts standing close underneath a flower or flower-cluster.

Involute Said of a flat body (as a leaf) rolled inward or toward the upper side See *Revolute*

Irregular flower Some parts different from other parts in same series.

Jointed. With nodes, or points of real or apparent articulation.

Keeled Ridged like the bottom of a boat, also the two front united petals of a papilionaceous flower

Knaur. An excrescence, bur or knot of woody tissue that will grow when removed and used as a cutting.

Labellum. Lip, particularly the lip of orchids.

Labiate. Lipped; a member of the Labiatæ.

Labyrinthiform With intricate winding lines or passages.

Lacerate Torn, irregularly cleft or cut

Lacinate Slashed into narrow pointed lobes

Lactescent Containing milk or a milk-like substance

Lacunose Having holes or empty places, particularly in the anatomical structure

Lamella A thin flat plate or part

Lamina. The blade of a leaf or petal or other expanded part or body

Lanceolate. Lance-shaped, much longer than broad; widening above the base and tapering to the apex

Lapidose Found in stony places

Lateral On or at the side

Layer A branch that takes root and gives rise to an independent plant

Leaflet One part of a compound leaf, secondary leaf.

Leaf-stalk The stem of a leaf, petiole, foot-stalk

Legume Simple pericarp dehiscing on both sutures, pod.

Lemma In grasses, the flowering glume,—the lower of the two bracts immediately inclosing the flower

Lenticular Lentil-shaped, lens-shaped

Lepals Sterile stamens, particularly those nectaries or scales representing stamens, term little used

Lepidote Surfaced with small scurfy scales

Liana, liane A woody twining or climbing plant entangling a tropical forest.

Life-history The sum of the events in the life of a plant

Ligneous Woody

Ligule A strap-shaped organ or body, particularly, a strap-shaped corolla, as in the ray-flowers of composites, also a projection from the top of the sheath in grasses and similar plants

Limb The expanded flat part of an organ, in particular, the expanding part of a gamopetalous corolla

Limbate Surrounded by an edging of another color; margined with color, also, provided with a limb.

Line One-twelfth of an inch

Linear Long and narrow, the sides parallel or nearly so.

Lineate Lined, bearing thin parallel lines

Linguiform Shaped like a lingula, or with a projecting tongue-like part or process

Lip One of the parts in an unequally divided corolla or calyx, these parts are usually two, the upper lip and the lower lip, although one lip is sometimes wanting; the upper lip of orchids is by a twist of the stipe made to appear as the lower, a labium

Lobe Any part or segment of an organ, specifically a part of petal or calyx or leaf that represents a division to about the middle.

Lobule A small lobe.

Locule Compartment or cell of a pistil or anther

Loculicidal Dehiscence between the partitions into the cavity

Lodicule A small scale in a grass flower, between the lemma and stamens

Loment A legume with constrictions or articulations.

Lorate Strap-shaped

Lyrate. Pinnatifid but with an enlarged terminal lobe and smaller lower lobes

Medullary Relating to the pith, the medullary rays seen in cross-sections of woody trunks radiate from the medulla or pith.

Meniscoidal. Like a meniscus or disk, with the form of a watch-crystal

Mericarp The peculiar seed-like fruit of the Umbelliferæ.

-merous In composition, referring to the numbers of parts, as flowers 5-merous, in which the parts of each kind or series are five or in fives.

Mesocarp Middle layer or part of a pericarp; the part between the endocarp and exocarp

Mesochil The intermediate or middle part of the lip of orchids when the lip is separated into three parts.

Micropyle. The opening through which impregnation takes place; the point on the seed marking the orifice of the ovule.

Midrib. The main rib of a leaf or leaf-like part.
Mitriform Mitre shaped, or like a cap.
Monadelphous. Stamens united in one group by their filaments as in many Leguminosæ
Moniliform Suggesting a string of beads
Mono- In Greek compounds, signifying *one.*
Monoclinous Hermaphrodite, perfect, the two sexes in the same flower See *Diclinous*
Monocotyledonous. With a single cotyledon.
Monœcious Staminate and pistillate flowers on the same plant
Monogynous With only one style
Monopetalous One-petaled, all the petals united to form one body or organ, as a gamopetalous corolla
Monopodial Axial direction continued by growth from terminal bud or persistance of the leader.
Monostichous In one row
Monstrosity Deformity, any unusual or non-typical kind of development
Morphology The science or subject that treats of forms or of the transformations of organs
Mucose With a slimy covering or secretion.
Mucro A short and sharp abrupt tip
Mule An old word for a cross, particularly between different species, hybrid, cross-breed
Multifid Cut or cleft into many narrow lobes or parts.
Multiple Of several or many distinct parts
Multiple fruit The united product (in one body) of several or many flowers
Multiseptate With many divisions or chambers, as some nuts
Muscariform In form of a brush or fly-brush.
Mycelium Vegetative part of a fungus, composed of threads or thready tissue

Naked flower With no floral envelopes, without calyx and corolla
Napiform Turnip-shaped, more or less short-fusiform, broader than high and abruptly tapering both ways
Navicular Boat-shaped, cymbiform
Nectariferous Nectar-bearing
Nectary A structure or organ that secretes nectar.
Nephroid Kidney-shaped, reniform
Nerve A vein or slender rib, particularly if not branched.
Netted Marked with reticulated lines or nerves that project somewhat above the surface
Neuter, neutral Neither stamens nor pistils, sexless
Nidulate Nested, as if like or borne in a nidus or nest
Node A joint where a leaf is borne or may be borne, also incorrectly the space between two joints, which is properly an internode
Nucleus The kernel of a seed, the central denser structure of a cell
Nucule A small nutlet, any hard seed-like fruit or part
Nut An indehiscent 1-celled and 1-seeded hard and bony fruit, even if resulting from a compound ovary.
Nutlet A small or diminutive nut, nucule

Ob- A Latin syllable, usually signifying inversion
Obconical Inversely conical, cone attached at the small point
Oblanceolate Inversely lanceolate, with the broadest part of a lanceolate body away from the point of attachment
Oblique Slanting, unequal-sided
Oblong Longer than broad, and with the sides nearly or quite parallel most of their length
Obovate Inverted ovate
Obovoid An ovoid body attached at the smaller end
Obsolescent Nearly obsolete, becoming rudimentary.
Obsolete Not evident or apparent, rudimentary.
Obtuse Blunt, rounded
Ocellated Eyed, a circular spot of one color inside a larger spot or area of another color
Ochraceous Ochre-yellow, gradually changing to brown.
Ocrea. A boot-shaped or tubular stipule, as in Polygonum.
Oculus. An eye, a leaf-bud when used as a cutting
Offset A plant arising close to the base of mother plant.
Oleaginous Fleshy and oily
Oligos In Greek compounds, signifying *few.*
Opaque Dull, not translucent or shining
Operculum A lid, as of a circumscissile capsule.
Orthos In Greek compounds, signifying *straight.*
Orthotropous (ovule or seed) An erect straight seed, with the micropyle at the apex and hilum at the base.
Osseous Bony, hard, brittle, of very close texture.
Ovary Ovule-bearing part of a pistil
Ovate With an outline like that of hen's egg cut in two lengthwise, the broader end downward.
Ovoid A solid that is oval in outline.
Ovule The body which, after fertilization, becomes the seed.
Ovuliferous. Ovule-bearing

Painted Said of colors that are in streaks of unequal brilliancy
Palate In personate corollas, a rounded projection or prominence of the lower lip, closing the throat or very nearly so
Palea, pale In the grass flower, the upper of the two inclosing bracts, the lower one being the lemma
Palmate Lobed or divided in a palm-like or hand-like fashion
Palmatifid Cut about half way down in a palmate form.
Panicle A branching raceme, flower-cluster in which the branches are racemose, the flowers being pedicellate.
Papilionaceous corolla Butterfly-like, pea-like flower, with a standard, wings, and keel
Pappiform Pappus-like
Pappus Peculiar calyx-limb of composites, being plumose, bristle-like, scales, or otherwise
Parasite Growing and living on or in another organism.
Parietal Borne on the paries or wall (inner surface) of a capsule
Parted Cleft or cut not quite to the base
Parthenogenetic Seed developing without fertilization or fecundation
Partial Of secondary importance or rank.
Partite Divided very nearly to the base.
Partitioned Divided in compartments or chambers by internal horizontal partitions
Pathological Diseased
Pedicel Stem of one flower in a cluster.
Peduncle Stem of a flower-cluster or of a solitary flower.
Pellucid Clear, transparent, that can nearly be seen through
Peltate Attached to its stalk inside the margin, peltate leaves are usually shield-shaped
Penninerved Nerves arising along the length of a central midrib
Pentamerous In fives
Pepo Fruit of pumpkin, squash, and the like
Perennial Of three or more seasons' duration
Perfect flower One that has both stamens and pistil.
Perfoliate The stem apparently passing through the part, as a leaf, united around the stem
Pergamenous, pergamentaceous Texture of parchment.
Peri- In Greek compounds, signifying *around*
Perianth The floral envelope considered together; commonly used for flowers in which there is usually no clear distinction between calyx and corolla, as the lilies
Pericarp The ripened ovary
Perigynium. The sac or utricle that incloses the ovary or achene in Carex, it is sometimes inflated
Perigynous Borne around the ovary and not beneath it, as when calyx, corolla and stamens are borne on the edge of a cup-shaped hypanthium, such cases are said to exhibit perigyny
Persistent Remaining attached, not falling off
Personate Said of a two-lipped corolla the throat of which is closed by a palate, as in toad-flax.
Petal One of the separate leaves of a corolla.
Petaloid Petal-like, of color and shape resembling a petal.
Petiole Leaf-stalk.

Petiolule. Stalk of a leaflet.
Phalanges (plural of *phalanx*) The groups or bundles of stamens in diadelphous or polyadelphous flowers.
Phenogam, phenogamous Flowering plants, seed-bearing plants (as distinguished from spore-bearing, or cryptogams).
Phyllodium. Leaf-like petiole and no blade, as in some acacias and other plants
Phyllotaxy. Order of arrangement of leaves on the stem.
Phytology The study of plants, particularly of the kinds or species, botany
Pileate, pileiform With the form of a pileus or rimless cap, in particular, pertaining to the cap of a mushroom.
Pinna. A primary division or leaflet of a pinnate leaf.
Pinnate Feather-formed, with the leaflets of a compound leaf placed on either side of the rachis
Pinnatifid Cleft or parted in a pinnate (rather than palmate) way
Pinnatipartite Pinnately-parted
Pinnatisect. Cut down to the midrib in a pinnate way.
Pinnule A secondary pinna or leaflet in a pinnately decompound leaf
Pip A perpendicular or upright small rootstock used in propagation, as of lily-of-the-valley.
Pisiform Pea-shaped, pea-like
Pistil The ovule-bearing and seed-bearing organ.
Pistillate. Having pistils and no stamens, female
Pitted Having little depressions or cavities
Placenta Part or place in the ovary where ovules are attached.
Plaited Folded lengthwise, as a closed fan
Plane Evenly flat, rather than wrinkled, folded, grooved or otherwise
Platys. In Greek combinations, signifying *broad* or *wide.*
Plumose Plumy, feather-like, with fine hairs, as the pappus of some composites.
Plumule The bud in the embryo
Plur-annual Of one season's duration only because killed by frost
Pod A dehiscent dry pericarp
Pollen Spores or grains borne by the anther, containing the male element, sometimes it is not granular
Pollination The mechanical or physical operation of transfering pollen from stamen to pistil.
Polliniferous Bearing-pollen.
Pollinium A coherent mass of pollen, as in orchids and milkweeds
Poly- In Greek combinations, signifying *numerous* or *many.*
Polyadelphous The stamens in many bundles or fascicles.
Polygamous Bearing imperfect and hermaphrodite flowers on the same plant
Polymerous Of many parts or series
Pome Fruit of apple, pear, quince, etc.
Porose With small holes, pores or perforations.
Posterior At or toward the back, opposite the front; toward the axis, away from the subtending bract
Præfoliation Arrangement of leaves in the bud, vernation.
Præmorse, Jagged, as if bitten off.
Prickle A small and weak spine-like body borne irregularly on the bark or epidermis
Prismatic. Prism-shaped, with plane sides separated by angles, body of nearly uniform size throughout, and with similar end-sections
Process An extension of any surface or part beyond the main outline
Procumbent Trailing or lying flat, but not rooting.
Proliferous Bearing offshoots or redundant parts; bearing other similar structures on itself
Proterandrous. Anthers maturing before pistils
Proterogynous Pistils maturing before anthers
Pseud-annual Perennial by means of bulbs, corms, or tubers
Pseudo-. In Greek compounds, signifying *spurious* or *false.*
Pseudobulb The thickened or bulb-form stems of certain orchids, the part being solid and borne above ground.
Puberulent. Somewhat or minutely pubescent.
Pubescent Covered with short, soft hairs; downy.
Pulverulent. Powdered or dusty
Pulvinate. Cushioned, with a cushion-like enlargement or structure, as at the base of some petioles or leaflets
Punctate With translucent or colored dots or depressions or pits
Pungent Ending in a stiff sharp point or tip, also acrid (to the taste)
Putamen The hard or bony shell of a nut or of a stone-fruit
Pyrene, pyrena Nutlet, particularly the nutlet in a drupe.
Pyriform Pear-formed or -shaped
Pyxis Pod opening or dehiscing by a transverse ring

Quadrangular Four-angled
Quaternate In fours
Quincunx Five plants in a square, one of them being in the center
Quintupled. Five times, multiplied by five.

Raceme A simple elongated indeterminate cluster with stalked flowers
Rachilla, rhachilla A diminutive or secondary axis, or rachis, in particular, in the grasses and sedges the axis that bears the florets
Rachis Axis bearing flowers or leaflets, petiole of a fern frond (plural *rachides* or *rachises*)
Radiate Standing on and spreading from a common center, also, with ray-flowers, as in the Compositæ.
Radical Belonging or pertaining to the root
Radicle The inferior or downward part of the embryo below the cotyledons, caudicle
Radix Root
Rameal Pertaining to a branch or branches.
Ramenta Chaffy loose scales borne on leaves and stems, as on the stems of ferns
Ramification The mode or style of branching of a plant.
Raphe, rhaphe The cord or ridge of fibro-vascular tissue connecting the hilum and chalaza on a seed (when the hilum and chalaza are separated)
Ray Outer modified florets of some composites, with an extended or strap-like part to the corolla, also the branches of an umbel or umbel-like cluster
Receptacle Torus, the more or less enlarged or elongated end of the stem or flower-axis on which some or all of the flower-parts are borne, sometimes the receptacle is greatly expanded, as in the Compositæ, sometimes it assumes capsule-like forms, as in the hypanthium of the rose
Reclinate, reclining Bent down or falling back from the perpendicular
Recondite Concealed, difficult to make out, not easily recognized
Recurved Bent or curved downward or backward
Reflexed Abruptly recurved or bent downward or backward
Regular flower With the parts in each series or set alike, as stamens all like each other, petals all like each other.
Reinforced fruit With other parts grown to the pericarp.
Remote Separated by spaces longer than common.
Reniform Kidney-shaped
Repent Creeping, rooting at the joints.
Resupinate Upside down, turned over.
Retrorse Bent or turned over back or downward.
Revolute Rolled backward, margin rolled toward lower side See *Involute*
Rhachis See *Rachis.*
Rhaphe See *Raphe.*
Rhizome Underground stem; rootstock.
Rhizos. In Greek compounds, signifying *root.*
Rib In a leaf or similar organ, the primary vein; also any prominent vein or nerve
Rimose. With cracks or chinks.
Ringent. Gaping; said of labiate flowers with an open throat or mouth.
Rootstock Subterranean stem; rhizome.

Rostellum. A little beak; particularly a projection above the stigma in the orchid flower.
Rosula A rosette, or dense more or less flat imbricated cluster of leaves
Rosulate In a rosula or rosette.
Rotate. Wheel-shaped, with short or obsolete tube and a flat and circular limb
Rotund Nearly circular, orbicular, inclining to be oblong.
Rudimentary Incomplete, very little developed
Ruminated Chewed, particularly applied to wrinkled albumen in seeds that are irregularly channeled or pierced, as in nutmeg and in annona fruits
Runcinate Said of sharply lobed or cut leaves that have the segments directed backward
Runner. A slender trailing shoot taking root at the nodes.

Sabulose Growing in or pertaining to sandy places
Sagittate. Like an arrowhead in form, triangular with the basal lobes pointing downward
Salver-shaped With a slender tube and an abruptly expanded flat limb, as that of the phlox, hypocrateriform.
Samara Indehiscent winged pericarp, as of the maple
Sap The watery contents of a plant, an indefinite and undescriptive term little used by botanists.
Sapid With a pleasant or savory taste
Scabrous Rough, feeling roughish or gritty to the touch
Scale A name given to many kinds of small mostly dry and appressed leaves or bracts, a vestige
Scape Leafless peduncle arising from the ground; it may bear scales or bracts but no foliage-leaves, and may be one- or many-flowered
Scarious Leaf-like parts or bracts that are not green, but thin, dry, and membranaceous, often more or less translucent
Scion See *Cion*
Sclereid Of a hard texture
Scorpoid Said of a cluster in which the flowers are 2-ranked and borne alternately at the right and the left
Seed The ripened ovule, the essential part is the embryo, and this is contained within integuments
Seedling A young plant raised from seed, a plant direct from seed without the intervention of grafting of any kind
Segment One of the parts of a leaf, petal, calyx or perianth that is divided but not truly compound
Self-fertilization Secured by pollen from same flower, close-fertilization
Self-pollination Transfer of pollen from stamen to pistil of same flower, close-pollination
Sepal One of the separate leaves of a calyx.
Separation Multiplication of plants by means of naturally detachable asexual bodies or organs, as offsets, stolons
Septate Partitioned, divided by partitions
Septicidal Dehiscence along or in the partitions, not directly into the locule
Septum A partition
Sessile Not stalked, sitting.
Set Applied loosely to vegetative parts used in propagation, as to offsets, layers, root-cuttings
Seta A bristle
Setiform Bristle-shaped.
Sheath. Any long or more or less tubular structure surrounding an organ or part.
Shoot. A new plant from the root of the old plant; also any growing twig or axis
Shrub A woody plant that remains low and produces shoots or trunks from the base
Silicle The short fruit of certain Cruciferæ
Silique The long fruit of certain Cruciferæ
Silky A condition produced by a covering of soft appressed fine hairs, sericeus.
Silvery. With a whitish metallic more or less shining luster.
Simple pistil Of one carpel
Sinus The space or recess between two lobes of a leaf or other expanded organ.
Slip A softwood cutting "slipped" off or pulled off; applied also to similar parts cut off.
Smooth Said of surfaces that have no hairiness, roughness or pubescence, particularly of those not rough
Solitary. Borne singly or alone.
Sorus. A heap or cluster. The fruit-dots or -cluster of ferns (plural *sori*)
Spadix A thick or fleshy spike of certain plants, as the Araceæ, surrounded or subtended by a spathe.
Span. Nine inches, distance from tip of thumb to tip of little finger when the hand is spread out
Spathe The bract or leaf surrounding or subtending a flower-cluster or a spadix, it is sometimes colored and flower-like, as in the calla
Spawn The dried mycelium of mushrooms used in propagation
Spheroidal A solid that is nearly spherical
Spiciform Spike-form
Spiculate With a small, fleshy and erect point
Spike Compact, more or less simple indeterminate, mostly elongated cluster, with flowers sessile or nearly so
Spikelet A secondary spike, one part of a compound spike, particularly, one of the ultimate clusters in gresses
Spine A strong and sharp-pointed woody body mostly arising from the wood of the stem.
Spinescent More or less spiny.
Spinule A little or weak spine
Spontaneous Said of plants that have escaped from cultivation, but that do not permanently persist
Sporangium A spore-case, a sac or body bearing spores
Spore A simple reproductive body, usually composed of a single detached cell, and containing no embryo
Sporocarp A receptacle containing sporangia or spores.
Sporophyll A spore-bearing leaf
Spreading Standing outward or horizontally
Spur A tubular or sac-like projection from a blossom, as of a petal or sepal, it usually secretes nectar.
Squama A scale
Squamella Very small squama or scale.
Stachys In Greek compounds, signifying a *spike.*
Stalk The stem of any organ, as the petiole, peduncle, pedicel, filament, stipe
Stamen The pollen-bearing or "male" organ
Staminate Having stamens and no pistils, male
Staminode, staminodium A sterile stamen, or a structure resembling such and borne in the staminal part of the flower, in some flowers (as in Canna) staminodia are petal-like and showy
Standard The upper and broad more or less erect petal of a papilionaceous flower
Stem The main axis of a plant, leaf-bearing and flower-bearing as distinguished from the root-bearing axis
Sterile flower Without pistils
Stigma The part of the pistil that receives the pollen.
Stigmatic Pertaining to the stigma
Stipe The stalk of a pistil or other small organ, also the petiole of a fern-leaf
Stipel Stipule of a leaflet
Stipule A basal appendage of a petiole; the three parts of a complete leaf are blade, petiole, stipules (usually 2).
Stock The part on which the cion is grafted, the strain or parentage
Stolon. A shoot that bends to the ground and takes root, more commonly, a horizontal stem at or below surface of the ground that gives rise to a new plant at its tip
Stone. The "pit" or putamen of a stone fruit.
Stool A clump of roots or rootstock that may be used in propagation, also an established low plant from which layers are taken
Stratification The operation or method of burying seeds to keep them fresh and to soften their integuments, or to expose them without injury to frost, that they may be more readily and successfully used in propagation.
Strict Straight and upright, little if any branched, often rigid.
Strobile Cone.
Strophiole. An appendage or protuberance at the hilum.

Style. More or less elongated part of the pistil between the ovary and stigma.
Stylopodium. Style-foot; an expansion at the base of a style, as in flowers of the Umbelliferæ.
Sub-. As a prefix, usually signifying *somewhat, slightly* or *rather.*
Subacute Somewhat or partially acute.
Subcoriaceous. Somewhat or approaching leathery in texture.
Sublignous Partially or somewhat woody.
Subterete Somewhat or imperfectly terete.
Succulent Juicy, fleshy, soft and thickened in texture.
Sucker A shoot arising from the roots or beneath the surface of the ground.
Suffrutescent. Partially or slightly shrubby.
Suffruticose. Pertaining to a low and somewhat woody plant, diminutively shrubby or fruticose, woody at base.
Sulcate. Grooved or furrowed lengthwise
Superior Said of an ovary that is free from the calyx
Supernumerary Said of buds when there is more than one in an axil
Suspended Hanging from the top, as an ovule attached in the top of the locule
Suture A line or mark of splitting open; a groove marking a natural division or union, the groove lengthwise a plum or similar fruit
Symmetrical Said of a flower that has the same number of parts in each series or circle, as five stamens, five petals.
Symphysis. Growing together, coalescence
Sympodial Axial growth continued by successive lateral shoots instead of by terminal bud
Syncarpium A fruit consisting of many cohering or consolidated carpels
Syncarpous Having carpels united See *Apocarpus*
Syngenesious. Anthers united in a ring, as in Compositæ.

Tapering Gradually becoming smaller or diminishing in diameter or width toward one end
Tap-root A strong nearly or quite perpendicular main root that carries the plant axis straight into the ground, all the other roots being secondary to it, rather than branching equally or diversely at the crown
Taxonomy Classification of species
Tendril A rotating or twisting thread-like process or extension by which a plant grasps an object and clings to it for support, morphologically it may be stem or leaf.
Teratology The subject of monstrosities, or of abnormal and aberrant forms and malformations
Terete. Circular in transverse section, imperfectly cylindrical because the object may taper both ways.
Terminology The subject dealing with names
Ternate. In threes
Testa The outer seed-coat, particularly when bony, hard or brittle
Tetradynamous Six stamens, four being long and two short.
Tetragonal Four-angled
Thallus A flat leaf-like organ, in some cryptogams, the entire cellular plant body without differentiation as to stem and foliage
Throat The opening or orifice into a gamopetalous corolla, or perianth, the place where the limb joins the tube.
Thyrse, thyrsus. Compact and more or less compound panicle, more correctly a panicle-like cluster with main axis indeterminate and other parts determinate.
Tip The plant arising at the end of a stolon, as in the black raspberry
Tomentose. With tomentum, densely woolly or pubescent; with matted soft wool-like hairiness.
Tomentulose Somewhat or delicately tomentose.
Tortuous Twisted, with irregular bending and twining.
Torus. Receptacle.
Tree. A woody plant that produces one main trunk and a more or less distinct and elevated head.
Tri- Three or three times.
Tricarpous. Of three carpels or fruits.
Trichome. A hair, particularly one that is strong or stiff.
Tricostate. With three ribs.
Trifid. Separated about halfway down into three parts.
Trifoliate. Of three leaves.
Trifoliolate. Of three leaflets.
Trigonous. Three-angled.
Trimerous. In threes
Trimorphous In three forms; as three lengths of stamens.
Tripinnate. Three times pinnate.
Trisected In three deeply cut parts
Triternate Three times three, the leaflets or segments of a twice ternate leaf again in three parts
Truncate Appearing as if cut off at the end, the end nearly or quite straight across.
Tuber. A short congested part, usually defined as subterranean (as of a rootstock), although this is not essential.
Tubercle A small tuber, or rounded protruding body.
Tuberiferous Tuber-bearing
Tuberous With or resembling a tuber or tubers.
Tumid Swollen
Tunicated Provided with concentric or enwrapping coats or layers, as bulb of onion
Turgid Swollen from fullness.

Umbel Corymbose or indeterminate cluster with branches or rays arising from a common point and about equal in length, resembling framework of umbrella, umbels are characteristic of the Umbelliferæ.
Umbellate Umbelled, with umbels, pertaining to umbels.
Umbellet Secondary umbel.
Umbellule. Umbellet.
Uni- One
Unisexual. Of one sex, staminate or pistillate only.
Utricle A small bladder, a bladdery 1-seeded fruit.

Valvate Opening by valves or pertaining to valves; meeting by the edges without overlapping, as leaves or petals in the bud
Valve A separable part of a pod, the units or pieces into which a capsule splits or divides in dehiscing
Vascular With vessels or ducts, or relating to them.
Vein A branch of the evident woody framework of a leaf or similar organ, secondary member of the fibro-vascular structure
Veinlet A small or slender vein, nerve
Venation Veining, arrangement or disposition of veins.
Ventral Front, relating to the anterior or inner face or part of an organ, opposite the back or dorsal part.
Vernation The disposition or arrangement of leaves in the bud
Versatile Hung or attached near the middle and usually moving freely, as an anther attached crosswise on the apex of filament and capable of turning.
Vertical A whorl
Vesicle A little bladder or bladder-like cavity
Vexillary Pertaining to the vexillum, standard or banner of a papilionaceous flower
Villous. Provided with long and soft, not matted, hairs; shaggy
Vitta. An oil-tube, as in the fruits of Umbelliferæ.
Vittate With vittæ, also striped lengthwise.
Volute. Rolled up.

Watersprout. A strong rapid-growing adventitious shoot in a tree-top or bush or on a trunk.
Whorl. Three or more leaves or flowers at one node, in a circle.
Wing. A thin dry or membranous expansion or flat extension or appendage of an organ; also the lateral petal of a papilionaceous flower.
Woolly. Provided with long, soft and more or less matted hairs; like wool, lanate.
Wort. Old word for a plant or herb, now used only in combination, as *motherwort, spiderwort, liverwort.*



V. Anemone coronaria, an old garden favorite.

A

ABACÁ, or Manila hemp, is the fiber of *Musa textilis,* a native of the Philippine Islands, where it is grown for commerce The plant is like the banana in general habit of growth, although it is seed-bearing It is propagated by seeds or suckers or root-cuttings When two to five years old it is at maturity, reaching a height of 6 to 15 feet and a diameter of trunk of 6 to 15 inches. The fiber is derived from the thick sheathing leaf-stems, the stems being cut between the flowering and fruiting stages After seed-bearing, the top or "plant" dies and new suckers or shoots spring from the roots The first stalks may be cut as early as twenty months after planting, and the plantation is cut over about once in eight months until it becomes unproductive, which will be fifteen to forty years New stalks continue to arise as the old ones are cut The fiber, as found in the market, is coarse and stiff and 6 to 12 feet long In the better grades it is very strong The fruit of *Musa textilis* is not edible See Cyclo Amer. Agric. II, p. 286, and I, p 126

ABÈLIA (bears the name of Dr Clark Abel, physician and author in China, d 1826) *Caprifoliàceæ* Ornamental plants, cultivated chiefly for their handsome flowers

Shrubs lvs opposite, short-petioled, small or medium-sized, entire or dentate fls in 1- to several-fld cymes, axillary or terminal on short branchlets, sometimes forming panicles at the end of the branches, sepals 2–5, conspicuous, persistent, corolla tubular or campanulate, 5-lobed, stamens 4, paired, ovary 3-celled, only 1 cell fertile, style elongated fr 1-seeded leathery achene crowned by the persistent calyx —More than 20 species in E and Cent Asia, 1 on the Himalayas and 2 in Mex For a key to all the species, see Rehder, Synopsis of the genus Abelia (in Sargent, Plantæ Wilsonianæ, I, pp 122–129) The genus is sometimes united with Linnæa

The abelias are small or medium-sized bushy shrubs with deciduous or persistent foliage and rather small but numerous flowers varying from white to pink or purple; after the flowers have fallen, the persistent usually purplish sepals are attractive. The recently introduced *A. Graebneriana* and *A Engleriana* are probably the hardiest; *A triflora, A chinensis* and *A grandiflora* are hardy as far north as Philadelphia the last-named is sometimes grown in sheltered situations as far north as Massachusetts, and, even if partly killed back, the young shoots flower profusely the same season; *A floribunda* is hardy only south of Washington, D C.

The cultivation of abelias presents no special difficulties. They do best in sunny, sheltered positions and prefer a well-drained soil enriched by peat or leaf-mold *A floribunda* is sometimes grown in pots and kept during the winter in the cool greenhouse; in this case a sandy compost of loam and peat or leaf-mold will be a suitable mixture

Propagation is usually by greenwood cuttings in summer under glass; also by cuttings of ripened wood taken in fall Seeds are not often obtainable, they are sown in spring and germinate after a month or two; the seedlings begin to bloom usually in their third year.



58. Abelia grandiflora. (×½)

A *Sepals 2*

Graebneriàna, Rehd Shrub, 4–10 ft lvs deciduous, ovate to oblong-ovate, acuminate, 1½–2 in long, remotely serrate, usually finely ciliate and hairy on midrib beneath, sometimes with scattered hairs above fls usually few at the end of short branchlets along last year's branches, sepals ½in long, oblong, corolla campanulate, 1 in long, pink with yellow throat Summer China

Engleriàna, Rehd (*Linnæa Engleriàna,* Graebn) Shrub, 3–6 ft lvs deciduous, ovate to elliptic-ovate, acute or acuminate, about 1 in long, with few small teeth fls in few-fld clusters in the axils of fascicled lvs along last year's branches, rosy purple or rosy pink, a little over ½in long Summer China —Similar to the preceding but smaller in every part, flowering more profusely and therefore handsomer Has proved hardy at the Arnold Arboretum.

AA. *Sepals varying from 2 to 5 on the same plant and often partly connate*

grandiflòra, Rehd (*A chinénsis* × *uniflòra A rupéstris,* Hort , not Lindl. *A. rupéstris* var *grandiflòra,* André *A. uniflòra,* Hort , not Turcz *Linnæa Spæthiàna* Graebn *L Perringiàna,* Graebn) Fig 58 Lvs ovate, rounded or attenuate at the base, acute, ¾–1½ in long, serrate, shining above, nearly glabrous, half-evergreen fls in terminal, loose panicles, white flushed pink, campanulate, ¾in long, stamens not exserted Of garden origin Gt 41 1366 Gn 76, p 528 J H III 8 77 —One of the hardiest and most free-flowering abelias, it flowers continuously from June to Nov

AAA. *Sepals 5*

chinénsis, R Br (*A rupéstris,* Lindl). Shrub, 3–6 ft lvs ovate, rounded at the base, ¾–1½ in long, serrate, hairy on the midrib beneath and sometimes with scattered hairs above, deciduous: fls in terminal dense panicles, funnel-form, white, ½in long, sepals oblong, ¼in long; stamens exserted Summer China B R 32 8 Gn 27, p 424 P F G 2 201 G 8 143 —*A rupestris* is sometimes considered a distinct species, but the differences are very slight

triflòra, R Br. Shrub, to 10 ft , branchlets with reflexed hairs lvs lanceolate or ovate-lanceolate, 1½–2½ in long, ciliate and sparingly hairy on both sides or nearly glabrous, entire or occasionally on vigorous shoots with a few coarse teeth, half-evergreen fls in terminal clusters, fragrant; sepals linear, hairy, ½in long, corolla tubular with spreading limb, white flushed pink, ¾in long Summer Himalayas P F G 3 91 Gn 10 29. G C II 16 34 G 29 483 R H 1870 511 J F 3, pl 319 —A very handsome species, after the

flowers are gone the feathery sepals remain as an attractive feature.

floribúnda, Decaisne. Shrub, 4 ft.: lvs persistent, oval to oval-oblong, ½–1 in long, crenate-serrate, ciliate: peduncles axillary, 1–3-fld ; corolla carmine-purple, nodding, tubular, 1½ in. long, sepals oblong, ⅛in long Summer Mex B M 4316. F S 2·5. R.B. 23 157 Gn 13 120 B R. 33 55. R H 1912 544.

A biflòra, Turcz Lvs ovate-lanceolate, hairy, coarsely serrate, deciduous fls white, tubular, in 2's, sepals 4 Manchuria, N. China —*A serràta,* Sieb & Zucc Similar to A biflora Fls funnelform, pink, little over ½in long, in 2's, sepals 2 Japan S Z 1 34 —*A spathulàta,* Sieb & Zucc Allied to A biflora Lvs ovate fls over 1 in long, white tinged yellow in throat, sepals 5 Japan S Z 1 34 B M 6601 G 27 345 G M 45 335 (as A serrata) —*A uniflòra,* R Br (A serrata, Nichols , not Sieb & Zucc) Lvs persistent, ovate-lanceolate fls in loose terminal panicles, campanulate, 1 in long, rosy white with yellow in throat, sepals 2 China B M 4694 F S 8 824 J F 4, pl 380 B H 3 338 G C III 37 323 Gn W 21 933 (as A chinensis) Gn 27, p. 425

ALFRED REHDER.

ABELÍCEA: *Zelkova*

ABELMÓSCHUS: *Hibiscus*

ABÈRIA (named from Mt. Aber, Abyssinia, where first species was found) *Doryàlis,* Arn & E. Mey. *Flacourtiàceæ* Small trees or shrubs, with alternate, simple exstipulate leaves and small inconspicuous flowers Flowers dœcious; staminate fls with a 4–5-parted calyx and no petals, and with many stamens, arranged on a fleshy receptacle; pistillate fls with a 5–7-parted, persistent calyx and no petals, the ovary free, sessile, 1–6-celled, on a lobed usually fleshy disk, fr fleshy, indehiscent —Eleven species in Afr and Ceylon.

cáffra, Hook. f & Harv Fig 59 Thorny, glabrous lvs. obovate, obtuse, cuneate at base, entire fls dœcious, apetalous G C III 18 737 R H 1904 256 —The kei apple of the Cape of Good Hope, a spiny plant grown S for hedges, is considered promising for S. Calif. and S Fla as a fr plant Fruit acid, used as pickles or conserves. Proves quite hardy in S Calif

Gárdneri, Clos A small, much-branched tree, 16–20 ft lvs 2½–4 in long, lanceolate or oval, acute at both ends fls greenish, staminate fls in umbellate clusters, the pistillate axillary in the branches fr 1 in. diam , pale purple, edible. June India and Ceylon.

N TAYLOR †



59 Aberia caffra. (fr. × ½)

ÀBIES (derivation doubtful). *Pinàceæ* FIR, but the name spruce is often erroneously applied Tall, pyramidal trees of temperate and cool climates, planted for ornament and for shelter, and also for timber. The word àbi-es is pronounced in three syllables, the *e* being long

Leaves lanceolate or oblanceolate, entire, sessile, persistent for many years, on young plants and lower sterile branches flattened, usually deep green and lustrous above and silvery white beneath from the presence of many rows of stomata, rounded and variously notched at the apex, appearing 2-ranked by a twist at their base, on upper fertile branches crowded, more or less erect, often incurved or falcate, thickened or quadrangular, obtuse or acute fls axillary, appearing in early spring from buds formed the previous summer on branchlets of the year, surrounded by involucres of the enlarged scales of the fl-buds, staminate fls. pendent on branches above the middle of the tree, pistillate fls globular, ovoid or oblong, erect on the topmost branches· fr. an erect ovoid or oblong cylindrical cone, its scales longer or shorter than their bracts, separating at maturity from the stout persistent axis. Northern and mountainous regions of the northern hemisphere, often gregarious Twenty-three species are distinguished; greatest segregation on the Cascade Mts of Ore , in the countries adjacent to the Medit , and in Japan. Many species which have been referred to Abies are now included in Picea. S.S. 12. Heinrich Mayr, Monographie der Abietineen des Japanischen Reiches. Gn 11, pp. 280, 281 See *Arboriculture.*

All the species of abies produce soft, perishable wood, sometimes manufactured into lumber, and balsamic exudations contained in the prominent resin vesicles in the bark characteristic of the genus. They are handsome in cultivation, but usually of short-lived beauty. The firs prefer moist, well-drained soil. As timber-producing trees, the species of abies are less valuable than the spruces (Picea) and in the United States they have not been planted except for ornament. In Europe, where this tree is sometimes planted as a forest crop, the wood of the European *A Picea* is valued, and in the Pacific states the wood of *A grandis, A concolor* and *A. magnifica* is employed in the manufacture of fruit-boxes and woodenware.

In cultivation, firs are most beautiful while young, and usually lose their lower branches and become thin and unsightly as they grow older, and many of the species have little ornamental value for more than fifty years In the northern and eastern states, the most valuable ornamental species are the Colorado form of *A. concolor,* with pale or bluish foliage, and the Japanese *A brachyphylla,* with leaves that are dark green and very lustrous above and silvery beneath. In the United States, *A. brachyphylla* assumes a compact pyramidal form of growth, but in Japan old trees become, unlike those of any other fir, round-headed. The other Japanese fir that has been cultivated in the United States long enough to show its value as an ornamental tree, *A Veitchii,* produces longer branches than *A brachyphylla* and is of more open habit and is less valuable for ornamental use After *A concolor* and *A brachyphylla,* the best fir trees for the eastern United States are *A cilicica* from Asia Minor and *A Nordmanniana* from the Caucasus In its young state, *A. cilicica* forms a dense pyramid of gray-green foliage and as it grows in the Pinetum at Wellesley, Massachusetts, is an object of great beauty. *A Nordmanniana* is one of the commonest fir trees cultivated in the eastern states, although it sometimes suffers from cold in New England, where it frequently becomes thin and unsightly. In the middle states, however, it is often an object of great beauty. The two eastern American species, *A balsamea* and *A. Fraseri,* and the related species from the Rocky Mountains, *A. lasiocarpa,* grow badly in cultivation, and are short-lived and not handsome. Of the Pacific coast species, *A grandis* can be kept alive in favorable situations in the eastern states, and *A amabilis,* which grows slowly always in cultivation, is hardy but gives little promise of becoming of much value anywhere except on the mountains of northeastern America The summers in the southern states are too hot for the successful cultivation of fir trees, and the climatic conditions of the Mississippi Valley are not favorable for their successful growth. In the parks and gardens of the Pacific states, fir trees grow better than in any other part of

North America, and in the neighborhood of the Pacific Ocean can be grown successfully the firs of western North America, Mexico, Europe, India and eastern Asia.

Propagation is mostly by seeds The percentage of fertile seeds produced by firs is much smaller than that yielded by spruces and pines, and small crops of seedlings are often secured from large sowings of the seeds. The seeds lose their fertility sooner than those of many conifers and cannot be safely kept more than one or two years; they should be planted in carefully prepared seedbeds and covered with soil to a depth equal to the thickness of the seed Young plants begin to appear at the end of a few weeks, and, as they are extremely sensitive to the heat of the sun, they need the protection of lath or brush screens Like other conifers, the different species can be propagated by side-grafting on other species of the genus Grafted plants, however, are less valuable than seedlings and propagation in this way is slow and expensive, as the work must be performed in glass houses The leading or other upright-growing shoot should be chosen for the graft, as trees obtained by the use of lateral branches for grafts do not often grow into erect or shapely trees The species most commonly used for stocks are *A Picea* and *A balsamea*.

INDEX

amabilis, 4, 8
Apollinis, 12
aurea, 9
aureo-variegata, 2
balsamea, 6
brachyphylla, 11
brevifolia, 9
cephalonica, 12
cilicica, 3
columnaris, 6
concolor, 9
falcata, 9
Fraseri, 7
glauca, 14
globosa, 9
Gordoniana, 8
grandis, 8
hudsonia, 6
hudsonica, 6
Lowiana, 9
lutescens, 6
magnifica, 15
nephrolepis, 10
nobilis, 14
Nordmanniana, 2
Parsonsiana, 9
pectinata, 1
Picea, 1
picta, 5
Pinsapo, 13
shastensis, 15
sibirica, 5
Veitchii, 10

A *Evabes Lvs flat, grooved on the upper surface, only occasionally stomatiferous above on upper fertile branches*

B *Lf blunt.*

C. *Foliage essentially green,—the lvs green above and whitish only beneath*

D *Cones usually upward of 4 in long*

1 **Picea,** Lindl. (*A pectinàta*, DC.) SILVER FIR. Fig 60 Tree, 100–200 ft trunk 6–8 ft in diam: lvs flat, distichously spreading, dark green and lustrous above, silvery white below cones slender, cylindrical, light green to dark purple, 5–6 in long, bracts slightly longer than their scales Mts of Cent. and S Eu., often gregarious —Wood esteemed and much used, yields Strasburg turpentine Dwarf forms, with erect and pendulous and with much abbreviated branches, are common in gardens Not perfectly hardy in New England.

2 **Nordmanniàna,** Spach Fig 61 Tree, 100–150 ft: trunk 4–6 ft in diam · lvs flat, crowded, dark green and very lustrous above, silvery white below cones oblong-cylindrical or ellipsoidal, dark orange-brown, 4–6 in long, bracts as long as or slightly longer than their scales Mts south and southeast of the Black Sea, and western spurs of the Caucasus B M. 6992 Gng 6.51 G C II 19.797 —Often hardy, one of the most desirable firs in the middle states Var. **aûreo-variegàta,** Hort. Shoots colored a pure golden yellow.

3. **cilícica,** Carr. Tree, 45–60 ft.. trunk 2–3 ft. in diam.: lvs narrow, flat, pale green above, silvery white below: cones stout, cylindrical, orange-brown, 5–6 in. long; bracts rather shorter than their scales At high elevations on the Anti-Taurus of Asia Minor, and on the Lebanon. A G. 16:255 Gng. 4·113 —Begins to grow early in the spring and is often injured by late frosts; hardy and desirable in the northern states.

4. **amábilis,** Forbes. WHITE FIR. Tree, 100–150 ft · trunk 4–6 ft. in diam.: lvs crowded, dark green and very lustrous above, silvery white below, occasionally stomatiferous on the upper surface: cones oblong, dark purple, 3½–6 in. long, bracts much shorter than their scales. Cascade Mts of Wash and Ore., and Coast Ranges from Vancouver Isl to Ore S S 12 614 G C. II 14 721, 725; III 30 191 —One of the handsomest of the genus, often forming groves at high elevations; in cult grows slowly, and is not satisfactory.

DD *Cones usually under 4 in long*

5 **sibírica,** Ledeb (*A pícta*, Forbes) Tree, 60–100 ft · trunk 2–4 ft in diam lvs crowded, dark yellow-green cones cylindrical, slender, brownish yellow, 2½–3 in long, bracts much shorter than their scales N and E Russia to Kamtschatka and Mongolia, gregarious on the Altai Mts —Very hardy, the early growth often injured by late frosts; in cult. soon becomes thin and loose in habit.



60. Cones of Abies —From bottom to top, A. grandis, A balsamea, A. Picea

6 **balsâmea,** Mill. BALSAM FIR. BALM OF GILEAD FIR Fig 60 Tree, 50–80 ft. trunk 17–30 in in diam.· lvs dark green and lustrous above, pale below, rounded or obtusely short-pointed and occasionally emarginate, acute or acuminate on fertile branches cones oblong, cylindrical, purple, 2½–4 in long; bracts shorter or rarely slightly longer than their scales E N Amer. from Labrador and the valley of the Athabasca to Iowa and the mts of Va. S.S 12 610. G C. III. 17:423, 425, 431.—Wood occasionally used for lumber; Cana-

dian balsam, or balsam of fir, is obtained from the bark; in cult. loses its beauty early. Var. **columnàris,** Hort. Branches very short, turned upward at the ends. Var **hudsònia,** Engelm. (*A. hudsónica,* Hort.), is a dwarf form Var **lutéscens,** Hort. Lvs. white, yellow or straw-colored when exposed to the sun

7. **Fràseri,** Poir SHE BALSAM. Tree, 30–50 or even 70 ft trunk reaching 2½ ft. in diam lvs flat, obtusely short-pointed, twisted at the base so as to appear to be crowded on the upper side of the branches, dark green and lustrous cones oblong-ovate or nearly oval, rounded at the slightly narrower apex, purple, 2½ in long and 1 in thick, the scales twice as wide as long, and at maturity nearly half covered by the ends of the pale reflexed bracts Mts of Va, Tenn., and N C. S S 12·609 G.F. 2 475 —Too much like the balsam fir to be prized as an ornamental tree. Trees sold under this name are nearly always forms of *A. balsamea.* Very short-lived in cult.



61 Cones of Abies —From bottom to top, A concolor, A. Nordmanniana, A magnifica.

8 **grándis,** Lindl. (*A. amábilis,* Murr., not Forbes *A Gordoniàna,* Carr *Pìcea grándis,* Loud.) Fig 60. Tree, 200–300 ft. trunk becoming 4 ft in diam lvs. thin and flexible, deeply grooved, very dark green above and silvery white beneath cones cylindrical, 2–4 in long, rounded or retuse at the apex, the broad scales somewhat squarrose and irregularly serrate and furnished with a short point Coast of N Calif. to Vancouver Isl and to the western slopes of the Rocky Mts of Mont S.S. 12 612. Gn. 38, p 291 G.C. II. 15 179, 181 R H 1894, p. 274 —Occasional specimens are seen in choice grounds, but it rarely does well in the eastern states.

CC. *Foliage pale blue or glaucous.*

9 **cóncolor,** Lindl & Gord (*A Lowiàna,* A Murr. *A. Parsonsiàna,* Hort., the Pacific form). WHITE FIR. Fig. 61. Tree, 100–250 ft: trunk 4–6 ft in diam.: lvs. elongated, stomatiferous on the upper surface, on fertile branches often falcate and thickened and keeled above: cones oblong, gray-green, dark purple or bright canary-yellow, 3–5 in. long; bracts shorter than their scales. W. N. Amer. from S. Ore. to Low. Calif. and to Utah, S Colo., New Mex., Ariz. and Sonora. S.S 12 613 G.C. II 13:649, II 15:661; III 8·748, 719, III 35·59 —Of all fir trees, the Colorado form best withstands heat and drought; very hardy, grows rapidly, and the most desirable of the genus in the eastern states. The form from the Pacific coast is less hardy and less desirable in the E as an ornamental tree Seedlings of the Colorado form, with rather longer and more glaucous leaves, are found in nurseries as *A cóncolor violàcea* Var **aùrea,** Beiss Young shoots golden yellow in May, afterward becoming silver-gray. Var **brevifòlia,** Beiss Lvs short and obtuse, twice as broad as in typical form Var **falcàta,** Niem Lvs. sickle-shaped, curved upward Var **globòsa,** Niem. Plant spherical, with symmetrical small branches.

BB *Lvs. pointed, especially on main shoots, and usually rigid*

10 **Vèitchii,** Lindl (*A. nephróleps,* Maxim). Tree, 80–100 ft trunk 3–4 ft in diam; branchlets slender, pubescent lvs crowded, dark green and lustrous above, silvery white below cones cylindrical, slender, dark purple, 2–2½ in long; bracts shorter than their scales Mts of Cent. Japan, gregarious and forming great forests, coast of Manchuria G C II 13 273 —Very hardy in the northern states, and when young is one of the most beautiful of fir trees

11 **brachyphýlla,** Maxim Tree, 80–100 ft., trunk 6 ft in diam., upper branches long and vigorous, ultimately forming a broad, round-topped head lvs elongated, sharp-pointed, dark green and very lustrous above, silvery white below cones cylindrical, stout, dark purple, 3–3½ in long, bracts much shorter than their scales Mts of Cent Japan, singly or in small groves B M 7114 —Very hardy, and when young one of the most desirable of the fir trees for the northern states

12 **cephalónica,** Loud Tree, 60–70 ft trunk 2–4 ft in diam lvs broad, rigid, sharp-pointed, standing out from the branches at right angles cones cylindrical, slender, pointed, gray-brown, 5–6 in long, bracts longer or rarely shorter than their scales Mt Enos, on the Isl. of Cephalonia Gng 6 49 G W 5, p 15, 12, p 399, 14, p 538 —Doubtfully hardy in northern states.

Var **Apóllinis,** Boiss (*A Apollinis,* Link), with narrow and blunter lvs., is remarkable in its power to produce vigorous shoots from adventitious buds Mts of Greece and Roumelia, often gregarious, more hardy than the type in the northern states Page 3565

13 **Pinsàpo,** Boiss SPANISH FIR Tree, 70–80 ft trunk 4–6 ft in diam lvs short, broad, rigid, sharp-pointed, bright green, spreading from all sides of the stiff branchlets cones cylindrical, slender, gray-brown, 5½–6 in long, bracts shorter than their scales Mts of Cent and S Spain, often gregarious G C III 21 407, 29.65, 31 407.—Not hardy north of the middle states

AA *Nobiles Lvs blue-green, often glaucous, stomatiferous on both surfaces, flat or 4-sided on sterile branches, 4-sided acute, incurved and crowded on fertile branches.*

14 **nóbilis,** Lindl (*Pìcea nóbilis,* Loud.) RED FIR. Tree, 150–250 ft trunk 6–8 ft in diam. lvs on lower branches grooved above, rounded and emarginate at the apex. cones oblong-cylindrical, purplish or olive-brown, 4–6 in. long, bracts much longer, thin and covering the scales, strongly reflexed, pale green. Cascade and Coast Mts. of Wash. and Ore., often gregarious. S S 12.617 G C. II 19 15, III 20 275 —There is a var **glaùca** in the trade.

15 **magnífica,** A. Murr RED FIR Fig 61 Tree, 200–250 ft trunk 6–10 ft in diam lvs. quadrangular, bluntly pointed on sterile and acute on fertile branches: cones oblong-cylindrical, purplish brown, 6–9 in long;

bracts much shorter than the scales. Sierra Nevada of Calif.; gregarious and forming great forests. S S 12. 618. Gn. 37, p. 591.—Wood occasionally manufactured into lumber. Less hardy in the eastern states than *A. nobilis*.

Var. **shastensis**, Lemm., of S. Ore. and N. Calif., cones somewhat smaller, with bracts as long as or longer than the scales. S S 12 620.

A Albertiana, Murr =Tsuga heterophylla —*A baborénsis*, Let Lvs dark, silvery below, very numerous, ½–1 in long cones 4 or 5 together, reaching 7 or 8 in long, 1 in diam N Afr R H 1866, p 106, desc —*A bifida*, Sieb & Zucc =A firma —*A bracteata*, Hook & Arn =A venusta —*A canadensis*, Michx =Tsuga canadensis —*A Delavayi*, Franch Tree, 20–50 ft lvs rolled back along margin W China G C III 39 212 —*A Fargesii*, Franch Tree, to 200 ft lvs very white on under surface cones deep purple Cent and W China G C III 39 213 —*A firma*, Sieb & Zucc = A Mome, Sieb Lvs thick and rigid, 1 in long cones cylindrical, often 6 in long, with keeled scales —*A homolepis*, Sieb & Zucc Closely related to A brachyphylla but less valuable as an ornamental tree, rare in cult (Arnold Arboretum) G C II 12 823 Japan Promising for the southern states —*A Hookeriana*, Murr =Tsuga Mertensiana —*A lasiocarpa*, Nutt Lvs blue-green and glaucous cones 3 in long, with very broad spineless scales W U S G C II 13 9 G F 4 349 Gng 4 371 S S 12 611 —Var *arizónica* is a form from the mts of Ariz with thicker, paler and more corky bark, the result probably of climatic influence —*A macrocárpa*, Vasey =Pseudotsuga macrocarpa —*A Mariesii*, Mast Small tree with crowded branches and short, dark foliage which is pale below cones large, dark purple N Japan G C II 12 789 —*A Mertensiana*, Lindl = Tsuga heterophylla —*A numidica*, Carrière =A baborensis —*A Pindrow*, Spach Himalayas This now being recognized as distinct from A Webbiana —*A Regnæ Amáliæ*=A cephalonica var Apollinis —*A religiosa*, Lindl Long, slender, drooping branches lvs silvery below cones 5 in long Mex B M 6753 —*A sachalinénsis*, Mast Tall tree, with pale bark, white buds, and long, slender, dark green lvs cones 3 in long E Asia G C II 12 589 —*A subalpina*, Engelm =A lasiocarpa G C II 15 236, 237 —*A venusta*, Koch Lvs acuminate, dark yellow, green above and silvery below cones 4 in. long, with long, slender bracts Calif S S 12 615, 616 B M 4740 —*A Webbiana*, Lindl Lvs 1–2½ in long, flat, silvery below cones cylindrical, 6 or 7 in long Himalayas See *Picea* for *A ajanensis*, *alba*, *Alcockiana*, *Engelmanni*, *excelsa*, *Gregoriana*, *minuata*, *Morinda*, *nigra*, *obovata*, *orientalis*, *pendula*, *polita*, *pungens*, *Schrenkiana*, *Smithsiana* See, also, *Pseudotsuga* and *Tsuga*

C. S SARGENT.

ABÒBRA (Brazilian name) *Cucurbitàceæ*. A monotypic genus allied to Cucurbita. The only species is a greenhouse climber, cult for its numerous small, showy frs: grows rapidly, and may be planted out in summer The tuberous roots are stored like dahlias Prop by seeds or rarely by soft cuttings.

Flowers dioecious green, all axillary and solitary; staminate fls with a tubular, cup-shaped calyx and a rotate 5-parted corolla, having oblong-lanceolate segms; stamens 3, free, the anthers thick, and 1-celled, or sometimes 2-celled, pistillate fls with a 3–4-celled ovary followed by an ovoid, indehiscent, 6-seeded, showy fr

tenuifòlia, Naudin (*A viridiflòra*, Naudin). Height 10–15 ft lvs much divided fls small, pale green, fragrant· fr a scarlet gourd Trop Amer. R H 1862:111

ABRÒMA (from *a*, not, and *broma*, food) *Sterculiàceæ*. A genus of 2 or 3 species, closely related to the cacao; grown as evergreen greenhouse trees, but apparently not in cult except in botanical collections. Fls dingy purple, the calyx 5-parted, corolla lobes 5, clawed Prop. by seeds or by cuttings in spring from half-ripened wood under glass. Probably not in cult.

A augusta, Linn f Lower lvs cordate, 3–5-lobed, upper lvs ovate-lanceolate Trop Asia B R 518 —*A fastuòsa*, R Br. Lower lvs cordate, 5-lobed, upper lvs ovate fls dark purple Trop Asia, Austral *A sinuòsa*, Nichols Lvs ovate pedately pinnatifid, on slender petioles Madagascar.

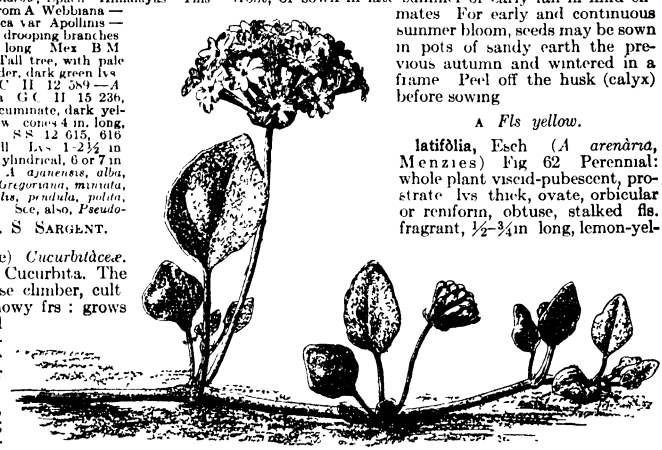
N. TAYLOR.

ABRÒNIA (from Greek *abros*, delicate, referring to the involucre) *Nyctaginàceæ*. SAND VERBENA. Trailing and upright annuals or perennials, with fragrant verbena-like flowers, suitable for baskets, rockeries or the open border

Herbs, often viscid lvs opposite from swollen nodes, unequal, petioled and entire fls 1 to many in a bracted peduncled head, small, salver-form, red, yellow or white, showy in mass, fragrant, stamens mostly 5, unequal, joined to the corolla-tube and included within it, calyx tubular and corolla-like, 4–5-lobed, the base persistent over the 1-seeded ovary or fr About 30 species in Amer S Watson, Bot Calif 2 3–5; P C Standley, Contr U S Nat Herb, 12 306

Abronias are garden annuals, or treated as annuals, of secondary importance They are low or trailing plants, rising from 6 to 18 inches high and spreading widely. They are best adapted to open sunny places and light soil *A umbellata* is the common garden species, the trailing stems often reaching a length of 3 to 5 feet, and the flowers appearing all summer and fall, in mild climates, the plant volunteers from self-sown seeds It is useful for borders and for baskets and porch-boxes, when a change or variety is wanted from the use of verbenas Under glass, the plant is nearly perennial

Propagation is by seeds, sown in open ground after frost, or sown in late summer or early fall in mild climates For early and continuous summer bloom, seeds may be sown in pots of sandy earth the previous autumn and wintered in a frame Peel off the husk (calyx) before sowing



62 Abronia latifolia (×½)

A *Fls yellow.*

latifòlia, Esch (*A arenària*, Menzies) Fig 62 Perennial: whole plant viscid-pubescent, prostrate lvs thick, ovate, orbicular or reniform, obtuse, stalked fls. fragrant, ½–¾in long, lemon-yellow. June, July Seacoasts, Cent Calif. and N. B.M. 6546 G.C II. 16·365

AA *Fls pink or rose*

umbellàta, Lam (*Tricràtus admirábilis*, L'Her. *A ròsea*, Hartweg) Fig 63 Perennial similar in habit and pubescence to the above, but lvs stalked, the blade ovate, acute at both ends· fls pink, about ½in May, June Calif seacoasts to Columbia R. F S 11 1095 P M. 16.36. Var. **grandiflòra**, Hort., has larger fls. and lvs.

villòsa, Wats. Perennial: smaller and slenderer than *A. umbellata* and covered with a glandular-villous pubescence· lvs rarely 1 in long: fls 5–15 in a cluster, rose Calif, Utah —Not common in cult., but well suited to sandy and dry situations Intro. 1891

AAA *Fls white*

mellifera, Dougl. (*A. Suksdórfii*, Coult & Fisch.). Perennial stouter than *A umbellata* st finely hairy involucre larger scarious fls 1 in long, the tube

greenish and glabrous: lvs long-stalked, in opposite pairs. Wash., Ore. B.M. 2879. Intro 1891.

frágrans, Nutt. Erect perennial. lvs. ovate or elliptical, paler beneath than above. fls. night-blooming, ¾–1 in long, the tube greenish, the white lobes bifid. Columbia R to New Mex B M 5544.

A puchélla, Nichols Erect, 6 in · fls pinkish rose —*A Cruxmáltæ*, Kellog, the handsomest of all the species is, Tripterocalyx Crux-maltæ, which see

N. TAYLOR.†



63 Abronia umbellata. (×¼; fl. ×1)

ABROPHÝLLUM (Greek combination signifying *delicate-leaved*) *Saxifragàceæ* An endemic monotypic genus of New S Wales tall, handsome shrub · lvs alternate, elliptic or ovate-lanceolate and acuminate, to 9 in long, somewhat toothed. fls. small, yellowish, in dichotomous corymbose panicles terminating the shoots or arising from the upper axils, petals, stamens and calyx-lobes 5 fr a 5-celled ovoid berry **A. órnans,** Hook f, was intro. to Calif in 1911 by Franceschi.

ÀBRUS (from *abros*, delicate, referring to leaves) *Leguminòsæ* Deciduous greenhouse climber, or used South outdoors for screens Roots a poor substitute for licorice, and the seeds are violently poisonous Needs strong heat for indoor culture Propagation is by seeds or by cuttings under glass in sand

The genus consists of usually creeping or climbing woody herbs with primately compound lvs fls small, in dense racemes on axillary peduncles or short branches; calyx bell-shaped, the teeth very short; corolla pea-like, much exserted; stamens 9, in a tube.

precatòrius, Linn CRAB'S-EYE VINE WEATHER-PLANT. Fig 64 Height 10–12 ft; frequently trailing over the ground S · lfts oblong, in numerous pairs fls varying from rose to white· seeds bright scarlet, with a black spot, used by Buddhists for rosaries, in India as standards of weight, and in the W Indies in bead work Seeds irritant; also used as an abortive in U S. A variety with a cream-colored bean is offered by Reasoner Bros Tropics generally —The claims made for its weather-foretelling properties are exposed by Oliver in Kew Bull. Jan, 1890 It does, however, "go to sleep" during storms, but this is a feature of other legumes. Sometimes confounded with *Rhynchosia phaseoloides* (*R precatoria*), which has similar seeds, but is a very different plant with large, 3-foliolate, bean-like lvs.

N. TAYLOR.†

ABSINTH, ABSINTHE (ab'sinth). A liquor made from plants of the wormwood group, particularly from the absinthium (*Artemisia Absinthium*). These are aromatic or bitter herbs. *A. Absinthium* yields a bluish or green volatile oil containing absinthol and other principles. Absinth is added to water as a beverage, and in excess produces peculiar intoxication, and may even prove fatal.

ABÙTA (native name). *Menispermàceæ* Greenhouse evergreen climber. plant dioecious, fascicled or panicled: staminate fls. with 3 exterior and 3 interior larger sepals, and 6 stamens; pistillate fls. with 6 staminodia and 3 carpels· fr. a drupe; 14 species in S Amer Prop. by cuttings under glass with bottom heat, and grown in peaty loam. **A. ruféscens,** Aubl. Lvs. broad-ovate or suborbicular, coriaceous, brown or tawny beneath, 3-nerved fls. small, dark purple within, the 3 large sepals obtuse. Little known in cult.

ABÙTILON (name of Arabic origin for a malvaceous plant). *Malvàceæ*. FLOWERING· MAPLE Attractive coolhouse shrubs and window-plants, and some kinds used for bedding Sometimes called Chinese Bellflower Fig 65

Leaves long-stalked, often maple-like. fls mostly pendulous, with naked 5-cleft calyx, 5 separate obovate petals, many stamens united in a column about the many-branched style, the anthers borne at the top of the column fr a collection or aggregate of 2-valved often beaked carpels that are deciduous from the central axis at maturity —Natives of warm regions in both hemispheres, comprising herbs, shrubs and trees, about 80 species

The abutilons oftenest seen in American gardens and conservatories are apparently hybrids and derivatives of pure species The colors are mostly yellow, white and pink, with attractive veining Well-known forms are Arthur Belsham, red, shaded gold Boule de Neige, pure white, very free California, a group of free bloomers Eclipse, foliage marbled green, and yellow fls of fair size, sepals scarlet, petals orange-buff, suited for baskets and vases, a form of *A megapotamicum* (another Eclipse is known) Erecta, pink, orange-veined, erect fls. Golden Bell, deep yellow, free-flowering Golden Fleece, pure yellow, free-flowering Royal Scarlet, rich, shining scarlet Santana, deep red Savitzii, dwarf, with white-edged foliage, useful for bedding Snowstorm, semi-dwarf, pure white Souvenir de Bonn, lvs large, deep green, not mottled, but edged with a broad white margin, distinct and striking, a useful bedding plant. Splendens, bright red



64. Abrus precatorius (×¼)

The cultivation of abutilons is simple, under conditions suitable for the growing of geraniums and fuchsias. Some of the forms are grown primarily for bloom, and they are practically continuous-flowering when well handled; the variegated-leaved forms are grown for foliage and used more or less for bedding-out. Abutilons make good pot-plants if kept within bounds by pinching back so that they will branch. *A megapotamicum* and some others are useful for baskets and vases. The showy *A. insigne* is an excellent rafter-plant



65. A flower of Abutilon.

Propagation is by cuttings or seeds Cuttings may be made in spring of new wood from old plants that have been cut back, or they may be taken in fall; as the abutilon is active practically all the year, the cuttings may be taken almost at will Seeds grow readily; if started in March, blooming plants should be had by fall Bedding material is raised from early-struck cuttings.

INDEX

compactum, 6.
Darwinii, 6
floribundum, 6
grandiflorum, 6
Hildebrandii, 6
hybridum, 12
igneum, 1
insigne, 1
longicuspe, 2
marmoratum, 5
megapotamicum, 4
pictum, 9
plenaflorum, 10
Sartizii, 12
Selloanum, 5
Sellovianum, 5
sinense, 3
spurium, 11
striatum, 9, 11
tessellatum 6
Thompsonii, 11
venosum, 8
vexillarium, 4
vitifolium, 7

A. *Lvs. not lobed, cordate, but prominently toothed, sometimes angled*

B. *Corolla wide open.*

1. **insígne,** Planch (*A igneum*, Hort). Lvs medium size, crenate-dentate, acuminate, villous pubescent underneath fls large, flaring-mouthed, under-color white but obscured by very heavy and rich veining and markings of purple and red, on slender hanging peduncles Colombia B M 4840 Gn 18 624, 53, p 300 F S 6 551 —Very showy, common Often trained under the roof of the greenhouse or conservatory. St. green, brown-hairy

2 **longicúspe,** Hochst White-canescent much-branched shrub, with long-acuminate broad-cordate and blunt-toothed long-stalked lvs, felt-like below: fls blush purple, veiny, wide open, on mostly many-branched axillary peduncles Abyssinia —Intro by S Calif Acclimatizing Assoc, from seed collected by Schweinfurth and distributed from Berlin in 1893.

3 **sinénse,** Oliver Lvs large and broadly cordate-ovate, long-acuminate, notched but not lobed, somewhat tomentose beneath. fls large (2 in. or more across), open-bell-shaped, orange-yellow with large interior veins and marks of reddish brown. Cent. China, recently intro. to cult Seed apparently not yet in the American trade. R H 1909:452.

BB *Corolla long and narrow.*

4. **megapotámicum,** St Hil & Naud. (*A vexillárium*, Morr.) Fig. 66. Drooping habit· lvs. rather small, lance-ovate, acuminate, sharp-serrate· fls 2–3 in long, on short drooping stalks, the long calyx bright red, the protruding petals lemon-yellow, the column of stamens conspicuously protruding Brazil, etc. B M 5717. Gn. 37·274. J H. III 18:359.—A strikingly handsome species, particularly for baskets and vases, apparently less seen than formerly. There is a variegated-lvd variety. Generally misspelled *mesapotamicum* Megapotamicum means "big river," signifying here the Rio Grande.

AA. *Lvs. prominently lobed, mostly maple-like or vitis-like.*

B. *Foliage silky or tomentose, at least beneath.*

5. **Selloviànum,** Regel (*A. Selloànum*, authors, a correction of the published name, as the plant is named for Sello *A. Sellowiànum*, Hort) Upright, thick-hairy plant lvs roundish deep-heartshaped, long-stalked, 3-lobed with long-pointed parts, 7–9-nerved, unequally toothed, the under side soft silky tomentose. fls light purple, with erect petals Brazil Var **marmorátum,** Hort, has lvs variegated with golden yellow.—A good summer bloomer. The variegated form is sometimes used for bedding.

6 **Dárwinii,** Hook f (*A Hildebrandii*, Fenzl.). Strong pubescent shrub of dwarfish habit lvs velvety pubescent beneath, thickish, 5–9-ribbed, the lower ones lobed to the middle, the upper ones shallow-3-lobed: fls. 1–3 in an axil on short sts, 1½–2 in across, orange-red with blood-red veins, widely open or spreading. Brazil B M 5917 Var **tessellátum,** Hort, has lvs. handsomely checkered with yellow —Blooms in both winter and summer Much hybridized with other species *A grandiflòrum* and *A compáctum* are garden forms, also *A floribúndum*, Hort, R.H. 1881:350. Gt. 23 794 (var *trinérve*, Regel).

BB. *Foliage not tomentose or silky, glabrous or slightly pubescent.*

C *Fls blue (varying to white in cult).*

7 **vitifólium,** Presl Lvs cordate in general outline, 3-5-, and sometimes 7-, lobed, the lobes long-pointed fls open bell-shaped or cup-shaped, large, lavender-blue, more or less veined (sometimes white), clustered, anthers yellow Chile —A hardy species, remaining out-of-doors in S of England, height becoming 30 ft lvs golden in autumn. B M 4227, 7328. Gn 51 334; 66, p 8 (clumps); 76, p. 415. J.H. III 62.380. B R. 30 57.

CC. *Fls yellow or orange in ground color.*

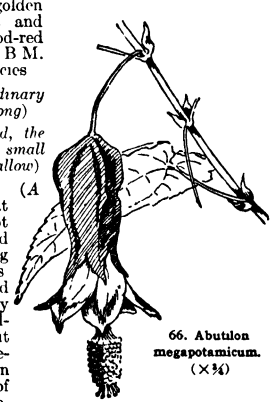
D. *Blossoms very large lvs 7-lobed*

8 **venòsum,** Lem Very strong, tall grower. lvs. large, deeply palmately 7-lobed and strongly toothed: fls large, 3 in long, on sts 10–12 in long, bell-shaped and not flaring, golden orange, with veins and over-colors of blood-red and brown Mex B M. 4463 —A showy species

DD *Blossoms of ordinary size (2 in or less long)*

E *Lf-blades 3-lobed, the side lobes often small (or the clefts shallow)*

9 **pictum,** Walp (*A striàtum*, Hort, at least in part, not Dickson) Strong and hardy free-blooming species, with lvs green or variegated and glabrous or thinly pubescent, the middle lobe usually about equaling or sometimes shorter than the undivided part of the lf and wedge-shape or tapering from the base calyx about 1 in. long, cleft about to its middle, brownish pubescent; corolla less than 1½ in. long, orange or yellow, veined crimson. S Brazil to Buenos Ayres —Has been confused with *A striatum*.



66. Abutilon megapotamicum. (×¾)

10 **plenifl̆orum,** N.E. Br. Lvs green, glabrous both sides, the middle lobe slightly narrowed at its base and half again as long as the undivided part of the blade. fls double.—Perhaps of hybrid origin, with *A. pictum* a probable parent.

EE. *Lf.-blades 5–7-lobed, the middle lobe always more or less narrowed at its base.*

11. **striàtum,** Dicks A Guatemalan species perhaps not in cult in its original form middle lobe of lf. usually at least twice as long as undivided part of blade and twice longer than broad, green. calyx somewhat less than 1 in long, the lobes about twice as long as tube, brown-pubescent; corolla 1¾ in or less long, orange, conspicuously dark crimson-veined B M 3840 (as *Sida picta*) —Var **Thŏmpsonii,** Veitch. Fig 67 Lvs variegated with yellow, not pubescent, first exhibited by Veitch & Sons in 1868, said to be from Jamaica, perhaps not in general cult at present —Var. **spūrium,** Lynch Lvs. variegated with yellow, thinly pubescent above but thickly pubescent beneath with fine hairs, the calyx white-pubescent corolla light reddish orange with redder veins, probably of garden origin —The cult. forms of this species-group are imperfectly understood, particularly those passing as *A. Thompsonii* In England, the form usually known as *A Thompsonii*, and used for bedding, is the var *spurium* In N Amer several different things are called *A. Thompsonii*, some of them not variegated and at least one of the variegated forms having double fls The Fig 67 is inserted to distinguish the plant originally distributed as *A Thompsonii*, and to which the name should be restricted Probably some of the *A Thompsonii* forms belong in the general *A hybridum* group.



67 Abutilon Thompsonii as originally pictured in Florist and Pomologist, 1869, p 21 Inserted to show the plant to which the name Thompsonii should be applied

The confusion between the Brazilian *A. pictum* and the Guatemalan *A striatum* is reduced by N. E. Brown, G. C. 1910 (2) pp 427 and 488.

12 **hȳbridum,** Hort Under this name have been placed the many garden forms and hybrids, most of which have many of the features of the *A striatum* group. *A. Darwinii* has been one of the parents in some of them, as in *A rosæflorum*, and Golden Fleece (Gn. 53:300), both of which are recorded as offspring of Darwinii and Boule de Neige Other varieties referable here are Fireball, Golden Bell, Gold Ball, Savitzii, Souvenir de Bonn, Caprice, Boule de Neige (Snowball) Fig. 68 shows one of the forms of this garden group, passing sometimes erroneously as *A. Thompsonii*.

A arbŏreum, Sweet Lvs cordate, tomentose fls pale yellow Peru —*A Bedfordiànum*, St Hil Lvs lobed fls yellow with red very tall Brazil —*A esculéntum*, St Hil Lvs cordate, acuminate, toothed, tomentose fls purple, solitary Fls. said to be cooked and eaten by natives in Brazil under name of Bencaode Deos —*A globiflŏrum*, Don Fls large, cream-colored Mauritius —*A integérrimum*, Hook & Jackson, Index Kewensis (Sida integerrima, Hook B M 4360) Lvs entire, cordate, tomentose below fls large, yellow, flaring Colombia —*A pæoniæflŏrum*, Walp Fls rather small pink Brazil —*A pulchéllum*, Sweet, and *A. pulchrum*, Don =Plagianthus pulchellus.

L. H. B.

ACACÁLLIS: *Ayapana*

ACÀCIA (from word meaning a *point* or *thorn*, referring to the stipules often spinescent). *Legumnòsæ*, tribe *Mimòseæ* Trees or shrubs grown out-of-doors in warmer parts of the United States and some of the species as cool greenhouse plants for the showy yellow bloom.

Leaves bipinnate or reduced to phyllodia with vertical edges (i e, lf-like petioles) fls regular, orange-yellow, occasionally lemon-yellow or white, in cylindrical spikes or globular heads, solitary, or in pairs or clusters, or in axillary racemes, sepals and petals 5, 4 or 3, free or united, stamens many, long pod a legume, opening by two valves (occasionally indehiscent): funicle of the seed filiform or ending in club-shaped aril, either twice encircling the seed or simply bent back upon itself (The difference between Acacia and Albizzia lies in the stamens, which are free in the former and united at base in the latter) A very large genus (said to be 450 species) dispersed throughout the tropical parts of the earth and even pushing their way into parts of the temperate zones The phyllodine series is confined almost entirely to Australia and the Pacific Isls, while the bipinnate series is scattered over the warm parts of the remainder of the globe The number of species reported from Amer is large (about 70), of which at least 30 are Mexican Acacias are said to be natives of the following states Ariz, Ark, Calif, Fla, Okla, Kan, La, Mo, Nev, New Mex and Texas Those in the following account are Australian, unless otherwise stated This list will undoubtedly be modified as botanists segregate the other genera from the Mimoseæ group Acacias vary greatly under cult, the variation affecting infl, size and shape of lf, and even the funicle One should not expect to determine an unfamiliar species without lvs., fls and fr, with its seeds in place

Other species interesting because of their ant-inhabited thorns are described under *Bull-horn Acacias* Other species referred to Acacia are to be found under *Albizzia*.

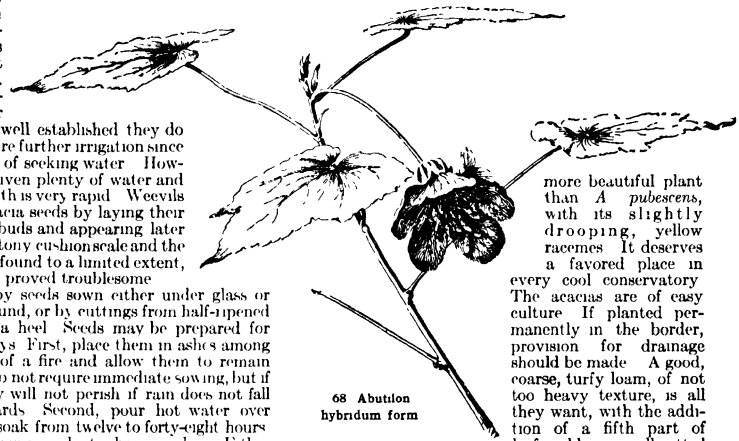
Acacias are quick-growing plants and are short-lived. Various kinds have been known to grow from 11 to 12 feet in four months and 25 feet in six years These trees are thus in their full maturity at thirty years of age, and shortly afterward begin to deteriorate While they may thus be used as street trees to secure immediate effects, more permanent trees should also be planted to take their places The leaves of some species are used in cookery, the flowers of *A Farnesiana* for perfumery, the bark of various species for tanning, *A. Senegal* furnishes most of the gum arabic of commerce; a drug or medicine is made from the wood of *A. Catechu*, a soap or hair-wash from *A. concinna;* several are used as forage plants, others for dyes, and still others for fiber. Many of them have scented wood, others make fine furniture wood, and are used for cabinetwork and fence-posts or fuel, still others for street trees (as *A melanoxylon* and *A dealbata*), and all are more or less ornamental The Ark of the Covenant, as well as the furniture of the Tabernacle, are said to have been made

from timber of *A. Seyal*, which yields the Shittim wood of the Bible Also on account of its incorruptible wood, this species for ages was used by the Egyptians to make coffins for the burial of their kings

Acacias out-of-doors will not endure much frost They seem to thrive very well in localities in which the winter temperature is as low as 20° F , or even 18°, and it is to be hoped that by careful selection strains may be secured that will withstand an even lower temperature. Some species are alkali-resistant as *A cyclops*, *A. retinodes* and perhaps others After the trees are once well established they do not ordinarily require further irrigation since they have a faculty of seeking water However, if they are given plenty of water and good soil their growth is very rapid Weevils sometimes ruin acacia seeds by laying their eggs in the flower-buds and appearing later in the pod The cottony cushion scale and the black scale are also found to a limited extent, but so far have not proved troublesome

Propagation is by seeds sown either under glass or out in the open ground, or by cuttings from half-ripened wood, taken with a heel Seeds may be prepared for planting in two ways First, place them in ashes among the dying embers of a fire and allow them to remain until cool These do not require immediate sowing, but if they are sown they will not perish if rain does not fall very soon afterwards Second, pour hot water over seed, let cool and soak from twelve to forty-eight hours Sow without allowing seeds to become dry Either method softens the hard seed-coats and hastens germination They will then usually germinate in about seven days to three or four weeks, depending upon the species and the season in which they are sown Seed may be sown in the propagating-house at any time throughout the year, though early spring is the natural time For open ground, sow in March or April After germination, the plants are pricked off into flats or pots and shifted into larger ones as occasion requires They are thus kept in pots until they are ready to be transplanted to their permanent quarters, since if placed in the open ground at once the tap-roots will grow with too great rapidity and the tree will either have to be balled or transplanted with the greatest care to prevent its receiving a shock, from which it will take at least a year to recover When buying seedlings from a nursery, therefore, reject all those whose roots have penetrated the pot While several species (*A pycnantha*, *A melanoxylon*, *A decurrens* var *dealbata*, etc) have been known to resow themselves in California, there is no danger of their becoming a pest (such as *A armata* in Australia), since the seedlings are seldom able to live through the dry season without irrigation Cuttings should be made from the half-ripened wood, of which the best are from the side shoots of the main stem, taken with a heel No bottom heat is required, or very little, but they should be covered with a light frame and kept moist and cool by shading They root slowly but freely and should be potted immediately after rooting, but should not be planted in the open soil until they have developed good roots

Cultivation in greenhouses as florists' plants is confined to few species, perhaps not more than a dozen being commercially valuable All of this most important section thrive in a winter temperature ranging from 40° to 50°, in fact, little above the freezing point is sufficient They do not like heat, and consequently are not adapted for forcing If wintered cool and allowed to come along naturally with the increasing heat and light of the spring, they will flower in March and April, a season when their graceful beauty is appreciated in the private conservatory or is valuable to the commercial florist The prevailing color of all the Australian species is yellow, varying from pale lemon to deep orange. The tall-growing kinds, or rather those inclined to make long, straight shoots, make excellent subjects for planting permanently against a glass partition of a conservatory, or against a pillar There is scarcely a



68 Abutilon hybridum form

more beautiful plant than *A pubescens*, with its slightly drooping, yellow racemes It deserves a favored place in every cool conservatory The acacias are of easy culture If planted permanently in the border, provision for drainage should be made A good, coarse, turfy loam, of not too heavy texture, is all they want, with the addition of a fifth part of leaf-mold or well-rotted spent hops Few of our greenhouse pests trouble them. Water in abundance they like at all times, and in their growing season, which is the early summer months, a daily syringing is necessary Several of the species of bushy habit are very much grown as pot-plants in Europe, and are now largely imported and sold for the eastern trade *A armata* and *A Drummondii* are good species for this purpose With our hot summers, the commercial man will do better to import than to attempt to grow them from cuttings The acacias need pruning, or they will soon grow straggling and unshapely, more especially is this true of those grown in pots After flowering, cut back the leading shoots rather severely Shift into a larger pot if roots demand it, and encourage growth by a genial heat and syringing, giving at same time abundance of light and air They should be plunged out-of-doors as soon as danger of frost is past, and removed to the greenhouse before any danger of early fall frosts Cuttings root surely but not quickly The best material is the side shoots from a main stem in the condition that florists call half-ripened —that is, not green and succulent as for a verbena, nor as firm and hard as the wood of a hybrid perpetual rose in November The wood or shoot will be in about the right condition in June No bottom heat is needed, but the cuttings should be covered with a close frame and kept moderately moist and cool by shading The following spring these young plants can be either planted out-of-doors, where there is a good chance to keep them well watered, or grown on in pots, as described above. A few of the finest species are *A pubescens*, suitable for training on pillars, *A Riceana* makes a bush or can be trained, *A longifolia*, an erect species, deserves a permanent position in the greenhouse border Of all the species best adapted for medium-sized, compact pot-plants, *A armata* and *A. Drummondii* are the best The former has small, simple, dark green leaves and globular, pure yellow flowers *A Drummondii* has drooping, cylindrical, pale lemon flowers. As both these flower in March without any forcing in our northern greenhouses,

they are very valuable acquisitions to our Easter plants The acacia has two distinctive charms: the foliage is either small, simple and glaucous, as in A. armata, or much divided, graceful and fern-like, as in A pubescens. All the acacias are among the freest-flowering of our hard-wooded plants (William Scott)

INDEX

acinacea, 13
aneura, 47
angustifolia, 20
arabica, 63
argyrophylla, 19
armata, 7
Baileyana, 55.
biflora, 9
binervata, 34
brachybotrya, 19
calamifolia, 4
Caleyi, 15
Catechu, 65
catechuoides, 65
Cavenia, 62
celastrifolia, 20
cinerascens, 48
cultrata, 16
cultriformis, 16
cuneata, 8
cuspidata, 3
cyanophylla, 27
cyclops, 43
dealbata, 58
decipiens, 9
decurrens, 58
diffusa, 3
discolor, 56
dodonæifolia, 14
dolabriformis, 9
Drummondii, 66
eburnea, 64
echinula, 1
elata, 54
elongata, 40
erythropus, 46
extensa, 6
falcata, 23
falciformis, 24.
Farnesiana, 61
filicina, 59
filicioides, 59.
floribunda, 52
Fraseri, 15
furcifera, 7
genistæfolia, 3
glabra, 19
glaucescens, 48
glaucophylla, 19
grandis, 60
Greggii, 67
harpophylla, 42
hispidissima, 60
holosericea, 50
homomalla, 48
implexa, 37
incrassata, 9
juncifolia, 5
juniperina, 1
koa, 38
Latrobei, 13
leiophylla, 26
leptophylla, 61
leucadendron, 48
leucophylla, 50
linearis, 51
linearis, 11
linifolia, 22
longifolia, 52
longissima, 51
lunata, 18
macradenia, 32
Maideni, 49
Meissneri, 10
melanoxylon, 36
mollis, 55
mollissima, 58
myrtifolia, 20.
neriifolia, 30
neurocarpa, 50.
normalis, 20, 58
obliqua, 12
obtusata, 28
oleæfolia, 18
Oswaldii, 41
oxycedrus, 44
paradoxa, 7
pendula, 35
penninervis, 24.
pentædra, 6
petiolaris, 25
planifolia, 5
plagiophylla, 23
podalyriæfolia, 15.
pravissima, 17
prominens, 22
pruinosa, 57
pubescens, 53
pulchella, 60
punicea, 1
pycnantha, 25.
retinodes, 29
Riceana, 46
rotundifolia, 12.
runciformis, 11.
salicina, 33
saligna, 26
sentis, 21
Sophoræ, 52
suaveolens, 31.
tenuifolia, 2
umbrosa, 34
undulata, 7.
verticillata, 45.
viscidula, 39.
Wayæ, 33.

KEY TO THE SPECIES.

A. *Lvs reduced to phyll (i e, the petiole is flattened to resemble a simple lf).*
B. *Fls in globular heads*
C. *Phyll terete or slightly flattened.*
D. *The phyll tapering into points.*
E. *Funicle filiform to its end* . **1. juniperina**
EE. *Funicle ending in enlarged aril.*
F *Fls cream-yellow, phyll slender, broad at base* 2 **tenuifolia**
FF *Fls rich yellow phyll thick, narrower at base* 3 **diffusa**
DD *The phyll with innocuous points, not pungent*
E *Peduncle usually more than 1-headed* 4 **calamifolia**
EE *Peduncle mostly 1-headed*
F. *Phyll obscurely nerved* 5 **juncifolia**
FF *Phyll prominently nerved, st almost winged* 6 **extensa**
CC. *Phyll vertically flattened*
D *Veins of phyll 1, or very rarely 2*
E *Fl-heads solitary or in pairs or clusters*
F *Length of phyll 1 in or less*
G *Stipules persistent as slender spines*
H. *Pods hirsute*
I *Phyll semiovate* 7 **armata**
II *Phyll wedge-shaped* 8 **cuneata**
HH *Pod glabrous phyll triangular or rhomboidal* 9 **decipiens**
GG *Stipules deciduous, small or none*
H. *Peduncles shorter than phyll* 10 **Meissneri**
HH *Peduncles longer than phyll.*
I. *Nerve near one edge phyll. 1/12 in wide* 11 **lineata**
II. *Nerve central. phyll. over 1/8 in. wide.*

J. *Phyll. orbicular...* 12. **obliqua**
JJ. *Phyll. oblong.* ...13. **acinacea**
FF. *Length of phyll. 1 1/4–4 in.*
G. *More or less spinescent.* 21. **sentis**
GG. *Not spinescent* . 14 **dodonæifolia**
EE. *Fl-heads in axillary racemes (rarely reduced to a solitary head)*
F *Length of phyll. 2 in or less*
G *Racemes much exceeding phyll*
H *Phyll hoary or pubescent* . 15 **podalyriæfolia**
HH *Phyll glabrous*
I *The phyll nearly as broad as long*
J *Shape of phyll obliquely ovate* 16 **cultriformis**
JJ *Shape of phyll triangular* 17 **pravissima**
II *The phyll oblong-falcate, not so broad as long* 18 **lunata**
GG *Racemes not or only slightly exceeding phyll (except A linifolia var prominens)*
H *Phyll obliquely obovate* 19 **brachybotrya**
HH *Phyll lanceolate (often 3 in long in Calif)* 20 **myrtifolia**
HHH *Phyll linear*
I *Stipules spinescent* 21 **sentis**
II *Stipules not spinescent*
J *Gland at base* 22 **linifolia**
JJ *Gland below middle* 22 **linifolia var. prominens**
FF *Length of phyll over 2 in (except A salicina var Wayæ)*
G *Some of phyll over 1 in. wide.*
H *Funicle encircling seed and bent back in double fold*
I *Pod 1/4 in wide.* 23 **falcata**
II *Pod over 1/4 in., nearly 1/2 in wide* 24 **penninervis**
HH *Funicle not encircling seed*
I *Phyll sickle-shape* 25 **pycnantha**
II. *Phyll not sickle-shape.* 26. **saligna** 27 **cyanophylla**
GG *All phyll under 1 in wide*
H *Phyll linear-lanceolate, mostly widest above middle*
I *Midrib much to one side, gland one-third from base, making a notch* 28 **obtusata**
II. *Midrib central or nearly so, gland 1/4–1/2 in from base*
J. *Funicle surrounding seed* 29 **retinodes**
JJ *Funicle not surrounding seed* 30 **neriifolia**
HH *Phyll linear-oblong, not widest above middle*
I *Seeds nearly transverse* 31. **suaveolens**
II *Seeds longitudinal*
J *Racemes compound* 32 **macradenia**
JJ *Racemes simple, often reduced to 2 or 3 heads.*
K *Foliage pale...* 33 **salicina**
KK *Foliage dark green* 33 **salicina var Wayæ**
DD. *Veins of phyll several (rarely only 2), longitudinal*
E *Fl-heads in racemes.*
F *Phyll 2-nerved* 34 **binervata**
FF *Phyll more than 2-nerved*
G. *Pod with narrow wing* 35 **pendula**
GG *Pod not winged*
H *Funicle encircling seed in double fold* 36 **melanoxylon**

BBB. *Funicle folded at end of seed, not encircling it.*
I. *Width of pod ¼in.* . . 37. **implexa**
II *Width of pod ¾-1 in* 38. **koa**
BB. *Fl.-heads solitary or in pairs or clusters*
F. *Width of phyll. ⅛in or less, linear.*
G *Phyll. viscid* . 39 **viscidula**
GG. *Phyll. not viscid* 40 **elongata**
FF. *Width of phyll over ⅛in, not linear.*
G. *The fl.-heads sessile, or nearly so* 41 **Oswaldi**
GG. *The fl.-heads not sessile*
H. *Funicle short, half as long as seed* 42 **harpophylla**
HH *Funicle long, scarlet, encircling seed in double fold* ..... 43. **cyclops**
BB. *Fls. in spikes.*
C. *Shape of phyll. narrow (⅛ to less than ¼in.), pungent pointed*
D. *Nerves 3 or 4 phyll scattered* 44 **oxycedrus**
DD *Nerves 1*
E *Phyll whorled* 45 **verticillata**
EE. *Phyll clustered fls mostly 3-merous* 46 **Riceana**
CC. *Shape of phyll broader (except A aneura and A longiflora var floribunda), less rigid, not pungent pointed*
D *Pod winged* . ... 47 **aneura**
DD *Pod not winged*
E *Calyx and phyll pubescent (A. Maidenii only slightly so)*
F *Sepals velvet-like, bright orange-yellow* 48 **glaucescens**
FF *Sepals not velvet-like yet more or less pubescent*
G *Funicle encircling seed* 49 **Maidenii**
GG. *Funicle folded and enlarged into cup-shaped aril* 50 **holosericea**
EE *Calyx and phyll not pubescent*
F *Phyll linear* 51 **linearis**
FF *Phyll elliptical, lanceolate*
G *Width of phyll over ¼in* 52 **longifolia**
GG. *Width of phyll less than ¼in.* . . . . . 52 **longifolia** [var **floribunda**
AA. *Lvs all bipinnate.*
B. *Fls in globular heads*
C. *Stipules none or brown and scarious.*
D *Pinnæ few, 2–10 pairs.*
E *Rachis hirsute* . 53 **pubescens**
EE *Rachis not hirsute*
F. *Lfts 1¼-1½ in long* 54 **elata**
FF. *Lfts less than 1¼ in long*
G. *Length of pinnæ 1 in.* 55 **Baileyana**
GG. *Length of pinnæ over 1 in*
H *Funicle filiform* 56 **discolor**
HH *Funicle cup-shaped aril* 57 **pruinosa**
DD. *Pinnæ many, 8–25 pairs*
E. *Plant a tree lfts 30–40 pairs, more or less tomentose-pubescent* 58 **decurrens**
F. *Lfts. dark green, shining above, imbricate fls bloom in June, pale yellow* 58 **decurrens**
FF. *Lfts more or less gray, farther apart fls bloom in Jan. and Feb., deep yellow* 58. **decurrens** [**mollis**
FFF. *Lfts light green, distant. sepals as long as petals* 58 **dealbata** **normalis**
EE. *Plant a shrub. lfts. 20–50 pairs, glabrous.* ..... 59 **filicina**
CC. *Stipules spinescent.*
D. *Pinnæ 1 pair* .. . 60 **pulchella**
DD. *Pinnæ more than 1 pair.*
E *Pod round* . . 61. **Farnesiana**
62. **Cavenia**
EE. *Pod moniliform* . ....63 **arabica**
EEE. *Pod not moniliform* ... .. 64 **eburnea**
BB. *Fls in spikes*
C *Pinnæ 10–40 pairs* .... 65 **Catechu**
CC. *Pinnæ 2–4 pairs*
D. *Pod not exceeding 1 in. long* 66 **Drummondii**
DD. *Pod 1½–4 in. long.* .. .. 67. **Greggii**

1. juniperina, Willd (*A echínula,* DC. *A. púngens,* Spreng.). A stiff shrub, 8 to 12 ft., with branchlets either pubescent or smooth. phyll scattered, numerous and tapering into a sharp point, ⅛ to rarely ½in long, 1-nerved. fl.-heads solitary on peduncles longer than the phyll., 5-merous; petals ciliate; petals acute, with prominent midrib. pod more or less falcate, flat, 1–2 in long, about ⅛in broad, usually contracted between the seeds; seeds longitudinal, the funicle but little folded and filiform to the end May, June.—May be distinguished from *A tenuifolia* by its funicle filiform the entire length, its petals with prominent midrib, and its 5-merous fls.

2 **tenuifòlia,** F v M Fig. 69. An everblooming shrub with a sticky exudation on sts and over the young fl.-buds branchlets slender and drooping: phyll linear-subulate, ¾–1 in. long, ⅛in wide, 1-nerved, ending in a pungent point, gland at base fls lemon-yellow, with peduncles ¼in long, solitary in axils of the phyll., 30 or more in a head pods straight, slightly constricted between seeds, 2–3 in long, nearly ¼in wide, pointed at both ends and bearing two rough longitudinal marks over each seed, characteristic of this species, funicle silvery white, half as long as seed and enlarged into a cup-shaped aril over one end, ripe June–Nov Fls every month F v M. Icon 1 8.—This attractive shrub is easily grown from seed, germinating in about three weeks and growing steadily It is delightful for situations that demand a low-branching habit Its everblooming fls., honey-like odor and dust-resistant qualities also recommend it.



69. Acacia tenuifolia. (×½)

3 **diffùsa,** Lindl (*A. genistæfòlia,* Link) A shrub of 5 or 6 ft with loosely scattered foliage: phyll linear or subulate, ½–1¼ in long (mostly ¾in.), $\frac{1}{12}$–⅛in wide, 1-nerved, ending in sharp point fls in pairs or reduced to a single head, either 4- or 5-merous, peduncles ¼in long; sepals not half length of petals pod stipitate, flat, acute, 3–4 in long, ½in. broad, valves convex over seeds, funicle much folded and thickened from the middle Apr., May B M 2417. B R 634 Var **cuspidàta,** Benth (*A cuspidàta,* Cunn.). Phyll. more slender, from ¾–2 in long, about as broad as thick

4 **calamifòlia,** Sweet. Broom Wattle. Fig 70 A tall shrub or small tree with slender erect branches: phyll narrow-linear to subulate, with oblique point at apex and narrowed to base, 1½–2¼ in long, $\frac{1}{16}$in. wide, 1-nerved, gland near base (obscure in dried specimens). racemes short, of 3 or 4 heads, or reduced to a single one, fls 20 to a head, 5-merous; sepals half as long as petals, peduncles ¼in long pods a rich brown, slightly contracted between the seeds, 1¼–3 in long, $\frac{3}{16}$in wide, funicle red, almost encircling the seed in a double fold, ending in a silvery club-shaped aril; ripe Aug Fls. Feb.–Apr B R. 839.—An attractive ornamental at all times but especially so when in full bloom. An excellent tan-bark species, analysis showing as much as 20 63 per cent of tannin.

5. **juncifòlia,** Benth. (*A pinifòlia,* Benth.). A tall shrub with terete branches, either glabrous or hirsute: phyll from slightly flattened to tetragonous, 3–6 in long or more, with a nerve on each side fls 5-merous, either solitary or in pairs, about 40 in a head; petals united; calyx spatulate and ciliate, not half so long as petals; peduncles ¼in. long (rarely ½in.) pod flat, with nerve-like margins, 3–4 in. long, less than ¼in. wide, seeds oblong, longitudinal, funicle half as long as seed, filiform but slightly thickened at hilum F v. M. Icon 2 8.


70. Acacia calamifolia (×½)

6 **extensa,** Lindl. (*A. pentàdra,* Regel) A shrub 5 ft tall, with more or less winged angular branchlets phyll linear-subulate or needle-like, 3–4 in. long (sometimes 8), $\frac{1}{24}$in wide, 1-nerved, ending in sharp point, gland ½–1 in from base fls solitary or shortly racemose, 20 in a head, 5-merous, sepals short, peduncles ½in. long pods with nerve-like margins, constricted between the seeds, 2–4 in long, ¼in wide; funicle straight and only slightly thickened at hilum end, ripe May. Fls March

7 **armàta,** R Br. (*A undulàta,* Willd *A paradòxa,* DC *A furcífera,* Lindl *Mimòsa paradoxa,* Poir.). Kangaroo Thorn Fig 71 A spreading shrub 8–10 ft wide, 7–11 ft. tall, with pendent finger-like branchlets phyll half-ovate, the straight edge hugging the st, the other edge more or less undulate, nerve excentric, ending in a pungent point, stipules reduced to slender spines about ¼in in length: fls solitary on peduncles ¾in. long, petals 5, sepals 5, more than one-half length of corolla: pods hairy, straight or slightly curled, in clusters of 2–5 or reduced to 1, 1½–2 in long, $\frac{3}{16}$in wide, funicle silvery, as long as seed and enlarged to a cup-shaped aril; ripe Aug. Fls Feb–Apr B M 1653 — A shrub with breadth often much greater than its height, sometimes 15–20 ft across, hence suitable for large grounds and roomy corners Makes a good hedge plant, and is also used to reclaim sand-dunes It is a good rich green and withstands considerable dust and drought There is a larger-lvd form with fissured bark and more straggling habit. The phyll is greener and more tender in texture than the type, and the fls are larger.

8 **cuneàta,** Benth A tall glabrous shrub phyll ½ to scarcely 1 in long, wedge-shaped, truncate at the apex, nerve excentric, ending in sharp point at one angle while the other angle is tipped by a gland, occasionally a faint secondary nerve; stipules setaceous fls solitary; peduncles about as long as phyll, 8–15 in a head, 4-merous; petals separate; calyx turbinate, half as long as corolla and with broad lobes. pod hirsute, thick margins, 2–3 in long and ⅛in wide B R 1839.—An interesting ornamental species, somewhat resembling *A pravissima*

9 **decipiens,** R Br (*A dolabriformis,* Colla *A. incrassàta,* Hook *A. biflòra,* Paxt). A shrub either low and bushy or up to 10 or 12 ft tall, glabrous or rarely hirsute phyll triangular or trapezoid, ⅛–⅜in long and nearly as broad, principal nerve excentric, ending in small point, gland on other angle, the occasional stipules are spinescent: fls solitary or in pairs, 6–10 in a head pod thick, hard, much incurved, 1–2 in long, $\frac{1}{12}$–$\frac{1}{8}$ in wide, narrowed at each end, seeds longitudinal, funicle ending in club-shaped aril B M 1745, 3244 —The difference between this and *A cuneata* seems to lie chiefly in fls and phyll, which are about as broad as long in *A decipiens,* and much longer than broad in *A. cuneata,* and wedge-shaped.

10 **Meissneri,** Lehm Tall shrub: young branches glabrous, acutely angular phyll ½–1 in long, $\frac{1}{16}$–⅛in broad, obovate-oblong or obliquely cuneate, obtuse, or with a small, hooked point peduncles shorter than the phyll pod flat, ¼–⅜in broad, the margins not thickened, seed oblong, longitudinal, funicle very long and much folded, the last fold almost encircling the seed and returning, but thickened only at the end

11 **linearis,** A Cunn (*A runciformis,* A Cunn) A bushy shrub branches usually pubescent, terete and often slightly resinous phyll linear, ½–¾in long or more, 1½ in wide, nerve near the margin and ending in small hooked point fls solitary, 5-merous, equal to or exceeding the phyll, sepals distinct, linear-spathulate, peduncles ¼–½in long pod curved or twisted, $\frac{1}{16}$in wide, funicle not so long as seed, ending in a clavate fleshy aril Fls March B M 3316 (as *A runciformis*) —This differs from *A acinacea* and *A obliqua* in only its narrow phyllodia Habitat in barren forest grounds in the interior of New South Wales.

12 **obliqua,** Cunn (*A rotundifòlia,* Hook) A drooping shrub, with finger-like branches, angular and slightly pubescent: phyll obliquely obovate to orbicular, ¼–½in long, $\frac{1}{12}$–⅜in wide, 1 excentric nerve ending in recurved point, stipules minute, gland, when present, one-third distant from base fls 5-merous, solitary or in pairs on peduncles ½in long; fls 15–20 in a head, petals with midrib, sepals narrow, half as long as petals pod more or less twisted and constricted between the seeds, 1–2 in long, $\frac{1}{8}$in wide, thin, with nerve-like margins, funicle club-shaped, half as long as seed, ripe July, Aug Fls. Feb. B M 4041


71 Acacia armata (×½)

13 **acinacea,** Lindl. (*A. Latrobei,* Meisn) A much-branched shrub: phyll. obliquely oblong, ½–¾in long, ¼–½in wide, obtuse, with a recurved point; gland one-third distance from base fls in pairs (rarely solitary), 5-merous, calyx spathulate, ciliate, half as long as petals, petals united; peduncles ½–¾in long pod twisted or curved, ⅛in wide, more or less constricted between the seeds; seed longitudinal; funicle not so long as seed and thickened into fleshy clavate aril Fls March F. v M Icon. 4 7 —F v Mueller proposed to unite this with the broad-lvd *A obliqua,* since the only difference between them seems to be based upon shape of phyll This group should be given further study to determine whether transition stages may be found between the narrow and the round forms and whether

the supposed distinction of straight pods in *A. acinacea* can be traced into the curled pods of *A. obliqua*.

14. **dodonæifòlia,** Willd A tall, glabrous, very resinous shrub· phyll. lanceolate to linear-falcate, tapering to base, having the appearance of being encrusted with a brownish powder, 1½–2, sometimes 4, in long, about ¼in wide, the lateral veins prominent and anastomosing; 1 central nerve ending in an oblique point fls solitary or in pairs, not exceeding the phyll ; peduncles ½in long, about 40 fls in a head, 5-merous, calyx more than half as long as corolla pod straight or falcate, about ¼in wide; seeds longitudinal, funicle with last 2 or 3 folds dilated into an irregular cup-shaped aril March —Superficially this resembles the *A retinodes* group, but the fls are solitary or in pairs instead of in racemes, and it has an apparent incrustation on foliage

15. **podalyriæfòlia,** Cunn (*A Fràseri*, Hook. *A Calèyi*, Cunn). Fig 72 A tall, glabrous shrub with conspicuous gray branchlets covered with a soft pubescence. phyll pinniveined, pubescent (rarely glabrous), ovate or oblong, 1–1½ in. long, ½–1¼ in wide, nerve-like margins and prominent excentric midrib ending in oblique point, the margins and midrib ciliate, gland at middle or just below racemes simple, longer than phyll , of numerous small heads, calyx turbinate, not half so long as corolla; petals hirsute, with prominent midrib· pod flat, either glabrous or pubescent, 1–3, or more, in long, ¾in. broad, seeds longitudinal, funicle not encircling seed but in short folds at hilum end, the last fold slightly thickened R B 33·105 G C III 43 11 Gt 54·1541. G W 9, p 158 —Its neat gray ovate lvs. and abundant long yellow racemes at the end of the branches make it a very decorative and popular species.

16 **cultrifórmis,** Cunn (*A cultràta*, Ait) A tall shrub with gray foliage thickly clothing the branches: phyll with nerve-like margins, obliquely ovate to almost triangular, ½–1 in long, ¼–½in wide, with gland on upper edge one-third distance from base, the intervening edge straight and closely hugging the branchlets, vein excentric, much curved, ending in mucronate point racemes axillary, much exceeding the phyll ; fls 30–40 in a head; sepals half as long as petals, peduncles ¼in long pod a rich brown, with nerve-like margins, 1½–3 in long, ¼in wide, occasionally constricted between the seed, seed oblong, longitudinal, funicle half as long as seed, silvery and enlarged into a cup-shaped aril almost from the beginning, ripe Sept , Oct Fls March, Apr R H 1896, p 503 J H III 34 131 —If kept well pruned it makes a good hedge Has been cult in Calif for many years in the open, and is considered a desirable plant

17 **pravíssima,** F v M. Fig 72 A small tree, 15–20 ft high with decurrent, pendulous, finger-like branchlets thickly clothed with short foliage phyll ¼–1 in. long, ¼–½in. broad, cuneiform to trapezoid, one angle rounded, the other acute, indistinctly 2-nerved, the prominent nerve excentric and ending in a mucronate point, gland large, near middle of upper edge. racemes much longer than phyll , 10 to more fls in a head; peduncles ⅛in long pods, when ripe, once or twice twisted, with nerve-like margins and mucronate tip, 1½–2¾ in. long, ¼in. wide; seed small, longitudinal, with prominent central marking; funicle as long as seed, enlarged into club-shaped aril, ripe July, Aug. Fls Feb , March.—A very graceful showy species that is becoming popular.

18 **lunàta,** Sieb (*A. oleæfòlia*, Cunn) A glabrous shrub with angular branches phyll oblong-falcate, obtuse, with sharp point, ¾–1 in long, ¼–½in wide; vein excentric; gland one-third distance from base· racemes simple, longer than phyll ; fls 4–15 in a head; calyx united, about one-third length of corolla pod straight or curved, ⅓in wide, seeds longitudinal, near upper suture, the last fold of the funicle thickened into a lateral club-shaped aril, the lower folds very small. Apr. B R 1352 —This resembles *A linifolia* var. *prominens* in fls and foliage; the fr is necessary to distinguish them

19 **brachybòtrya,** Benth Tall shrub· phyll ½–1¾ in , rarely, in luxuriant specimens, 2 in long, obliquely obovate or oblong, firm, rather broad, obtuse or mucronulate fl -heads few, short, axillary racemes, about equaling the phyll , or rarely reduced to 1 head; fls 20–50 in a head pod flat, linear to narrow-elliptical.

Var **argyrophýlla,** Benth (*A argyrophylla*, Hook.). Silvery-silky, turning sometimes golden yellow phyll. mostly ¾–1½ in long fl -heads often solitary. B M. 4384

Var **glaucophýlla,** Benth Glaucous and more or less pubescent phyll mostly ½–¾in long. fl -heads mostly 2–5, shortly racemose

Var **glàbra,** Benth Quite glabrous phyll small and narrow. fl -heads small

20 **myrtifòlia,** Willd A tall shrub with angular branchlets, the angles, glands and margins of phyll. edged with light red or pink phyll oval to ovate-lanceolate, the apex either acute with oblique point or obtuse and rounded, 1¼–2 in long, ⅓–½in. wide, gland ¼in from base, nerve excentric fls in racemes nearly as long as phyll ; peduncles ⅛in long, fl -heads few (3–5), though large, 4-merous, petals with prominent midrib, sepals short, united pod with nerve-like margins, curved and contracted between the seeds and tough, 3 in long, ⅛in broad, funicle short, thickened into cup-shaped aril B M 302 Fls Feb–Mar

Var **celastrifòlia,** Benth (*A celastrifòlia*, Benth). Phyll mostly 1½ in long and often 1 in broad. B M. 4306

Var **normàlis,** Benth Phyll mostly 1–2 in long and about ½in broad.

Var **angustifòlia,** Benth Phyll. mostly 2–4 in. long, 1/16–⅛in broad.

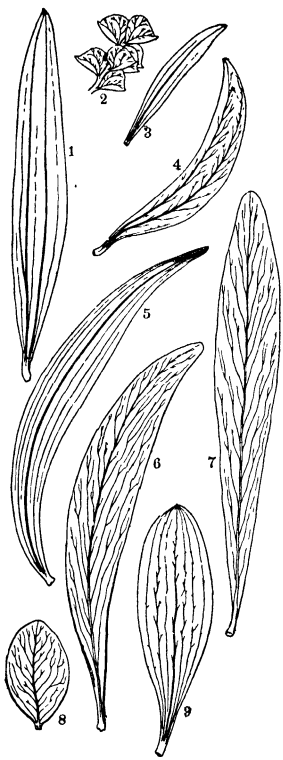
21 **séntis,** F. v M A rigid shrub or small tree 30 or 40 ft high, with terete branchlets and when young either glabrous or pubescent phyll various, either lanceolate-oblong with a short point or linear with a hooked point, in some specimens ¾in long by ⅛ or ¼in broad and in others again they may be 2 in. long and ⅛in broad, marginal gland near base or wanting, stipules reduced to spines, occasionally none fls solitary or in pairs or racemes, 20–30 fls in a head; sepals linear, spatulate, ciliate pod flat, 2–3 in long, ½–¾in. broad, seeds nearly oblique, the funicle gradually thickened and folded several times, fitting against seed like a cap May F v M Icon 4 9 —A desert species commonly growing in sandy soil It thrives with scant rainfall but requires much light, although in its native country it is now and then found among large trees It is a valuable fodder plant, cattle eating it greedily A specimen in Calif was growing on soil that was almost rock and consequently became shallow-rooted The wind threw it down repeatedly but each time when set in place it continued its growth, apparently unharmed. In New S Wales it is said that the presence of this tree is a sure indication of underground water Its roots have been found 80 ft. from the surface

22 **linifòlia,** Willd A tall shrub with a minute pubescence on the branchlets and at the base of the young phyll · phyll linear on young shoots to linear-lanceolate on more mature ones, ¾–1½ in long, ⅛–⅓in wide, 1-nerved, ending in mucronate point, gland below the middle small racemes shorter than phyll , with 8–12 fls in a head pod flat, with nerve-like margins, 2½–4 in. long, ⅜in wide; funicle half as long as seed, with club-shaped aril B M. 2168

Var **prôminens,** Moore (*A. prôminens*, Cunn.). Phyll wider, oblong-lanceolate, 1–1½ in. long, ⅛–⅜in.

wide; very prominent gland, its position varying, sometimes above, sometimes below the middle. pod wider, 1½–3 in. long, ½in wide, funicle short (not surrounding the seed), filiform and ending in fleshy aril Fls. late Feb and March B M. 3502.—This variety does not appear to seed in Calif

23. **falcàta,** Willd. (*A plagiophýlla,* Spreng). Tree or tall shrub phyll distinctly pinnivened, lanceolate-falcate, much narrowed toward base, 3–6 in long; nerve excentric; gland at base or none racemes shorter than phyll , 20 fls in a head, sepals free, narrow, ciliate, about half as long as petals; petals striate, with prominent midrib pod flat, 2–3 in long, ¼in. wide, seed longitudinal, close to the margin; funicle colored, extending around seed and bent back on itself in a double fold, enlarged at hilum end into a fleshy aril —This may be distinguished from *A penninérvis* by its smaller pod (half the size), by its gland close to base instead of distant from it, and by its free, narrow, spatulate ciliate sepals.



72 Acacia leaves. 1, A longifolia; 2, A pravissima; 3, A cyclops, 4, A binervata, 5, A. implexa; 6, A pycnantha, 7, A. saligna, 8, A podalyriæfolia, 9, A melanoxylon. (×½)

24 **penninérvis,** Sieb MOUNTAIN HICKORY A tall glabrous shrub or a tree, 40–80 ft. high phyll pinnivened, lanceolate-falcate, acuminate, much narrowed at the base, 3–4 in. long (sometimes twice that length) about ½in broad, nerve excentric with a short secondary nerve terminating in a marginal gland below the middle fls pale yellow, in short racemes, much shorter than phyll ; peduncles ¼in. long· pod 3½–5 in. long, ½in broad with nerve-like margins, seed longitudinal; funicle colored, extending around seed and bent back on same side so as to encircle in double fold B M. 2754. Maiden Wattles and Wattlebark, p 35 —A variable species with very narrow phyll , often ¼–½in wide and 8–12 in long, the average being 1 in broad and 5 in long

Var falcifórmis, Benth (*A. falcifórmis,* DC.). A shrub 6–10 ft. high with young shoots and infl. minutely hoary or golden pubescent: phyll. broad, obliquely ovate-oblong, obtuse, smooth and feather-veined, 3–4 in long, 1 in broad, gland at base· fls in racemes.—Larger and more falcate than the type.

25. **pycnántha,** Benth. (*A. petiolàris,* Lehm.). GOLDEN WATTLE. BROAD-LEAVED WATTLE. Fig. 72 A small tree with more or less pendulous branchlets phyll pinnivened, oblong-lanceolate to falcate-lanceolate or even broadly obovate, 2½–6 in long, ¾–1½ in wide, 1-nerved, the nerve more or less excentric, gland ½–¾ in. from base racemes either simple or compound, large-fld , fragrant and showy, often bending the tree with its weight of bloom, 50–60 fls in a head with peduncles ⅛in long, sepals 5, ciliate, almost as long as petals. pods varying, 2–4½ or 5 in long, ¼in wide, contracted and slightly constricted between the seeds and with nerve-like margins, funicle whitish, club-shaped, not folded, half as long as seed or occasionally folded and transverse to the seed, ripe Aug Fls Feb , March Maiden Wattles and Wattlebark, p 39. R H 1896, p 501 Brown, For. Flora of S Austral —The name "broad-leaved" is derived from its reference to the seedling lvs , which are of great size, sometimes 5 in long and 4 in wide The bark contains the highest percentage of tannin of any of the species, but the tree does not attain the size of *A decurrens,* and hence so great a quantity is not obtained from any one tree It is made into perfume, exudes a good gum, and is used as a sand-binder

26 **salígna,** Wendl (*A lævophylla,* Benth) Fig 72. A low tree or tall shrub with angular, rather drooping branches phyll lanceolate to linear-lanceolate, or even oblanceolate, 3–8½ in or lower lvs 1 ft. long, ¼–1¼ or even 1¾ in wide, acute to obtuse, narrowed to base; 1 central nerve, often excentric, ending in a recurved point or obtuse, gland at base or none fls large (½in in diam), either in large racemes at the ends of the branches or reduced to 1 or 5 heads strung along the axils of the lvs for 2 or 3 ft , peduncles varying from ¼–½in in length pods constricted between the seeds, flat with nerve-like margins, 3–5 in long, ¼in wide, funicle club-shaped, three-fourths length of seed, ripe Aug Fls March–May and to slight extent at various times —Botanists do not find any well-marked differences between this species and the next and are therefore inclined to combine the two Nurserymen base their distinction on the color of the phyll , a blush-tinged one being called *A. cyanophylla,* while the green phyll , especially if it is smaller, is called *A saligna* Both forms are also said to have been secured from seed gathered from a single tree Nurserymen should test this to satisfy themselves Another so-called botanical distinction gives the funicle straight in one species and folded in the other This does not hold, as such a combination can be seen in the same plant, and even in the same pod This species is variable in other respects Fls may be in groups of 4 or 5 and strung along the axis of lvs for 2 or 3 ft This type may have either large or small or even mixed phyll , or the fls may be in large clusters (either erect or pendulous) at the ends of the branches In either case, the large or the small or the mixed types of phyll. may accompany them.

27. **cyanophýlla,** Lindl. BLUE-LEAVED WATTLE. Tall shrub, 18 ft , stoloniferous· branches drooping· lower phyll about 12 in long, upper 6 in or less and narrower, linear-oblong to lanceolate-falcate, much narrowed toward the base, glabrous and often glaucous peduncles ¼–½in long, fls 3–5, large, golden yellow. March Gn 52, p 99 —Said to be the same as *A saligna,* as they run into each other.

28 **obtusàta,** Sieb Tall, glabrous shrub· phyll. 1½–3 in long, oblong-linear, or almost spatulate, usually almost straight, rather obtuse, point not curved, thick, rigid, with thickened, nerve-like margins, marginal gland 1, distant from the base, not prominent racemes about ¾in. long, with densely packed heads; fls. 30 or more. March.

29. **retinòdes,** Schlecht. A tall shrub or small tree: phyll lanceolate, with nerve-like margins and narrowed to base, acute, pinnately veined, 3–6 in. long, ¼–¾in wide, gland ¼in. from base fls in racemes, mostly compound; peduncles ¼in long, 30–40 fls in a head pod flat, with nerve-like margin, 3–4 in. long, about ¼in. wide; funicle colored red, encircling seed, bent back upon itself in a double fold and ending in club-shaped aril, ripe June–Oct Fls Feb.–Sept. F v. M. Icon 5.9.—Very closely resembling *A. neriifolia* in foliage and fls, but differs in pod, being narrower than that of *A neriifolia*, while the funicle is red and encircles seed in double fold.

30. **neriifòlia,** Cunn. A small tree with angular branchlets phyll lanceolate, acute, narrowed at both ends, 1½–5¼ in long, ¼–⅜in wide, 1 central nerve; gland ½in from base fls about 40 in a head, 5-merous, in short racemes, sepals 5, separate, ciliate, peduncles ⅛–¼in long pods with nerve-like margins, contracted between the seeds and often constricted, a rich brown, 3–6 in long, ⅜in wide, funicle white, short, not encircling seed, but thickened into a club-shaped aril, seed longitudinal, oval, with central depression Fls. July.

31 **suavèolens,** Willd A glabrous shrub, 3–6 ft. tall phyll linear to lanceolate, apex acute, tapering to base, 1 central nerve, gland near base fl-heads in axillary racemes, at first inclosed by imbricate scaly bracts, which soon fall, fls 6–10 in a head pod oblong, rounded at both ends, flat, impressed between the seeds, 1–1½ in long, ½–⅔in wide; seeds transverse; funicle filiform and suddenly enlarged into fleshy aril at right angles to itself Fls Apr —Superficially it resembles narrow-lvd. *A retinodes*, but note the imbricated bracts; the pods are shorter and wider and the funicle does not encircle the seed.

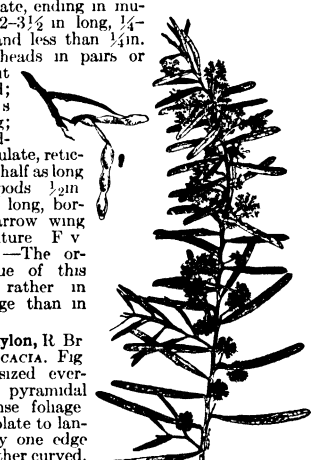
32 **macradènia,** Benth. A glabrous shrub, 10–12 ft. tall, or, in favorable situations, a tree 30–50 ft high: phyll lanceolate-falcate, narrowed to base, 5½–12 in. long, ½in wide, veins fine, prominent and transverse; gland at base, large or often wanting racemes compound, short, fls small, petals pubescent, calyx more than half as long as corolla, turbinate, toothed and ciliate pod with nerve-like margin, 2–4 in long, ¼in. wide or more, slightly constricted between the seeds; seeds longitudinal, funicle not enfolding seed but bent upon itself and ending in club-shaped aril, about half as long as seed F. v M Icon 5 7 —A beautiful close-grained wood that is capable of taking a high polish.

33. **salícina,** Lindl Small tree; branches drooping: foliage pale; phyll. 2–5 in long, ¼–½in. wide, oblong-linear or lanceolate, narrowed at base, thick, rigid, with a curved point, midrib and marginal veins scarcely prominent racemes short, often reduced to 2 or 3 heads, or even only 1, peduncles slender; fls about 20 in the head pods straight, 1–3 in long, ¼in broad, valves convex, hard and thick, seeds longitudinal, funicle thickened and usually scarlet almost from the base, forming several folds under the seed —The timber is dark brown and tough, taking a high polish It is a good forage plant and on this account is becoming scarce in the wild state.

Var. **Wàyæ,** Maiden. Fig 73 A shrub 8 ft tall, which blooms sparingly at various times during the year. phyll somewhat thick (flat when dried) and succulent-looking, oblong-linear, narrowed at base, 1½–2½ in long, less than ¼in. wide; 1 central nerve ending in oblique point, gland below middle. fls solitary or in pairs, or occasionally in short racemes of 3–5 fls, sepals united, truncate; petals 5· pod 1–2 in long, less than ¼in. broad, contracted between the seeds; seed longitudinal; funicle scarlet its entire length, folded several times at one end of seed; ripe June–Sept Fls Feb.–May.—A neat little shrub with bright green lvs. The pods must be picked as soon as ripe and just before dehiscence, for the elastic opening of the pod will discharge the seed in every direction.

34 **binervàta,** DC (*A umbròsa*, Cunn) Fig 72. Two-veined Hickory A tall shrub or shrubby tree of 25 ft, with terete branchlets phyll falcate-lanceolate to triangular, with 2 distinct veins (occasionally 3-veined) and pinnately veined between, 2½–4 in. long, ⅛–1 in. wide; gland ½in. from base fls in racemes shorter than phyll; peduncles ¼in long or more, 30 fls in a head, 4- or 5-merous; calyx not half so long as corolla pods straight, very thin, convex over seed, 4–5 in long, ½in. wide, seed oblong, funicle long, nearly encircling seed and bent back upon itself in double dark red fold, with light aril at hilum end B M 3338 Maiden, Flowering Plants of New S Wales, pt 5, p. 53 Wattles and Wattlebarks, p 50 —It inhabits dry, shaded woods in the mountainous district of the coast.

35 **péndula,** Cunn. Weeping Myall. A small tree with gray foliage and pendulous branchlets: phyll. covered with a minute pubescence, finely striate with 3–5 obscurely parallel veins, linear-lanceolate, often falcate, acuminate, ending in mucronate point, 2–3½ in long, ¼–⅓in wide, gland less than ¼in. from base fl-heads in pairs or clusters, about 30 in a head; peduncles less than ½in long; petals with midrib, sepals spatulate, reticulately veined, half as long as petals. pods ½in broad, 2-3 in long, bordered by a narrow wing along each suture F v M Icon. 6 8 —The ornamental value of this species lies rather in drooping foliage than in the fls.



73 Acacia salicina var. Wayæ. (×½)

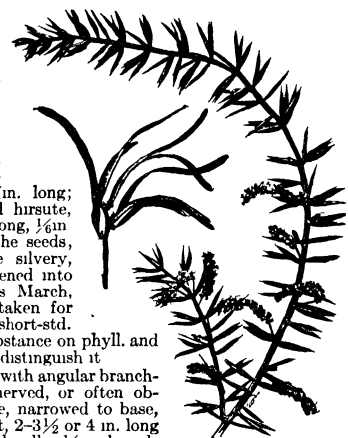
36 **melanóxylon,** R Br Blackwood Acacia. Fig 72. A good-sized evergreen tree of pyramidal form and dense foliage phyll oblanceolate to lanceolate, usually one edge straight, the other curved, 2½–4½ in. long (average 3½ in long by ¾in wide), 3–6 parallel nerves, reticulately veined between, gland ⅛in from base· fls. cream-color, 40–50 in a head, with peduncles over ½in. long, and in short racemes of 3–5 heads pod reddish brown, with nerve-like margins, more or less twisted into shape of letter C or S. 3–5 in. long, ⅜in wide; seed longitudinal, ⅛in. in length, encircled in double fold by a long red funicle which is very characteristic of the species, the seed hanging on the trees thus for months, pods ripe July–Nov Fls late Feb. and March. B M. 1659 —Its wood is but little inferior to black walnut for furniture-making and grillwork; it makes a good street tree in Calif. and as a fuel it is equal to hickory.

37 **implèxa,** Benth Fig 72. A tall tree, 50 ft high, with light green foliage and rough bark: phyll. falcate-lanceolate, acuminate, with a more or less hooked point, 4–7 in long, ⅜–¾in wide, veins 3–5, with finer parallel veins between; no gland fls. cream-yellow, in racemes much shorter than phyll, 40–50 in a head; peduncles ⅜in. long· pod curved, often like an interrogation point, light brown with nerve-like margin, more or less constricted and contracted between the seeds, 4–6 in. long, ¼in. wide, seeds longitudinal, funicle

club-shaped, folded once or twice at end of seed. F. v. M. Icon. 8:2 —Distinguished from *A melanoxylon* by the more pointed and hooked phyll., while the funicle is cream-colored and folded at the end of the seed instead of being scarlet and twice encircling it as in *A. melanoxylon*.

38 **kôa,** Gray. KOA. Tree of 50–60 ft., with spreading branches: phyll. falcate, acuminate and tapering to base, striate with 3–5 parallel nerves more prominent, 4–5 in. long, ⅜–½in wide; gland at base prominent: fls in short racemes or rarely solitary, or in pairs, 50–60 fls in a head; peduncles ½in. long, 5-merous, calyx united, ciliate edges pod brown, flat, thin, reticulately nerved, more or less constricted between seeds, 5–6 in. long, ¾–1 in wide, seed dark brown, nearly transverse, oblong, about ½in long by ¼in. wide; funicle light brown, filiform, not encircling seed but with 2 or 3 twists at hilum end. Hawaiian Isls.—A valuable timber tree, capable of receiving a high polish It should be more largely grown in Calif.

39 **viscídula,** Cunn A tall shrub, 12–15 ft. high, with terete branches covered by a glossy viscid gum· phyll long-linear, with a small oblique point, sparingly pubescent, at least when young, 2–3½ in long, ⅛ to less than ¼in wide, with several obscure parallel veins; gland near base fls 40 in a head, solitary or in pairs, either 5- or 4-merous, with peduncles ¼in. long; calyx and corolla pubescent pod hirsute, with nerve-like margins, 1¼–2 in long, ⅛in wide, slightly depressed between the seeds, seed small, longitudinal; funicle silvery, twice or thrice twisted and thickened into cap at end of seed, ripe Aug. Fls March, Apr —At first glance easily mistaken for narrow-lvd *A. retinodes*, but its short-std. fls. in pairs, the resinous viscid substance on phyll. and its small narrow pods will at once distinguish it



74. Acacia verticillata. (×½)

40. **elongàta,** Sieb A tall shrub with angular branchlets phyll distinctly striate, 3-nerved, or often obscured, long-linear, slightly falcate, narrowed to base, obtuse and ending in oblique point, 2–3½ or 4 in. long (or narrower and 5½ in long), hardly ⅛in. broad; peduncles ½in. long, solitary or in pairs pod thin, with nerve-like margins, 1½–2½ in. long, ⅛in wide, slightly impressed between seeds, pod convex over them; seed oblong, brown, funicle not folded about seed but with 2 or 3 folds fitting over end of seed like a cap. B.M 3337 —Especially suitable for damp, sandy land.

41. **Oswaldii,** F. v M A stiff shrub, 8 to 10 ft tall: phyll linear to oblong-falcate, with numerous fine parallel veins ending in oblique mucronate point, 1–2 in long, nearly ¼in. wide; gland near base. fl.-heads sessile, solitary or in pairs, about 15–20 in a head; sepals over half as long as petals: pods hard, curved into crescents about each seed; funicle filiform, half the length of seed and suddenly dilated into a cap nearly as long, which fits over and covers up one-third of seed. F v M Icon 6:10.—May be easily recognized by its finely striate, narrow, 2-in -long phyll, its sessile yellow fls. that sit at base of phyll, nearly hiding st, by the pods twisted in lunar shape with valves convex over seed and by the cap covering one-third of seed. A small bushy tree in Australia, producing a scented timber, the natives make short weapons from it.

42 **harpophýlla,** F. v M A tree with slightly angular branchlets phyll. striate, 3–5-nerved, falcate-lanceolate, tapering to both ends, 6–8 in. long, ⅓–¾in. wide: fls. in clusters with peduncles ½in. long, or in short racemes, much shorter than phyll, 15–20 fls. in a head, sepals not half so long as petals. pod striate, more or less constricted and contracted between seeds, 3–4, or even 5, in. long, ⅛in wide, seed elliptic; funicle half as long as seed and but slightly enlarged into aril. F. v. M 6·9.

43 **cyclops,** Cunn Fig 72. A low spreading shrub, 8–10 ft tall, with many sts: phyll narrow-oblong to lanceolate or even falcate-lanceolate, with oblique point, 1½–3½ in long, ¼–⅜in wide, gland at base more or less obscure; 3–6 longitudinal nerves fls solitary or in pairs, or even in short racemes, peduncles ¼in long. pods in clusters of 2–7 from one head, 2–2½ in long, ⅜in wide, more or less curled, seeds transverse, with odor, when fresh, something like a leek, surrounded by conspicuous scarlet funicle in double fold, ripe Aug – Nov Fls off and on from July–Dec F v M Icon. 8 3.—Young specimens are very compact and attractive, although in a few years they become spreading and unsymmetrical; but, as short-lived tub-plants for certain formal effects, they would be very effective. While the seed-pods are at first charmingly artistic with the scarlet funicle surrounding the black seeds and the rich brown pods, in age they are unsightly, as they persist until they are ragged, ugly and black The pods contain much tannin that is hard on the mucous membrane when the seeds are cleaned.

44 **oxycèdrus,** Sieb A rigid shrub with terete and usually pubescent branches phyll striate, linear-lanceolate but broad at base and tapering to a pungent point, 1½–3¼in or even 1 in long and 3–4-nerved on each side, small stipules, often spinescent spikes 1 in long, fls 4-merous; calyx short with obtuse lobes pods 3 in long, ⅛in wide, striate, incurved and with convex valves, seed longitudinal, funicle thickened from the base and much folded B M. 2928 —Superficially resembles *A. verticillata*, but the phyll are broader and the valves of the pods are thicker than in that species

45 **verticillàta,** Willd (*Mimòsa verticillàta*, L'Her). WHORL-LEAVED ACACIA Fig 74 A spreading shrub or small tree of graceful habit; branches more or less pubescent phyll in whorls or often scattered, linear-subulate, about ½–⅝in long, or more, less than ⅛in. wide, ending in a pungent point, 1-nerved, occasional gland near middle spikes ½–1 in long, often concealing the phyll pods flat, straight or slightly curved, with nerve-like margins, 2–3 in long, ⅛in wide, tapering to a point, seeds longitudinal, ¼in long, with light-colored funicles of about same length thickened at end of seed into cup-shaped aril; ripe June and early July. Fls March, Apr. B.M 110 —Used for hedges and as ornamental, also to some extent as a street tree, in which case it may be trimmed to assume a pyramidal form, but can hardly be recommended for this purpose since it is short-lived and in age becomes straggling It may be made to assume a pendulous habit by weighting its branches with a brick when young There seem to be several types, some being soft to the touch while others are harsh and rigid There is also much difference in the length of the fl.-spikes.

46. **Riceàna,** Hensl (*A. erýthropus*, Tenore). A tall shrub or small tree, with graceful drooping branchlets: phyll clustered, less than 1 in long and ⅛in. broad (or narrower and 1½ in long) linear-subulate, tapering into pungent point. spikes slender, 1½–2 in. long;

peduncles ½in long; fls. distant, acute in the bud, 3-merous, the petals with distinct nerve; calyx short, ciliate pod usually curved, acuminate, often 2–3 in. long, scarcely ⅛in broad, slightly pubescent when young, but soon glabrous, valves very convex, coriaceous, contracted between the seeds; seeds longitudinal; funicle much folded and thickened nearly from the base Fls lemon-yellow, last of Feb and March to Apr Tasmania. N 1:7 This may be distinguished from *A verticillata* by its phyll in clusters rather than in whorls and by its distant, 3-merous fls Its habitat is in moist shady places in its native country.

47 **aneùra,** F v M Mulga A shrub with terete branches lined with gum along the longitudinal fissures phyll rigid, with oblique point, varying from lanceolate-falcate to long-linear or almost terete on the same plant, 1–3 in long, ⅛in wide, no prominent nerves, but distinctly striate under a lens fls in spikes (which may be single or in pairs), ½–¾in long, 5-merous, calyx narrow spatulate, not half so long as petals, peduncles less than ¼in long pods flat, oblique, with a narrow wing at suture and recurved point at apex, 1–1½ in long, nearly ½in wide, seeds nearly transverse, marked by a minute horseshoe, funicle not encircling seed but with 2 or 3 short thick folds F.v.M. Icon 10 8

48 **glaucéscens,** Willd (*A cinerascens*, Sieb *A. homomálla*, Wendl. *A leucadéndron*, Cunn) A tree up to 50 ft high, with branchlets and phyll covered with a gray pubescence which gives an ashy hue to the foliage, the young shoots yellowish phyll lanceolate to sickle-shaped, widest in center and tapering at both ends, striate, with 3 or 4 nerves more prominent, 3½–6 in. long, from less than ½–¾in or even 1 in. wide, gland near base spikes several, in the axils of the phyll , 1–2 in long, fls 4- or 5-merous, petals united and very narrow at base giving prominence to the short united sepals covered with a bright yellow pubescence like pile on velvet According to J H Maiden, the pod, as originally described, was that of *A Maidenii*, and the error seems to have been copied into subsequent publications B M 3174 —This is often confused with *A Maidenii*, but that species is less pubescent, has a much-twisted pod, and red funicles almost encircling seeds It is known as the Coast Myall

49 **Maidenii,** F. v M A tall shrub or tree 50 ft. high, with rough bark, fissured at intervals phyll lanceolate to lanceolate-falcate, narrowed at each end, striate with fine veins, several more prominent, more or less pubescent, 4–6 in long, ⅛–½in wide, gland about ¼in from base fl.-spikes in pairs about 1 in long; fls 4-merous, calyx not half so long as corolla. pod narrow, ½in wide, variously twisted into bow-knots and usually with one suture of the valves gaping open, seeds longitudinal, shining, black, funicle pale reddish, almost or quite encircling the seed and suddenly doubled back from the summit Fls Sept

50 **holosericea,** Cunn (*A leucophylla*, Lindl *A neurocárpa*, Cunn) A shrub or small tree 10 to 20 ft high, clothed with a white, silky pubescence, branchlets with 3 much-raised angles phyll obliquely ovaloblong, obtuse or mucronate, 4–6 in long, 1–3 in wide, 3–4 nerves, pinnately veined between them· fls 5-merous in spikes 2 in long; calyx and corolla pubescent: pod more or less twisted, seeds longitudinal; funicle folded and enlarged into cup-shaped aril Fls March.

51. **linearis,** Sims (*A longissima*, Wendl). A straggly shrub with phyll as long and slender as pine needles, 4–8 in long, or twice that length, ⅛in wide; prominent longitudinal vein fls loose, slender in interrupted spikes, 1–2 in long, 4-merous, calyx short, not half so long as corolla. pod 4 in long, ⅛in broad, slightly impressed between seeds and convex over them; seeds longitudinal, oblong, shining; funicle not surrounding seed but bent back and forth into a cap-shaped aril over one end B M 2156 B R 680.—It may grow to 20 ft in height, and the wood is useful for furniture and many small articles.

52 **longifòlia,** Willd Sydney Golden Wattle **Fig. 72** A tall shrub or small tree phyll oblong-lanceolate, either acute or obtuse, narrowed to the base, 2–3 in or even 4–6 in long and from ⅛–½in wide; 3 or 4 longitudinal nerves, reticulately veined between; gland very near base fls in spikes ¾–2½in long, 4-merous pods 1½–3¾ in long or more, about ¼ in broad, coriaceous, terete until fully ripe when their valves flatten, separate, become dark and curled and persist on the tree, seeds longitudinal, black, fat and shining, funicle silvery, not enfolding seed but bent upon itself several times, dilated and fitted like a cap over one end of the seed, ripe Aug, Sept Fls Feb, March B R 362 B M 2166 R H 1896, p 504 Wattles and Wattle-barks, p 51 —A valuable ornamental as well as a good tree for narrow streets, also used as a tan for heavy leathers.

Var **Sophòræ,** F v M (*A Sophòræ*, R Br) Phyll shorter, and with rounded apex, 1½–3½in long, ¾–1¼in broad spikes generally shorter, 1–1½ in ; blooms later and seed matures later than type Brown, Fl of S Austral —Under cult it becomes difficult to distinguish this from the type, but in general its foliage is shorter and more rounded at apex

Var **floribúnda,** F v M A tall shrub or small tree, with the foliage all at the ends of the branches, giving the tree a thin, delicate appearance phyll 2½–3¼ in. long, ⅛–¼in wide, or more, linear-lanceolate, ending in oblique point, acuminate, striate, several nerves more prominent than others spikes 1½ in long, flowering to base, fls whitish yellow pods contracted and long-constricted between seeds, seed longitudinal; funicle silvery, not encircling seed but folded like a cap, ripe July, Aug Fls Feb , March B M 3203 (as *A intermedia*) —This varies so much from the type that it is difficult to conceive of its relationship, but since all variations between this and the type can be traced, it can be given only varietal rank.

53 **pubéscens,** R Br Hairy Wattle. A shrub, with drooping branches and hirsute petioles and rachis; pinnæ 3–10 pairs (mostly 3–8), ½–¾in long; lfts. 6–20 pairs (mostly 16), crowded, linear, smooth, ⅛–⅙in wide fls in simple racemes longer than lvs , on long pubescent peduncles, 15–20 in a head, calyx short, sinuate-toothed, corolla smooth, protruding in bud, the petals united Blooms in spring B M 1263 F R 1 733 —This belongs to the series in which the pods are all flat, seeds longitudinal, last fold of funicle forming a short lateral or oblique aril, with very small folds below it Much grown in greenhouses in the E U S , where it is a general favorite on account of its feathery lvs and bright blossoms, which are in their full beauty at Eastertide, and are becoming very popular for church decorations at that time.

54 **elàta,** Cunn A handsome tree of 50–60 ft with dark green foliage and young shoots clothed with a yellow pubescence lvs compound, 1 ft long by 8–10 in. wide, pinnæ 2–6 pairs, 5–7 in long, lfts 8–13 pairs, lanceolate, acuminate, pubescent, 1¼–1½ in. long, ⅛–⅜in wide, about ⅜in distant fls in compound racemes, about 40 in a head, sepals 5, united, half as long as petals, petals 5 pod a rich brown, with nerve-like margins, 3½–6 in long, ⅜in. broad, funicle silvery, the club-shaped aril half as long as lenticular seed, ripe Aug Blooms Sept , Oct , Dec etc. F. v M. Icon 12 7 Wattles and Wattle-barks, p 54 —Rich in tannic acid. Grows in shaded ravines in its native country.

55 **Baileyàna,** F. v M. An attractive shrub or small tree, with gray foliage arranged spirally around the branchlets and nearly concealing them lvs. com-

pound, 1–2 in. long, with gland at base of each pair of pinnæ; pinnæ 2–3 pairs (occasionally 4), 1 in long; lfts about 20 pairs, ¼in long, nearly ⅛in. wide· racemes longer than lvs , 2–3½ in long, fls. 15 in a head, on peduncles ⅛–¼in long pod 1½–4 in long, ½in. wide, with nerve-like margins, occasionally constricted between seeds, seeds transverse, ¼in long, with club-shaped funicle one-half its length, ripe July, Aug Fls. Jan , Feb F. v. M Icon 12.5. G C III 15.37 —A much-prized ornamental and sometimes used as a street tree

56 **díscolor,** Willd A tall shrub or small tree, either glabrous or pubescent: pinnæ 2–6 pairs, lfts. 10–15 pairs, ¼–½in long, 1-nerved, pale beneath; large gland on petiole and a few small ones on upper pairs of lfts fls 6–15 in a head, in axillary racemes, 5-merous; petals with prominent midribs, calyx short, ciliate. pod flat, with nerve-like margins, 1–3 in long, ⅜in. wide; funicle enlarged at hilum end.

57 **pruinósa,** Cunn A small tree with young foliage bronze-like pinnæ 2–4 pairs, 2½–4 in long; lfts 11–24 pairs, ⅛–¾in long, oblong to linear, nerve excentric, occasionally 1 or 2 short nerves; gland prominent, distant from base fls in racemes, 30 in a head, 5-merous; sepals united, half the length of petals pods with nerve-like margins, 2½–3 in long, ⅜in broad, occasionally constricted between seeds, funicle short, filiform half its length, then enlarged into club-shaped aril Fls. Feb –Apr

58 **decúrrens,** Willd GREEN WATTLE. A handsome tree, glabrous or more or less tomentose-pubescent with branches more or less prominently angled pinnæ 8–15 pairs or more (sometimes reduced to 5 or 6); lfts 30–40 pairs or more, linear, from under 2 to nearly 5 lines long, according to the variety fls 20–30 in a head, mostly 5-merous pods 3–4 in long, about ¼in broad, more or less contracted between the seeds Wattles and Wattle-barks, p. 55. Brown, Kor Fl of S Austral — There is much confusion regarding this group among nurserymen and others.



75. Acacia decurrens var dealbata. (×½)

Var. **normàlis,** Benth. SYDNEY BLACK WATTLE Lfts ¼–½in long Restricted range on the coast of Austral. According to Maiden, var *normalis* differs from type in having sepals as long as petals and cilia on interior of lobe in *A decurrens*, the petals have a midrib and a short, broadly lobed ciliate calyx.

Var **móllis,** Lindl (*A mollíssima,* Willd) BLACK WATTLE. A tree 20–50 ft high, with reddish bark showing under the fissures pinnæ 8–20 pairs, shining on upper surface, 2–6 in long, lfts 30–60 pairs, closely crowded, not ⅛in in length, gland between each pair of pinnæ and generally additional ones on internodes between· fl -clusters in racemes, 30–36 in a head, 5-merous, peduncles ⅛–¼in long pods dark, pubescent, 2–4 in long, not ¼in wide, constricted and contracted between the seeds, seed longitudinal, funicle filiform, enlarged to a light-colored cap over seed; ripe June–Oct. Fls. pale yellow, blooming profusely in June and intermittently at other times. B.R 371.—Distinguished from var *dealbata* by its later blooming period, by its lighter fls , its characteristic pubescent pods and smaller seeds and by the short lfts , shining above, which sit close together

Var **dealbàta,** F v. M (*A. dealbàta,* Link) SILVER WATTLE Fig 75 A tree 50 or more ft high, with smooth bark and gray pubescent branchlets· lvs. silver-gray to light green, 3–6½ in. long; pinnæ 13–25 pairs, lfts 30–40 pairs; glands 1 between each pair of pinnæ racemes often compound, 30 fls in a head, 5-merous, sepals united, petals with faint midrib; peduncles ¼in long pods 1½–4¼ in long, ⅜–½in wide, smooth, a rich brown, seeds longitudinal; funicle as long as seed, filiform half its distance and ending in silvery club-shaped aril, ripe July, Aug Fls Feb , March A F 13 880 R H 1896 p 502 —Mts in its native country It is sometimes given specific rank as *A. dealbata,* but intermediate forms occur.

59. **filicìna,** Willd (*Mimòsa filicoìdes,* Cav) TIMBE Unarmed shrub lvs fern-like, pinnæ 5–30 pairs; lfts 20–50 or more pairs (rarely 10–15), very small fl -heads globular, orange or yellow, in terminal panicles pods broadly linear, straight or slightly curved, often irregular, flat not pulpy Texas and Mex —The astringent, bitter bark called *timbe* is used by the Mexicans in making pulque for precipitating mucilaginous matter Safford, Science, Jan 22, 1909 160

60 **pulchélla,** R Br A handsome shrub, either glabrous or hirsute, with slender branches, mostly armed with subulate spines pinnæ 1 pair, lfts. 4–7 pairs, obovate-oblong, ⅛–¼in long, gland on stipes between pinnæ, or none· peduncles solitary, fls 5-merous, petals with prominent midrib; calyx half as long as petals and sinuate-toothed pods flat, thick margins, 1–2 in long, ⅛–¼in wide, seed longitudinal, funicle filiform and thickened into club-shaped aril Fls Apr.

Var **grándis,** Hort (*A grándis,* Henfr) Glabrous lfts 8–10 pairs, a little larger and more numerous than the type. Fls Feb –May J H III 35 369 (1897)

Var **hispidíssima,** Hort (*A hispidíssima,* DC). Branches covered with long, spreading hairs lfts narrow and revolute. fls white B M 4588

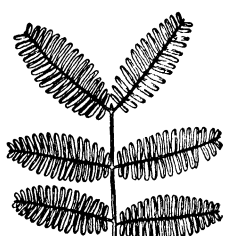
61 **Farnesiàna,** Willd (*A leptophylla,* DC) POPINAC OPOPANAX CASSIE HUISACHE Much-branching shrub, 6–10 ft stipules straight, slender, sometimes minute spines, pinnæ 5–8 pairs, lfts mostly 10–25 pairs, 1–2 lines long, narrow, linear, glabrous peduncles 2 or 3 in the older axils, fl -heads large, globular, deep yellow, very fragrant pods almost terete, indehiscent, at length turgid and pulpy Feb , March Texas, Mex , Asia, Afr and Austral Grown in France for perfumery.—Its origin is probably American, but it is now naturalized in nearly every tropical country. It was intro. into the Hawaiian Isls as an ornamental, but escaped from cult and has now almost become a pest A new variety of *A Farnesiana* has been discovered which is more hardy than the type and grows more rapidly It produces two crops of fls. a year, which makes it very lucrative for the making of perfumery The pods are said to contain a tannin

62. **Cavènia,** Bert. ESPINO CAVAN. Height 20 ft : spines stout· lfts scabrous, scabrous-pubescent Otherwise near to *A Farnesiana,* of which it is sometimes considered a mere variety. Chile —A good hedge plant.

63 **arábica,** Willd GUM ARABIC TREE Fig 76. Shrub or small tree with gray branchlets; stipules spiny: pinnæ 3–8 pairs, ½–1½ in. long, lfts. 10–20 pairs, ⅛–¼in long, glands several. fls in groups of 2–5, calyx half the length of corolla· pods distinctly stalked, flat, mostly moniliform, gray-downy, 3–6 in long. Arabia and Eu —Some confusion exists between this species and *A Farnesiana,* but they are easily distinguished by means of the pod which in *A. arabica* is

from slightly constricted between the seeds to moniliform or bead-like, while in *A Farnesiana* it is round and smooth with the seeds arranged in 2 rows in a pulpy mass.

64 **ebúrnea,** Willd A shrub with a reddish brown bark lvs 1–1¼ in long.; phyll 5 or 6 pairs, ¼–⅝in long, lfts 5–9 pairs, less than 1½ in long, stipules ¼–2 in long; gland between each of the 2 lowest pairs. fls 40 in a head on peduncles ½–1 in long with a circle of bracts at middle, petals 5, sepals united, half as long as petals pod flat, 3–6 in. long, ⅜in wide; seeds longitudinal, funicle short — A desert region species and also used as a forage plant.



76. Acacia arabica.

65. **Cátechu,** Willd. (*A catechuoides,* Benth) A medium-sized tree, with opposite, recurved, stipular spines pinnæ 10–40 pairs, lfts 30–50 pairs, linear, about ¼in long; gland near base and between upper pair of pinnæ spikes solitary or fascicled, 2–5 in long, calyx and corolla tomentose, the former half the size of the latter: pods dehiscent, flat, a rich brown, reticulately veined and with nerve-like margin, 2–3 (or 5) in long, ½–¾in. broad, seed orbicular, transverse, funicle flat, not curving around seed but leading directly to hilum with a twist or two. E Indies

66 **Drúmmondii,** Benth Bush or small tree. pinnæ 2–4 pairs, each with 4–10 linear, very obtuse, glabrous lfts fls pale lemon-yellow, in dense, solitary, drooping spikes 1–1½ in long pod not exceeding 1 in long, ¼in broad, flat, with thickened margins, glabrous or pubescent, seeds transverse, funicle short, thickened into small aril of about 2 folds under seed. B M 5191 —A favorite greenhouse species

67 **Gréggii,** Gray TEXAS MIMOSA Sometimes a tree 20 ft high, but usually a shrub of 4–5 ft, growing in thickets along river banks: compound lvs 1 in long, pubescent, pinnæ 2–3 pairs (occasionally reduced to 1 pair), ½–¾in long, lfts 4–7 pairs (usually 5), oblong, pubescent and 2-nerved spikes cream-yellow, 1½–2¼ in long, including the peduncles, which are half the length of spikes, petals and sepals greenish, 5-merous; sepals united and half as long as petals: pods much bent and twisted, nerve-like margins and more or less constricted between the seeds, 1½–4 or more in long, about ¾in wide, seed ⅛in long, ¼in. wide with an arrow-shaped depression in the center, funicle filiform its entire length Fls. Aug, Sept In dry or rocky places in Texas and N. Mex and S. Known as Devil's Claws and Catsclaw from the short curved, spines; also as Paradise Flower

In the following supplementary list, the heights given are those attained by the plants under glass in N Eu., in the open air in the S W U S they often grow much taller, and sometimes flower 2 months earlier Except when otherwise stated, the fls are yellow Those marked (*) are considered most desirable Those marked "stove" need hothouse treatment, the others can be grown in a cool-house, or in the open in Calif *A abietina,* Willd =A. linifolia —*A acanthocarpa,* Willd =Mimosa acanthocarpa —*A acapulcénsis,* Kunth =Lysiloma acapulcensis —*A accóla,* Maiden & Betche —*A aciculáris* (Needle-leaved Acacia) 4 ft —*A affínis,* Sweet= A. dealbata —*A akkra,* R Br 6 ft May B R 396 —*A albicans*= Pitheocolobium albicans —*A amœna,* Wendl 3 ft May Near to A heterophylla —*A. angulàta,* Desv =A discolor —*A angustifólia,* Lodd.=A longifolia var floribunda —*A argyrophýlla,* Hook =A brachybotrya var argyrophylla —*A aspera,* Lindl (A Ausfeldii, Regel A. densifolia, Benth) 4 ft May —*A Ausfèldii,* Regel= A. aspera —*A Bancroftiàna,* Bert =Cæsalpinia bijuga —*A Baxteriàna,* Hort =A Berteriana(?).—*A Berlandièri,* Benth Fls (?) Mex —*A Berteriana,* Balb =Pithecolobium fragrans —*A biflòra,* R Br 3 ft May —*A brachyacántha,* Humb & Bonpl =Mimosa acanthocarpa —*A brevifólia,* Lodd =A lunata —*A brévipes,* Cunn =A melanoxylon —*A Burmanniana,* DC Shrub 6 ft Ceylon Stove —*A burvifólia,* Cunn 4 ft Apr Hook Icon 164 —*A cæsia,* Wight & Arn (A Intsia, Willd) Climber beset with curved prickles E Indies Stove —*A calamistrata,* Hort lists=(?) —*A celastrifólia,* Benth =A myrtifolia var celastrifolia —*A centrophylla,* DC 20 ft white Jamaica Stove —*A Ceratònia,* Willd = Mimosa Ceratonia —*A chrysóstachys,* Hort =Piptadenia chrysostachys —*A ciliata,* R Br —A strigosa —*A cinerascens,* Sieb = A glaucescens —*A cochlearis,* Wendl 4 ft Apr to May —*A. cærulea,* Lindl —*A concinna,* DC 20 ft, fls white E Indies. Stove —*A Concordiana,* Loud =Pithecolobium umbellatum —*A conferta,* Cunn Apr —*A cordata,* a trade name, probably belonging to some other species —*A coriacea,* DC 5 ft May —*A coronillæfólia,* Desf 10 ft N Afr Stove —*A corymbòsa,* Hort lists=(?) —*A crassicárpa,* Cunn 6 ft May —*A cultràta,* Hort =A cultriformis —*A cuspidàta,* Cunn =A diffusa var cuspidata —*A cyanophýlla magnífica,* Hort lists=(?) —*A cycnórum,* Hook =A obscura —*A Daviesiæfólia,* Cunn 6 ft June —*A decipiens* var *pramorsa,* Hort * 3 ft May B M 3244 —*A densiflòra,* Benth = A aspera —*A dentífera,* Benth Apr B M 4032 —*A dependens,* Cunn =A longifolia var mucronata —*A detinens,* Burch 3 ft May S Afr —*A Dietrichiana,* F Muell —*A diptera,* Willd = Prosopis juliflora —*A diptera,* Lindl Shrub fls (?) —*A diptera* var *ervóptera,* Graham Sept B M 3939 —*A dissitiflòra,* Benth =a form of A longifolia —*A discolor,* Willd =Lysiloma Schiedeana —*A dolabriformis,* Colla—A decipiens —*A Donkelaarii* as a trade name —Mimosa(?) —*A doratoxylon,* Cunn *(Currawang), a beautiful small tree fls golden yellow —*A dumòsa,* Wight & Arn =A latronum —*A echinula,* DC =A pumperna —*A edulis,* Humb & Bonpl =A Farnesiana —*A emarginata,* Wendl =A stricta —*A ericoìdes,* Benth June —*A Esteshazii,* Mackay 4 ft May —*A falciformis,* DC =A penninervis var falciformis —*A ferruginea,* DC From E Indies Stove —*A flexicaulis,* Benth =Pithecolobium flexicaule, Coulter —*A floribunda,* Willd =A longifolia var floribunda —*A floribunda,* Hort =A neriifolia —*A formòsa,* Kunth =Calliandra formosa —*A fragrans,* Teniore= Albizzia fragrans ("Acacia fragrance" Hort ?) *A frondòsa,* Willd =Leucæna glauca =A fruticòsa, Mart =Piptadenia latifolia *A genistæfolia,* Link =A diffusa —*A giràffæ,* Willd (Camel-thorn) 40 ft S Afr Fls (?) Stove —*A glauca,* Hort =A glaucescens —*A grándis,* Henfr =A pulchella var grandis —*A grata,* Willd =Piptadenia macrocarpa —*A gravèolens,* Cunn =A vernicifiua —*A guayaquilénsis,* Desf =Mimosa guayaquilensis —*A guianénsis,* Willd =Stryphnodendron guianense —*A gummifera,* Willd 30 ft Guinea Fls (?) —*A Hamatóxylon,* Willd 20 ft Fls yellow or white S Afr Stove —*A hastulàta,* Smith 4 ft May B M 3341 —*A heteracántha,* Burch 15 ft, fls (?) S Afr —*A heterophylla,* Willd 5 ft May Mascarene Isls —*A hispida,* Hort =Robinia hispida —*A hispidissima,* DC =A pulchella var hispidissima —*A holosericea,* A Cunn —*A homalophylla,** "Yarran" —*A homatophylla,* probably clerical error for A homalophylla —*A homomálla,* Wendl =A glaucescens —*A hórrida,* Willd S Afr —*A Huegèlii,* Benth * Pale yellow Feb —*A humifusa,* Cunn Austral —*A inermis* Lodd =A armata —*A imperialis,* Hort lists—(?) —*A intermèdia,* Cunn =A longifolia var floribunda —*A intertèxta,* Sieb =A longifolia —*A Intsia,* Willd =A cæsia —*A Jónesii,* F Muell Racemes simple, longer than lvs which somewhat resemble those of green-lvd A dealbata —*A Julibrissin,* Willd =Albizzia Julibrissin —*A Kalkòra,* G Don =Albizzia Julibrissin —*A Lambertiana,* D Don =Calliandra Lambertiana —*A lanigera,* Cunn 6 ft Apr B M 3944 —*A latifólia,* Benth —*A latisiliqua* Willd =Lysiloma latisiliqua —*A Latrobei,* Meisn =A acuminacea —*A latrónum,* Willd (A dumosa, Wight & Arn) Up to 20 ft, E Indies Stove —*A laurifolia,* Willd 4 ft May Pacific Isls Stove —*A Lébbeck,* Willd =Albizzia Lebbek —*A leiophylla,* Benth =A saligna —*A lentiscifolia,* Desf 20 ft fls (?) Mex Stove —*A leprósa,* Sieb * May B R 1441 "Graceful, linear leaves, and habit of a willow" —*A leprósa* var *tenuifolia,* Benth Stove —*A leptocárpa,* Cunn 6 ft Apr —*A leptóclada,* Cunn —*A leptonura,* Benth 6 ft Apr B M 4350 —*A leptophylla,* Roxb =A. Farnesiana —*A leucocéphala,* Link=Leucæna glauca —*A leucophlæa,* Willd 12 ft, pale yellow Trop Asia Stove —*A leucophylla,* Colvill =A. holosericea —*A ligulata,* Cunn =A salicina —*A longifólia* var *mucronàta,* F v M (A dependens, Cunn A mucronata, F v M) March B M 2747 —*A longissima,* Wendl =A. linearis —*A lophántha,* Willd =Albizzia lophantha —*A lophántha* var *gigantèa,* Hort =Albizzia lophantha var gigantea —*A lucida,* Ball =Albizzia lucida —*A Manguum,* Willd 10 ft Moluccа Isls Stove —*A microphylla,* Willd =Piptadenia peregrina —*A móllis,* Wall =Albizzia Julibrissin —*A Nèmu,* Willd =Albizzia Julibrissin —*A neurocárpa,* Cunn =A holosericea —*A nigricans,* R Br 6 ft Apr B M 2188 —*A notabilis,* F Muell —*A nudiflòra,* Willd (A Rohriana, DC) 30 ft, white W Indies Stove —*A obscura,* DC (A cycnorum, Hook) 2½ ft B M 4653 —*A odoratissima,* Willd =Albizzia odoratissima —*A oleræfólia,* Cunn =A lunata —*A ohgophýlla,* Hoffmgg 4 ft Habitat(?) Stove —*A ornàta* is a name in the trade, probably of some well-known species —*A paradóxa,* DC =A armata —*A pentadènia,* Lindl 10 ft May B R 1521 —*A pinnifólia,* Benth =A juncifolia, —*A pinnàta,* Link =A tamarindifolia —*A platyphylla,* Sweet 10 ft June —*A plumòsa,* Lowe 20 ft Brazil B M 3366 A stove climber —*A podalyrìa,* Hort lists=(?) —*A polybótrya,* Benth * A beautiful pinnate-lvd species —*A portoricénsis,* Willd =Calliandra portoricensis —*A. primòsa,* probably clerical error for A pruinosa —*A prismática,* Hoffmgg 6 ft Habitat(?) Stove —*A prúinens,* Cunn =A linifolia var prominens —*A Pseudacdcia,* Hort =Robinia Pseudacacia —*A pulcherrima,* Willd =Stryphnodendron floribundum —*A pyramidàlis,* Hort lists=(?) —*A quadran-*

gulāris, Link =Calliandra tetragona.—*A. Remeri*, local name for variety intro. by Remmers into San Francisco.—*A. ripāria*, HBK (*A. sarmentosa*, Griseb.) 10 ft. W. Indies. A stove climber.—*A. Rohriana*, DC. =*A. nudiflora*.—*A. rōsea*, Hort. =Robinia hispida.—*A. ruscifōlia*, Cunn. =*A. verticillata* var. *latifolia*.—*A. sarmentōsa*, Griseb. =*A. riparia*.—*A. scandens*, Willd. =Entada scandens.—*A. semicordata*, Roxbg. 40 ft. fls. (?). E. Indies. Stove.—*A. Sénegal*, Willd. 30 ft. fls. white. Trop. W. Afr. Stove.—*A. sericāta*, Cunn. Apr.—*A. Simsii*, Cunn. Apr.—*A. Sophōræ*, R. Br. =*A. longifolia* var. Sophoræ.—*A. speciōsa*, Willd. =Albizzia Lebbek.—*A. speciōsissima*, Cunn.* Apr. B. R. 1843. 40. Remarkably beautiful.—*A. Spina*, Balb. 15 ft., red and yellow. Guadeloupe Isl. Stove.—*A. squamāta*, Lindl. Apr. Hook. Icon. Plant. 307.—*A. stenophylla*, Cunn. March.—*A. stipulāta*, DC. =Albizzia stipulata.—*A. stolonifera*, Burchell, a species from S. Afr. with underground sts.—*A. stricta*, Willd. (*A. emarginata*, Wendl.) 2 ft. March. B. M. 1121.—*A. strigōsa*, Link (*A. ciliata*, R. Br.) 4 ft.—*A. strombulifera*, Willd. =Prosopis strombulifera.—*A. subulata*, Bonpl. 4 ft. May.—*A. suleata*, R. Br. 2 ft. July. B. R. 928.—*A. Suma*, Gurz. 10 ft.; fls. (?). E. Indies. Stove.—*A. tamarindifōlia*, Willd. (*A. pinnata*) 4 ft. white. S. Amer. Stove.—*A. taxifōlia*, Lodd. =*A. Riceana*.—*A. tomentōsa*, Willd. 20 ft. fls. (?). E. Indies. Stove.—*A. trichōdes*, Willd. =Leucæna trichodes.—*A. trinervata*, Sieb. 6 ft. Apr.—*A. tristis*, Graham=*A. armata*.—*A. umbellata*, Cunn. Apr.—*A. uncināta*, Lodd. =*A. undulæfolia*.—*A. undulæfolia* (*A. uncinata*, Lodd.). 4 ft. May. B. M. 3394.—*A. urophylla*, Benth. Pale yellow. Apr. B. M. 4573.—*A. vāga*, Willd. 40 ft. white. Brazil. Stove.—*A. venūsta*, Willd. =Calliandra portoricensis.—*A. vēra*, Willd. =*A. arabica*.—*A. vermicifluа*, Cunn. (*A. graveolens*, Cunn. *A. virgata*, Lodd.) 6 ft. Apr. B. M. 3266, 3279.—*A. vertuillāta* var. *angusta*, Hort. 10 ft. Apr.—*A. verticillāta* var. *latifolia*, Benth. (*A. ruscifolia*, Cunn. *A. moesta*, Lindl.) 10 ft. Apr. B. M. 3195. B. R. 1846. 67.—*A. vestita*, Ker-Gawl.* 6 ft. June. B. R. 698.—*A. viminalis*, Ait. Apr.—*A. virescens*, DC. 20 ft. S. Amer. Stove.—*A. virgata*, Lodd. =*A. vernicifluа*.—*A. viridiramis*, Burch. =Xerocladia Zeyheri.—*A. viscidula*, Cunn. 6 ft. Feb. Gt. 1109. *A. viscōsa*, Schrad. =*A. dodonæifolia*.—*A. vomeriformis*, Cunn. Apr.—*A. Wallichiana*, DC. = Catechu.

KATHERINE D. JONES.

ACACIA, FALSE: *Robinia Pseudacacia*

ACACIA, ROSE: *Robinia hispida*

ACÆNA (from Greek word signifying *thorn*) *Rosāceæ*. NEW ZEALAND BUR. Trailing, more or less evergreen plants used in rockwork and as ground cover under trees and between other plants.

About 40 species of sub-shrubs or herbs of the southern hemisphere, allied to Agrimonia and Sanguisorba. lvs. unequally pinnate, alternate, the lfts. toothed or cut. fls. small, crowded in erect terminal spikes or heads, petals none; calyx 5–7-lobed, usually armed with spines; stamens 1–10, or even more. fr. an achene, 1 or 2 being enclosed in the hardened calyx.

Acænas are little grown in this country, but are prized in England as groundwork for dwarf spring-flowering bulbs, as trilliums, also useful in protecting native orchids and bog plants. Propagation is by cuttings, divisions and seeds.

Buchánanii, Hook. f. Plant usually densely or silky pale gray, the numerous sts. and branches lying very close on the ground. lvs. 1 in. or less long, the lfts. 3–6 pairs, very broad, finely serrate. fls. in small sessile heads, spines or bristles 4, yellow and hairy or barbed, the fruiting calyx broader than long. New Zeal.

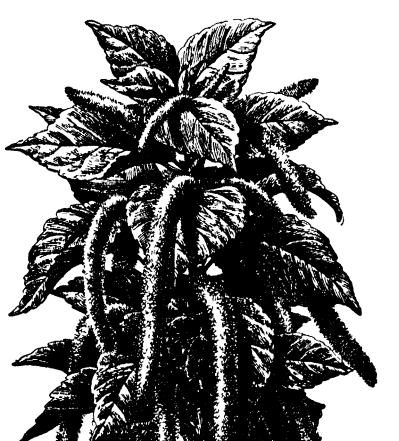
microphýlla, Hook. f. Plant glabrous or only sparingly silky, often making very large patches. lvs. pale, 2 in. or less long, lfts. 3–6 pairs, broad, deeply cut. fls. in globose stalked heads, fruiting calyx broader than long, the red spines attractive all summer and autumn. New Zeal.—Grows well in either wet or dry soils.—Var. **inérmis**, Kirk (*A. inérmis*, Hook. f.), has longer lvs. and the fruiting calyx without spines or bristles.

ovalifòlia, Ruiz & Pav. Lvs. a little larger than the last, lfts. oblong, subcuneate. Chile. Gn. 52, p. 46.

adscéndens, Vahl. Plant usually glabrous, bronzy, the sts. stout and prostrate, the leafy branches ascending at the tips. lvs. 2–4 in. long. lfts. 4–6 pairs, ovate or obovate, deeply toothed. fls. in stalked heads, calyx-tube longer than broad, the spines 4 and stout. New Zeal., S. Amer.—Apparently the plant in the trade under the name of *A. adsurgens*.

A. argéntea, Ruiz & Pav. Lvs. silvery. Chilean Andes.—*A. myriophylla*, Lindl. Fern-like. lfts. deeply cut. fls. green. Chile.—*A. novæ-zealándiæ*, Kirk. Prostrate, silky. lfts. oblong, coarsely serrate. heads globose, stalked. bristles reddish purple. achene narrowed both ways. New Zeal.—*A. ovina*, A. Cunn. Said to be much like *A. ovalifolia*, but larger and less graceful. fls. purple, in long spikes. Austral.—*A. Sanguisorbæ*, Vahl. Prostrate, silky. lfts. broad, toothed or serrate. heads globose, stalked, bristles long and barbed, at each angle of calyx. achene broadest near base and narrowing upward, one of the troublesome sheep-burs. New Zeal.—*A. sarmentōsa*, Carmich. =*A. Sanguisorbæ*.

L. H. B.



77. Acalypha hispida (*A. Sanderi*)

ACALŸPHA (a name given by Hippocrates to a nettle) *Euphorbiàceæ*. COPPER-LEAF. THREE-SEEDED MERCURY. Brilliant tender foliage shrubs or herbs much used for greenhouse ornament, and especially for bedding-out, and in Florida and southward for lawn shrubs and hedges.

The acalyphas are erect shrubs or, in the native species, rather weedy herbs, with alternate stipulate lvs. fls. in spikes or spike-like racemes, the staminate cluster peduncled, each fl. in the axil of a minute bractlet, with a 4-parted calyx and 8-16 stamens, pistillate fls. subtended by a foliaceous bractlet, the calyx 3–5 parted, petals wanting in both kinds of fls., the long spike-like ament being the showy part of the fls. fr. usually of 3–2-valved capels, each 1-seeded.

For bedding, it is desirable to have strong, well-hardened plants in 4-inch pots, which should be set out the last week in May, and grown in a rich, moist soil without check. The leading horticultural species is *A. hispida*. The main point in the cultivation of this species is that it can be grown either to a single stem or in a spreading bush form, both of which ways are effective. Stock plants of acalypha do well in a mixture of three parts loam, one part well-decomposed manure, and, if the loam is heavy, also some sharp sand. In central Florida, none of the acalyphas is quite hardy. They should be banked late in the fall with dry sand, which must be removed when all danger of frost is over.

Propagation is by cuttings, chiefly in three ways: (1) in fall from outdoor bedded plants, (2) from plants lifted in fall, cut back, and kept for spring stock; (3) from stock plants in pots reserved from the previous season. The well-ripened wood of these last is a great advantage, and gives cuttings that may be taken with a heel. A mature stem will furnish several beside the

top one This is the best method for general purposes. Cuttings may also be taken below the joints when the shoots are half mature The cuttings require mild bottom heat For greenhouse ornament in fall and winter, excellent specimens may be secured from cuttings made in summer from such stock plants.



78 Acalypha Wilkesiana var Macafeana (× ⅓)

The acalyphas are subject to mealy-bug, scale and red-spider For the first two, fumigate with hydrocyanic acid gas The red-spider can be kept in check by syringing or spraying

A *Annual*

indica, Linn An erect hairy plant 1–3 ft lvs broad, ovate, the petiole longer than the blade· fls greenish, the spikes 1–2 in long Old World tropics — Not showy The hort name *A. Miltonana* may belong here

AA *Perennial*

B *Fl.-clusters much exceeding the lvs*

hispida, Burm f (*A. Sánderi,* N E Br) Red-hot Cat-tail Fig 77 Cult chiefly for its long red, amarantus-like spikes of fls which are much longer than the lvs lvs green E Indies Burm Fl Ind, p 303, t 61, f 1 A F 13 1285 A G 19 453, 827 F E 10 554 G C III 23 248 Gt 47 276; 48 1465. Gn 54 62 Gng 6 279 B M 7632 R H 1898 456 —A very striking garden plant Called by various names, as Chenille Plant, Philippine Medusa, and others Var **ramosa,** Hort, has upper spikes branched or compound Var **alba,** Hort, spikes creamy white

BB *Fl.-clusters shorter than, and usually half hidden by the lvs branches not spiny*

Wilkesiana, Muell Arg (*A. tricolor,* Hort ex Seem) Lvs ovate-acuminate, bronzy green, variously mottled with red fls usually some shade of red, inconspicuous S Sea Isls Var **Macafeana,** Hort Fig 78 Lvs red, marked with crimson and bronze —Perhaps the commonest variety R H 1882·288 Var. **macrophylla** (*A. macrophylla,* Hort, not HBK.) Lvs cordate, ovate, russet-brown Var **marginata,** Hort Lvs with marked crimson margin. F M. 1875·156 Gn 7, p 521 I.H 24.275 Var **musaica,** Hort. Lvs green, with orange and red markings Var **obovata,** Hort Lvs obovate, green, edged white when young, changing to bronzy green with rosy pink margins Var. **triumphans,** Hort. (*A. triumphans,* Lind. & Rod). Lvs large, spotted with crimson, green, and brown I H. 35:55 (1888).

integrifolia, Willd, not Bojer (*A. colorata,* Spreng. *A. Commersoniana,* Baill) Shrub, 4–6 ft lvs oblong-fiddle-shaped, variable in size, crenate or entire, green above, purplish beneath fls small, the clusters shorter than the lvs Mauritius and Madagascar

Godseffiana, Mast Low-growing shrub of dense bushy habit lvs short-petioled, ovate or ovate-lanceolate, cordate, acuminate, coarsely toothed, green with a prominent cream-colored margin fls inconspicuous, greenish-yellow, the clusters shorter than the lvs Apr, May New Guinea G C III 23.242 Gng 6 278. F E 10 554 A F 13 1286 Var **heterophylla,** Hort. Lvs, especially the lower, linear-lanceolate, irregularly repand

BBB *Fl.-cluster as in* BB, *but branches spiny*

Var **eremorum,** Muell Of peculiar habit and with spiny branches lvs green, short-petioled, crenate fls in spikes, the clusters shorter than the lvs Austral.— Coolhouse plant, chiefly interesting botanically

A. Chantrieri, Hort =A. Hamiltoniana × Wilkesiana var. macrophylla - *A. marginata,* Hort, not Spreng =A. Wilkesiana var. marginata — *A. obovata,* Hort, not Benth =A. Wilkesiana var. obovata Other trade names are *A. Hamiltoniana,* Hort Bruant 1895 Lvs bright green, the rounded teeth yellow-margined —*A. Miltoniana,* Hort Intro 1911 *A. mortfontainensis,* Hort =A. Hamiltoniana × Wilkesiana var. marginata *A. torta,* Hort Lvs dark green, the margins cut into blunt oblong segms Samoan Isls

N. Taylor †

ACÁMPE (named from the brittle nature of the flower) *Orchidàceæ* Greenhouse epiphytes

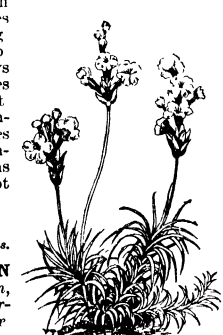
A. longifolia, Lindl (Vanda longifolia, Lindl) E Indies A plant of no decorative value, and rarely, if ever, seen in cult

ACANTHEPHÍPPIUM. *Acanthophippium*

ACANTHOCÈREUS (Greek, *thorn* and *cereus*). *Cactàceæ* An erect or clambering night-flowering cactus, the sts elongated, usually 3-angled, but young shoots very diverse and sometimes 8-ribbed, never producing aerial roots, areolæ remote, bearing prominent spines fls large, funnelform fr a berry, sometimes with spines, flesh red, seeds black —Perhaps several species, but some authors recognize only one species.

pentagonus, Brit & Rose (*Cactus pentagonus,* Linn. *Cereus princeps,* Pfeiff *C. baxaniensis,* Karw. *C. variabilis,* Engelm) Half erect, 3–20 ft high spines 4–6, the longer 1½ in long fls 7 8 in long Trop Amer —This species grows wild in S E Texas and does well there as a garden plant It is also a common greenhouse plant where it does well, often growing to considerable size It blooms freely, but the fls are not very attractive

J N Rose.



79. Acantholimon glumaceum

ACANTHÒDIUM: *Blepharis.*

ACANTHOLÌMON (*akanthos,* spine, and *limon,* sea lavender) Syn, *Armeriastrum Plumbaginàceæ* Prickly Thrift Hardy evergreen perennials, sometimes a little woody

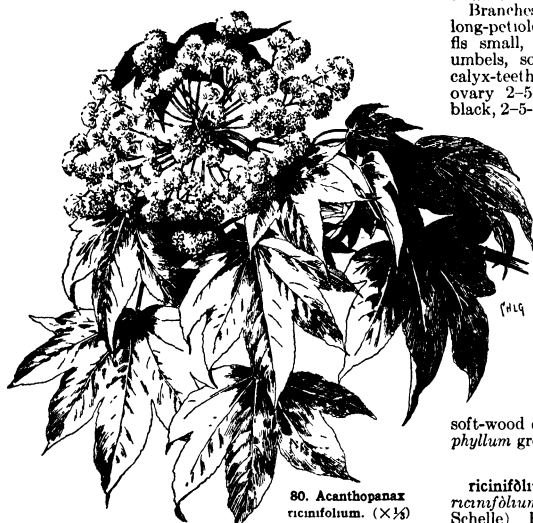
Leaves stiff, linear, round or slightly 3-angled, the angles channeled, the apex nearly always sharp-pointed scape and peduncle nearly always simple, sometimes a little branched· fls usually between and half hidden by the numerous bracts of the tightly compressed heads, spikes or racemes, corolla rose or white,

the petals at the base united to form a ring around the stamens; calyx tubular, the tube 10-ribbed. Boissier describes 74 species in the Flora Orientalis See A. Bunge, Die Gattung Acantholimon, St. Petersburg, 1872

The acantholimons are dwarf, tufted herbs, with sharp-pointed, rigid leaves, less common than Statice and Armeria, from both of which it is distinguished by its sharp-pointed leaves An oriental genus of slow-growing and sun-loving plants for rockeries and sandy places Most of them can be grown in the open border, *A. glumaceum* particularly, but they prefer warm, sunny situations in the rock-garden

Propagation is best effected by cuttings taken in late summer and kept in a coldframe, protected from the frost, over winter. Layering is also a quicker method of propagation.

acerôsum, Willd Woody, low perennial, with glaucous, spotted foliage lvs. thick, 2–3 in. long, long-



80. Acanthopanax ricinifolium. (×⅓)

pointed, flatly 3-angled, the margins rough scape longer than the lvs , topped by a laxly many-spiked fl - cluster, petals white E Medit region —Most suitable for rock-garden Scarcely grown in Amer

glumàceum, Boiss (*Státice Araráti,* Hort) Fig 79 Height 6 in · lvs green fls small, rose, on 1-sided spicate racemes, 6–9 in each short, dense racemelet. July–Sept Armenia. F S. 7.677. Gn 31·350 R H. 1891, p. 489.

venûstum, Boiss. (*Armerástrum dianthifólium,* O. Kuntze). About 8 in . lvs gray-green, very stiff· fls. larger than the last, rose, 12–20 in each long, loose spikelet July–Sept. Asia Minor R H 1866.450. Gn. 13·186. B M. 7506 Gn 53, p 405

A. Kótschyi, Boiss Fls. white, rising well above the lvs Cilicia. —*A. melandnthum,* Boiss Short dense spikes, sepals violet or blackish-margined Persia. N. Taylor.†

ACANTHOMÍNTHA (from Greek words for a *prickle* or *thorn,* and *mint*) *Labiàtæ* Thorny Mint A genus of only 2 species of tender annuals, with the habit of Lamium Its chief interest is botanical, the nearest relative of the genus being the Brazilian genus Glechon Calyx tubular-campanulate, 13-nerved, and with the calyx teeth all spinulose-tipped, corolla exceeding the calyx. Prop by seeds in spring under glass

ilicifôlia, Gray. Height 6 in . lvs. petioled, ovate, coriaceous, coarsely crenate-dentate. fls 3–8 in a whorl, chiefly rose or purplish rose, with yellow and white marks Calif B M 6750. Intro. 1891 —Less desirable than *Lamium,* which see. N. Taylor.†

ACANTHONÈMA (Greek combination referring to the spinous processes on the filaments) *Gesneràceæ* A monotypic genus, comprising **A. strigôsum,** Hook f , from Trop Afr , closely resembling Streptocarpus hothouse perennial with small fls dark purple on the limb and otherwise white, in panicles 2 in or less high arising from the base of the solitary prostrate narrowly oblong lf

ACANTHÓPANAX (*acanthos,* thorn, and *panax,* a prickly panax-like plant). *Araliàceæ* Including *Kalopànax* and *Eleutherocóccus.* Hardy trees or shrubs, cultivated chiefly for their ornamental foliage

Branches and sts usually prickly lvs alternate, long-petioled, palmately lobed or digitate, deciduous. fls small, usually greenish, perfect or polygamous, in umbels, sometimes forming large terminal panicles, calyx-teeth minute, petals and stamens 5, rarely 4; ovary 2–5-celled, styles 2–5, free or connate fr a black, 2–5-seeded berry —More than 15 species in Cent and E Asia and in the Himalayas

The members of this genus are trees or large shrubs with stout, usually prickly branches and large, palmately lobed or digitate leaves, small greenish flowers in umbels, sometimes forming large terminal panicles, followed by small black berries

For cultivation of Acanthopanax, see the genus Aralia The species described below are hardy except *A pentaphyllum,* which is tender north of Massachusetts, and *A trifoliatum* and *A setchuenense,* which are probably still more tender

Propagation is by seeds, to be sown as soon as received, or stratified and sown in spring, they germinate irregularly and may lie two years, also propagated by root-cuttings with bottom heat, and by soft-wood cuttings taken from forced plants, *A pentaphyllum* grows also from cuttings of ripened wood.

A *Lvs simple, palmately lobed*

ricinifôlium, Seem (*Kalopànax ricinifólium,* Miq *A. ricinifólium* var *magnificum,* Zabel *A acerifólium,* Schelle) Fig 80 Sparingly branched tree, to 80 ft : branches and sts with numerous stout prickles lvs 5–7-lobed, 9-14 in in diam , lobes triangular-ovate, acuminate, serrate, glabrous or nearly so infl compound, terminal, large, styles 2, nearly connate Japan. S I F 2 56 G W 11·537 Var **Maximowíczii,** Schneid (*Aralia Maximowiczii,* Van Houtte) Fig 81. Lvs deeply 5–7-lobed, with oblong-lanceolate lobes, downy beneath Japan F.S 20 2067. M D G. 1897. 233.—Very ornamental trees of striking subtropical effect

AA *Lvs. digitate.*

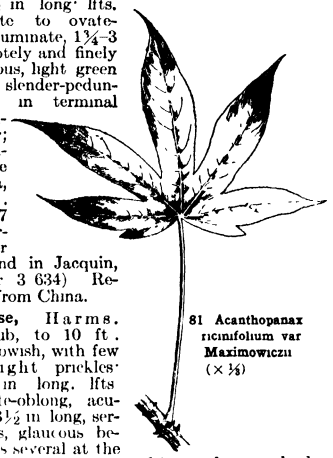
B *Fls short-pedicelled.*

sessiliflôrum, Seem (*Pànax sessiliflórum,* Rupr. & Max). Shrub with stout upright branches, to 12 ft.: branches with only few prickles lfts mostly 3, obovate-lanceolate or oblong-lanceolate, cuneate, acuminate, 3–7 in long, irregularly crenate-serrate, nearly smooth fls dull purplish, nearly sessile, in globular heads on stout, downy peduncles, usually several at the end of the branches Manchuria, N. China G C III 22:339 Gt. 11 369.—The freely produced heads of black berries are decorative Var **párviceps,** Rehd. Lower and denser lvs elliptic, 2–3 in. long· heads smaller, usually solitary.

BB. *Fls. slender-pedicelled.*

C. *Lvs. usually 3-foliolate.*

trifoliàtum, Schneid (*Zanthoxylum trifoliàtum,* Linn. *A aculeàtum,* Seem *A sépium,* Seem) Climbing shrub, to 20 ft.. branches with few hooked spines: petiole 1–1½ in long· lfts. stalked, ovate to ovate-lanceolate, acuminate, 1¼–3 in long, remotely and finely serrate, glabrous, light green beneath the slender-peduncled umbels in terminal whorls; pedicels slender; styles 2, connate to the middle China, Himalayas. L B C 10·977 (infl abnormal, a better figure is found in Jacquin, Icon Pl Rar 3 634) Recently intro from China.



81 Acanthopanax ricinifolium var Maximowiczii (×⅓)

setchuenénse, Harms. Upright shrub, to 10 ft. branches yellowish, with few nearly straight prickles· petiole 2–4 in long. lfts stalked, ovate-oblong, acuminate, 2½–3½ in long, serrate, glabrous, glaucous beneath umbels several at the end of the branches, peduncles ½–1 in long, pedicels slender, ovary 5-celled, styles connate into one W. China

cc *Lvs 5–7-foliolate*

senticòsum, Harms (*Eleutherocóccus senticòsus,* Maxim) Shrub, to 15 ft branches upright, densely covered with slender prickles lfts 5, occasionally 3, stalked, elliptic-obovate to oblong, shortly acuminate, narrowed at the base, 3–5 in long, sharply and doubly serrate, bright green, when young, with brown hairs on the veins beneath and with scattered hairs above. umbels long-peduncled, several at the end of the branches, ovary 5-celled, styles connate fr about ½in. long. July. N China, Manchuria. Gt 12·393

pentaphýllum, Marsh (*A spinòsum,* Hort., not Miq *Aràlia pentaphylla,* Thunb) Fig 82. Shrub, 5–10 ft branches arching and slender, with few compressed, straight prickles lfts 5–7, oblong-obovate or oblong-lanceolate, cuneate, acute, ¾–1½ in. long, crenate-serrate, smooth fls green, in slender-peduncled umbels, solitary on spur-like branchlets along last year's branches, styles 5, connate Japan —A graceful shrub, with arching branches and bright green, shining foliage, excellent on rocky banks and slopes. Only the pistillate form seems to be in cult, but produces no fr for want of pollen Var **variegàtum,** Hort Lvs edged white F S 20 2079 —Possibly a variety of *A spinosum* Also *A quinquefolium variegatum,* Veitch Cat., may be the same

1 *divaricatum,* Seem Allied to A sessiliflorum Lfts 5, downy beneath fls pedicelled Japan S I F 2 56 —*A Henryi,* Harms (Eleutherococcus Henryi, Oliver) Allied to A sessiliflorum. Branches with few hooked prickles lfts 3–5, nearly sessile, cuneate at the base, oblong, 2–3 in long fls pedicelled Cent China B M 8316 —1 *fanovans,* Franch & Sav Unarmed small tree lvs fascicled 3-foliolate, occasionally 2-foliolate or undivided and cordate, lfts nearly sessile, glabrous umbels paniculate Japan —*A leucorrhizum,* Harms Allied to A senticosum Branches only below the petiole with several straight reflexed prickles lfts oblanceolate, glabrous umbels solitary or few Cent China —*A scaduphylloides,* Franch & Sav Unarmed tree, to 10 ft., lfts 5, stalked, nearly glabrous umbels forming large [illegible] peduncles Japan S I F 2 55 —*A Simonii,* Schneid Allied to A senticosum Branches with several prickles below the petiole lfts 5, prickly on both sides, oblong China M D G 1910 25 —1 *spinòsum,* Miq Allied to A pentaphyllum Lvs often sparingly suppressed-setose above peduncles shorter than petioles, styles 2, separate China

ALFRED REHDER

ACANTHOPHÍPPIUM (meaning unexplained). Sometimes spelled *Acanthephippium. Orchidàceæ.* Stove terrestrial orchids

Pseudobulbs conic or cylindric, of several internodes, with several large, plicate-veined, jointed lvs at the apex fls borne on a lateral leafless scape, in a few-fld raceme, the broad, fleshy sepals form an urn-shaped tube, which incloses the narrower petals and the lip, lip jointed to the apex of the short, thick column which is produced below into a foot to which the sepals and petals are attached, pollinia 8.—A genus of 4 species, natives of the E Indies and Malay Archipelago

These are very rarely seen in cultivation, but are warmhouse terrestrial orchids from the hottest moist shaded jungles of Java A compost of fibrous loam and leaf-mold is best suited to them, keeping the plants in the warmest house in winter Propagate by dividing the pseudobulbs in spring before growth has made much advancement (Orpet)

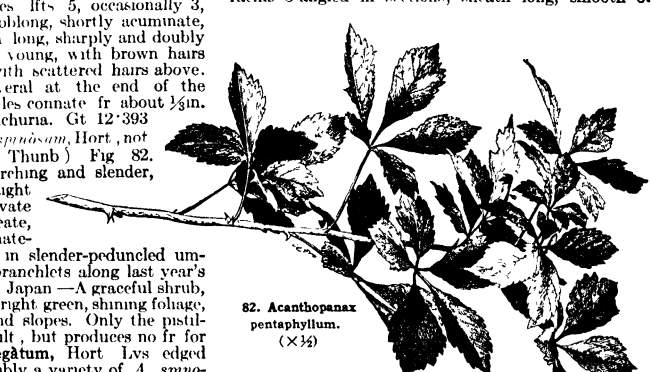
javánicum, Blume Fls yellow, flushed and striped with purplish red, the sepals and petals spreading at the tip Java J F 1 35 B M 4492

A bicolor, Lindl Fls yellow, tipped and marked with purple —*A Curtisii,* Reichb Fls light rose, flushed and striped with purple. The 5 keels between the side lobes serve to distinguish this from related species Malay Archipelago —*A sylhetènse,* Lindl Fls about 2 in long, white Himalayas

GEORGE V. NASH. †

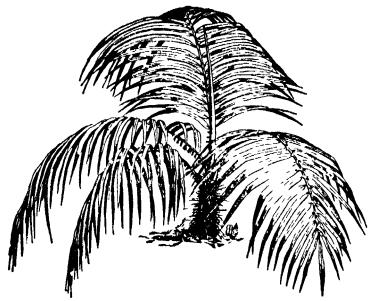
ACANTHOPHŒNIX (*acantha,* thorn, and *phœnix,* a date palm) *Palmàceæ,* tribe *Arèceæ* Very elegant greenhouse palms

Leaves pinnate, finely dissected, more or less armed with long, slender, brown or black spines, lfts narrow, linear-lanceolate, acute, rarely acuminate, prominently veined above, scaly beneath, the margins revolute; rachis 3-angled in sections, sheath long, smooth or



82. Acanthopanax pentaphyllum. (×⅓)

spiny infl (spadix) twice branched, sometimes smooth, but often hairy or even spiny, hanging by a short, stout stalk; the secondary branches slender or sometimes thick and twisted. spathes 2, flattened, soon falling fls monœcious, in spirally disposed 3-fld clusters, red, pinkish or orange, inner segms. of the perianth valvate in male fls, imbricate in female fls, stamens 12, reduced in the pistillate fls to a ring of functionless staminoidea fr black, about twice the size of a grain of wheat —There are only 3 or 4 species confined



83. Acanthophœnix crinita.

exclusively to the Mascarene Isls, Mauritius and Bourbon. G C II 22·426

These are tall palms or sometimes of moderate stature, the spiny and often ringed trunks conspicuously swollen at the base. Horticulturally, they have not figured very prominently in the trade in this country, but they are among the finest of cultivated palms in the collections of fanciers and botanic gardens.

They should be grown in a warm house, from 70 to 90°, never less than a night temperature of 55 to 60° They will root best in a soil composed as follows: loam three parts, peat one part, leaf-mold one part, mixed with a little sand or crushed charcoal. The drainage, so long as the plants are in pots and tubs, must be very good, as they require much water. If possible, when the plants are 6 feet or more, plant out permanently.

Propagation is only by seeds, which frequently require two to three years to germinate The seeds should be placed in a seed-pan and kept in a warm, moist place.

crinita, H Wendl (*Arèca crinita*, Bory) Fig 83 Trunk 50–60 ft. lvs 7–13 ft long; petiole densely tomentose, 4–8 in long; lf -sheath 2½–4½ ft long, thickly covered with short brown bristles and spines; segms silvery white beneath spadix 1–2 ft. long, brown, woolly and with slender brown spines; perianth reddish pink, or sometimes whitish. fr. ½–½in long F S 16·1706. F R 2.201.—Young plants have pale yellowish green lvs.

rùbra, H Wendl. (*Arèca rùbra*, Bory. *Cálamus Verschaffélti*, Hort). Trunk 60 ft lvs. 6–12 ft. long, petiole glabrous, 2–4 in. long, lf.-sheath 2½–4½ ft long, thickly covered with long, brown-black spines, pinnæ slightly glaucous beneath: spadix 2½–3½ ft long, armed with straight black spines; perianth reddish brown· fr. globose ⅛–⅜in in diam, with a prominent ridge extending from the stigma to the base —Young plants have dark green lvs with red veins. N. Taylor. †

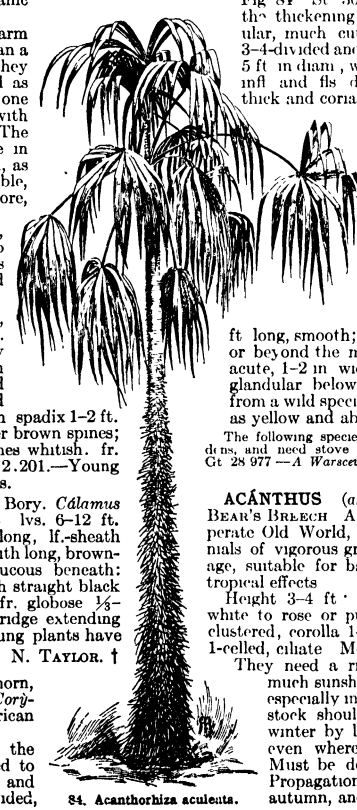
ACANTHORHÌZA (Greek for thorn, and *rhiza*, root). *Palmàceæ*, tribe *Coryphеæ* A genus of tropical American medium-sized palms.

Leaves crowded at the end of the trunk, palmate, 3 to many, divided to the base, but the segms stalkless, and in age becoming typically 3–4 divided, the segms. then wedge-shaped; lf -stalk flattened, very persistent, slender and smooth, the sheath short and fibrous; as the lvs. unfold the margins are bent inward, the external faces applied together· infl. flattened at first, the short peduncle and thickening branches, white, bracteate, the bracts diminishing downward, fls. cream-white, in spike-like, dense clusters, these racemose, stamens quite free, differing from Trithrinax, where they are united to form a tube It has never been known to fruit in cult —Three or four species only, are known, all from Trop. Amer, but not so well known to the trade as their great beauty and stately dimensions deserve G C II 22.426

These palms have spineless trunks, except at the base, where the aerial roots subsequently harden into stiff downward-pointing spines, differing in this from Trithrinax, the nearest relative

They should be grown as stove palms, a night temperature not less than 60° being preferable If possible, plant out the tall plants, as they do much better when not disturbed by subsequent repotting A good mixture should contain good, fibrous loam and considerable sand

Propagation is only by seeds, sown preferably in the spring, in fresh peat over bottom heat



84. Acanthorhiza aculeata.

aculeàta, H Wendl (*Chamæ̀rops stauracántha*, Hort) Fig 84 St 30–40 ft, spiny at base through the thickening of the aerial roots lvs orbicular, much cut in young trees, subsequently 3–4-divided and palmate in the older specimens, 5 ft in diam, whitish beneath, lf -stalk 3–4 ft· infl and fls dark creamy pink, fls spicate, thick and coriaceous, calyx lobes erect, oblong, equaling the roundish and concave petals Mex I H 26 367 B M 7302 —Succeeds in an intermediate house

Chûco, Drude (*Thrinax Chùco*, Mart) Trunk smooth, about 30 ft high, usually not more than 5 in in diam, slender, flexuous lvs orbicular, with a narrow sinus at the base, usually 10–25 in a cluster, petioles slender, 3–6 ft long, smooth; blade 6 ft in diam, divided to or beyond the middle, segms 15–20, lanceolate, acute, 1–2 in wide, dark green above, paler and glandular below· fls and fr unknown, except from a wild specimen in which the fr is described as yellow and about 1 in diam. Brazil

The following species are rarely seen outside botanic gardens, and need stove temperature *A Wállisii*, H Wendl. Gt 28 977 —*A Warscewiczii*, H Wendl Panama Gt 25 860

N. Taylor †

ACÁNTHUS (*akanthos*, thorn) *Acanthàceæ*. Bear's Breech A genus of twenty species of temperate Old World, mostly hardy herbaceous perennials of vigorous growth and broad pinnatifid foliage, suitable for backgrounds of borders and subtropical effects

Height 3–4 ft· spikes 1–1½ ft long; fls dull white to rose or purplish, sessile, spicate, densely clustered, corolla 1-lipped, the lip 3-lobed; anthers 1-celled, ciliate Mostly S Eu

They need a rich, light, well-drained soil and much sunshine Excessive moisture is fatal, especially in winter and spring Fall-planted stock should always be protected for the winter by long litter or evergreen boughs, even where established plants are hardy. Must be deeply mulched north in winter. Propagation is by division in spring or early autumn, and by seeds.

It is supposed that acanthus leaves afforded the suggestion for the foliage decoration on the capital of the Corinthian and other columns Fig 85 shows the conventionalized decoration, and Fig 86 the form of leaf of *A spinosus*. The leaves of *A mollis* were probably also involved in variations of decoration.

A. *Lvs. spiny*

Cároli-Alexándri, Hausskn. Nine to 18 in.: lvs. few, radical, in a lax rosette, lanceolate, spiny, 16 in long, 3-3½ in broad spike dense, fls white or suffused rose-color. Summer Greece



85 The Acanthus decoration of an architectural column

spinosíssimus, Desf Fig 87 Lvs dark green, pinnately parted, spines glistening, whitish fls infrequent, rosy, sessile: autumn, spikes loose, pilose or glabrescent: spines of the bracts recurved S Eu Grows 3–4 feet

Pérringi, Sieht. About 1–1½ ft high. lvs sessile, 5–6 in long, lanceolate tapering, deeply toothed and spiny fls very profuse, rosy red, its bracts spiny Mts of Turkey in Asia June.—Suitable for alpine garden Doubtfully hardy where summers are hot and dry

spinósus, Linn. Fig 86 Lvs lanceolate, pinnatifid, pubescent, spines short, whitish fls smaller than in the last, purplish, summer, spikes dense, slightly villous. B M 1808 Gn 8 147

montánus, T Anders Lvs pinnatifid or sinuate-spinose, 1 ft or more long, olive-green, the lobes spine-pointed fls rosy white in a long spike. Trop Afr.—Greenhouse

AA *Lvs not spiny*

móllis, Linn Fig 88 Lvs 2 × 1 ft, cordate, sinuately pinnatifid, mostly radical fls summer, spikes loose, pubescent Gn 52, p 239.—Also recommended as a window plant Var **latifólius,** Hort (*A latifólius,* Hort *A lusitánicus,* Hort) is larger and hardier. Gn. 1, p 303

longifólius, Poir Lvs radical, longer and narrower than in *A. mollis*, bright green fls purple, June. Dalmatia



86 Acanthus spinosus From drawing by John Ruskin

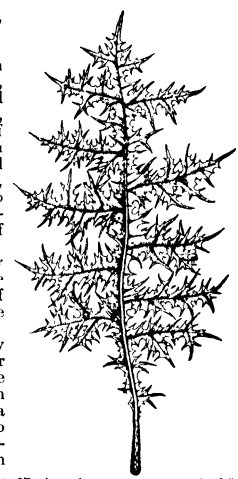
4 *arbóreus,* Forsk Evergreen prickly-shrub attaining a height of nearly 20 ft N E Trop Afr G C III 31, 222 — 4 *carduifólius,* Lann = Blepharis carduifolia.—4 *hispánicus,* Hort 2 ft lvs large, deeply cleft, shaming green as white Aug Spain Perhaps *A niger,* Mill.—*A ilicifólius* (Dilivaria ilicifolia, Juss) Smooth greenhouse sub-shrub with lvs resembling Ilex aquifolium, the Eu Holly Prop by cuttings under glass E Asia.—*A niger,* Mill Lvs not spiny, sinuate, glabrous fls purplish white Portugal

N. TAYLOR †

ÀCER (classical Latin name) *Aceràceæ* MAPLE Native and foreign trees cultivated chiefly for shade and for the ornamental foliage

Trees, rarely shrubs lvs opposite, petioled, simple and mostly palmately lobed, or 3–5 foliolate, deciduous, rarely evergreen fls small, polygamous or dioecious, in racemes, panicles or corymbs, petals and sepals 5, rarely 4, rarely sepals connate and petals wanting, disk usually annular, conspicuous, rarely lobed or wanting; stamens 4–10, mostly 8; styles 2, usually more or less connate fr. consisting of 2 long-winged, compressed nutlets (samaras), each containing 1 seed.—About 110 species in N. Amer., Asia, especially Cent and E Asia, Europe and N Afr Monogr. by Pax in Engler, Pflanzenreich IV, fam 163 (1903), quoted below as Pax, see, also, Rehder, The Maples of E Continental Asia, in Sargent, Trees and Shrubs, 1 175 (1905), and Koidzumi, Revisio Aceracearum Japonicarum in Jour College of Science, Tokyo, 32, Art 1 (1911), both with many plates Monogr of the garden forms by Graf Schwerin in Gt 1893, see also G C II. 16.75.

The maples are hardy ornamental trees or shrubs, with handsome large foliage which, in some species, shows a remarkable tendency to vary in shape and coloring Numerous garden forms are in cultivation. Though the flowers are small, they are quite attractive in the early-flowering species as in *A rubrum* and *A. saccharum*, since they appear in great profusion, in some species the young fruits assume a bright red color, particularly in *A. tataricum, A ginnala, A pseudoplatanus* var *erythrocarpum,* and *A rubrum* The maples are among our most ornamental and valuable trees for park and street planting Nearly all assume a splendid color in autumn, especially the species of North America and Eastern Asia, which surpass by far the European maples Many species are valuable timber trees, and some American species, especially *A. saccharum,* produce sugar For purposes of shade, the common sugar maple is best and most popular The Norway maple makes a very dense and round head, and is excellent for lawns, but it is too low-headed for the streets *A pictum* is similar, but smaller in every part. The silver maple, *A saccharinum* and its vars., is also popular where quick-growing trees are desired The Japanese maples of the Palmata section are among the most striking and showy exotic small trees, and are adapted for fine grounds and for growing in pots



87. Acanthus spinosissimus. (×⅛)

The maples are not particular as to soil, some species, as *A monspessulanum* and *A campestre,* prefer drier situations, while *A saccharinum* and *A rubrum* prefer moist situations, the latter growing well even in swampy soil Most of the species are hardy in the northern and middle states; among the hardiest are *A. Negundo, A saccharum* (Figs 89, 90), *A. saccharinum, A rubrum, A. nigrum, A pennsylvanicum, A. spicatum, A platanoides, A tataricum*



88. Acanthus mollis. (×⅛)

Propagation is by

seeds, which soon lose their germinating power and must be sown soon after maturity or stratified and sown in spring; *A. saccharum* and *A. Negundo* keep their germinating power somewhat longer. The early-ripening species, like *A. saccharinum* and *A rubrum*, must be sown as soon as they are ripe and they will germinate the same year. *A. campestre*, *A. monspessulanum* and other species of this group do not usually germinate until the second year The varieties and rare species may be budded in summer on the typical forms or on species of the same group, kinds belonging to different groups cannot, as a rule, be grafted on each other; e g, varieties of *A. platanoides* will not grow on *A pseudoplatanus* and vice versa, but *A. insigne* will grow on *A. pseudoplatanus*, as they belong to the same group Some shrubby species, as *A palmatum*, also *A. cissifolium*, *A ginnala* var *Semenowi*, and *A latum* var *rubrum*, may be propagated by layers or half-ripened greenwood cuttings in summer, or, still better, by cuttings taken from forced plants in early spring in the greenhouse *A. Negundo* grows also from hardwood cuttings Fancy maples are readily winter-grafted by the veneer method, the stocks being grown in pots The Japanese kinds are usually worked on imported stocks of *A. palmatum*.



89. A pasture maple in autumn, showing the strong framework

INDEX.

albo-limbatum, 32,
albo-variegatum, 5, 22, 36
argenteo-variegatum, 2, 24, 49
argutum, 35
atrolineare, 13
atropurpureum, 13, 22
auratum, 49
aureo-maculatum, 49
aureo-marginatum, 5, 49
aureo-variegatum, 49
aureum, 8, 13, 15
austriacum, 2
barbatum, 38, 39.
betulifolium, 34
bicolor, 13, 22
californicum, 49
campestre, 2
cappadocicum, 8
carpinifolium, 27
catalpifolium, 10
caudatum, 20
circinatum, 12
cissifolium, 48
colchicum, 8
columnare, 5, 37
concolor, 26
crataegifolium, 36
crispum, 13, 36, 49.
cucullatum, 5
dasycarpum, 36.
Davidii, 28
diabolicum, 43.
discolor, 26
dissectum, 5, 13
Douglasii, 11
Drummondii, 5, 37.
elobulatum, 34
eriocarpum, 36
erosum, 20
erythrocarpum, 22.
erythrocladum, 33.
flicifolium, 15
floridanum, 39.
Frederici-Guilelmi, 13.
Geneva, 5
ginnala, 18
glabrum, 11
globosum, 5, 37
grandidentatum, 42.
griseum, 45.



90. Pasture tree of Acer saccharum, sugar maple. Tree flatter-topped than usual

INDEX, CONTINUED

Handjeryi, 22
hebecarpum, 2.
Heldreichi, 23
Henryi, 47
heterophyllum, 36
hortícola, 8
hyrcanum, 3.
iberícum, 1
insigne, 24, 25
interior, 49
italum, 3
japonicum, 14, 15
Jühlkei, 36
Kingii, 49
lacinatum, 5, 15, 19.
latum, 8
laxiflorum, 29
Leopoldi, 22
leucoderme, 41
lineariloburn, 13
lobulatum, 34
longeracemosum, 34
longilobum, 29
longipes, 9
Lorbergii, 5
lutescens, 22, 36
macrophyllum, 15, 21
magnificum, 37
mandshuricum, 46
microphyllum, 14, 37
Miyabei, 4
Mono, 7
monspessulanum, 1
montanum, 19
monumentale, 38
multiserratum, 20
Negundo, 49
nervosum, 22
nigrum, 13, 38, 40
nikoense, 44, 45
oblongum, 26
Oliverianum, 16
Opalus, 3
ornatum, 13
palmatum, 13
Parsonsii, 15
parviflorum, 7
pennsylvanicum, 33
pictum, 7
pinnatifidum 13
pinnatifolium, 13
platanoides, 5
polymorphum, 13
pseudo-californicum, 49
pseudoplatanus, 22
pulchrum, 13
pulverulentum, 2
purpurascens, 22, 43
purpuratum, 23
purpureum, 22
quadricolor, 22
Reitenbachii, 5
reticulatum, 13
rhodocarpum, 11
roseo-marginatum, 13
rubrum, 5, 13, 37
rufinerve, 32
Rugeli, 38
saccharinum, 36, 38, 40
saccharum, 38, 40, 41
sanguineum, 13
Schlesingeri, 37
Schwedleri, 5
scolopendrifolium, 13.
Semenowii, 18.
semirubicaulatum, 37.
septemlobum, 13.
sessilifolium, 13.
Sieboldianum, 14.
sinicum, 8
Simonii, 22
spicatum, 19, 20
stachyophyllum, 34.
Stollii, 5
striatum, 33
tataricum, 17, 18.
tauricum, 2, 3
tenellum, 7
tetramerum, 34.
Thunbergi, 13
tiliifolium, 34
tomentosum, 37.
Trautvetteri, 24.
tricaudatum, 8
tricolor, 8, 13, 22.
tridens, 37
tribobatum, 1, 3
triparitum, 11, 36.
truncatum, 6
Tschonoski, 31
ukurunduense, 20.
Van Volxemi, 25
velutinum, 24, 25.
versicolor, 13
villosum, 22
violaceum, 49
Wieri, 36
Wittmacki, 5.
Wolfii, 25
Worleei, 22.

KEY TO THE SPECIES.

A *Lvs simple, mostly palmately lobed (occasionally 3-foliolate in No 11)*
B *Sepals and petals distinct (petals wanting in Nos 27 and 35)*
C *Fls appearing with or after the lvs in corymbs, panicles, or racemes*
D *Arrangement of infl corymbose (broadly paniculate in No 4)*
E *Winter-buds with several imbricate scales lobes entire or coarsely toothed, rarely lvs without lobes*
F *Lobes obtuse or bluntly pointed*
G *Lvs 1–3½ in. across, usually 3-lobed, lobes usually entire or with few teeth.*
H *Corymbs glabrous lobes entire, lvs glaucous beneath* — 1 **monspessulanum**
HH. *Corymbs pubescent, upright lobes usually dentate, lvs green beneath* — 2 **campestre**
GG *Lvs 3 6 in across, 3–5-lobed, lobes toothed*
H *Infl corymbose, many-fld pendulous lvs glaucescent beneath, lobes obtuse or acute* — 3 **Opalus**
HH *Infl paniculate, upright lvs green beneath and pubescent, lobes obtusely acuminate* — 4 **Miyabei**
FF. *Lobes acuminate, finely pointed corymbs glabrous*
G. *Lvs glabrous beneath, 5–7-, rarely 3-lobed corymbs stalked*
H *Bark of mature branches ashy gray or light grayish brown, slightly fissured and marked with lenticels*
I. *The lobes coarsely toothed* — 5. **platanoides**
II. *The lobes entire or rarely with few teeth.*

JJ. *Wings about as long as nutlets lvs truncate at base* 6 **truncatum**

JJ *Wings about twice as long as nutlets lvs cordate or subcordate* 7 **pictum**

HH *Bark remaining smooth and lustrous for several years, without or with few inconspicuous lenticels, greenish or purplish* 8 **cappadocicum**

GG. *Lvs pubescent beneath, usually 3-lobed, occasionally 5-lobed or quite entire corymbs nearly sessile, very large* 9 **longipes**

FFF. *Lobes none or not prevalent, the lvs quite entire, ovate to ovate-oblong, rarely mixed with a few 3 5-lobed lvs corymb nearly sessile, very large* 10 **catalpifolium**

EE. *Winter-buds with 2 outer valvate scales lobes serrate or doubly serrate corymbs small*

F *Lvs 3-lobed or 3-foliolate, occasionally 5-lobed, pale or glaucescent beneath, quite glabrous* 11 **glabrum**

FF *Lvs 5–11-lobed, green beneath*

G *Petioles and peduncles glabrous ovary glabrous*

H *Sepals purplish, petals white lvs lobed nearly to the middle* 12 **circinatum**

HH *Sepals and petals purplish lvs lobed beyond the middle* 13 **palmatum**

GG. *Petioles and peduncles pubescent, at least while young ovary villous*

H *Fls yellowish lvs subcordate or cordate, sharply or doubly serrate* 14 **Sieboldianum**

HH *Fls purple, larger lvs deeply cordate, incisely serrate* 15. **japonicum**

DD. *Arrangement of infl paniculate or racemose*

E. *Infl paniculate (nearly corymbose in No 16)*

F *Lvs dentate or serrate, usually lobed*

G *Edges of lvs sharply serrate*

H. *Panicle only little longer than broad*

I *The lvs 5-lobed, sharply and simply serrate* 16 **Oliverianum**

II. *The lvs 3-lobed or without lobes, doubly serrate*

J. *Foliage dull green, lvs ovate-oblong, not lobed* 17. **tataricum**

JJ. *Foliage shining dark green lvs 3-lobed* 18 **ginnala**

HH. *Panicle narrow, spikelike, upright lvs 3-5-lobed, doubly serrate petals linear, much longer than the sepals*

I *Foliage pubescent beneath lvs 3-, rarely 5-lobed* 19 **spicatum**

II *Foliage glabrous or pubescent beneath lvs 5-, rarely 7-lobed* 20 **caudatum**

GG. *Edges of lvs coarsely or crenately dentate, 5-lobed*

H. *Panicles pendulous, much longer than broad*

I. *Fr hispid lvs 10–12 in long, deeply lobed* 21 **macrophyllum**

II. *Fr glabrous lvs 4–6 in long* 22. **pseudoplatanus**

HH. *Panicles upright, little longer than broad*

I. *Blade with middle lobe free nearly to the base* 23 **Heldreichii**

II. *Blade with lobes divided to the middle or little beyond*

J *Lobes longer than broad lvs glaucescent beneath* 24 **Trautvetteri**

JJ *Lobes about as long as broad lvs green beneath* 25 **insigne**

FF *Lvs quite entire, generally oblong* 26 **oblongum**

EE. *Infl racemose*

F. *Lvs oblong, undivided, serrate, with about 20 pairs of parallel veins winter-buds with many imbricate scales* 27 **carpinifolium**

FF. *Lvs lobed or undivided, with about 10 pairs of veins or less winter-buds with 2 outer valvate scales*

G *Sepals and petals 5, racemes terminal lvs brownish pubescent beneath while young, at least on the veins*

H. *Outline of lvs oblong, without lobes or with 2 lobes near the base*

I *The lvs undivided, crenately serrate* 28. **Davidii**

II. *The lvs lobed*

J *With lvs green beneath, sharply serrate, long-acuminate, slightly lobed* 29 **laxiflorum**

JJ. *With lvs glaucescent beneath, unequally serrate, acuminate, often deeply lobed* 30 **cratægifolium**

HH *Outline of lvs ovate or roundish, 5-lobed* 31 **Tschonoskii**

HHH *Outline of lvs obovate, 3-lobed, with the lobes near or above the middle*

I *Young branchlets bloomy young lvs densely brownish villous on the veins beneath raceme pubescent* 32 **rufinerve**

II. *Young branchlets not bloomy young unfolding lvs brownish villous on the whole under side, primary veins glabrescent raceme often glabrous* 33 **pennsylvanicum**

GG. *Sepals and petals 4, staminate fls from lateral leafless buds lvs doubly serrate, 5-lobed or without lobes*

H *Lvs undivided or incisely lobed, ovate to oblong* 34 **tetramerum**

HH *Lvs distinctly 5-lobed, roundish in outline* 35 **argutum**

CC *Fls. appearing long before the lvs in dense lateral clusters lvs 5-lobed fr. ripening in May or June.*

DD. *Ovary and young fr. tomentose· short-stalked. lvs. deeply 5-lobed* . 36. **saccharinum**

DD *Ovary and young fr glabrous fls on long pedicels lvs 3–5-lobed* 37 **rubrum**

BB. *Sepals connate and petals wanting at least in the staminate fls , fls on long, pendulous, mostly hairy pedicels*

C. *Pistillate and staminate fls corymbose, terminal and lateral fr glabrous or villous American species*

D *Corymb sessile or nearly sessile*

E *Lvs glaucous or pale beneath*

F *Lobes acuminate, lvs glabrous beneath at maturity* 38 **saccharum**

FF *Lobes obtuse, lvs pubescent beneath* 39 **floridanum**

EE *Lvs green beneath, lobes acuminate*

F. *Bark of trunk dark lvs hirsute-pubescent, 5 6 in across* 40 **nigrum**

FF. *Bark pale lvs soft-pubescent beneath, 2–3½ in across* 41 **leucoderme**

DD. *Corymbs short-stalked lvs pubescent beneath, lobes obtuse or acute* 42 **grandi-[dentatum**

CC *Pistillate fls racemose, with petals and distinct sepals, staminate corymbose, with connate sepals and without petals, both from lateral leafless buds Japanese species* 43. **diabolicum**

AA *Lvs 3–5-foliolate fls dœcious*

B. *Fls in terminal corymbs, after the lvs winter-buds with several imbricate scales disk large, annular lvs 3-foliolate*

C *Petioles, lvs beneath and corymbs pilose; petioles short*

D *Shape of lvs elliptic-oblong, sparingly serrate, 2–5 in long* 44 **nikoense**

DD *Shape of lvs elliptic, coarsely dentate, 1–2 in long* 45 **griseum**

CC. *Petioles, lvs and corymbs glabrous, lvs oblong-lanceolate, petioles slender* 46 **mandshuri-[cum**

BB *Fls , at least the pistillate, in lateral, long and slender racemes winter-buds with 2 valvate scales*

C *Petals present, fls of both sexes in racemes, sometimes leafy at base, with the lvs · lvs 3-foliolate*

D. *Petioles and lvs pubescent beneath sepals and petals 5* 47 **Henryi**

DD *Petioles and lvs glabrous at maturity sepals and petals 4* 48 **cissifolium**

CC *Petals wanting, pistillate fls in pendulous racemes, staminate corymbose, pendulous, both sexes from lateral leafless buds before the lvs lvs 3–5-foliolate* 49 **Negundo**

Section CAMPESTRIA.

1. **monspessulànum,** Linn (*A trilobàtum,* Lam). Shrub or small tree, 25 ft.: lvs. 3-lobed, coriaceous, 1–3 in across, shining above, glaucous and glabrous beneath, lobes entire or with few obtuse teeth corymbs erect. fr. with slightly spreading wings S Eu , N. Afr , W. Asia. Gt 1893, p 363 H W 3, p 46 G W 8, p. 195 (habit) —Shrub or small tree of slow growth, with a dense, rounded head and, in temperate regions, nearly evergreen foliage, thriving well in dry situations. Var. **ibèricum,** Koch (*A ibèricum,* Bieb.). Lvs. larger, the inner lobes usually slightly 3-lobed, obtuse

2 **campéstre,** Linn. Shrub or tree, occasionally 50 ft., with corky branches lvs 3–5-lobed, 1½–3½ in. long, green and pubescent beneath or nearly glabrous; lobes entire or the middle one slightly 3-lobed. corymbs erect, hairy. fr with horizontally spreading wings Eu., W. Asia. H.W. 3:46, p. 45. F.E 20, pl. 108 (habit). Gt. 1893, p. 327.—Shrub or tree of moderate, dense growth, with dull green foliage, valuable for planting as undergrowth and on dry ground. Many varieties and garden forms· Var **argénteo-variegàtum,** Schwerin Lvs with large white blotches Var **pulverulèntum,** Kirchn Lvs sprinkled with white Var **austriacum,** DC Usually a tree. lvs 5-lobed, with acute, nearly entire lobes fr glabrous. F E 19, pl 98 (habit). Var **taùricum,** Kirchn Shrub lvs 5-lobed small, lobes 3-lobed Var **hebecárpum,** DC. Fr and generally the lvs pubescent beneath

3 **Ópalus,** Mill (*A Italum,* Lauth) Small tree, 30 ft lvs 5-lobed, 3–5 in. long, glaucous beneath and at length glabrous, lobes obtusely dentate, short and broad, the middle ones often 3-lobed corymbs somewhat drooping fr with slightly spreading wings S Eu , Orient W D B. 2 171 —A variable species, similar to a small-lvd sycamore maple Var. **hyrcànum,** Pax (*A hyrcànum,* Fisch & Mey *A taùricum,* Hort *A. trilobàtum,* Hort , not Lam) Petioles very slender, red, 2–4 in long, segms. of the lvs 3-lobed, longer than broad, with straight margins Gt 1893, p 361.



91. Acer Miyabei.
(×½)

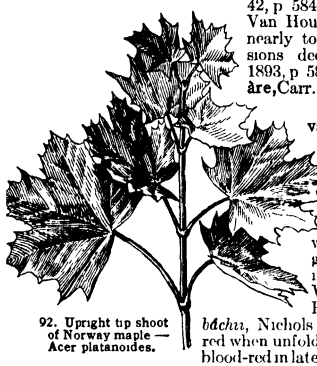
Section PLATANOIDEA.

4 **Miyâbei,** Maxim Fig 91 Tree, to 40 ft branches corky lvs 5-lobed, lobes lobulate or coarsely dentate, obtusely acuminate, with obtuse teeth, at first pubescent on both sides, later only beneath, pale green beneath, 5 6 in long corymbs long-stalked, 10–15-fld pubescent fr pubescent with horizontally spreading wings Japan G F 6·113 (adapted in Fig 91) S I F 2 45 —Handsome, vigorous tree, quite hardy at the Arnold Arboretum

5 **platanoìdes,** Linn NORWAY MAPLE Fig 92 Large tree, to 100 ft lvs 5-lobed, cordate at base, glabrous, light green and lustrous beneath, lobes pointed, remotely dentate with pointed teeth corymbs glabrous, fls yellowish green fr glabrous, with horizontally spreading wings Eu , Caucasus H W. 3 45 Pax 49 Gt 42, p 561, 584, 585 —Large, handsome tree, with round, spreading head, resembling somewhat *A saccharum* The lvs turn pale yellow in autumn Many garden forms, some of which are here arranged in two groups, the first being remarkable for the manner in which the lvs are cut and for the habit, the second being chiefly remarkable for their coloring·

(1) Var **cucullàtum,** Nichols Lvs irregularly and shortly lobed, crimped, light green Var **dissèctum,**

Jacq. Similar to var. *Lòrbergii*, but with darker foliage and of slower growth. Var **globòsum,** Nichols Forming a globose head. M.D G. 1903:189. G.W. 5, p. 14 Var **lacinìatum,** Ait. Lvs. irregularly divided, the divisions bending downward growth upright. Gt. 42, p 584. Var **Lorbérgii,** Van Houtte. Lvs divided nearly to the base, divisions deeply lobed Gt. 1893, p 584. Var **columnàre,** Carr. Habit columnar.



92. Upright tip shoot of Norway maple — Acer platanoides.

(2) Var. **álbovariegàtum,** Nichols Lvs with large white blotches. Var **aùreomarginàtum,** Pax. Lvs. with yellow margin, somewhat irregularly lobed. Var **rùbrum,** Herd (var *Reitenbàchii*, Nichols) Lvs greenish red when unfolding, turning dark blood-red in late summer Gt 16: 545 B H 18 39 Var *Genèva*, Ellwanger & Barry, is probably not much different Var **Schwédleri,** Koch. Lvs bright red when young, changing to dark green. G C II 15 565 Var **Stòllii,** Spaeth More upright-growing lvs usually 3-lobed, with entire lobes, purple when unfolding, later dark green Gt 42, p 585 Var. **Wittmáckii,** Schwerin Lvs usually 3-lobed, with an irregularly dentate and undulate yellow margin, reddish brown when unfolding, later bright green with most of the tips transformed into peculiar reddish brown appendages becoming, finally, dark green Gt 52 1516 Var **Drúmmondii,** Drumm Lvs green with white margin, red when unfolding M D. 1910 1.

6 **truncàtum,** Bunge Tree, to 25 ft lvs deeply 5-lobed and mostly truncate at the base, 2½–4 in across, glabrous, light green, purplish when unfolding, lobes acuminate, setosely pointed, entire or sometimes the middle ones 3-lobed fr with yellow, short and broad wings, spreading at right or obtuse angles N China. S.T S 1 76 —Hardy tree, with handsome, dense foliage.

7 **pictum,** Thunb Tree, 60 ft · lvs 5- or 7-lobed, 3–7 in across, usually pubescent beneath when young; lobes entire, acuminate, sometimes very broad and short: fls yellow. wings of the fr upright, brown or brownish yellow, hardly twice as long as the nutlets Manchuria, Japan S I F 1 65 —Handsome round-headed tree, with bright green foliage, hardy Var **parvifòrum,** Schneid (*A pictum* var *Mòno*, Pax *A. Mònc*, Maxim) Wings of the frs spreading lvs more cordate China J H S 29·319, 350. The form intro as *A. tenellum* belongs here; the true *A. tenellum*, Pax, is not in cult.

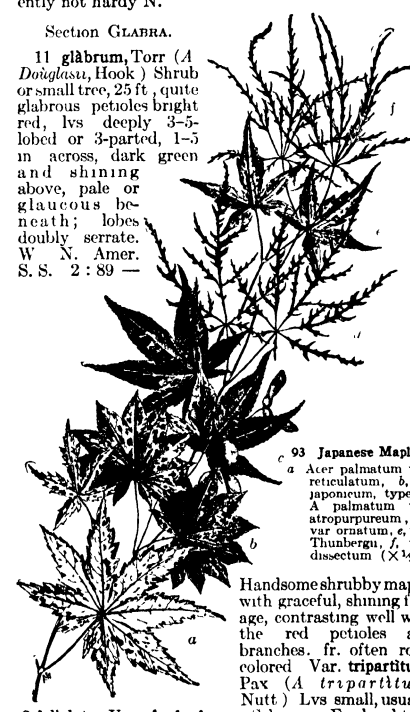
8. **cappadócicum,** Gled (*A. làtum*, C. A. Mey.). Tree, to 50 ft lvs 5–7-lobed, usually cordate, 3–6 in across, glabrous, light green and lustrous beneath; lobes entire, acuminate fls greenish yellow, in upright peduncled corymbs fr with spreading wings, the wings usually 2–3 times as long as the nutlets From the Caucasus to W China and the Himalayas —Resembles *A. platanoides*, but lobes of lvs entire and branches smooth; not quite hardy N Var **sínicum,** Rehd. Smaller in every part lvs 2½–4 in across, usually 5-lobed, subcordate or truncate at the base wings of fr about twice as long as nutlet W. China. J H S. 29·358 (as *A lætum* var. *cultratum*) —Very similar to *A pictum*, but always easily distinguished by the smooth greenish bark of the younger branches. Var **tricaudàtum,** Rehd Similar to the preceding, but lvs. 3-lobed. J.H.S. 29:357, 358. Var. **hortícola,** Rehd. (*A. lætum* var. *rùbrum*, Schwerin; *A. cólchicum* var. *rùbrum*, Hort.). Lvs blood-red, when unfolding. Var. **tricolor,** Rehd (*A lætum* var *tricolor*, Schwerin) Lvs. blood-red, sprinkled with rosy pink, when young The last two beautiful forms usually remain shrubby Var. **aùreum,** Rehd (*A. lætum aureum*, Hesse). Lvs. red and golden yellow

9 **lóngipes,** Rehd Tree, to 30 ft : young branches with smooth greenish bark lvs 3-, rarely 5-lobed, or occasionally undivided and ovate, 5–7 in broad, lobes entire, long-acuminate, light green and soft-pubescent beneath, purple when unfolding: corymb large and loose, short-peduncled or nearly sessile, glabrous. fr with the wings spreading at right angles W China.—A very handsome maple, easily distinguished from all allied species by the large, 3-lobed lvs, pubescent beneath.

10. **catalpifòlium,** Rehd. Tree, to 60 ft : younger branches smooth, greenish lvs ovate to ovate-oblong, undivided, entire, sometimes with a broad rounded lobe near the base, 4–8 in long and 2–5 in broad, rarely mixed with a few 3–5-lobed lvs, light green and glabrous beneath. corymbs sessile, large and loose, to 8 in. across wings of the fr. spreading at obtuse angles W. China —Very distinct and beautiful tree, but apparently not hardy N.

Section GLABRA.

11 **glàbrum,** Torr (*A Douglasii*, Hook) Shrub or small tree, 25 ft, quite glabrous petioles bright red, lvs deeply 3–5-lobed or 3-parted, 1–5 in across, dark green and shining above, pale or glaucous beneath; lobes doubly serrate. W N. Amer. S. S. 2 : 89 —



93 Japanese Maples.
a Acer palmatum var reticulatum, *b*, A japonicum, type, *c*, A palmatum var atropurpureum, *d*, var ornatum, *e*, var. Thunbergii, *f*, var. dissectum (×½)

Handsome shrubby maple, with graceful, shining foliage, contrasting well with the red petioles and branches. fr. often rose-colored Var. **tripartìtum,** Pax (*A tripartìtum*, Nutt) Lvs small, usually 3-foliolate Var. **rhodocárpum,** Schwerin. Frs. bright red until fully ripe.

Section PALMATA.

12 **circinàtum,** Pursh Small tree, rarely 40 ft : branchlets, petioles and peduncles glabrous lvs 7–9-lobed, 2–7 in across, glabrous, lobes acute, doubly serrate fls in drooping corymbs, with purple sepals. W.

N. Amer. S.S. 2:87.—Handsome, round-headed tree or shrub, beautiful with its delicate light green foliage, red fls., rose-colored fr., and its orange and scarlet fall coloring.

13. **palmàtum,** Thunb (*A. polymórphum,* Sieb. & Zucc.). JAPAN MAPLE Shrub or small tree, 20 ft.: branchlets, petioles and peduncles glabrous: lvs. 5–9-lobed or divided, 2–4 in. across, glabrous, lobes oblong, acuminate, doubly serrate or incised. corymbs few-fld., glabrous, erect, with small purple fls: fr small, glabrous; the wings spreading at an obtuse angle Japan. S Z. 1:145, 146. S I F 1 68 F.E 19, pl 92 (habit).—A.F.



94. Acer japonicum. (×⅓)

12:11. J.H S. 29·340.—This species and *A japonicum* are known as Japanese maples They are extremely handsome shrubs of dense though graceful habit, and with elegant foliage, beautiful especially in spring for its delicate shades of green and red, and again in autumn, when the lvs. assume the most striking tints. Some of the more vigorous-growing varieties, like *atropurpureum, dissectum, ornatum,* and the typical forms, are hardy even in New England, while most of the variegated forms are more tender They grow best in partly shaded situations and in well-drained, rich soil. There are many varieties, mostly intro from Japanese gardens, of which the following are some of the best They may be divided into 5 groups, representing various degrees of dissection of the lvs:

(1) **A. palmàtum** var **Thúnbergii,** Pax (*A palmàtum,* Thunb.). Fig 93, *e* Lvs deeply 5–9-lobed or cleft, lobes oblong-lanceolate, coarsely and doubly serrate or incised Var **atropurpùreum,** Van Houtte (var *nìgrum,* Hort.). Fig 93, *c.* Lvs dark purple, coarsely doubly serrate. F.S 12 1273. J H S 29 342. F.E 14, pl 42, 32:767 (habit). Var **sanguíneum,** Carr, is lighter red than var. *atropurpureum* I.H. 14·526 Var **bícolor,** Koch (var *atropurpùreum variegàtum,* Hort.) Lvs dark purple, with large carmine blotches, the lobes half purple and half carmine Var. **aùreum,** Nichols Lvs. yellow. Var **versícolor,** Schwerin (*A polymórphum septémlobum versicolòrum,* Van Houtte). Lvs bright green, with large white spots F S 14 1498 Var. **ròseo-marginàtum,** Schwerin (*A. polymórphum ròseum marginàtum,* Pynaert) Lvs small, deeply cut, with narrow pink margin. F S. 15:1566 I H 28·430 Var. **crìspum,** André Lvs. small, with involute margins; of distinctly upright growth I H 17.43.

(2) Var. **septémlobum,** Koch (*A. septémlobum,* Thunb.) Lvs mostly 7-lobed, lobes broad, equally doubly serrate. Gt 42, p 680 J H S 29:345. Var. **rùbrum,** Schwerin Lvs large, deep red when young, becoming almost green later Var. **reticulàtum,** André Fig. 93, *a* Lvs greenish yellow, with green margin and dark green veins I.H. 17:18. Var **tricolor,** Nichols. Lvs with red, pink and white spots.

(3) Var **linearilobum,** Sieb. & Zucc. (var. *scolopendrifòlium,* Hort., not Schwerin) Lvs. divided nearly to the base, lobes linear, remotely serrate or nearly entire. Gt 42, p. 681. Var **atrolineàre,** Schwerin (var *linearilobum atropurpùreum,* Nichols; var *pinnatifòlium atropurpùreum,* Hort.) Lvs dark red.

(4) Var. **dissèctum,** Koch (*A. polymórphum* var. *decompósitum,* Sieb. & Zucc *A polymórphum palmatifidum,* Van Houtte). Fig 93, *f* Lvs divided to the base in 5–9 pinnatifid lobes S Z. 1 146 F S 21:2156. J.H S 29.346. M.D G. 1902 209. F W 1875 G C. III. 31:46 (suppl.) Var. **ornàtum,** Carr (var *dissèctum atropurpùreum,* Hort.) Fig 93, *d* Lvs deeply cut, deep red. I H 17·46 R H 1867:391 F E, pl 49 (habit). Var **Frederici-Guilélmi,** Carr. (var *pinnatifidum ròseo-pictum,* Lem.). Lvs finely cut, green, with white and pink spots. I.H. 14·523. R H 1867 391.

(5) Var. **sessilifòlium,** Maxim Lvs deeply cut, with very short petioles. G C. II. 16.—Of little decorative value.

14 **Sieboldiànum,** Miq (*A japónicum* var *Sieboldiànum,* Franch & Sav.) Small tree or shrub branchlets, petioles and peduncles pubescent when young. lvs 7–9-lobed, cordate or nearly truncate at the base, 2–3½ in across, glabrous except on the veins beneath; lobes ovate-oblong, acuminate, sharply serrate corymbs long-peduncled, nodding, fls yellowish, small fr. small, glabrous or slightly pubescent, the wings spreading at an obtuse angle Japan. S I F. 2 45 Var. **microphýllum,** Maxim Lvs smaller, 1½–2½ in. across S I F 2 42 —This species is hardy at the Arnold Arboretum, it is similar to *A palmatum,* but somewhat coarser.

15 **japónicum,** Thunb Figs 93, *b,* and 94 Small tree or shrub branchlets, petioles and peduncles pubescent when young lvs 7–11-lobed, cordate, 3–6 in. across, light green, with silky hairs when unfolding; lobes ovate, doubly serrate: corymbs few-fld., pendulous; fls large, purple fr finally glabrous, wings spreading at an obtuse angle Japan S Z 1·144. S I F 1 66 Var **macrophýllum,** Schwerin Lvs large, light green Var **aùreum,** Schwerin Lvs yellow Var. **Pársonsii,** Veitch (var *filicifòlium,* Hort., var *laciniàtum,* Hort.) Lvs large, divided nearly to the base in 9–11 pinnatisect segms. J.H S 29 334 R B 32:197

Section SPICATA

16 **Oliveriànum,** Pax Tree, to 30 ft branchlets glabrous: lvs 5-lobed, truncate or subcordate at the base, glabrous, finely reticulate and lustrous beneath, 2½–4 in across, lobes broad, ovate, long-acuminate, finely serrate panicles nearly corymbose, long-peduncled, glabrous; fls whitish, small wings of fr. spreading nearly horizontally, wing with nutlet about 1 in. long. W. China S.T S 1 77.—A graceful maple, resembling *A palmatum,* but larger In young plants, the lvs are often deeply cut with narrow, elongated lobes. J.H.S 29.356, 359 (as Acer sp.).

17. **tatáricum,** Linn. Shrub or small tree, 20 ft. lvs. roundish oval or oblong, cordate, sometimes slightly lobed, 2–4 in. long, doubly serrate, nearly glabrous fls. in long-peduncled panicles, white wings of fr nearly upright or slightly spreading, bright red in summer S E Eu, Orient H W 3, p 43 —Round-headed small tree, growing best in somewhat moist soil.

18. **ginnàla,** Maxim (*A tatáricum* var *ginnàla,* Maxim.) Fig. 95 Shrub or small tree, 20 ft lvs. 3-lobed, 1½–3½ in. long, glabrous, the terminal lobe elongated, doubly serrate fls in long-peduncled panicles, yellowish, fragrant Manchuria, N China, Japan. Gt. 1877.308. S I F. 2 44. F E 17, pl 72 (habit). Var **Semenòwii,** Pax (*A Semenòwii,* Regel & Herd.). Shrub lvs smaller, deeply 3- or nearly 5-lobed Turkestan —Graceful shrub, with handsome foliage, turning bright red in autumn; may be used as a substitute for the Japanese maples where these are not hardy

19 **spicàtum,** Lam. (*A. montànum,* Ait.) MOUNTAIN MAPLE. Shrub or small tree, rarely 30 ft.: lvs 3-,

or slightly 5-lobed, coarsely serrate, pubescent beneath, 2½–4½ in long racemes rather dense, long, upright. fr with diverging wings, bright red in summer. E N. Amer S S 2 82, 83 H T 328 —Valuable as undergrowth; lvs turn yellow and scarlet in fall Var **laciniàtum,** Joun Lvs deeply and irregularly lobed and incised

20. **caudàtum,** Wall. Large tree: lvs 5-, or sometimes 7-lobed, cordate, 3–5 in long and about as broad, brownish pubescent on the veins beneath, lobes ovate, long-acuminate, inciesely serrate panicle upright, cylindric, with the peduncle 5–6 in long· fr small, in upright panicles, wings spreading at right angles Himalayas The type is not in cult, but the two following varieties are Var **ukurunduénse,** Rehd (*A ukurunduénse,* Fisch & Mey. *A. spicàtum* var *ukurunduénse,* Maxim) Small tree branchlets and petioles pubescent while young lvs glabrous above, pubescent beneath, sometimes only along the veins, lobes coarsely serrate panicle pubescent wings of the fr often nearly upright otherwise like the type Japan, Manchuria S T S 1 82 S I F 2 43 G C II 15 172 Var **multiserràtum,** Rehd (*A multiserràtum,* Maxim *A eròsum,* Pax) Tree, to 30 ft , very similar to the preceding variety, but glabrous or nearly glabrous W China

21 **macrophýllum,** Pursh LARGE-LEAVED MAPLE Tree, to 100 feet high· lvs cordate, deeply 3–5-lobed or cleft, pubescent when young, pale green beneath, 8–12 in across, middle lobe mostly 3-lobed panicles glabrous, narrow, pendulous, 4–5 in long fr. with yellow, bristly hairs, wings spreading at right angles or nearly upright, over 1 in long W N Amer S S 2 86, 87 F E 14, pl 44 (habit) Gn M 2 107 (habit) —Handsome round-headed tree, remarkable for its large foliage, not hardy in the N.

22 **pseùdoplátanus,** Linn SYCAMORE MAPLE Tree, 70 ft high lvs 5-lobed, coarsely crenate-serrate, 3½–7 in across, deep green above, glaucous and mostly glabrous beneath racemes pendulous fr glabrous Eu , Caucasus Gt 12 260, 261 H W 3 44, p 39 F S R 3, p 181 F E 15, pl 47 (habit) —Large tree of vigorous growth, with large, spreading head, thrives well even in exposed situations Many varieties and garden forms Var. **villòsum,** Presl Lvs chartaceous, pubescent beneath Var **erythrocárpum,** Carr. Fr. bright red lvs smaller and more lustrous. R H 1864. 171 M D 1905 1 Gn 76, p 540 Var **purpuráscens,** Pax (vars *purpùreum* and *atropurpùreum,* Hort) Lvs. purplish red beneath, of robust growth Var **Handjèryi,** Spaeth (var *Prinz Handjery,* Hort) Lvs purplish beneath, bright red when unfolding Var **Wórleei,** Schwerin (var *lutéscens,* Hort) Lvs yellow Var. **álbo-variegàtum,** Kuehn Lvs with white blotches and spots, reddish while young Var **Leopóldii,** Lem Similar to the preceding variety, bright rosy pink while young I H 1864 411 R B 1906·197 Var. **bícolor,** Spaeth Lvs light green while young, with yellow, finally whitish, spots Var **tricolor,** Kirchn. Lvs purplish while young, spotted with yellow Var. **quadricolor,** Schwerin (var *Simonii* Pax, var *Simon-Louis frères,* Deegen). Lvs with large, white spots and also sprinkled with small dots; pink while young. Var. **nervòsum,** Schwerin. Habit pyramidal, of slow growth lvs marked with yellow between the veins above, purplish beneath

23 **Heldreichii,** Orph Tree lvs 5-lobed, the middle lobe divided nearly to, the outer half way to the base, 3–5 in across, glabrous, dark green and shining above, glaucous beneath, lobes coarsely and doubly serrate panicle erect, long-stalked, ovate S. E. Eu. Gt 34·1185 G C II 16·141. Var **purpuràtum,** Schwerin Lvs intensely red beneath.

24 **Trautvétteri,** Medw. (*A. velùtinum,* Hort., not Boiss. *A. insigne,* Nichols , not Boiss & Buhse). Lvs. slightly cordate, deeply 5-lobed, 5–7 in. across, glaucous beneath and pubescent when young, lobes coarsely crenate-serrate, longer than broad· panicle erect, ovate. Caucasus Gt. 40, pp 264–266 G C. II 16.75 B.M. 6697 (as *A insigne*) —Similar to *A. insigne,* but hardier, with smaller lvs and smaller panicle

25. **insígne,** Boiss & Buhse (*A Van Vólxemi,* Mast). Large tree. lvs 5-lobed, deeply cordate, 5–10 in across, bright green above, glaucous and at length glabrous beneath, lobes about as long as broad, coarsely crenate-serrate panicles large, erect Caucasus, N Persia. G C. II. 7 73; III 10 9 —Remarkable for its large, handsome foliage; not hardy in the N Var **velûtinum,** Boiss Lvs densely pubescent beneath G C. III. 10 189. Var **Wólfii,** Schwerin Lvs red beneath.

Section INTEGRIFOLIA.

26 **oblóngum,** Wall Tree, to 50 ft: lvs coriaceous, oblong, entire, long but bluntly acuminate, rounded and 3-nerved at the base, glabrous, reticulate and usually glaucous beneath, 2–7 in long panicle short, pubescent, fls small, greenish wings of fr at right angles or horizontally spreading Himalayas, W and Cent. China Jacquemont, Voy Inde 4 34 Var **cóncolor,** Pax Lvs green beneath —Not hardy in the northern states In young plants, the lvs are sometimes lobed at the base J H S 29 95 Recently advertised as *A. discolor,* the true *A discolor,* Maxim , is not in cult.

Section INDIVISA.

27 **carpinifòlium,** Sieb & Zucc HORNBEAM MAPLE. Tree, 30 ft lvs oblong-ovate, acuminate, sharply and doubly serrate, nearly glabrous, 3 6 in long staminate fls apetalous, in few-fld racemes, pistillate with petals, in longer racemes S Z 2 142. G C II 15.564. Gt 41, p 174 S I F 1 69 J H S 29 75 G W 3 615 —Very distinct, hardy species, the lvs. are almost exactly like those of Carpinus This is the only species of this section, the other species included here by Pax have been referred to other sections, mostly to the following (see Sargent, Plantæ Wilsonianæ 1 92)



95 Acer ginnala. (×½)

Section MACRANTHA.

28 **Dâvidii,** Franch. Tree, to 50 ft branchlets glabrous lvs. ovate or oblong-ovate, 2½–8 in long, acuminate, subcordate or rounded at base, unequally crenate-serrate, green beneath and rufously villous on the veins while young, finally glabrous or nearly so. racemes slender, pendulous, glabrous wings of fr spreading horizontally Cent China S T S 1 83 J H S 29 86, 90 —Handsome tree, hardy at the Arnold Arboretum, the lvs turning bright yellow or purple in autumn In young plants, the lvs are often lobed at the base.

29. **laxiflòrum,** Pax. Tree, to 50 ft · lvs ovate-oblong, with 2 or 4 short lobes near the base, 2½–4 in.

long, long-acuminate, cordate at the base, sharply serrate, green beneath, soon glabrous racemes slender, pendulous, glabrous; fls yellowish. wings of fr. spreading at right angles, rarely horizontally W China. Pax 35 Var. **longflobum,** Rehd Lvs distinctly 5-lobed, upper pair of lobes long-acuminate, floccose-tomentose on the veins beneath while young fls. purple W. China —More graceful than the typical form.

30 **cratægifòlium,** Sieb & Zucc Small tree, to 30 ft.: lvs oblong-ovate, often with 2 or 4 lobes near the base, 2–3 in. long, acuminate, rounded or cordate at the base, unequally serrate, bluish gray beneath racemes 5–8-fld, glabrous: fr. on pedicels about ¼in long, wings nearly horizontal. Japan S Z 1 147. S I F 1 67 —Graceful species, hardy at the Arnold Arboretum.



96 Acer saccharinum (or A. dasycarpum).—Silver or soft maple. (×⅓)

31 **Tschonóskii,** Maxim Small tree, to 15 ft lvs orbicular-ovate in outline, 5-, or rarely 7-lobed, 1¾–4 in. long, light green beneath and rufously pubescent on the veins, finally glabrous or nearly so; lobes ovate, long-acuminate, sharply and doubly serrate, the middle one slightly lobed racemes slender, few-fld. fr on slender, filiform stalks; wings spreading at about right angles Japan S T S. 1 17 S I F 2 43 —Graceful shrubby tree, hardy at the Arnold Arboretum.

32 **rufinérve,** Sieb & Zucc Tree, to 40 ft, with striped bark: branches glaucous when young lvs rounded at the base, 3-lobed, 3–5 in long, doubly serrate, ferrugineously pubescent on the veins beneath when young. racemes ferrugineously pubescent fr short-stalked; wings spreading at right angles Japan. S Z 2.148. S I F 1 67. Var **álbo-limbâtum,** Hook. Lvs. edged with white. B.M 5793.

33 **pennsylvánicum,** Linn (*A striàtum,* Dur.). Striped Maple Moosewood Tree, rarely 40 ft.: bark greenish, striped with white lines lvs slightly cordate, roundish-obovate, 3-lobed at the apex, 5–7 in long, finely serrate, ferrugineously pubescent on the whole lower surface when young racemes glabrous, drooping fr short-stalked, in long, drooping racemes; wings spreading at right angles E N Amer. S S. 2 84, 85. Michx Hist Arb 2 17 Em. 566 H T. 330 —Handsome medium-sized tree of upright, dense habit, with bright green, large foliage, turning clear yellow in autumn, and attractive even in winter from its smooth, greenish bark, striped with white. Var. **erythrócladum,** Spaeth. Shoots bright red during autumn and winter.

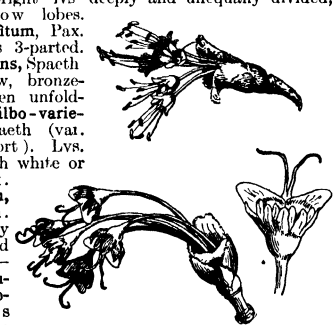
Section Arguta.

34. **tetrámerum,** Pax Tree, to 25 ft: branchlets glabrous lvs ovate to oblong-ovate, 2–3½ in long, acuminate, truncate or rounded and usually 3-nerved at the base, unequally incisely serrate or sometimes slightly lobed, light green and pubescent beneath, rarely nearly glabrous staminate fls in few-fld sessile racemes from lateral leafless buds, stamens 4 or sometimes 6, disk lobed, pistillate fls in elongated racemes, usually few-fld fr slender-stalked; nutlet thick, strongly veined Cent and W China S T S 1:85 —Graceful, hardy tree, very variable Var. **lobulâtum,** Rehd Lvs. distinctly lobed, nearly glabrous J H.S. 29·352, 355. Var **betulifòlium,** Rehd (*A betulifòlium,* Maxim) Lvs not, or very slightly, lobed, rounded or cuneate at the base, glabrous or glabrescent Var. **elobulâtum,** Rehd Lvs not or scarcely lobed, long-acuminate, rounded and 3-nerved at the base, pubescent beneath. Intro as *A. stachyophyllum,* but the true *A. stachyophyllum* is a Himalayan species, not in cult Var **tiliifòlium,** Rehd. Lvs. ovate, cordate at the base, and 5-nerved, pubescent beneath Var. **longeracemòsum,** Rehd Lvs like in var *elobulatum:* racemes to 6 in long, slender

35. **argùtum,** Maxim Small tree, to 25 ft · branchlets pubescent· lvs. broadly ovate in outline, 5-, or rarely 7-lobed, 2–3½ in long, pale green beneath and grayish pubescent chiefly on the veins, finally nearly glabrous, lobes ovate, long-acuminate, sharply serrate. staminate fls in short racemes from lateral leafless buds; stamens 4, pistillate fls in slender many-fld racemes fr slender-stalked, in pendulous racemes, wings spreading horizontally Japan S I F 1 69 S T S 66 — Graceful shrubby tree, hardy at the Arnold Arboretum.

Section Rubra.

36 **saccharìnum,** Linn (*A dasycárpum,* Ehrh *A. eriocárpum,* Michx) White or Silver Maple Fig. 96 Large tree, 120 ft.. lvs deeply 5-lobed to 5-cleft, 4–6 in long, green above, silvery white beneath, lobes deeply and doubly serrate fls greenish yellow, apetalous fr pubescent when young E N Amer S S 2 93 G C II 1 37 Em 556 H T 332 F E 32 443 (habit), 29 983 (habit) —Ornamental tree, with wide-spreading, slender branches, growing best in rich and moist soil, but succeeds almost anywhere Lvs turn clear yellow in fall Many garden forms Var **Wièri,** Schwerin (var *Wièri laciniàtum,* Hort) Branches pendulous lvs deeply cleft, with dissected lobes —A graceful variety, remarkable for its drooping branches and finely divided foliage M D G 1903 628 (habit) Var. **heterophýllum,** Pax (var *heterophyllum laciniàtum,* Hort) Upright lvs deeply and unequally divided, with narrow lobes. Var **tripartìtum,** Pax. Upright lvs 3-parted. Var **lutéscens,** Spaeth Lvs. yellow, bronze-colored when unfolding Var **álbo-variegàtum,** Spaeth (var. *Juhlkei,* Hort). Lvs. spotted with white or rosy pink. Var **críspum,** Schwerin. Lvs deeply cut and crimped — Linnæus evidently supposed this species to be the sugar maple, and named it accordingly. He did not know the true sugar maple.



97. Acer rubrum.—Red Maple. (Enlarged)

37 **rùbrum,** Linn. Red, Scarlet or Swamp Maple. Fig. 97 Large tree, 120 ft.. lvs 3–5-lobed, 3–4 in. long, green above, pale or glaucous beneath; lobes unequally and crenately serrate fls red or scarlet, rarely yellowish; petals 5· fr glabrous. E N. Amer S S 2 94 Em. 557 G C II 1:173. H T 334 —Very valuable tree for street and park planting, attractive at every season from its excellent habit, earliness of the scarlet fls, bright red frs in late spring, and the beautiful foliage, which turns bright scarlet or orange in autumn Var **columnàre,** Rehd Of upright, colum-

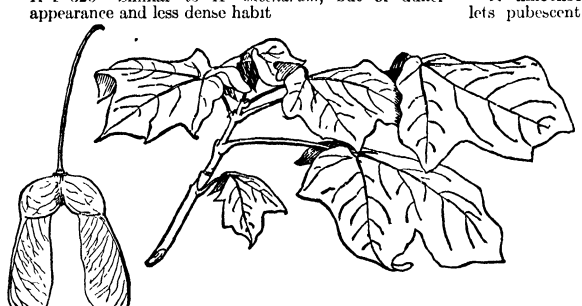
nar habit. Var. **globòsum,** Rehd. Dwarf, compact: lvs glaucous beneath. fls bright scarlet. Var. **Drúmmondii,** Sarg (*A. Drúmmondii,* Hook. & Arn.) Lvs. large, mostly 3-lobed, tomentose beneath: fr. bright scarlet. Southern states S S 2 95 Var **tomentòsum,** Kirchn. (*A tomentòsum,* Desf. *A rùbrum* var. *fúlgens,* Hort.) Of moderate growth: lvs 5-lobed, pubescent beneath fls bright red Var **trídens,** Wood (*A macrophýllum,* Pax, *A semorbiculàtum,* Pax). Lvs 3-lobed, rather small, rounded or rarely cuneate at the base, usually pubescent below On young plants and vigorous shoots, the lvs are like those of the type S S 13 626 Var **magnífícum,** Schwerin Fall-coloring of the lvs scarlet with green veins. M D. 1910 1.—The form distributed as var. *Schlesingeri,* Schwerin, does not differ from the type

Section Saccharina

38 **sáccharum,** Marsh (*A sacchárinum,* Wang., not Linn. *A barbàtum,* Michx.) Sugar or Rock Maple Fig 98 Large tree, 120 ft., with gray bark: lvs 3-5-lobed, cordate, 3–6 in. long, with narrow and deep sinuses, lobes acuminate, sparingly dentate, usually glaucous and glabrous beneath corymb hairy. fr. with slightly spreading wings, glabrous E N Amer. S S 2 90 Em 558 H T 324 Gn 65, p 55 (habit). —An excellent street and shade tree of upright, dense growth, turning bright yellow and scarlet in autumn. It does well in almost every soil. Var **Rugelii,** Rehd. (*A Rugelii,* Pax, *A sáccharum* var *barbàtum,* Trel.) Lvs 3-lobed, generally broader than long, 2–5 in. across, pale green or glaucous beneath, and at length mostly glabrous, coriaceous, lobes nearly entire. Central states S S 2 91 (as var *nigrum*) Var **monumentàle,** Schwerin (*A nìgrum* var *monumentàle,* Rehd.). Of upright, columnar habit

39 **floridànum,** Chapm (*A barbàtum* var *floridànum,* Sarg.) Tree, rarely 50 ft., with pale bark lvs. mostly truncate at the base, 3-lobed, 1½–3 in. across, glaucous beneath, pubescent, lobes obtuse, entire or slightly 3-lobed corymb sparingly hairy or nearly glabrous fr sparingly villous, finally glabrous Gulf states S S 2 91 G F 4.148

40 **nigrum,** Michx (*A sacchárinum* var *nìgrum,* Torr & Gray *A. sáccharum* var *nìgrum,* Brit.) Black Maple Fig 99 Large tree, 120 ft., with black bark lvs cordate, with the sinus mostly closed, generally 3-lobed, 5–6 in across, with broad sinuses, the sides of the blade mostly drooping, green and pubescent beneath; lobes acute, entire or obtusely toothed: fr with diverging wings Central states. S S. 13.625. H T 326.—Similar to *A saccharum,* but of duller appearance and less dense habit



99. Acer nigrum.—Black Sugar Maple (×½)

41. **leucodérme,** Small (*A. sáccharum* var *leucodérme,* Sarg.). Tree, to 25, rarely to 40 ft., with light gray or grayish brown bark. lvs 3–5-lobed, 2–3½ in. across, truncate or slightly cordate at the base, bright yellow-green and soft-pubescent beneath; lobes acuminate, sinuately dentate corymbs glabrous. fr. villous, finally glabrous, wings wide-spreading From N. C to Ga and La S S 13 624.—Sometimes planted as a street tree in Ga and Ala; hardy at the Arnold Arboretum



98. Acer saccharum.—Common Sugar Maple (×½)

42 **grandidentàtum,** Nutt Tree, 40 ft., with dark brown bark petioles comparatively short lvs. slightly cordate, 3–5-lobed, with broad sinuses, 2–3 in. across, pubescent beneath, coriaceous, lobes acute or obtuse, entire or slightly 3-lobed corymbs few-fld., hairy, short-stalked Rocky Mts. S S 2 92.—Hardy at the Arnold Arboretum

43 **diabólicum,** Koch Tree, to 30 ft branchlets pubescent lvs 5-lobed, cordate or subcordate, 4–6 in across, pale green beneath and sparingly pubescent; lobes broadly ovate-acuminate, coarsely and remotely dentate with acute or obtusish teeth fls from lateral leafless buds, staminate on long and pendulous, hairy pedicels, sepals wholly or partly connate, petals wanting, pistillate in few-fld racemes, sepals and petals distinct pedicels of the fr ½–2 in long; nutlets thick, strongly veined, bristly, wings upright or slightly spreading Japan G C H 15 532 S T S 1 67 Var. **purpurascens,** Rehd (*A purpurascens,* Franch & Sav. *A pulchrum,* Lavallé) Fls purple lvs turning red in autumn S I F. 1 65.—Hardy at the Arnold Arboretum; similar to *A pseudoplatanus,* but lvs. larger; the var. *purpurascens* is to be recommended for its early-appearing purple fls

Section Trifoliata.

44 **nikoénse,** Maxim Fig. 100 Tree, 40 ft branchlets pubescent lfts ovate or oblong-elliptic, short-stalked, acute, entire or obtusely dentate, 2–5 in. long, villous-pubescent beneath, petioles hairy, ¾–1½ in. long corymb few-fld., pubescent fr on nodding pedicels ½–1 in long, nutlets thick, hairy, wings upright, curved inward Japan, Cent China G F 6.155 (adapted in Fig 100.) Gt 41, p 149 S I F 1 68 J H S 29 81 R H. 1912 126, 127.—Very distinct; lvs turning brilliant scarlet in autumn

45 **griseum,** Pax (*A nikoénse* var. *griseum,* Franch.) Tree, to 25 ft., with cinnamon-brown bark separating in thin flakes branchlets pubescent lfts short-stalked, elliptic or ovate-oblong, 1–2 in long, acute, coarsely toothed with large bluntish teeth, the lateral ones

unequal, deeply dentate on the outer margin, entire or nearly so on the inner, glaucous and pubescent beneath; petioles densely hairy· fls. rather large, in few-fld. hairy corymbs· fr. pendulous on short stalks, with the peduncle scarcely ½in. long; nutlets thick, tomentose; wings spreading at an acute angle. W. China —J H S. 29 98. R.H. 1912:127.—Remarkable for its flaky bark, resembling that of the river birch; hardy at the Arnold Arboretum.

46. **mandshùricum,** Maxim Shrub or small tree· branchlets glabrous lfts oblong or oblong-lanceolate, 2–3½ in long, short-stalked, acuminate, remotely and obtusely serrate, glabrous, glaucous beneath, petioles glabrous, red, 2–4 in long fls. in few-fld. glabrous corymbs. fr. on stalks ½–¾in long, nutlets thick, glabrous; wings spreading at obtuse angles Manchuria. —Graceful maple, hardy at the Arnold Arboretum, the red color of the slender lf -stalks contrasts well with the dark green foliage.

Section NEGUNDO.

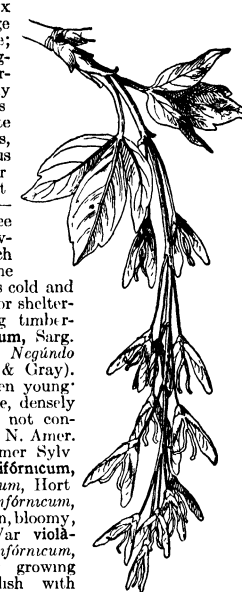
47. **Hénryi,** Pax. Tree, to 30 ft branchlets slightly pubescent·, lfts. 3, elliptic, 2–3½ in. long, stalked, acuminate, entire or coarsely serrate, pale green and pubescent beneath, petioles finely puberulous fls nearly sessile, small, greenish in slender pendulous pubescent racemes, lateral, without lvs or with small lvs at the base fr glabrous, short-pedicelled, in pendulous racemes with the stalk 4–7 in long, wings upright or slightly spreading Cent China J H S 29 93, 96 (as *A sutchuenense*) —Hardy at the Arnold Arboretum —It has been concluded that this and the following species which have been hitherto referred to the preceding section are more closely related to *A. Negundo* and therefore better transferred to this section

48 **cissifòlium,** Koch (*Negúndo cissifólium,* Sieb & Zucc. *Crùla cissifòlia,* Nieuwl) Small tree· lfts 3, stalked, ovate or elliptic, acuminate, coarsely serrate, sparingly ciliate, 2–3½ in. long, light green beneath and glabrous, or nearly so: racemes slender, many-fld , pubescent; pedicels less than ¼in long; sepals and petals 4, small· fr. in pendulous racemes; wings slightly spreading. Japan S.I F 2 41 —Handsome, round-headed tree, with slender, spreading branches and graceful bright green foliage, turning orange-yellow and scarlet in autumn; hardy at the Arnold Arboretum.



100 Acer nikoense. (×½)

49. **Negúndo,** Linn. (*Negúndo fraxinifòlium,* Nutt. *N aceroides,* Moench. *Rùlac Negúndo,* Hitchc.). ASH-LEAVED MAPLE. BOX ELDER Fig 101 Large tree, 70 ft lvs pinnate; lfts 3–5, ovate or oblong-lanceolate, coarsely serrate or 3-lobed, mostly glabrous, 2–5 in long fls before the lvs , staminate fls in pendulous corymbs, pistillate fls in pendulous racemes E N Amer S S 2·96 Michx. Hist Arb 2 18 H T 336 — Large, rapid-growing tree of spreading habit, thriving best in moist and rich soil. Much prized in the W , where it withstands cold and dryness Largely used for shelter-belts and for planting timber-claims Var **californicum,** Sarg. (*A californicum,* Dietr. *Negúndo californicum,* Torr & Gray). Branches pubescent when young· lfts 3, of firmer texture, densely pubescent beneath· fr not constricted at the base W N. Amer. S S 2 97 Nutt N Amer Sylv 2 72 Var. **pseùdo-californicum,** Schwerin (*A californicum,* Hort *A. Negúndo* var. *californicum,* Kirchn) Branches green, bloomy, of vigorous growth Var **violàceum,** Kirchn (*A californicum,* Hort) A vigorously growing form branches purplish with glaucous bloom or finely pubescent when young Var. **argénteo-variegàtum,** Bonamy Lvs with broad white margin Probably the most effective of all variegated hardy trees F S. 17 1781 Gn 68, p 402 (habit) G. 2 37; 11.97 (habit) Var. **aùreo-variegàtum,** Booth (var. *aùreo-maculàtum,* Schwerin) Lvs spotted with yellow. Var. **aùreo-marginàtum,** Dieck Lvs with yellow margin. Var **auràtum,** Spaeth (var *californicum aùreum,* Hort.) Lvs. yellow R B 1906 197 Var **crispum,** G. Don Lfts curled These horticultural varieties may be grafted on common box elder seedlings Box elder also grows from hardwood cuttings, like the grape. Two new forms have been recently described as new species by Britton· *A. interior,* distributed from Alberta and Mont to Ariz. and New Mex (B T 655), and *A Kingii* (B T 656), from Utah, they are closely allied to var. *californicum,* but differ in their glabrous foliage; in the first the wings of the samara are adnate to the nutlet only to or above the middle, in the second the wings reach the point of union of the nutlets.



101 Raceme of young fruit of box elder — Acer Negundo (Nat. size)

A acuminàtum, Wall (A caudatum, Brandis, not Wall A. stereuliaceum, Koch, not Wall) Allied to A argutum Tree lvs 3-lobed, 3-4½ in long, glabrous and light green beneath, lobes long-acuminate, and doubly serrate wings of fr spreading at a right angle Himalayas G C II 15 364 (as A caudatum) Tender at the Arnold Arboretum —*A ambiguum,* Dippel Allied to A pictum Lvs pilose beneath fls and fr unknown Doubtful species of unknown origin —*A amplum,* Rehd Allied to A longipes. Tree, to 35 ft lvs 5-lobed, 4-7 in broad, glabrous corymb nearly sessile, 5-6 in across Cent China —*A barbinèrve,* Maxim. Allied to A argutum Shrubby tree lvs 5-lobed, coarsely serrate; pistillate racemes usually 7-fld. fr larger Manchuria. S T S.

1 86 —*A. Bóscii*, Spach. Probably hybrid. A. monspessulanum × tataricum —*A. brevilobum*, Hesse=A parviflorum —*A. cæsium*, Wall Allied to A insigne Tree lvs. 5-lobed, glabrous, whitish beneath, 6–8 in across, lobes acuminate, obtusely crenulate-serrate Himalayas Not hardy N —*A. capillipes*, Maxim Allied to A rufinerve Tree, to 30 ft lvs 3-lobed, glabrous beneath, red when unfolding, 3½–5 in long fls on slender stalks about ½ in long Japan S T S 1 16 Not perfectly hardy at the Arnold Arboretum —*A. caudàtum*, Brandis=A acuminatum —*A. cinerascens*, Boiss Shrub or small tree lvs 3-lobed, ½–2 in long Similar to A monspessulanum Persia —*A. coriaceum*, Tsch (A creticum, Tratt A polymorphum, Spach) Probably A creticum × pseudoplatanus —*A. crásipes*, Pax Supposed to be a hybrid between A obtusatum and A pennsylvanicum —*A. crassipes*, Hesse=A parviflorum —*A. créticum*, Linn =A orientale —*A. créticum*, Tratt =A coriaceum —*A. Dieckii*, Pax (A platanoides var integrilobum, Zabel) Similar to A platanoides, but lobes entire, probably A Lobelii × platanoides —*A. distylum*, Sieb & Zucc Allied to A oblongum Tree lvs ovate, 5–7 in long, cordate, crenately serrate, light green and lustrous beneath Japan, G C II 15 499 S I F 2 41 J H S 29 76 —*A. Duretii*, Pax Probably A monspessulanum × pseudoplatanus —*A. erianthum*, Schwerin Allied to A caudatum Small tree lvs 5-lobed, 2–3½ in long, lobes broad, unequally and simply serrate, nearly glabrous beneath fls with densely villous disk W China S T S 1 80 —*A. Fargesii*, Franch (A lævigatum var Fargesii, Veitch) Allied to A oblongum Tree, to 30 ft lvs coriaceous, lanceolate-oblong, 2 3½ in long, narrowed at the base, penninerved, glabrous, light green beneath, not reticulate W China J H S 29 91 —*A. flabellàtum*, Rehd Allied to A Oliverianum Tree, to 30 ft lvs 7-lobed, deeply cordate, 3–5 in across, light green beneath and villous along the veins Cent China S T S 1 81 —*A. Franchetii*, Pax Tree, to 15 ft lvs 3-lobed, slightly pubescent beneath or glabrous at maturity and light green, 3–4 in long, lobes broadly ovate, acute, remotely toothed fls in short pubescent racemes from lateral leafless buds, with the lvs fr with the wings spreading at right angles or less, nutlets thick, hairy winter-buds with numerous imbricate scales Cent China S T S 1 87 Belongs to the section Lithocarpa —*A. fulvescens*, Rehd Allied to A pictum Tree, to 60 ft lvs usually 3-lobed, 2 4 in across, beneath covered with a yellowish or fulvous pubescence W China Hardy at the Arnold Arboretum —*A. heterophyllum*, Willd =A orientale —*A. Hookeri*, Miq Allied to A Davidii Tree, 60 ft lvs cordate-oblong, serrate, 4–6 in long, quite glabrous beneath Himalayas —*A. hybridum*, Spach Probably A italum × pseudoplatanus —*A. hybridum*, Baudr =A Boscii —*A. lævigatum*, Wall Allied to A oblongum Small tree lvs oblong, nearly entire, attenuate at the base, penninerved, green beneath Himalayas, China —*A. lævigatum*, Hort =A acuminatum —*A. Lobelii*, Ten Allied to A cappadocicum Branches glaucous lvs rounded at the base, lobes mostly undulated, abruptly pointed Italy —*A. Maximowiczii*, Pax (A urophyllum, Maxim) Allied to A Tschonoskii Small tree lvs 3–5-lobed, doubly serrate, the middle lobe much elongated, long-acuminate, glaucescent beneath, glabrous, 2 3 in long fr slender-stalked, wings spreading at an obtuse angle Cent China S T S 1 84 —*A. Mayrii*, Schwerin Allied to A cappadocicum and A amplum Tree with smooth bark lvs usually 3-lobed, glabrous, 3 in across, lobes very broad, long-acuminate wings of fr upright, incurved Japan —*A. mexicànum*, Pax (Negundo mexicanum, DC A serratum, Pax) Allied to A Negundo Lfts 3, pubescent beneath, densely serrate fr glabrous, wings spreading at an acute angle, Mex —*A. micránthum*, Sieb & Zucc Allied to A Tschonoskii Shrub or small tree lvs 5–7-lobed, lobes incised and doubly serrate, glabrous fls and fr small S Z 1 141 S I F 2 41 —*A. neapolitànum*, Ten =A obtusatum —*A. neglectum*, Lange (A zæschense, Pax) Probably A campestre × Lobelii Var Annæ, Schwerin Young lvs deep red, later olive-green M D 1908 1 —*A. obtusàtum*, Waldst & Kit (A neapolitanum, Ten) Allied to A Opalus Small tree or shrub lvs 5-lobed, pubescent beneath, about 4 in across, lobes broad, often rounded, obtusely denticulate wings of fr spreading at a right angle or less S Eu, N Afr H W 3, p 47 Tender at the Arnold Arboretum —*A. orientàle*, Linn (A creticum, Linn A sempervirens, Linn A heterophyllum, Willd) Allied to A monspessulanum Shrub, 4 ft lvs nearly evergreen, short-stalked, orbicular or oval, entire or 3-lobed, ½–1½ in long, glabrous Orient —*A. parviflòrum*, Franch & Sav (A crassipes, Hesse, not Pax A brevilobum, Hesse) Allied to A caudatum Tree lvs 3–5-lobed, pubescent beneath, 4–6 in across, lobes broadly ovate, acute, doubly serrate wings of fr spreading at an obtuse angle Japan S I F 2 42 Not quite hardy at the Arnold Arboretum —*A. pectinàtum*, Wall Allied to A pennsylvanicum Tree lvs 3-lobed, setosely serrulate, 2½–3½ in across, the middle lobe elongated, acuminate Himalayas G C II 15 365 —*A. Pérónii*, Schwerin Supposed hybrid of A Opalus × monspessulanum Originated at Vallombrosa near Florence —*A. robustum*, Pax Allied to A palmatum Small tree lvs 7–9-lobed, cordate, 3–4 in across, glabrous beneath except the tufts of hairs in the axils of the veins, lobes ovate, acuminate, sharply serrate wings of fr nearly horizontally spreading Cent China —*A. rotundilobum*, Schwerin (A barbatum, Booth, not Michx) Possibly A obtusatum × monspessulanum —*A. Schwérinii*, Pax Affinity doubtful lvs coriaceous, ovate-oblong, cordate, undivided or 3-lobed, glaucous beneath, soon glabrous, 5–7 in long fls and fr unknown. Probably from the Himalayas Var *marmorátum*, Schwerin, has the lvs variegated with light green Var *monophýllum*, Schwerin, has the lvs 2–3½ in long —*A. sempervirens*, Linn =A orientale —*A. serràtum*, Pax=A. mexicanum —*A. sikkimènse*, Miq Allied to A Davidii Tree lvs cordate-ovate, coriaceous, long-acuminate, quite glabrous, entire or serrulate, 4–7 in long wings of fr spreading at a right angle. Himalayas —*A. sinénse*, Pax. Allied to A Oliverianum Tree lvs 5-lobed, cordate or sometimes truncate, glaucescent beneath, glabrous, 3–6 in long, lobes ovate, acuminate, sparingly appressed-serrate panicle elongated wings of fr spreading horizontally Cent China S T S 1 78 J H S. 29 92 —*A. stenolucaceum*, Wall (A villosum, Wall) Allied to A. Franchetii. Tall tree lvs 3–5-lobed, cordate, 6–8 in across, tomentose below, coarsely serrate racemes from lateral leafless buds fr in long pendulous racemes, often branched at the base, wings of fr nearly upright Himalayas —*A. sutchuenénse*, Franch (A sutchuense, Pax) Allied to A mandshuricum Small tree lfts 3, oblong-lanceolate, unequally serrate, glaucous beneath, 1¼–3 in long corymb many-fld, rather dense Cent China S T S 2 112 —Probably not in cult, the plant figured by Veitch under this name is A Henryi —*A. tegmentòsum*, Maxim Allied to A pennsylvanicum Lvs 3–4 in long, glabrous beneath, lobes short fls small Manchuria G C II 15 75 —*A. trifidum*, Hook & Arn Allied to A tataricum Small tree lvs coriaceous, cuneate-obovate, 3-lobed, glaucous beneath, glabrous, 2–3 in long, lobes entire China, Japan S Z 2 143 —*A. urophyllum*, Maxim =A Maximowiczii —*A. Veitchii*, Schwerin Possibly A crataegifolium × rufinerve —*A. villosum*, Wall =A stenolucaceum —*A. Wilsonii*, Rehd Allied to A Oliverianum Tree lvs 3-lobed, light green beneath, glabrous, 3½–4 in across, lobes ovate to oblong-ovate, acuminate, entire, or sparingly serrate panicle elongated wings of the fr spreading at a right angle Cent China. S T S 1 79 —*A. zæschénse*, Pax=A neglectum

ALFRED REHDER.

ACERÁNTHUS (*Acer*, maple, and *anthos*, flower, in allusion to the maple-like flowers) *Berberidàceæ*. BARBENWORT. A genus of 4–6 species of slender, hardy, herbaceous perennials from Temp Asia and Algeria, related to the native twin-leaf, Diphyllea. Fls. variously colored, racemose; sepals 7–8, petaloid, the



102. Achillea Millefolium var. rubrum. (×⅙)

outer ones smaller than the inner, petals flat. lvs. solitary —Not commonly cult and the following seen only in botanic gardens

A. diphyllus, Morr & Decne (Epimedium diphyllum, Lodd). Plant rhizomatous lfts obliquely cordate, green above, glaucous beneath fls small, bluish white Japan B M 3448 L B C. 19 1858.

N. TAYLOR.

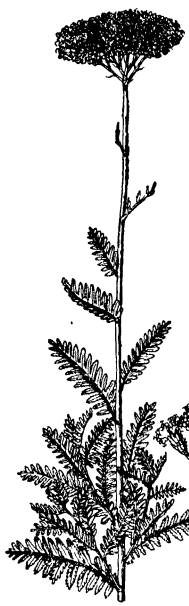
ACHÀNIA *Malvaviscus*.

ACHILLÈA (its virtues said to have been discovered by Achilles) *Compósitæ* Includes *Ptarmica* About 100 species, some of which are hardy herbaceous border and alpine perennials of easy culture

Leaves simple or compound, often ternate· fl-heads small, corymbose or racemose; receptacle nearly flat

or convex, chaffy; ray fls. pistillate, fertile, the rays white or pink; disk fls perfect, fertile.

Most of the achilleas can be grown in ordinary garden soil, preferring open sunlight and well-drained situations Some are alpine or sub-alpine and require rock-garden conditions These are indicated under the individual species. Dwarf kinds make carpets in dry, sunny places, large kinds suitable for wild gardens



103. Achillea filipendulina. (Plant × 1/6)

Propagation in spring by division, cuttings and seeds, chiefly by the first method and easily accomplished

A. *Rays about 5, except in double forms, half as long as the ovate-oblong involucre, fls white, red, or yellow*

B *Fls white or red*

Millefŏlium, Linn MILFOIL. YARROW Height 1–3 ft lvs bipinnately parted, segms linear, 3–5 cleft fls in flat corymbs June–Oct Eu. Asia, Amer Common in pastures — Less commonly cult than vars **rŭbrum** (Fig 102) and **rŏseum,** with red or purple fls

BB *Fls yellow*

Tournefŏrtii, DC (*A. ægyptiaca,* Linn) Height 12–18 in lvs pinnatisect, segms roundish, coarsely toothed fls pale yellow June–Oct Greece.

filipendulĭna, Lam (*A. Eupatŏrium,* Bieb) Fig 103. Height 4–5 ft.: st erect, furrowed, glandular spotted and almost hairy fls. yellow in dense, convex compound corymbs, often 5 in. across June–Sept. Orient —Needs staking

holoserĭcea, Sibth & Sm Similar to preceding, but not glandular spotted fls as in *A. filipendulina,* but corymbs simple, terminal, and the petals scarcely as long as the bracts of the involucre Mts of Greece Summer —More suitable to semi-alpine situations than *A. filipendulina*

tomentōsa, Linn. A woolly, carpet-like plant for rockeries Height 8–10 in. Eu, Orient, N Amer B M 498 Gn 52, p 421.

AA. *Rays 6–20, as long as or longer than the rotund or campanulate involucre; fls white*

B *Lvs not divided.*

Ptârmica, Linn (*A. macrocéphala,* Pill & Mitterb) SNEEZEWORT. Height 1–2 ft lvs serrate fls in loose corymbs, all summer North temperate regions — Its full-double var The Pearl (Fig 104) is much used for cut-flowers and in cemeteries, and is one of the most popular of all hardy herbaceous plants There are many other varieties.

lingulàta, Waldst (*A. buglòssis,* Hort.) A stiff, simple-stemmed perennial, simulating *A. Ptarmica,* but hairy lvs broadly spatulate, the petiole long-attenuate and dotted heads corymbose, the fls. numerous, petals 3–4 times as long as the involucre. Sub-alpine. Hungary and southward. Summer.

sibĭrica, Ledeb (*A. mongòlica,* Fisch. *A. Ptarmicoïdes,* Maxim). Denser than the last, more erect and rigid height 1½–2 ft.. fls larger and in more compact corymbs July–Sept.

grandiflŏra, Bieb A smooth and erect perennial lvs narrowly linear, narrower than in any of the Ptarmica group, distinctly serrulate corymbs simple or sometimes loosely branched, the peduncles 4–5 times longer than the head; fls white, large and more showy than most of the genus, longer than the bracts of the involucre. Sub-alpine and scarcely good for ordinary garden conditions Caucasus June, July.

BB. *Lvs deeply divided*

macrophўlla, Linn Height 3 ft lvs long, broad. July Alps Gn. 52, p 421 —Better suited to shrubbery than to herbaceous border

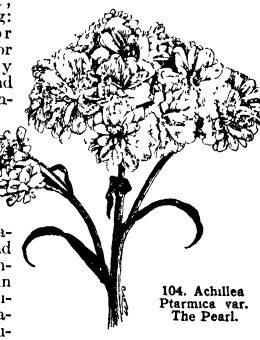
Clavénæ, Linn (commonly spelled *A. Clavénnæ. A. argéntea,* Hort., not Lam) Dwarf, tufted, hoary alpine plant, height 10 in lvs dentate at apex; segms obtuse fls spring and summer Eu. B M. 1287 Gn 52, p 421 —Thrives in sand

A. ageratum, Linn Fls yellow Eu —*A. ageratifŏlia,* Benth. & Hook (Anthemis Aizoon) Tufted, woolly, silvery gray fls. white May, June Alps —*A. asplenifŏlia,* Vent Lvs pinnate, smooth, fls white There is a red-fld form N Amer —*A. atrata,* Linn Dwarf, tufted, aromatic radical lvs pinnate, cauline lvs. pinnatisect fls white Alps —*A. aurea,* Lam Fls golden yellow, the seeds stipitate lvs woolly Aug., Sept S Eu = Chrysanthemum achilleæfolium (which see) —*A. decolŏrans,* Schrad Lvs undivided fls pale yellow July Eu —*A. Herbarôta,* All. Dwarf, tufted, aromatic alpine lvs undivided, serrate fls. white May, June —*A. lagustica,* All Lvs pinnatifid fls white Eu., Orient —*A. moschàta,* Jacq Lvs smooth, pinnately parted, lobes uncut fls white Eu —*A. nana,* Linn Dwarf, hairy, woolly, aromatic lvs pinnatisect fls white Spring Eu Used in making Chartreuse —*A. odorata,* Linn Lvs pinnatisect, lobes cut fls white —*A. pectinata,* Willd Fls pale yellow —*A. rupestris,* Huter Lvs 1 µm long, linear-spatulate, entire S Italy B M 6905 —*A. santolinoides,* Lag 1 ft lvs pinnatisect, hairy-woolly fls white July Spain —*A. serrata,* Retz Lvs pinnatifid, woolly fls white Siberia(?) —*A. Sichaua,* Hort Fls golden yellow, fragrant Asia Minor —*A. umbellata,* Sibth Very woolly rock plant, 4–5 in lvs pinnatifid, lobes oblong, bluntish, entire or serrate fls white June Greece —*A. valesiaca,* Stein Lvs pinnately parted fls white June–Aug Eu Other trade names are *A. corymbosa, A. transylvanica* and *A. Hudsoni,* none is known in hort or botanical literature

N. TAYLOR †

ACHÍMENES (Greek, *cheimaino,* to suffer from cold) Including *Schièria Gesneràcea* Greenhouse herbs, allied to gloxinias, native to tropical America, grown for bloom in late spring and in summer

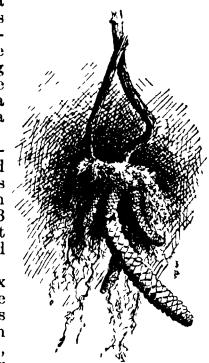
Plant upright, erect, or drooping: lvs opposite or whorled, serrate or toothed, mostly hairy underground sts scaly and catkin-like, and similar growths sometimes in the axils of the lvs fls axillary, 5 calyx-lobes narrow and short, corolla-tube cylindrical and limb spreading, anthers 4, connivent in the tube, and a rudiment of a fifth stamen, style long, usually exserted, the stigma dilated or obscurely 2-lobed. —Perhaps 40 species



104. Achillea Ptarmica var. The Pearl.

The garden achimenes are much confused by hybridization, and it is doubtful whether any of the pure species are in general cultivation in this country. Years ago, the small red-flowered types (of the coccinea section) were frequent, but modern evolution has proceeded from the broad-flowered purple species The species

described further on seem to have contributed most largely to the present garden forms Some of the best species are *A longiflora*, purplish blue, *A longiflora* var *alba maxima*, the best white kind; *A patens* var *major*, a large flower of purplish rose, *A pedunculata*, orange, *A heterophylla*, tubular, a fiery orange at one end and blazing yellow at the other There are many named varieties, some of the names being Latin in form In the grandiflora group the tubers or bulbs are clustered; in the longiflora group the tubers are pear-shaped bodies, growing on the ends of root-like rhizomes The coccinea (Fig 105) and hirsuta groups are late bloomers



105 Achimenes, tubers of the coccinea section.

The rhizomes of achimenes should be removed from their winter quarters and spread out thinly in boxes, using a size some 3 inches deep, and a light open mixture of leaf-mold and sand to start them in The lower inch in the box should be covered with some material that will act as drainage, then cover with an inch or so of the compost, and spread out the rhizomes on this and cover with half an inch of the mixture which has been passed through a half-inch mesh sieve Place in a moist house in a temperature of 60° to 65° F and water sparingly until the young growths appear When these are some 2 inches high, they should be lifted from the boxes with the material that is attached to the roots and potted up into 5- or 6-inch pots or 8-inch pans, spacing them equally, and using some ten to fifteen growths for each pot or pan The material used for this potting should be rich in humus and of a very open porous nature, so as to provide free access of air to the roots and at the same time allow any excess of water to pass away freely A useful mixture for this purpose is equal parts of loam, leaf-mold and sand About one-third the depth of the pots or pans should be occupied with drainage All the rhizomatous forms of achimenes are shallow-rooting, so that there is no advantage in using large and deep pots This method of starting the rhizomes first and then potting those that have been started together, is much to be preferred to potting them up directly into the flowering sizes, which method, however, is practised by many cultivators The advantage of the method advised is that all the pots are filled regularly with growths of equal size and vigor, whereas in the other and older method the rhizomes often start irregularly and the pots are only partially filled with growths After potting up, the pots should be replaced again in the same house as the rhizomes were started in, and kept shaded from all hot sun From this period onward, growth is rapid and care must be taken not to allow any of them to suffer for want of moisture at the roots, or failure will ensue When the plants are 6 or 8 inches high, feeding with weak liquid manure should begin, and should be continued regularly until the plants show signs of exhaustion after flowering When the flowers appear, the plants should then be removed to a somewhat drier airy greenhouse, kept at a temperature of about 50° F, where they will remain until the flowering season is over They may then be removed to a greenhouse or coolframe to ripen up The water-supply should be gradually reduced until the plants die down The best method of storing the rhizomes is to shake entirely out of the old soil, mix them up in a box of sand, and keep them entirely dry in a shed which does not fall below a temperature of 45° F until the time comes round for starting them again in March or April —Propagation is readily effected by means of the rhizomes Each of these may be used for forming one or many plants Some of the kinds form numerous scaly buds or short rhizomes in the axils of the upper leaves, these may be saved and treated in exactly the same way as the underground rhizomes for propagation Cuttings of any of the sorts root readily in a moist warmhouse in summer-time Every node may be used for stock and the parts may be inserted without removing the leaves —All members of the genus, including the numerous garden forms, are of the easiest possible culture, and there are few greenhouse plants that will furnish such a display of flowers at such a little cost in time and attention Some of the forms of weak habit make charming subjects for growing as basket plants (C P Raffill)

A. *Fls colored, the tube usually not more than twice the length of the limb*

B. *Blossoms small, red, scarlet, or orange the limb narrow and sometimes not much spreading*

ocellàta, Hook Rhizomes small and tuberous st 1–2 ft lvs rich green above and purple beneath, ovate, strongly serrate, with conspicuous purplish petioles fls small, 1 in long, broad-tubed, spotted with black and yellow, the lobes short and obtuse and well separated, drooping on reddish peduncles Panama B M 4359 —Fine for foliage

coccínea, Pers Fig 105 Height 1–2 ft st reddish lvs 3-whorled or opposite, green, ovate-acuminate, serrate fls small, scarlet, the corolla twice longer than the erect lanceolate parted calyx on short peduncles Minute lvs often borne in the axils Blooms late Jamaica —One of the older types

heterophýlla, DC (*A ignéscens*, Lem *A Ghiesbrechtii*, Hort). Root fibrous st 1 ft or less, dark purple, somewhat hairy lvs ovate-acuminate, stalked, serrate, the 2 of each pair usually unequal in size fls solitary, on peduncles somewhat longer than the lf-stalks, long-tubular and slightly curved, with a narrow nearly equal flaring limb, rich scarlet, yellow within. Mex. B M 4871 — This species has tubers like those of the grandiflora section



106. Achimenes longiflora. (×½)

pedunculàta, Benth Rhizomes scaly st 1½–2 ft, hairy, reddish, tuber-bearing lvs opposite, small, ovate, sharply serrate, green, hairy, on short reddish stalks fls medium size, drooping and dilated upwards, yellow-red with dark markings and a yellow throat, the limb comparatively short, on long (4–5 in) bracted sts Guatemala B M 4077

BB. *Blossom large, with wide-flaring limb, mostly violet in many color*

longiflòra, DC (*A Jauregüia*, Warscz) Fig 106 Rhizomes root-like and filiform, producing pear-shaped tubers at their ends st 1–2 ft, hairy lvs opposite or 3–4-whorled, ovate-oblong, serrate, hairy, paler and

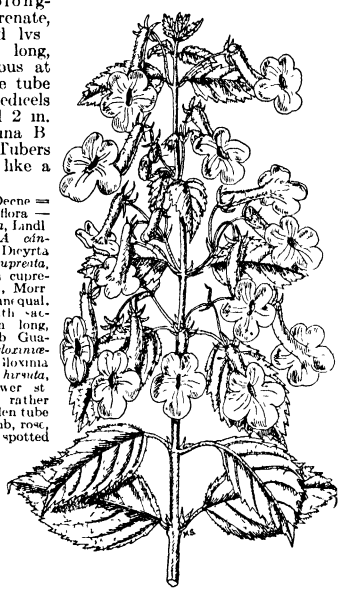
sometimes tinted beneath: fls solitary, the corolla salver-shaped, with a long and graceful tube, the limb very large and widely spreading, violet-blue and whitish beneath, the lowest segm sometimes divided. Guatemala. B M 3980 P M 9.151 —A popular blue type. Var *álba máxima*, Hort Fls large, white.

grandiflòra, DC Fig 107 Lvs mostly larger than in last, rusty below fls. often more than one from an axil, very large, distinctly red-tinged Mex B M. 4012 —A popular red or wine-colored type.

pàtens, Benth Height 1–1½ ft lvs unequal, ovate-acuminate, hispid and serrate· fls violet-blue, with downy calyx, tube shorter than spreading crenate limb Var *màjor*, Hort Large-fld Mex

AA *Fls pure white, the tube 3–4 times the length of the limb.*

tubiflòra, Nichols, Suppl p 483 (*Gloxinia tubiflòra*, Hook *Dolichodèira tubiflòra*, Hanst). St. short, with opposite oblong-acuminate, crenate, short-petioled lvs fls 4 in long, curved, gibbous at the base, the tube downy, the pedicels opposite and 2 in. long Argentina B M 3971 —Tubers solid, much like a potato



107 Achimenes grandiflora. (×¼)

A amábilis, Decne = Negelia multiflora — *A atrosanguínea*, Lindl =A foliosa —*A cándida*, Lindl = Dicyrta candida —*A cuprea*, Hook =Episcea cuprea —*A foliósa*, Morr Lvs cordate, unequal, fls crimson, with saccate tube 1 in long, with narrow limb Guatemala —*A gloxiniæflòra*, Forkel =Gloxinia gibbata — *A hirsuta*, DC Loose grower st bulbiferous fls rather large, with swollen tube and oblique limb, rose, with yellow and spotted throat Guatemala B M 4144 P M 12 7 Once popular —*A Kleèri*, Paxt Dwarf fls pink-purple P M 16. 289 Form of A. longiflora —*A lanáta*, Hanst. (Scheeria lanata, Hanst) Woolly or white-hairy fl pinkish or lilac, large and showy Mex B M 4963 (alt to 4954) —*A multiflòra*, Gardn Hairy lvs broad-ovate fls. blue, fringed Brazil B M 3993 —*A pícta*, Benth =Tydæa picta —*A rósea*, Lindl Fls pink or rose, the peduncles many-fld Guatamala —*A Schèèri*, Hemsl (Scheeria mexicana, Seem) Erect, with purple or blue, large and showy fls Mex B M 4743 —*A Skínneri*, Gord, =A hirsuta —Garden forms and hybrids are *A floribúnda*, *A intermèdia*, *A Jàya*, *A Mountfórdia*, *A nargelioides*, *A nána*, *A venusta* (P M 15 121), *A Verschaffèlii*

L H B

ÀCHLYS (the goddess of obscurity). *Berberidàceæ*. Hardy herbaceous perennial allied to the may-apple, and sometimes so called where wild Lvs all radical, with 3 lfts · fls minute, apetalous, numerous, spicate, on a slender scape fr very small, at first pulpy but becoming dry —Species 2, one of them Japanese

triphýlla, DC Rootstock terminated by a strong, scaly winter-bud lvs 1 or 2, on petioles 1 ft. or more long; lfts. fan-shaped, sinuate-dentate, 2½ x 5 in · scape 1 ft. long· spike 1 in long Spring Calif to Brit. Col, in shady woods —An interesting and delicate plant Intro. 1881

ÁCHRAS· *Sapodilla*

ACHYRÁNTHES. *Iresine*

ACIDANTHÈRA (from *akis*, a cusp, and *anthera*, an anther, in allusion to cuspidate anthers) *Iridàceæ*. Tender herbaceous perennials.

Leaves many, linear, ensiform, 1–1½ ft long spikes 3–6-fld., simple, lax fls long-tubed, the tube slightly dilated upwards; stamens unilateral, inserted at or below the throat corms roundish, flattened, covered with a matted fiber Natives of Trop and S Afr., and intermediate between Gladiolus and Ixia

The propagation is by seed or by the numerous corms.

bícolor, Hochst Fig 108 St 15–18 in fls creamy white, blotched chocolate-brown within, fragrant corms ½–1 in diam Abyssinia G F 1 486, 487 (adapted in Fig 108) Gn 47 343 G C III 20 393. Mn 8 11 —Requires a somewhat stiffer soil than the tender species of gladiolus May be grown in a tub outdoors during summer, and flowered within during Oct. Several corms in a large pot give good results. Corms should be dried as soon as lifted, to prevent rot.

A æquinoctialis, Baker St 3–4 ft, stout, stiffly erect lvs strongly ribbed fls about 6 in a distichous spike, the tube 5–6 in long, white, blotched crimson or purple within corms large Sierra Leone B M 7393 May be a stronger-growing and more tropical form of the above Requires warmhouse culture —*A cándida*, Rendle A slender, erect, leafy herb fls white, very sweet-scented Trop E Afr B M 7879

N TAYLOR †

ACINÈTA (*immovable*, referring to the jointless lip) *Orchidàceæ* Epiphytic hothouse orchids

Pseudobulbs conic or ovate, with the large plicate-veined lvs articulated to the summit fls fleshy, borne in pendulous racemes on lateral leafless scapes, sepals broad, equal, finally somewhat spreading, petals similar to the sepals but smaller, lip fleshy, continuous with the base of the column, the middle lobe continuous or articulated, entire or 3-lobed; pollinia 2 —About 10 species, distributed from Mex. to northern S Amer

These plants require a warm house and plenty of moisture during the growing season, with a decided rest, to make them flower They need to be cultivated in wooden baskets and suspended from the roof of the house, as the flower-spikes are always produced from the base of the bulbs and there should be no hindrance in the way of crocks to prevent their egress. The rooting material may be peat fiber only, and not a great quantity under the plants, but plenty around them With basket culture of orchids, it is very necessary, once a week in the growing season, to take the plants down and give a soaking by immersion, in addition to the ordinary spraying overhead from day to day, in this way alone can one be sure of the proper growing conditions In winter, much less water is required Propagation is by division of the plants in spring (Orpet)

Bárkeri, Lindl (*Peristèria Bárkeri*, Batem) Fig 109. Pseudobulbs conic, 4–5 in long, usually bearing 3 or more lvs 2–3 ft long fls yellow, striped with red-brown, 12 or more, in pendulous racemes Mex B M. 4203 I H 2·44. Gn 54, p 332 P M 14 145 G M. 40·697

Húmboldtii, Lindl (*Peristèria Húmboldtii*, Lindl. *A supérba*, Reichb) Pseudobulbs ovate, about 3 in long, bearing 3 or 4 lvs about 1 ft. long fls chocolate, spotted with crimson, 6 or more, in pendulous racemes Mts of N. S Amer Gn 3 11, 32, p 157; 25, p. 482 Var. **Cólmanii,** Hort. Fls profusely spotted with purple

A chrysántha, Lindl Fls golden yellow, the lip whitish, and the column purplish or crimson Mex —*A dénsa*, Lindl (*A Warscewiczii*, Klotzsch) Fls in a dense raceme, pale yellow, externally spotted with reddish brown, fragrant, lip yellow, marked with crimson Costa Rica B M 7143 —*A Hrubyána*, Reichb Fls. white, the lip spotted with purple Colombia —*A. Moóreæ*, Rolfe Fls straw-colored, sub-globose, thickly brown-spotted;

the lip fleshy, the lateral lobes obliquely reniform, the midlobe oblong, blunt S Amer. B M 8392 —*A. sulcàta*, Reichb f Fls. yellow, otherwise similar to A Humboldtii

GEORGE V NASH †

ACIPHÝLLA (Greek for *sharp-leaved*) *Umbelliferæ* About a dozen or so herbs, all of New Zealand except 2 in the mts of Austral, sometimes seen in rock-gardens but apparently not grown in N Amer Plant erect, and rigid, somewhat spiny, with thick pinnate lvs, and the small fls in compound bracted umbels Some of them are large plants. Allied to Ligusticum.

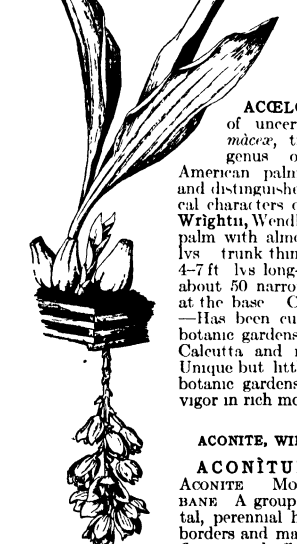
ACIS: *Leucojum*

ACOCANTHÈRA (*mucronate anthers*) Sometimes spelled *Acokanthèra* Syn, *Toxicophlæa Apocynàceæ* A genus consisting of 5 species of African shrubs, cult in greenhouses N, and outdoors in Fla and Calif Fls with the odor of jasmine, lasting, calyx 5-parted, glandless, corolla 5-parted, its 5 lobes twisted In Cent Fla, they require some protection during the winter Prop by cuttings taken early in the spring

spectábilis, G Don (*Toxicophlæa spectábilis*, Sond *T Thúnbergii*, Hort, not Harv) WINTER-SWEET Lvs 3–5 in long, short petiolate, leathery, elliptic, acute, shining above fls numerous, in dense, axillary, branched cymes, which are sometimes 2 ft long, pure white, very sweet-scented fr blackish purple, almost as large as an olive and of the same form, contains one large, nut-like seed Natal B M 6359 R H 1879 270 G F 6 185 G C 1872 363 —Poisonous The plants cult. under this name are said by trade catalogues to have pink or violet fls

venenàta, G Don (*Toxicophlæa cestroïdes*, DC *T Thúnbergii*, Harv, not Hort) BUSHMAN'S POISON Fls. white or rose. Differs from the above in the well-marked venation of the lvs, its fls a third smaller, its calyx not pubescent, and its corolla-limb less widely spreading I H 32 553 R H 1880 370

N TAYLOR †



109. Acineta Barkeri. (×⅓)

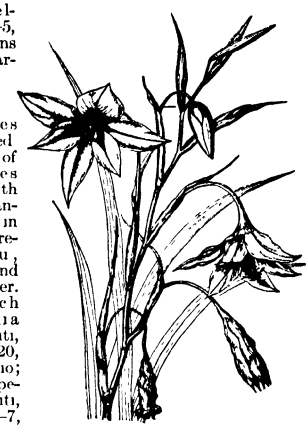
ACŒLORRHÀPHE (name of uncertain origin) *Palmàceæ*, tribe *Coryphex* A genus of 2 species of American palms allied to Brahea and distinguished from it by technical characters of the albumen **A. Wrightii,** Wendl, a graceful, slender palm with almost orbicular-bladed lvs trunk thin, scarcely exceeding 4–7 ft lvs long-petioled, made up of about 50 narrow segms, all united at the base Cuba and Honduras —Has been cult outdoors at the botanic gardens at Buitenzorg and Calcutta and in extreme S Fla Unique but little known outside of botanic gardens Grows with great vigor in rich moist soil

N. TAYLOR.

ACONITE, WINTER: *Eranthis*

ACONÌTUM. *Ranunculàceæ.* ACONITE MONKSHOOD. WOLFSBANE A group of hardy ornamental, perennial herbs, much used in borders and masses for their showy flowers and effective foliage

Root tuberous, turnip-shaped, or thick-fibrous st tall or long, erect, ascending, ing lvs palmately divided or cleft and cut-lobed, large, irregular, showy, sepals 5, the large upper sep. in shape of a hood or helmet; petals 2–5, small, stamens numerous; carpels 3–5, sessile, many-ovuled, forming follicles when ripened The number of species varies from 18–80, with different botanists Native in mountain regions of Eu, Temp Asia, and 5 in N Amer. Reichenbach Monographia Generis Aconiti, Leipsic, 1820, 2 vols, folio; Illustratio Specierum Aconiti, Leipsic, 1822–7, folio Many species are planted in European gardens, but only a few have been much used in Amer



108. Acidanthera bicolor. (×⅓)

The aconitums yield important drugs, although none of them is grown for this purpose in this country The officinal aconite is derived from the roots of *A Napellus* from England and continental Europe The leaves are also used for medicinal purposes *A japonicum* yields Japanese aconite, *A chinense*, the Chinese aconite, and *A ferox* the "bish" or Nepaul aconite The poisonous alkaloid *aconitin* is secured from *A Napellus*, and similar alkaloids from *A ferox*, *A luridum* and *A palmatum*, of India. *A Fischeri*, *A Lycoctonum*, *A septentrionale* Not all these species are described here, as they are not horticultural subjects

These plants present a pleasing contrast to the yellow helianthus and rudbeckias, the white of *Phlox paniculata*, to *Chrysanthemum maximum* and *Anemone japonica* They are also effective for mixing in on shrub borders The first season, these herbs do not attain their full perfection Aconitums should be left undisturbed as long as possible They will survive the north in winters if kept under a leaf-covering, while for the central part of the country, straw or evergreen boughs are sufficient protection

The following species do well in any garden land, but respond better if given very rich soil They thrive in open sun, but flowers last longer in shaded places. Aconites should never be planted in or too near the kitchen-garden or the children's garden, as the roots and some of the flowers have a deadly poison They are suited to the back of the border, as they are tall

Propagation is effected easily by division of roots in either late fall or early spring, also by seeds sown as soon as mature, in warm spring, in the North, the seeds may be started in small seed-beds in the spring and then be transplanted when the seedlings are about 2 inches high. In the Central States and southward, a year is gained by sowing the seed in late summer or early fall.

A. *Roots globular-tuberous.*

B. *Lvs. deeply cut, but not to the base.*

Fischeri, Reichb (*A. columbiànum*, Nutt. *A. californicum*, Hort.). Sts 4–6 ft. lvs large, smooth, 3-

parted, attractive; segms much cut and divided: fls. numerous, pale blue, panicled, pedicels pubescent; helmets hemispherico-conical Autumn N. Amer and Asia. F S R 1 214 R B 33 205 (as *A sinensis* var *bicolor*) Var **Wilsonii** (*A Wilsonii*, Stapf), is a very tall form, with violet fls R H 1910, p 223 Gn W. 21:197. Gn 64, p. 339 B M 7130 (as *A. Fischeri*)

Cammàrum, Linn. (*A décorum*, Reichb. *A exaltàtum*, Bernh.) St 3-4 ft lvs with short, bluntish lobes: fls purple or blue, panicles or loose spikes few-fld; helmet hemispherical, closed July–Sept Hungary Intro 1889 —*A Storkiànum*, Reichb., is a dwarf form of this, with fewer fls and somewhat fibrous roots

uncinàtum, Linn WILD MONKSHOOD Fig 110 St. slender, 3–5 ft, inclined to climb lvs thick, deeply cut into 3–5 cut-toothed lobes fls loosely panicled, but crowded at the apex, blue, pubescent, 1 in broad, helmet erect, nearly as broad as long, obtusely conical: follicles 3 June–Sept Low grounds of Pa, S and W. Japan Mn 4 81 —Much planted now

BB *Lvs divided to the base.*

variegàtum, Linn Erect, 1–6 ft lvs. variously divided into usually broad lobes and cut divisions, lower petioles long, others short or none. fls in a loose panicle or raceme, blue, varying to whitish, rather smooth, helmet higher than wide, top curved forward, visor pointed, horizontal or ascending. July Eu —*A álbum*, Ait., is a pure white-fld. form of this, with rather fibrous roots *A. volùbile*, var *latisèctum*, Hort., is a twining form of *A variegatum* The plants are allowed to ramble naturally or to climb on arbors; height 8 ft Var **tenuisèctum,** Hort. Sts slender though not twining: large blue fls Manchuria

AA *Roots long-tuberous.*

B *Carpels usually 5*

japónicum, Decne St. erect, 3–4 ft., smooth lvs. dark green, shining, petioled; lobes 2–3 times cut, the parts blunt and deeply toothed fls large, deep blue or violet, tinged with red, on loose panicles with ascending branches, helmet conical, beak abruptly pointed follicles 5 July–Sept. Japan. Intro. 1889 R H 1851, p. 475. Var **cærùleum,** Hort Fls very abundant; panicles shortened.



110 Aconitum uncinatum. (×½)

BB. *Carpels 3 or 4.*

Napéllus, Linn. (*A taúricum*, Jacq *A pyramidàle*, Mill *A. inúnctum*, Koch). TRUE MONKSHOOD OFFICINAL ACONITE Fig. 111. The best known and most poisonous species, and used in medicine Sts erect, 3–4 ft.: lvs divided to the base, and cleft 2–3 times into linear lobes fls blue, in a raceme; peduncles erect, pubescent; helmet broad and low, gaping, smoothish fr 3–4-celled June, July Gn M. 4:34. R V 8:2 Gn 12, p 362 — Very many varieties, differing in shade of fls, often mottled or lined with white. Var. **álbum** is nearly white Var. **bícolor** and var. **versícolor,** much used in gardens for the large blue and white fls Reichenbach has divided this species into 20–30 species *A. Hálleri* is one of his divisions appearing in catalogues. B.M. 8152 (as var. *Emnicus*)



111. Aconitum Napellus (×¼)

AAA. *Roots in the form of a scaly, elongated bulb, or somewhat fibrous.*

B. *Sepals deciduous.*

autumnàle, Reichb AUTUMN ACONITE Fig. 112 St. 3–5 ft: lvs pedately 5-lobed: fls in a simple spike, becoming a panicle, blue, lilac, or whitish, helmet closed Sept.–Nov. N China

Lycóctonum, Linn (*A barbàtum*, Patr *A squarròsum*, *A. ochroleùcum*, Willd.) PALE YELLOW WOLFSBANE St slender, simple, 3–6 ft lvs deeply cut into 5–9 lobes, long petioles and under ribs pubescent fls yellow or whitish, in racemes, helmet a pinched elongated cone, middle sepals usually bearded fr usually 3-celled. June–Sept Eu, Siberia. B M 2570. G M 34 124.

BB *Sepals persistent*

Anthòra, Linn (*A pyrenàicum*, Pall.) St 1–2 ft lvs parted almost to the base, parts deeply cut and lobed, more or less hispid beneath, smoothish above, petioles long fls in lateral and terminal racemes, pale yellow, often large, racemes or panicles generally pubescent, spur bent back or hooked, helmet arched, but cylindrical at base follicles 5. June, July S. Eu B M 2654 Var **aùreum,** Hort, and several other varieties

A chinènse, Sieb Deep blue spike of fls from the axil of every lf foliage bold and hand some B M 3852 P M 5 3 —*A delphinifòlium*, DC Allied to *A Napellus* —*A gymnándrum*, Maxim., is a good species B M 8113 —*A Hemsleyànum*, E Pritz Sts twining and rambling China R B 33, p 328 G 32 39 —*A heterophyllum*, Wall Fls yellow and violet Used as a tonic medicine in India B M 6092 — *A. nouhoracense*, Gray Probably=*A paniculatum*. —*A paniculàtum*, Lam (*A toxicum*, Reichb.) Has blue fls L B C 9 810 —*A pyramidàle*, Mill Form of *A Napellus* — *A reclinatum*, Gray, of the Alleghanies, with white fls and large lvs, is worth cult —*A scapósum* var. *pyramidàle*, Franch Lvs broadly 5-lobed fls very numerous, ¾–1 in long, heliotrope, greenish yellow at the throat Cent China —*A septentrionale* var *carpáticum*, Sims, is a beautiful purple kind closely related to *A Lycoctonum* B M 2106 —*A Storkiànum*, Hort, may be a form of *A variegatum*, with the lvs so much cut up as to give a pinnate form —*A tortuósum*, Willd Once listed in the trade, not now found

K. C DAVIS

ÁCORUS (ancient name of unknown meaning). *Aràceæ* Hardy, herbaceous water-loving plants Lvs sword-shaped, erect spadix appearing lateral, with no true spathe, fls inconspicuous They thrive best in moist soil, and may be grown in shallow water or on dry land. Prop easily in spring or autumn by division

Cálamus, Linn SWEET FLAG. Height 2 ft rootstock horizontal, pungent, aromatic fls. early summer. N. Amer, Eu. V 2 198 Var **variegàtus,** Hort Lvs. striped deep yellow when young, fading to a paler color later in summer Eu —Commoner in cult. than the type.

gramíneus, Soland Height 8–12 in. Much smaller than *A. Calamus*, forming compact, grassy tufts. Japan Var. **variegàtus,** Hort Lvs striped white.— Used in hanging-baskets, vases, rockeries and for cutting. Often grown indoors

A japónicus argénteo-striàtus, Hort, and *A japónicus fòlia variegàtis*, Hort, are catalogue names, and are referable, from description, to *A gramineus*, Soland var variegatus, Hort

GEORGE V NASH.†

ACRIÓPSIS (Greek combination for *top* and *eye*). *Orchidàceæ*. A few epiphytic orchids from the E. Indies, with panicles of small fls with colors in green, pink, yellow and purple, and little known in cult. **A. latifòlia,** Rolfe, has very broad lvs and very small whitish yellow red-striped and spotted fls.

ACRÍSTA (origin of name unexplained) *Palmàceæ*, tribe *Arèceæ*. A tall palm suitable for planting S.

Leaves pinnate, usually very large, from 10–20 in a terminal crown: infl usually maturing well below the lvs, the spadix 1-branched, the branches coarse, tapering.—Only 1 species, *A. montícola*, confined to Porto Rico, Cuba and St. Kitts. The nearest relative, the royal palm, differs in having a bulging trunk, and in having 2-3-branched infls. See Bull. Torrey Club, 28: 555 (1901).



112. Aconitum autumnale. (×½)

This palm is not as yet common, but well worthy of a wider cultivation. It resembles the royal palm but is shorter, and has a smooth trunk of uniform diameter. For cultivation see *Palms*.

montícola, O. F. Cook. Thirty-five to 45 ft.; trunk smooth, with many ring-like scars; lvs. about 6 ft., the lfts. lanceolate in one plane, equally spaced, and nearly at right angles to the rachis; infl. coming out between the lvs., and by the dropping of latter, appearing well below the lf.-crown at maturity; fls. not well known; fr. with lateral stigma, grayish brown, nearly smooth, obovate, ½×1 in. Bull. Torrey Club, 28, pl. 44 (as *Thrinconia alta*).

N. Taylor.

ACROCLÍNIUM *Helipterum*.

ACROCÒMIA (name means *a tuft of leaves at the top*). *Palmàceæ*, tribe *Bactridìneæ*. A showy genus of American palms. Not popular in the trade because of their spiny habit and rather unattractive young state. The adult plants, however, are very graceful.

Leaflets narrowly linear, long, usually obliquely acuminate, the margins naked and recurved, the midrib often spiny on lower sides of lfts.; rachis and petioles usually hairy, always more or less spiny; fls. yellowish, monœcious, the spathes ultimately becoming woody, calyx small, of 3 ovate sepals, corolla of 3 oblong-lanceolate or ovate petals; fr. usually about 1 in. diam., glabrous or sometimes prickly or tomentose.—There are only 8 species, all natives of Trop. Amer. except *A. Totai*. Most closely related to Cocos, from which the Amer. species differ in having spines. See G.C. II. 22: 127. Bull. Torrey Club, 28: 565.

These palms are usually spiny and have large, terminal, pinnate leaves. All except *A. Totai* should be grown in a warmhouse, with a night temperature not lower than 60°. They should be potted in soil similar to that for the cocoanuts, and, if possible, planted out directly. It has been found by some that overpotting the young plants is a danger likely to be incurred. The palms grow slowly and should not be transferred to a new pot until they become almost pot-bound.

Propagation is by suckers, which come freely in most species. Seeds are not known in cultivation for any of the species except *A. sclerocarpa*.

A. *Trunk greater in diam. a few ft. above the ground than elsewhere, spines 5–6 in. long.*

mèdia, O. F. Cook. Trunk 20–30 ft., conspicuously thickened above the ground, spines slender, black, mostly confined to the lower half of the internodes; lvs. opening about as they are pushed out, not spire-like, as in the royal palm, forming a dense crown, lfts. coming out from the rachis at all angles; fr. about 1½ in. diam., fibrous on the outside, yellowish.—A magnificent palm, known only from U. S. and not common outside of fanciers' collections and botanic gardens.

AA. *Trunks of essentially uniform diam. near base; spines 1–4 in. long.*

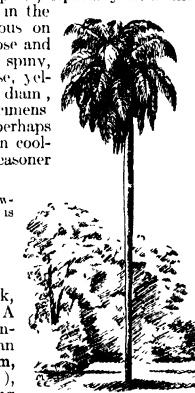
B. *Lvs. more or less spreading, and sometimes drooping; trunk predominately spiny throughout, 10–20 ft.*

mexicàna, Karw. Trunk brown-woolly, and covered with stout spines 1–3 in. long; lvs. terminal, 6–8 ft. long, the sheathing bases armed with long black spines; rachis and petiole spiny, lfts. rather stiff, linear, and shining; spathe very spiny; fr. globose, about 1 in. diam. Mex.—This palm is said to be perfectly hardy at Santa Barbara, Calif.

BB. *Lvs. more or less stiff and erect; trunks predominately more spiny above than below, 30–40 ft.*

sclerocárpa, Mart. (*A. aculeàta*, Lodd.) Fig. 113. Height 30–45 ft.; trunk cylindrical, about 1 ft. thick, with black spines 2–4 in. long, more common toward the summit than below; lvs. 12–15 ft. long, more or less erect; segms. in irregular groups of 2 or 3, 2–3 ft. long, ¾–1 in. wide, smooth and shining above, whitish, appressed-pilose below, entirely free of spines, except along the midrib on the under side; rachis tomentose, and bearing a few small spines; fr. yellowish, a little more than 1 in. diam. Brazil to W. Indies. I.H. 15: 547.—Not hardy at Oneco, Fla. Cult. in Calif. but apparently not out-of-doors. "Gru-gru" and "corozo" are native names of this palm.

Totaï, Mart. Trunk 30–40 ft., about 10–15 in. diam., clothed with stout spines, especially near the summit; lvs. not so large as in the preceding, green and glabrous on both sides, petioles tomentose and a little spiny; spathe very spiny, the fls. yellowish; fr. globose, yellow, a little less than 1 in. diam., scarcely known in cult.; specimens Paraguay and Argentine, perhaps in Brazil.—May be grown in coolhouse. Offered in 1912 by Reasoner Bros., Oneco, Fla.



113. Acrocomia sclerocarpa

A. havanénsis, Hort. A slow-growing, thorny plant, of which little is known, a trade name.

N. Taylor.

ACROPÈRA: *Gongora*.

ACROPHÝLLUM (Greek, *top* and *leaf*). *Cunoniàceæ*. A monotypic genus allied to Cunonia, containing the Australian evergreen shrub, **A. venòsum,** Benth. (*A. verticillàtum*, Hook.), excellent for spring flowering in the coolhouse. Prop. by cuttings in early summer. Let the plant rest during summer. Do not expose to frost. It produces many pinkish fls. in dense spicate whorls near the top of the branches. Lvs. in 3's, nearly all terminal and above the fls., sessile, dentate or serrate, cordate and acute; fls. with 5 petals and 10 stamens; 4–6 ft. B.M. 4050 (as *A. verticillatum*).

N. Taylor †

ACROSPÌRA (name of ambiguous application) *Lulàceæ*. One species, *A asphodeloìdes*, Welw , from Trop. Afr , with the habit of Eremurus, and white fls. in spikes, has been offered in Eu.

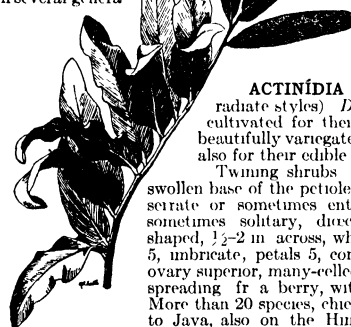
ACRÓSTICHUM (derivation uncertain). *Polypodiàceæ* As properly delimited, a small genus of coarse tropical swamp ferns, sometimes grown under glass.

Stem stout, erect· lvs clustered, erect, once-pinnate, 3–8 ft high sporangia completely covering the backs of some or all the pinnæ of the fertile lvs.

aùreum, Linn Fig 114 Three to 8 ft long, with pinnæ 6–10 in long, short-stalked, coriaceous sporangia only on upper pinnæ of fertile lvs Fla to Brazil and in the tropics of the Old World S 1.187 —Strong-growing. One of the best Should be treated as an aquatic

excélsum, Maxon (*A lomarioìdes*, Jenman). Similar in size to preceding sterile lvs also similar Distinguished by having sporangia on all the pinnæ of the fertile lvs Fla to Brazil

Acrostichum has been considered to include a much larger array of species, including, as in the previous editions of the Cyclopedia of Horticulture, ferns of very diverse form and habit of growth Fern students, however, are now united in distributing the species of Acrostichum as formerly understood among several genera Thus the species included in Acrostichum in the former Cyclopedia are here grouped in several genera as follows **Acrostichum:** (as above). **Elaphoglossum:** *conforme, crinitum, flaccidum, gorgoneum, muscosum, plosum, reticulatum, simplex, squamosum, vicosum, villosum,* **Leptochilus:** *ahenum, nicotianæfolium,* **Olfersia:** *cervina,* **Polybotrya:** *osmundacea,* **Rhipidopteris:** *peltata,* **Stenochlæna:** *scandens, sorbifolia.* R. C Benedict.



114 Acrostichum aureum (×¾)

ACTÆA (ancient name of the elder, transferred by Linnæus) *Ranunculàceæ*. Actea. Baneberry Cohosh. Native hardy herbaceous perennials. Sometimes offered in collections of hardy border plants Not to be confounded with blue cohosh, which is Caulophyllum.

Leaflets of the twice- or thrice-ternate lvs ovate, sharply cleft, and cut-toothed. fls. small, white, in terminal racemes, sepals 4 or 5, falling early, petals 4–10, clawed; stamens many: fr. a many-seeded berry

Acteas are grown chiefly for the showy spikes of small white flowers in spring, and handsome clusters of berries in autumn Useful for rockery and wild garden, or for clumps and borders. They thrive in rich woods and shade.

Propagation is by seeds sown in late fall to germinate the next spring or sown in spring. Old seed is said not to germinate well A more satisfactory means of propagation is by root-division in spring.

álba, Mill (*A rùbra*, Bigel) White Baneberry. Height 1–1½ ft.· much like *A. spicata*, but the lfts. more cut, teeth and points sharper; plant smoother: fls white, in an oblong raceme, and a week or two later: pedicels in fr. very thick, turning red; berries white, ovate-oblong, often purplish at the end. N. states

spicàta, Linn. Cohosh Herb-Christopher Plant 1–2 ft.. lvs bi- or triternate, serrated. fls white or blush, in ovate racemes in Apr to June. berries purplish black, oblong. Eu., Japan.—Less cult. than the red-fruited variety. Figured as *A. racemosa* in G W 5:4 and 14:507. Figured as *A. japonica* in G M. 50·28 and G.W. 5:3 and 15:173.

Var. **rùbra,** Ait. (*A. rùbra,* Willd.). Red Baneberry. Rather taller than *A. alba* lvs. bi- or triternate, serrated· fl.-cluster white, larger than in *A. spicata* berries bright red, very handsome Northern states.

Var **argùta,** Torr Sts rather taller than var *rubra:* lfts very deeply incised· racemes elongated in age: berries either red or white. Neb., W., and N. W.

K. C Davis.

ACTINÉLLA (Greek, *small-rayed*). *Tetraneùris,* Greene *Compósitæ* Hardy perennials from W N. Amer , for cult in alpine gardens and the open border. Height 6–12 in · fls tubular and radiate, yellow, bracts of the involucre appressed, rays 3-toothed —Of easy culture in light soil Prop. by division of the roots in spring, or by seeds

grandiflòra, Torr & Gray (*Rydbérgia grandiflòra,* Greene) Plant densely woolly lower lvs pinnately or bipinnately parted, with margined petioles from broad, scarious bases, upper cauline lvs simple or sparingly divided. fls 2–3 in wide, summer —A pretty alpine plant

scapòsa, Nutt Plant villous lvs radical, linear-spatulate, 2–3 in long, punctate, entire fls 1 in. wide, scapes single, leafless, 1-fld , 3–9 in long

A. lanàta, Pursh=Eriophyllum cæspitosum - - *A lanata,* Nutt Short, densely hairy lvs, with scape 5–9 in long Summer

N. Taylor †

ACTINÍDIA (*aktis,* ray, referring to the radiate styles) *Dilleniàceæ* Climbing shrubs cultivated for their handsome foliage which is beautifully variegated in some species, and a few also for their edible fruit

Twining shrubs winter-buds inclosed in the swollen base of the petiole lvs alternate, long-stalked, serrate or sometimes entire fls in axillary cymes sometimes solitary, dioecious or polygamous, cup-shaped, ½–2 in across, white or rarely reddish, sepals 5, imbricate, petals 5, convolute, stamens numerous; ovary superior, many-celled; styles numerous, ray-like spreading fr a berry, with numerous small seeds — More than 20 species, chiefly in E Asia from Saghalin to Java, also on the Himalayas A revision of the genus has been published by Dunn in Jour Linn Soc. Bot 39 394–410 (1911)

About 7 species are in cultivation, of these *A Kolomikta* is the hardiest, growing as far north as eastern Canada, *A arguta* and *A polygama* are hardy in Massachusetts, while *A chinensis,* which is the most beautiful of all, and *A coriacea,* are hardy only south of Washington, but may be grown farther north if taken down in autumn and covered with leaves. *A arguta* is excellent for covering arbors, trellises, walls and the like and is remarkably free from insects and fungi *A. Kolomikta* and *A polygama* show a very striking silvery white or pinkish variegation of the foliage, which is more pronounced in the staminate plant *A arguta* and *A chinensis* are also worth cultivating for their edible fruits, particularly the latter, which has fruits up to 2 inches long, of a gooseberry-like flavor, to obtain fruit, it is necessary to plant both sexes or a plant with polygamous flowers. *A polygama,* and, in a lesser degree, *A. Kolomikta,* attract cats and are often destroyed by them if not protected by screens

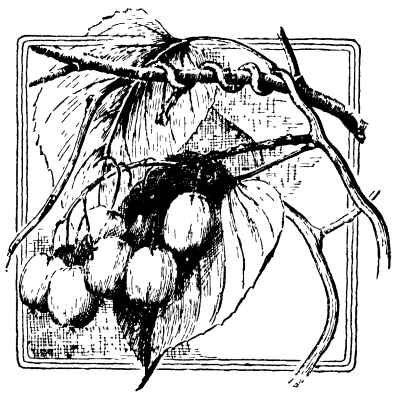
The actinidias prefer somewhat moist and rich soil and grow as well in a sunny as in a half-shady position

Propagation is by seeds, which are sown in spring and germinate readily; also by cuttings, of half-ripened wood in summer or by hardwood cuttings under glass, and also by layers.

A. *Branchlets glabrous: lvs. glabrous beneath or only pubescent on the veins, acuminate.*

B. *Lvs. dark green, shining above, chartaceous, never variegated. anthers dark purple.*

argûta, Miq (*A. polýgama,* Lauche, not Miq. *A. volùbilis,* Carr., not Miq *A rùfa,* Miq.). Fig 115 High-climbing branches with brown lamellate pith lvs broad-elliptic or broadly ovate, 4–5 in long, cuneate to subcordate at the base, setosely appressed serrate, glabrous beneath except the setose midrib:



115. Actinidia arguta. (×⅓)

fls. 3 or more, white, ¾in. across; sepals elliptic-oblong, tomentulose, petals brownish at the base fr subglobose, greenish yellow, about an inch long, sweet June Japan, Korea, Manchuria. L I 25. R H 1874, p. 394. B.M. 7197 (as *A. polygama*) A G. 1891.147. M.D.G. 1895.97; 1898.378. G. 29 503.

BB. *Lvs. bright green, membranous, often variegated· anthers yellow. fls 1–3*

polýgama, Maxim. To 25 ft. pith of branches solid, white· lvs. broadly ovate to ovate-oblong, 3–6 in. long, rounded or subcordate at the base, appressed serrate, mostly setose on the veins beneath, variegation white or yellowish fls white, ¾in. across; ovary bottle-shaped fr yellow, bitter June Japan, Korea, Manchuria to Cent and W China —Known as silver vine on account of the beautiful silvery white color of the young lvs of the staminate plant.

Kolomíkta, Maxim. Climbing 15 ft high· pith of branches lamellate, brown lvs ovate-oblong, 4–5 in. long, rounded or cordate, unequally setosely serrate, pubescent on the veins beneath, variegation white or pink. fls white, ¾in across, ovary cylindric fr oblong-ovoid, blue, sweet June Japan, Saghalin, Manchuria, Cent and W China R H 1898 36 M D G. 1896 397 G W 3, p 61.—The staminate plant is very striking with its beautifully white and carmine variegated young lvs.

AA. *Branchlets densely hairy· lvs. tomentose beneath, usually rounded or emarginate at the apex.*

chinénsis, Planch. Climbing, to 25 ft.: hairs of young branchlets and lvs bright red; pith of branches lamellate: lvs orbicular or oval, cordate, firm, 3–5 in. long, ciliate-serrulate, finally glabrous above and dark green, whitish beneath fls several, creamy white, 1½–2 in across fr ovoid or subglobose, 1–2 in. long, hairy, edible. China G C. III 46:77 and 79 R H. 1909, p 473 J.H S 1903:59. H.I. 16·1593.—The most beautiful of the actinidias with the largest fls. and a promising fruiting vine; the frs. have the flavor of a gooseberry

A callósa, Landl Similar to A Kolomikta Branchlets with conspicuous lenticels, with lamellate pith lvs oval to oblong, 3–5 in long, serrulate, quite glabrous fls white, ½ in across fr ovoid, spotted, 1 in long China —*A coriácea,* Dunn Allied to the preceding species Lvs coriaceous, oblong to lanceolate, remotely serrate, 3–4 in long, petioles less than 1 in long fls several, reddish. fr ovoid, spotted, ½–¾in long China Recently offered under the name of A Henryi, which is a totally different species, allied to A chinensis —*A melanándra,* Franch Allied to A arguta Lvs ovate-oblong or oblong, closely serrulate staminate corymbs many-fld, petals greenish at the base fr purple China

ALFRED REHDER.

ACTINÓLEPIS (Greek, *a scale-like ray*). *Compósitæ.* About 6–8 species of hardy annuals, mostly from Calif., freely branching, and mostly yellow-fld The fls are in pedunculate heads at the tips of the branches, rays usually 2–3-toothed, in one series lvs opposite. Considered by da Della Torre and Harms to be a section of the genus Eriophyllum, and by Gray to belong properly to Baeria

coronária, Gray (*Shórtia califórnica,* Hort *Baèria coronària,* Gray) Fig 116 Lvs opposite, except the upper ones, 2 in or more long, pinnately, or the lower ones bipinnately, parted into linear, narrow divisions· pappus of awned or of muticous, often erose palæ, rarely wanting B M 3828 (as *Hymenóxys califórnica*) —One of the prettiest of annual fls, and deserving of greater popularity Excellent for edging An everlasting

N. TAYLOR.†

ACTINÓMERIS (from Greek *aktis,* ray, and *meris,* part, alluding to the irregularity of the rays). *Compósitæ* Native hardy herbaceous perennials suitable for wild gardens and shrubbery

Tall, branching, yellow-fld herbs, with aspect of native sunflowers, but with smaller fls lvs. often decurrent on the stem fls in corymbose or solitary heads, composed of both ray and tubular fls.—Cult. like Helianthus Prop by division ·

squarròsa, Nutt (*Verbesìna alternifòlia,* Linn.). Height 4–8 ft lvs lance-oblong, acuminate, toothed, subpetiolate, tapering to both ends fls numerous, corymbed, yellow, 1–2 in across, rays 2–10, irregular. Autumn. E N. Amer

A helianthoides, Nutt (Verbesina helianthoides, Michx) Lvs silky villous underneath rays about 8, usually more than in A squarrosa Mn 4 129 —*A prócera,* Steud, is only a taller form of A squarrosa

N TAYLOR †

ACTINÓPTERIS (*aktis,* ray, and *pteris,* the leaves radiately cut). Syn, *Actinópteris Polypodiàceæ.* Greenhouse ferns from India, resembling miniature fan-palms The sori are linear-elongate and submarginal, and covered with indusia *A radiàta,* Link (*A. australis,* Linn. f.) is the only recognized species Apparently not in the horticultural trade.



116. Actinolepis coronaria flower.

ACTINOSTÉMMA (*ray* and *wreath* or *stems*) *Cucurbitàceæ* Three or 4 species of climbing or running plants from China and Japan, of which *A. paniculàtum,* Maxim, has been grown in European collections It is a hardy perennial in Cent Eu, with tuberous roots, palmate lvs. and small fls; said to thrive in dry and barren places.

ÀDA (a complimentary name). *Orchidàceæ.* Epiphytic coolhouse orchids

Pseudobulbs elongated, bearing at the apex 1–3 coriaceous lvs · fls nodding, in a somewhat 1-sided raceme, terminating the lateral leafless scape; sepals nearly equal, free, usually spreading above, petals similar to the sepals but smaller; lip sessile, continuous with the base of the column, entire, shorter than the

sepals; pollinia 2.—Species 2, natives of the Colombian Andes.

Ada aurantiaca is a coolhouse orchid and will thrive well with the odontoglossums where they are cultivated; the bright orange-colored blooms add interest to the collection when in spring display. The culture is



117. Ada aurantiaca *a* shows the lip and column. (Plant × ⅓)

simple if potted in peat fiber with plenty of drainage; sphagnum may be added if it can be made to grow, but if not it becomes sour and inert, and is best left out of the material for cool orchids Adas are evergreen and should never be dried at the roots as they grow in boggy soil at 8,500 feet elevation in Colombia There is another species, *A Lehmannii*, which is very distinct, but since the unfortunate death of Consul Lehmann, it seems never to have been reintroduced to cultivation (Orpet)

aurantiaca, Lindl Fig 117 Pseudobulbs 2–3 in long, usually somewhat compressed, tapering, bearing 1–3 lvs up to 12 in long fls cinnabar, the sepals and petals lanceolate, twice as long as the lip B M 5435 C O , pl 1 G C III 13.247. F W 1873 225 Var **maculàta,** Hort Sepals and petals spotted with dark brown C.O , pl 1*a*. GEORGE V NASH

ADAM-AND-EVE: *Sempervivum tectorum*, and *Aplectrum hyemale*

ADAMÀRA (from a personal name) *Orchidàceæ* A name proposed by the Royal Horticultural Society of London to cover the multigeneric hybrids of the genera Brassavola, Cattleya, Epidendrum and Lælia, the name *Lanneara* being proposed for combinations of certain other orchid genera The International Congress of Horticulture held at Brussels in 1910 adopted *Lanneara* for four genera named above, and legislated that "multigeneric hybrids receive a conventional generic name, preferably that of a distinguished man, to which is added the termination *ara* A distinct generic name will be formed for each different combination of genera." See *Lanneara;* also *Brasso-cattlælia.*

ADÀMIA *Dichroa*

ADAM'S APPLE· *Citrus Limetta*, *Musa paradisiaca*, and *Tabernæmontana coronaria*

ADAM'S NEEDLE: *Yucca*

ADANSÒNIA (named after M Adanson, French botanist). *Bombacàceæ.* A genus of 10 species of tropical shrubs and trees, closely related to Bombax· fls. large, pendulous, petals 5, white, obovate, stamens numerous, united in a column about the styles; ovary 5–10-celled. fr oblong, woody, indehiscent, filled with a mealy pulp in which are numerous seeds

digitàta, Linn BAOBAB TREE Figs 118, 119. Height not more than 60 ft diam said to be sometimes 30 ft or more and to have the thickest trunk of any tree in the world lvs palmate, with 3 lfts in young plants, and 5–7 in older ones fls 6 in across, with purplish anthers, on long axillary, solitary peduncles; stigma 7–10-rayed in full anthesis Afr B M 2791–2792 G C III 27.57 —Rarely cult in extreme S. Fla , where fr is 9–12 in long, and called "monkey's bread" Figs 118 and 119 are from specimens growing in the American tropics The fl opens wide, something like a spreading hibiscus, and the petals soon roll back and wither, as shown in Fig 119 The tree is very thick-boled, and the wood is soft and light The tree is supposed to attain to vast age The fr of the baobab is a gourd-like structure, of which the pulp is said sometimes to be eaten and the juice used for the making of a beverage The bark produces a very strong fiber

N. TAYLOR †

ADDER'S-TONGUE *Erythronium*

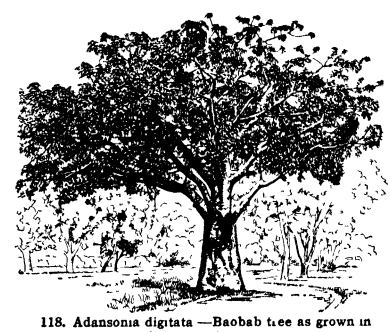
ADDER'S-TONGUE FERN· *Ophioglossum*

ADÈLIA (Greek, *adelos*, obscure, from the small flowers) *Ricinélla,* Muell Arg *Euphorbiàceæ* Thorny, 1 hop American trees, rare in cult and probably of little horticultural value Lvs alternate, short-petioled, clustered on short side branches fls dioecious in axillary clusters or the pistillate single, stamens 8–15 *A Ricinella,* Linn , is the best known Those grown under the name of *A acidotòmis* should perhaps be referred to *Securinega buxifòlia* J. B. S NORTON.

ADÈLIA *Forestiera*

ADENÁNDRA (from the glandular anthers). *Rutàceæ* Small, summer-flowering, tender shrubs from the Cape of Good Hope

Lvs alternate, small, leathery, subsessile, entire, glandular-dotted fls white or rosy, solitary and usually terminal, petals obovate, stamens 5, alternating with 5



118. Adansonia digitata —Baobab tree as grown in American tropics

staminodia which are longer than the stamens —About 20 species Prop by cuttings from the ripened wood.

fràgrans, Roem & Schult. (*Diósma fràgrans,* Sims) BREATH OF HEAVEN. Height 2–3 ft.· lvs. oblong, obtuse, dark green above, whitish beneath, with a glandular, denticulate margin fls rosy. B M 1519.—A favorite in Calif.

The following are sometimes cultivated in botanic gardens. *A amœna,* Bartl & Wendl 1–2 ft lvs oblong or oval, obtuse, glabrous, dotted beneath fls white above, reddish beneath —*A.*

coriácea, Lichtst 1–2 ft lvs oblong, obtuse, glabrous, revolute fls solitary, terminal, pink —*A umbellata*, Willd 1–2 ft lvs oblong or obovate, dotted beneath, fringed on the edges fls vesaile or nearly so, terminal, pink, the petals fringed —One of the best

N. TAYLOR †

ADENANTHÈRA (from the deciduous pedicillate gland on each anther) *Leguminòsæ* A group of 4 species of tender trees, allied to Mimosa Lvs bipinnate or decompound fls small, racemose, usually golden yellow or whitish —The following unarmed evergreen tree is cult in greenhouses only for its economic interest, and also in Calif in the open air Prop by seeds, which should be softened in hot water previous to sowing

pavonina Linn RED SANDALWOOD TREE Lfts about 13, ovate, obtuse, glabrous on both faces fls in an axillary spike-like raceme, white and yellow in the same cluster Trop Asia, where it grows to a tree of great size —The red lens-shaped "Circassian seeds" are curiosities with travelers, and are used for necklaces, and the like. Plant sometimes called "peacock flower fence"

N TAYLOR †

ADÈNIA: *Modecca*

ADENOCALÝMMA, (*glandular covering*; referring to leaves, etc) Sometimes but incorrectly, spelled *Adenocalymna Bignoniàceæ* More than 50, mostly Brazilian species of tender climbing shrubs, closely allied to Bignonia Fls large, yellow or orange, bracteate, racemose, trumpet-shaped lvs ternate or binate Grown in hothouses, requiring considerable moisture Prop by cuttings in frames

comòsum, DC St rough, punctate lvs opposite, trifoholate, petioles thickened at junction with the blades racemes so densely clothed at first with large bracts as to suggest the aments of the hop-vine, fls 2 in across, brilliant yellow, trumpet-shaped, upper lip of 2, and lower lip of 3 rounded, waved lobes Brazil B M 4210.

A nitidum, Mart 10 ft · lvs trifoholate or unifoholate tendrilled, the lfts elliptic-oblong fls. yellow in axillary and terminal racemes

N TAYLOR †

ADENOCÁRPUS (*aden*, gland, *karpos*, fruit easily distinguished from allied genera by its glandular pod) *Leguminòsæ* Ornamental woody plants cultivated chiefly for their yellow flowers

Shrubs, rarely small trees, more or less pubescent lvs alternate, trifoholate, small fls papilionaceous, yellow, in terminal racemes, calyx 2-lipped, the 2 upper teeth free, the 3 lower more or less connate fr a glandular pod, oblong or linear, compressed —About 14 species in S Eu, Asia Minor, N and W. Afr, Canary Isls This genus consists of low shrubs, rarely more than 3 ft, of spreading habit, with handsome fls produced profusely in spring, very attractive when in full bloom

They require a sunny position and well-drained soil They are especially adapted for temperate regions, but do not bear transplanting well, and should be grown in pots until planted They are also handsome greenhouse shrubs, and grow best in a sandy compost of peat and loam

Propagation is by seeds and greenwood cuttings in spring, sometimes also by layers and grafting.

A. *Branchlets pubescent or tomentose: lvs. persistent, crowded*

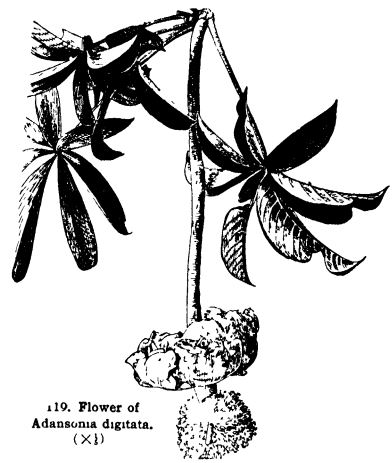
viscòsus, Webb & Berth (*A Anagỳrus*, Spreng *A frankenioìdes*, Choisy) Branchlets pubescent lfts linear-oblong, folded fls crowded, in short racemes; calyx glandular, the lateral segm of the lower lip longer than the middle one, exceeding the upper lip. Teneriffe

hispánicus, DC Shrub, about 6 ft or more · branchlets velvety-pubescent: lfts lanceolate, acute, tomentose beneath racemes dense, oblong, many-fld, short-peduncled, calyx pubescent and glandular, segms very unequal, those of the lower lip nearly equal, but much longer than those of the upper lip Spain.

decórticans, Boiss (*A Boissièri*, Webb) Shrub or small tree, 15–25 ft. branches tomentose lfts linear, pubescent racemes short, compact, calyx villous, segms nearly equal Spain R H 1883 156 G C. II. 25 725. Gn 30 498 —Resembles English gorse, but is thornless Bark peels naturally. Thrives in poor, sandy soil

AA *Branchlets soon glabrous lvs deciduous.*

complicàtus, Gay (*A divaricàtus*, Sweet *A parvifòlius*, DC) Much-branched shrub, 1–3 ft · lvs deciduous, fascicled, lfts obovate or oblong-lanceolate, pubescent beneath, often folded fls in elongated racemes; calyx pubescent, usually glandular, middle segm of the lower lip longer than the lateral ones, usually much



119. Flower of Adansonia digitata. (×⅓)

exceeding the upper lip S Eu, Orient. B M. 1387 (as *Cytisus divaricàtus*) Var **intermèdius,** Aschers & Graebn (*A intermèdius*, DC) Branchlets villous calyx glandular, with very unequal lips Spain, Portugal, Madeira Var **commutàtus,** Aschers & Graebn (*A commutàtus*, Guss *A telonénsis*, DC, not Robert). Racemes usually short, calyx not glandular, with the lips little differing in length S Eu, Orient

A foliolosus, DC Branches and lvs crowded, villous racemes compact, many fld, calyx villous Canary Isls —*A grandiflòrus*, Boiss =A telonensis —*A dumetorum*, DC =A complicatus var intermedius —*A parvifòlius*, DC =A complicatus, Gay —*A telonensis*, Robert (*A grandiflorus*, Boiss) Branches and lvs glabrous racemes few-fld, calyx pubescent S France, Spain —*A telonénsis*, DC =A commutatus

ALFRED REHDER

ADENÓPHORA (*gland-bearing*, referring to the cylindrical nectary which surrounds the base of the style) *Campanulàceæ* Campanula-like border perennials

Herbs, differing from Campanula chiefly by the style being surrounded by a cylindrical gland · corolla bell-shaped, 5-lobed stamens free from corolla, the filaments dilated and ciliate toward base, caps 3-celled — About 14 species of hardy herbaceous perennials in Siberia, China and Japan Fls blue, nodding, on short pedicels, produced freely in midsummer in slender but stiff, erect panicles or loose racemes —For cult see *Campanula*

Propagation is by seeds or cuttings in spring The

plants do not take kindly to division or other disturbance of the roots Many other species than those in the trade are worthy

commūnis, Fisch (*A. liliflòra,* Schur *A. Fischeri,* Don *A. liliflòra,* Ledeb) Radical lvs petiolate, ovate-rotund, cordate, crenate-dentate; cauline lvs. sessile, ovate-lanceolate, coarsely serrate fls numerous, in a pyramidal panicle, lobes of the calyx triangular; style exserted

Lamárckii, Fisch Lvs ovate-lanceolate, sharply serrate, ciliate, otherwise glabrous fls racemose, lobes of the calyx lanceolate, style not exserted.

Potaninii, Hort Shrubby spikes 2–3 ft high, fls. 1¼ in across, light blue. July, Aug Intro 1899

polymórpha, Ledeb Three ft lvs verticillate, the whorls remote, and small fls which are darker in color than *A. Potaninii* Aug Russia Var **stricta,** with more erect habit than the type, seems to be more common

A. coronopifòlia, Fisch 1–3 ft radical lvs petiolate, ovate-rotund, cordate, crenately toothed, hairy, upper lvs sessile, entire or nearly so, glabrous, and linear lanceolate fls racemose, 3–10 in a cluster, blue, each fl on a slender pedicel June Dahuria —*A. denticulata,* Fisch (*A. tricuspidata,* DC) 1½–2 ft upper lvs sessile, ovate-lanceolate, the lower and radical ones petioled and more or less orbicular fls small, blue, pedicillate, in a terminal, loose raceme July Dahuria —*A. Gmelìni,* Fisch 1–2½ ft lvs , or at least the upper ones, linear, narrow, entire or nearly so, and quite glabrous fls blue, 3–10 in a second racemose cluster which is axillary near the upper part of the st Dahuria —Suitable for dry and stony places —*A. intermèdia,* Ledeb , not Sweet (*A. coronata,* DC) Plant 2–3½ ft radical lvs petiolate, cordate, toothed, upper lvs acutish at base, serrate, crowded fls pale blue, racemose, small May Siberia —*A. periplocæfòlia,* DC A dwarf (3 in) perennial suitable for rockeries, with ascending st lvs petiolate, ovate, acute at the apex, slightly cordate at the base, crenately serrate fls usually solitary and scapose, pale blue June Siberia.—*A. stylòsa,* Fisch 1–2 ft , erect lvs petiolate, the lower obovate and sinuate, the upper ovate, acuminate, quite glabrous fls few, racemose, the raceme naked, and lax May E Eu —*A. verticillata,* Fisch 2–3 ft st simple lvs whorled, serrate, the upper ovate-lanceolate, the lower petiolate, sub-orbicular fls pale blue, small, arranged in irregular clusters near the top of the st , some, along the lower part of the st , in whorls June Dahuria

N. Taylor †

ADENÓSTOMA (*aden,* gland, *stoma,* mouth, calyx with five glands at the mouth) *Rosàceæ* Ornamental woody plants, cultivated chiefly for their handsome white flowers

Evergreen, somewhat resinous shrubs, rarely small trees lvs linear, small fls white, about 1–5 in broad, in terminal panicles, calyx-tube obconical, with 5 short teeth and 5 glands at the mouth, petals 5, stamens 10–15; pistil 1, with the lateral style strongly curved above the base fr a small achene, inclosed in the persistent calyx-tube —Two species in Calif

The adenostomas are heath-like evergreen shrubs, very handsome when in full bloom They may be cult. in temperate regions in a sunny position and well-drained soil *A. fasciculatum* stands many degrees of frost. Prop is by seeds and greenwood cuttings in spring

fasciculàtum, Hook & Arn Shrub, 2–20 ft lvs fascicuiate, linear, about ¼in long panicles rather dense, 2–4 in long, fls nearly sessile May, June Ranges northward to Sierra Co —The characteristic shrub of the chaparral or chamisal regions of the coast ranges of Calif Hooker & Arnott, Bot Beechey's Voy 30. Intro. 1891.

sparsifòlium, Torr. Shrub or small tree, 6–12 ft , rarely 30 ft , resinous lvs alternate panicles loose, fls. pedicelled, larger, ⅛in. across, fragrant. S. and Low. Calif Emory Rep U. S. and Mex Bound. Surv. 20. Intro. 1891 Alfred Rehder

ADENÓSTYLES (from *aden,* a gland, and *stylus,* a style, in allusion to warty glands of the stigmas). *Compósitæ* A little-known group of hardy perennials, grown for their purplish or whitish flowers, perhaps known in America only in botanic gardens.

Leaves alternate or radical, usually broad, the petiole frequently dilated into a stipule-like, st.-clasping base. fls in medium-sized heads, the fls all tubular, long, exserted, involucre cylindric or bell-shaped, its bracts small and unequal —There are only 5 species, all natives of Cent S Eu None is of horticultural importance. May be grown in the open border. Prop. is by seed and division.

álbifrons, Reichb A much-branched, hairy perennial, 2–3 ft lvs on the lower surface cottony, bright green above, almost round and deeply cordate, basal lvs long-stalked, the stalks eared heads 15–20-fld , purple, rather attractively paniculate or corymbose. Woody mts , S Eu July, Aug

A. alpina, Bluff & Fingeruth A lower, smooth perennial, with the heads 3–6-fld , is scarcely known in Amer It is not so showy as A. albifrons S Eu

N Taylor

ADÉSMIA (*not bound,* referring to the free stamens) *Leguminòsæ* More than 100 species of tender herbs, shrubs or sub-shrubs from S Amer , allied to the peanut Lvs abruptly pinnate, ending in a bristle fls. axillary, solitary, or sometimes racemose and terminal. Some of them are showy

A. balsámica, Bert Lvs 1–1½ in long, lfts 10–16 in pairs racemes 3–8-fld , fls ¾in across, golden yellow Chile B M 6921 Has the odor of balsam —*A. boronioides,* Hook A pretty shrub, warted all over, except the petals and lfts , with large balsamiferous glands lvs 1½–2 in long, made up of from 10–13 pairs of sessile, orbicular, coarsely crenate, dark green lfts fls bright orange-yellow, in terminal racemes Patagonia B M 7748 —*A. glutinòsa,* Hook & Arn 2 ft , shrubby, the branches clothed with glutinous hairs lvs with 3–4 pairs of hairy elliptic lfts fls yellow, racemose and terminal Chile —Neither is in the American trade, but both cult in botanic gardens

N Taylor †

ADHÁTODA (native name) *Acanthàceæ* About 25 species of tender shrubs, distinguished from Justicia by the less-spurred anthers, and often by the habit and calyx, but considered by de Dalla Torre and Harms as a mere section of that genus Fls whitish or purplish, calyx 5-cleft, often exceeded by the bracts; corolla long-tubed, the limb prominently 2-lipped; stamens 2 For culture, see *Justicia*

cydoniæfòlia, Nees Brazilian Bower-Plant Lvs. opposite on short petioles, ovate lower lip broadly obovate, purple Brazil B M 4962 F S 12 1222 R H 1873 110 —Cult in Calif

A. Vásica, Nees Lvs ovate-lanceolate, acuminate fls white, streaked red or purple Ceylon B M 861 (as *Justicia Adhatoda*)

N Taylor †

ADIANTÓPSIS (Greek, *like Adiantum*) *Polypodiàceæ.* Like Adiantum, but differing in having the sori simple, one to each vemlet and not occupying the ends of several vemlets, as in Adiantum —A small genus, little known in cult

pedàta, Moore (*Cheilánthes pedàta,* R Br.) Lvs cespitose, on long (9–12 in) sts , about 6 in either way, the 3 divisions bipinnatifid, sori numerous, placed on both sides of the segm Jamaica, Cuba

R C Benedict.

ADIÁNTUM (Greek, *unwetted*) *Polypodiàceæ.* Maidenhair Fern. A large, widely distributed genus of ferns, mainly of tropical countries, some of them popular greenhouse and conservatory plants

The leaves have usually polished black or purplish stalks, the blades thin and delicate, simple or divided into usually fan-shaped segments, with the outer margins revolute, covering linear sori Of the one hundred or more species, only one, *A. pedatum,* occurs, commonly in temperate North America A few others are found in the southwestern states and in Florida *A. cuneatum* is the most frequently cultivated of the exotic species.

The genus Adiantum furnishes some of the most useful and popular species of commercial ferns They are easy of cult They need a slightly shaded position, moderately moist atmosphere, and a temp. of 60–

65° F. The soil should be composed of rich loam and leaf-mold in equal parts, and should be kept moderately moist Some of the most useful ones for general purposes (given under their trade names) are *A amulum*, grows about 12–15 in high, and has very graceful dark green fronds, *A. bellum*, a dwarf, very compact species, 6–8 in , *A cuneatum*, *A cuneatum* var *grandiceps*, with long, heavily crested, drooping fronds, *A. cuneatum* var *variegatum* making a neat specimen; *A concinnum*, gracefully drooping dark green fronds 15 in. long, with overlapping pinnæ, *A concinnum* var *lætum*, of upright growth, is 24 in high, *A decorum* very useful, 12–15. in., and has young fronds of a pleasing metallic tint, *A excisum* var. *multifidum; A formosum, A. Fergusonii, A. fragrantissimum; A. pubescens, A. tenerum* and var *roseum, A Wiegandii, A. LeGrandii*, very dwarf, *A. mundulum*, a very neat, dwarf species, *A. rubellum*, a dwarf species with mature fronds light green, young fronds of a deep ruby tint The above may easily be grown from spores, if sown on a compost consisting of half each of finely screened clean soil and leaf-mold or peat, and placed in a moderately moist and shady place in the greenhouse in a temp of 60° F To be grown most economically, they should be transplanted in clumps of 3 or 4 plants as soon as the first pinnæ have appeared, and, as soon as strong enough, potted off, either in clumps or singly Some very desirable species to grow into large, tall specimens are *A æthiopicum, A Bausei, A Collisii, A Fergusonii, A formosum, A. Lathomii, A peruvianum, A princeps, A rhombodeum, A Sanctæ-Catharinæ, A trapeziforme*, and *A Williamsii* The following are also recommended for special purposes for fern-dishes, *A. fulvum*, for cutting, *A gracillimum* The following kinds are economically prop. by division, temp 65° F *A Farleyense*, the different varieties of *A. Capillus-Veneris, A rhodophyllum, A assimile* Some kinds, as *A dolabriforme, A caudatum* and *A Edgeworthii*, form small plants on the ends of fronds, which may be detached and potted separately, and if kept in a close atmosphere will in a short time grow into choice little plants Temp 65–70° F (Nichol N Bruckner)

The following directions (mostly for commercial growing) are prepared for this entry by James C Clark·

Adiantums, when grown in large quantities, are best propagated from spores sown in pots or pans, 6-inch being a good size, pots being preferred to pans as they maintain a more constant and equal moisture The pots should be filled with two-thirds good drainage (coal-ashes or potsherds are very suitable), top-dressed with one-third sterilized loam mixed with one-tenth part of sharp sand finely sifted and evenly pressed down in the pot, so that the top of the soil will be about ¼ inch below the rim The pots should then be placed on a greenhouse bench, under shaded glass, and where a temperature of 65° to 70° can be maintained Then water until they are thoroughly soaked (and to make sure that they are wet, water again, it is impossible to make too wet) Allow to drain for an hour or so and then dust the spores evenly, and as thinly as possible, over the surface and cover immediately with glass. The glass should remain on, and no water should be required or given, unless by dipping, until the spores have developed to the prothallus stage, when it will be advantageous to give a slight watering, using a very fine rose, and raise the glass 8 inches above the pots, supporting so that a free current of air can pass directly over the pots.

At this stage of their development adiantums, like all other fern prothalluses, must never be allowed to become dry. At the same time, great care must be exercised so that there will be sufficient air to prevent damping and yet no direct draft either from the heating pipes or ventilators to cause wilting or drying out of the pots

As soon as the first real fronds appear (generally in eight to twelve weeks from time of sowing, according to season of year, eight weeks in spring and summer; twelve weeks in fall or winter), the seedlings should be transplanted in small clumps of three to five seedlings each, into flats or seed-pans, spaced about 1 inch apart, and placed in a close warmhouse, in a night temperature of 65° to 70°, until the seedlings show signs of taking root and making new fronds, when the temperature may be lowered to 60° at night and 65° to 70° in the day This temperature will be found to suit all adiantums (except *A Farleyense*), in all stages of their future development

When the transplanted seedlings are about 1 inch high, they may be placed in small pots and repotted into larger ones as soon as they require it In potting, a good compost consists of nine parts of loam and one part of well-rotted cow-manure, the pots being provided with good drainage, especially the larger sizes. In potting, the crown of the plant should be placed deep enough so that it will be covered with ½ to ¾ inch of fresh soil, making the soil only moderately firm (never hard) Place the plants in a greenhouse, spaced so that there will be a free circulation of air all around the plants, the glass moderately shaded from March 15 to November 1, and all shade removed during the winter months, giving as much ventilation (without draft) as possible. The soil should be kept moderately moist at all times and a good atmospheric moisture maintained by wetting down the walks, but at no time should the foliage be wet more than possible Well-drained, solid beds are better adapted to the growth of adiantums than tables, but, if grown on the latter, a ½-inch overhead heating-pipe over each table, say 18 inches above the foliage, will be found of great assistance in overcoming the condensation that is so destructive to the foliage when the plants are grown on tables

Treated as above, adiantums can be grown into 6-inch pot specimens in one year from time of sowing spores, and when grown rapidly are seldom troubled with insect pests, unless it be green-fly, which can be kept under control by a weekly application of nikoteen, using two ounces to five gallons of water, applied in as fine spray as possible.

Specimen adiantums, in 8-inch pots or larger, can be grown in the same-sized pots for several years, provided they are slightly rested during the winter months by being kept on the dry side and in a lower temperature, say 45° to 55° In February the plants should be removed from the pots, the drainage examined, a little of the top-soil removed, and then top-dressed with old rotted cow-manure, and the plants returned to a growing temperature and given more water as required. Feed either with liquid manure or dust with pulverized animal manure every second week during the growing season Some of the finest specimen adiantums in this country have been grown in the same-size pots for five to seven years

Scale sometimes attacks old specimen adiantums, and there is only one remedy,—rest the plants by keeping to the dry side and in a cool temperature for about a month; then cut off all the fronds clear down to the crowns, and treat the same as old specimen plants

For amateurs and small growers, all adiantums can be propagated by division of the crown and rhizomes This is best done in January and February Wash off all soil and cut the roots off as close to the crowns as possible. Then divide to single eyes. Place the eyes in sharp sand, merely covering them. Place in a situation such as advised for spores and cover with glass, when the first fronds appear, treat exactly the same as recommended for seedlings, when they will make plants about as quickly and equally as good as those grown from spores.

Adiantum Farleyense, being a sterile species, must be propagated by division. It requires the treatment recom-

mended for adiantums in general with the exception of a much higher temperature, 65° to 70° at night and 75° to 80° during the day. The variety Glory of Moordrecht has the great advantage of producing fertile spores and it also thrives in the lower temperatures recommended for general adiantums It gives promise of being one of the most useful varieties for decorations and cut-fronds use, as the fronds are very much harder than typical *A. Farleyense* and will compare well with such kinds for standing as *A cuneatum, A. hybridum* and *A. Croweanum.*

INDEX

acutum, 21
æmulum, 33
æthiopicum, 28.
affine, 10
amabile, 34
ancitense, 26
assimile, 28.
Bardii, 33
Bausei, 21
bellum, 31
Bessoniæ 32
Capillus-Veneris, 30
caudatum, 2
Collisii, 24
concinnum, 25
Croweanum, 33.
cuneatum, 33
curvatum, 18
cyclosorum, 35
decorum, 35
diaphanum, 9
digitatum, 40
dolabriforme, 1.
Edgeworthii, 2
elegans, 35
emarginatum, 22.
excisum, 29
Farleyense, 20.
Fergusonii, 30.
formosum, 13
fragrantissimum, 33
fulvum, 11
gracillimum, 39.
grandiceps, 33
hispidulum, 19
hybridum, 33.
intermedium, 12
Jordanii, 22
Kaulfussii, 5
Lathomii, 21
latum, 25
LeGrandii, 39
lunulatum, 1
macrophyllum, 4
Mairisii, 30
monochlamys, 37
Moorei, 34
mundulum, 33
novæ-caledoniæ, 16
Owenii, 35
palmatum, 40
pedatum, 17
peruvianum, 3
platyphyllum, 6.
polyphyllum, 8.
princeps, 21
pubescens, 19.
pulverulentum, 14.
rhodophyllum, 21
rhomboideum, 15
rubellum, 36
Sanctæ-Catharinæ, 7
setulosum, 9
Siebrechtii, 35
speciosum, 40.
tenerum, 21
tinctum, 27
trapeziforme, 7.
variegatum, 33
venustum, 38
versaillense, 33.
Victoriæ, 21.
villosum, 15
Wagneri, 35
Weigandii, 35
Williamsii, 23

A. *Lvs. with a single row of small lfts. on either side, rooting at the apex.*

1. **lunulàtum,** Burm (*A dolabriforme*, Hook). Lvs. 1 ft long on blackish, wiry, polished stalks, lower lfts. nearly semicircular, all on hair-like stalks. India, Trop. Amer , Austral G 6.203

2 **caudàtum,** Linn (*A Edgeworthii*, Hook). Lvs 6–12 in long, on short, brownish, densely hairy stalks; lfts deeply cut into several spreading narrow lobes Old World Gn 68, p 315

AA. *Lvs. with usually a single row of large lfts. on either side, not rooting at the apex*

3. **peruviànum,** Klotzsch Lvs 1 ft. or more long, on polished stipes, with obliquely ovate pointed lfts 2 in long by 1½ in wide, on slender stalks, sori 8–10 on either side of the lfts , twice as long as wide Peru.

4. **macrophýllum,** Swartz Lvs 1 ft. long, on rather stout polished stipes, with 4–6 pairs of wedge-shaped sessile lfts 1½–2 in long by ¾–1 in. wide, indusium nearly continuous on either side of the lft. Trop. Amer.

5 **Kaúlfussii,** Kunze Lvs 6–8 in. long, on slender black stalks, lfts 5–11, 2 in long, ¾–1 in. wide, with unequal base; indusia very long and narrow, forming an almost continuous marginal band on either side of the lfts. Mex., W Indies.

6 **platyphýllum,** Swartz Lvs 1–2 ft. long, stalks black, glossy, lf -blades 6–12 in long, 2–4 in broad, with a long terminal pinna and 3–6 pairs of lateral pinnæ; lowest pinnæ sometimes pinnately divided; segm 3–4 in long, 1½–2 in broad, sporangia in nearly continuous line along the margin. Cent. Amer. to Brazil and Bolivia.

AAA. *Lvs. at least bipinnate, the segms. twice as long as broad, with the vernlets all springing from the lower side.*

B. *Lfts. 1½–2 in. long.*

7. **trapezifórme,** Linn Lvs 18 in. or more long, with the terminal lft. longer than the lateral; lfts trapezoidal, ½–¾in. wide, lobed, and with numerous sori.

A. Sánctæ-Catharìnæ is a form with deeper lobes. Trop Amer.

BB. *Lfts. smaller, an inch or less long.*

C *Stalks polished, smooth.*

8 **polyphýllum,** Willd Lvs often tripinnate, with stout black stalks; pinnæ 6–8, long, with closely set lfts. which are ¾–1 in long, the upper margin curved, with 4–6 circular or oblong indusia S Amer.

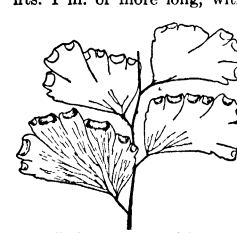
9 **diáphanum,** Blume (*A setulòsum*, J Smith). Lvs simply pinnate or usually 2-pinnate at the base; lfts. ½in long, ¼in wide, with numerous sori placed in the sinuses of the inner and outer edges. Asia to New Zeal.

10 **affine,** Willd Lvs bipinnate, with a terminal pinna and several lateral ones, lfts not exceeding ¾in long, ¼in wide, the upper edge parallel with the lower, and crenate, bearing numerous rounded sori on the upper and outer margin. New Zeal

11 **fúlvum,** Raoul Lvs 15–20 in long, the stalks erect, dark brown, shiny, rough below with long hairs; the lf -blades 9–12 in long, 6–8 in broad, deltoid, 2-pinnate, the segm ¾in long, ¼in broad, dimidiate, lower edge straight, the upper edge parallel with sharp-tooth lobes, the sori uniform, numerous New Zeal.

CC. *Stalks polished but somewhat woolly.*

12 **intermèdium,** Swartz Lvs 1 ft or more long, with a terminal pinna and 1–3 lateral ones on each side, lfts. 1 in. or more long, with interrupted sori on the upper and two-thirds of the outer margins. Trop Amer



120. Fruiting pinnules of Adiantum pedatum. (×1)

CCC *Stalks rough or hairy*

13. **formòsum,** R Br Lvs 1–2 ft long, two-thirds as broad, mostly tripinnate, with rough, scabrous stalks and rather small, deeply lobed lfts ½–¾ in long, with rounded and toothed outer margins Austral G 20 769

14 **pulveruléntum,** Linn Lvs often a foot long, with a large terminal pinna and several lateral ones, bipinnate, stalks purplish, hairy, as are also the rachises, lfts ¾–1 in long, ¼in wide, closely placed, the outer edge rounded or truncate W Indies

15 **villòsum,** Linn (*A rhomboìdeum*, Swartz) Lvs. large, with a terminal and several lateral pinnæ 6–12 in long, on stout, villous-hairy stalks, lfts numerous, nearly 1 in long, ⅓in wide, trapezoidal, with the inner side parallel to the rachis; indusia forming an almost continuous line along the upper and outer margins. W. Indies and S Amer

16. **nòvæ-caledòniæ,** Keys Lvs. 6–8 in. long and wide, somewhat pentagonal, once pinnate with one or two secondary basal pinnæ on the lower side at base; lfts attached to the rachises by a broad base, nearly 1 in. long, pointed, irregularly incised, bearing 1–4 rounded sori next to the base New Caledonia.

AAAA. *Lvs. forked, the two branches bearing pinnæ from the upper side*

B *Stalks polished, smooth.*

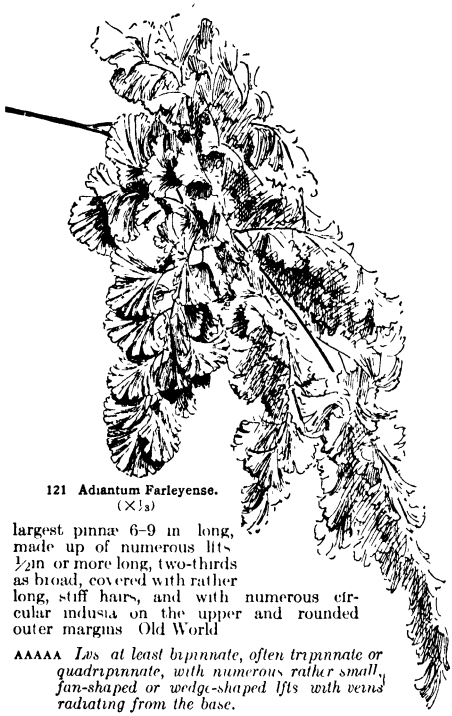
17. **pedàtum,** Linn. Fig 120 COMMON MAIDENHAIR of our northern states, with circular lvs on purplish stalks 1 ft or more high —Sometimes transplanted into gardens, requiring a shady, moist and protected place. G. 21:9.

18 **curvàtum,** Kaulf Lvs forked and with the main divisions once or twice forked, lfts 1–1½ in long,

nearly ½in. wide, the upper margin rounded and lobed. Brazil.

BB *Stalks scabrous (or rough).*

19 **hispídulum,** Swartz (*A. pubéscens,* Schk.). Lvs. forked, two divisions branching like a fan, with the



121 Adiantum Farleyense. (×⅓)

largest pinnæ 6–9 in long, made up of numerous lfts ½in or more long, two-thirds as broad, covered with rather long, stiff hairs, and with numerous circular indusia on the upper and rounded outer margins Old World

AAAAA *Lvs at least bipinnate, often tripinnate or quadripinnate, with numerous rather small, fan-shaped or wedge-shaped lfts with veins radiating from the base.*

B *Lfts an inch or less across*

C. *Edges deeply cut into a series of narrow lobes*

20 **Farleyénse,** Moore Fig 121 Lvs often reaching 15–24 in in length, forming a rich profusion of closely overlapping pinnæ, light green; lfts more or less wedge-shaped at base, with curved sides and the outer margin rounded and deeply cut into 10–15 narrow lobes, which rarely bear sori Barbadoes —Said to be a garden variety of *A tenerum,* but apparently a good species G C III 49 73

CC *Edges not lacinıately cut.*

21 **ténerum,** Swartz Lvs deltoid, 12–24 in long, two-thirds as wide, the terminal lfts equally, the lateral unequally, wedge-shaped at base, all of them rhombic and deciduous when dry, with 10 or less small sori on the outer and inner margins *A Làthomii, A Victòriæ, A rhodophýllum, A princeps, A acutum,* and *A. Bausei* are horticultural forms Fla. and Trop Amer

22 **Jórdanii,** C. Muell (*A. emarginàtum,* D C. Eaton, not Hook) Lvs 1 ft or more long, 6 in. wide, mostly twice pinnate, with nearly semicircular lfts , sori elongate, the indusium almost continuous around the margin of the lft Calif and Ore

23. **Williamsii,** Moore Lvs. triangular, nearly 1 ft. long, lfts. nearly semicircular, 3–4-lobed on the outer margin, bearing 5–8 sori covered with oblong indusia. Peru —Similar in habit to the last, but smaller and with more numerous sori.

BB. *Lfts. mostly less than a half inch across*

C. *Lvs. at least quadripinnate, broader than long.*

24 **Cóllisii,** Moore Lvs 1 ft. or more long, very broad, the black rachises apparently repeatedly forking, lfts rhombic-ovate or cuneate, those toward the outer portions longer and larger than those nearer the base —Of garden origin, possibly a hybrid.

CC *Lvs mostly triangular or oblong, longer than broad*

D *Shape of lfts rhombic, the indusia kidney-shaped or nearly circular.*

25 **concínnum,** HBK Fig 122 Lvs 2–3 pinnate, 12–18 in long, 6–9 in wide, on rather stout black stalks; lfts rhombic-oblong, slightly lobed, sori 4–8 on each lft , usually set close together Mex to Brazil Var. **làtum,** Moore Differs from type by stiff upright habit, and lfts twice as large and much separated

26 **aneiténse,** Carr Rootstock wide-creeping, covered with minute dark brown linear scales, lvs 2–2½ ft long, the stalks castaneous, rusty hairy above, the lf-blades deltoid, 1½–2 ft long and broad, 3–4-pinnate, the segm rhomboidal, the sori 4–6 to a segm. Aneiteum, New Hebrides

27 **tínctum,** Moore Lvs on stalks 4–6 in long, the blades 2-pinnate, deltoid, the stalks black, glossy, naked, the segms rhomboid, 3–4 lines long, the lower edge straight, the inner parallel to the rachis or just overlapping it, the outer edge bluntly lobed, sori round, on ultimate lobes Costa Rica to Peru

DD. *Shape of lfts roundish with obtuse base, small or medium size*

28. **æthiópicum,** Linn (*A. assímile,* Swartz) Lvs. 1 ft or more long on slender stalks, 2–3-pinnate, rather narrow, lfts roundish or obscurely 3-lobed, the margin finely serrulate, sori 2–3 to a lft , with oblong or kidney-shaped indusia Afr. and Austral

29 **excísum,** Kunze. Lvs. 2–3-pinnate, 6–12 in long, 3–4 in wide; lfts about ½in wide, roundish, with the margin cut into small rounded lobes, sori large, 2–4 to each lft , kidney-shaped or circular Chile

DDD *Shape of lfts distinctly cuneate at the base*

E *Indusia oblong or indistinctly lunate*

30 **Capíllus-Véneris,** Linn (*A. Férgusonii, A Mairisii,* Moore) Fig 123 Lvs 2–3-pinnate, 6–20 in long, 3–8 in wide, lfts nearly ½in wide, more or less irregularly lobed, at the outer margin; sori 1–3 to each lft with oblong or more or less elongate narrow indusia Native southward, and widely distributed throughout the Old World — Exists in many varieties, some of them deeply lobed, like *A Farleyense,* a compact imbricated form is very effective.



122 Pinna of Adiantum concinnum (×⅔)

31 **béllum,** Moore Small, tufted, 3–8 in high lvs. bipinnate, lfts with the outer margin erose and often divided into 2–3 shallow lobes; sori 2–3 to each lft., rather long and broad or somewhat lunate Bermuda. —A greenhouse species.

32 **Bessóniæ,** Jenman. Lvs 11–16 in. long, the stalks in tufts, stiff, black, shiny, with a few pale scales; lf -blades deltoid, 4-pinnate, the pinnulæ very densely imbricated so that many of them are covered over. Trinidad.



123. Pinna of Adiantum Capillus-Veneris. (×⅔)

EE. *Indusia nearly circular, with a narrow sinus.*

33 **cuneàtum,** Langs. & Fisch (*A æmulum, A múndulum,* Moore *A versaillénse, A. fragrantíssimum, A hýbridum,* Hort). Fig 124 Lvs 3–4-pinnate, deltoid, 6–15 in long, 5–9 in wide; lfts numerous, obtuse or broadly wedge-shaped at base, the margin rounded and more or less crenately lobed; sori 3–5 to each segm , with rather small rounded indusia Brazil — Runs into many forms, of which *A variegàtum* is one A F 18·508 *A Bárdii* differs from the type in having the fronds 2 ft or more long Var **grandíceps,** Moore Robust lvs numerous from a tufted crown, elongated, with tassel-like growths at the ends Var **Croweànum,** Hort A vigorous hardy form

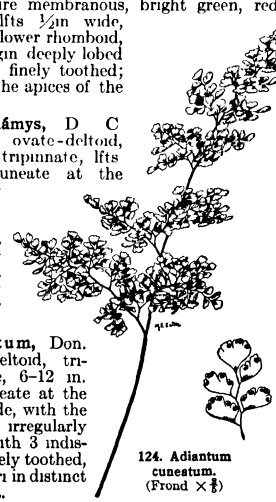
34. **Moòrei,** Baker (*A amábile,* Moore, not Liebm) Lvs 2–3-pinnate on long, slender stalks, 6–15 in long; lfts ¼–½in long, rhomboidal, with wedge-like base, deeply lobed, sori of medium size, 4–6 to each lft Peru

35 **Wágneri,** Mett (*A décorum, A Wièganáii, A élegans, A. Ówenii, A. cyclosòrum,* Moore) Lvs 2-3-pinnate, 6–9 in long, 4–6 in wide, lateral lfts rhomboid, the terminal cuneate, slightly lobed or incised, sori 4–6 to each lft.; very large membranous circular indusia Peru —*A Siébrechtii,* Hort , "supposed to be a cross between *A decorum* and *A Williamsii,*" has strong, graceful lvs thickly set with round pinnules of firm texture

36 **rubéllum,** Moore Lvs 4–6 in long, deltoid, bipinnate, texture membranous, bright green, reddish when young, lfts ½in wide, deltoid or the lower rhomboid, the outer margin deeply lobed and the lobes finely toothed; sori round at the apices of the lobes Bolivia

37. **monochlámys,** D C Eaton Lvs ovate-deltoid, 6–12 in long, tripinnate, lfts ¼in. wide, cuneate at the base, the upper edge rounded, and slightly toothed, with a single sorus or rarely two in a decided hollow at the upper edge Japan.

38. **venùstum,** Don. Lvs. ovate-deltoid, triquadri-pinnate, 6–12 in. long; lfts. cuneate at the base, ¼in wide, with the upper edge irregularly rounded or with 3 indistinct lobes, finely toothed, bearing 1–3 sori in distinct hollows. India.



124. Adiantum cuneatum. (Frond ×⅔)

BBB. *Lfts minute, innumerable, lvs 4–6-pinnate.*

39 **gracíllimum,** Moore (of horticultural origin). Lvs 1 ft or more long, nearly as wide, 4–6-pinnate, with innumerable very small lfts , which are ⅛–¼in wide and usually bear a single sorus or rarely two —Dense, compact forms are in cult. under the name of *A. Le-Grándii*

AAAAAA. *Lvs. 3–4-pinnate: st. climbing, several ft. long*

40. **digitàtum,** Presl (*A. speciòsum,* Hook *A palmàtum,* Moore) Lvs 2–3 ft long on a stalk 18 in or more long, with palmately lobed lfts. 1 in or more wide S Amer

A grossum, Mett Stove lvs lanceolate, to 1½ ft and 4 in broad, once-pinnate, leathery Colombia G C III 45 51 —*A roseum,* Backh , an undetermined horticultural name probably referable to A rubellum —*A scutum ramosum,* Hort *A* distinct form with fan-shaped lvs (properly A Ghiesbreghtii, Moore)

L M UNDERWOOD.
R. C. BENEDICT †

ADLÙMIA (from John Adlum). *Fumariàceæ* A hardy biennial vine, which climbs over high bushes in moist woods fls with the petals united into cordate-ovate corolla which ultimately encloses the small, few-seeded pod —Sow seed in spring in a damp, cool place Transplant in fall, if possible, if transplanted at all It does not flower the first season but remains low and bushy It will not tolerate open sun or windy situation



125. Adlumia fungosa

fungòsa, Greene (*A. cirrhòsa,* Raf). CLIMBING FUMITORY MOUNTAIN FRINGE ALLEGHENY VINE Figs 125, 126 Climbs by the slender young lf -stalks Lvs thrice pinnate, lfts cut-lobed, delicate fls white or purplish, in ample panicles G W F 13. V. 2 76 and 4 22 (all as *A. cirrhosa*). N TAYLOR †

ADODÉNDRUM *Rhododendron*

ADÒNIS (a favorite of Venus, after his death changed into a flower). *Ranunculàceæ* Hardy annual and perennial herbs planted for their showy flowers

Flowers solitary, terminal; petals 5–16, yellow or red, carpels many st about 1 ft high, very leafy· lvs. alternate, cut into very narrow divisions: fr an achene

The culture is simple in any good soil, light moist earth preferred. They thrive in full sun or partial shade; the perennial species well suited for rockwork and borders Only a few well-known species, natives of temperate regions of Europe and Asia; perhaps 20 in the genus

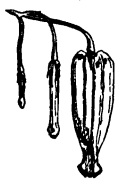
Annuals are propagated by the seeds, which are slow-germinating; the freshest seed is sown in autumn or earliest spring Perennials may, in like manner, be grown from seed and come to flower the first season,

but division of the roots is to be preferred as the flowers are then more abundant. Very early spring is the best time for dividing.

A *Annuals: fls crimson or scarlet.*

B *St simple except at top: center of fl yellow.*

æstivàlis, Linn. PHEASANT'S-EYE SUMMER ADONIS. Sts erect, often branched at top fls crimson, petals flat, obtuse, half longer than calyx. June, July Var **citrìna,** Hoffm., is a garden variety with citron-yellow fls



126 Flower of Adlumia fungosa (×¾)

parviflòra, Fisch Allied to above, not well recognized as a distinct species Differs in being smaller-fld. and less showy.

microcárpa, DC Apparently a pale-fld variation of *A æstivalis.*

BB *St branched center of fl dark*

autumnàlis, Linn FLOS ADONIS. AUTUMN ADONIS St branched fls. small, crimson, with dark center, globose, petals 6–8, concave, slightly larger than calyx. June–Sept Gn 12, p. 131.—Sparingly naturalized

AA *Perennials fls yellow*

B *St not branched*

vernàlis, Linn (*A apennìna,* Jacq *A. davùrica,* Reichb.) SPRING ADONIS Fig 127 St simple, lower lvs scale-like, others with lobes numerous, entire fls large, petals 10–15, lanceolate, slightly toothed, sepals smooth Early spring Gn 5, p 519, 39 268 Gn W 23 153 G 29 146, 9 122, 1 249 Var **álba,** Hort A form with white fls J H 52 39 (desc.) *A distórta,* Tenore, from Italy, a form with later fls

apennìna, Linn (*A vernàlis* var *sibírica* DC *A. sibirica,* Patrin.) This species is much like *A vernalis:* fls larger lower lvs sheath-like April Siberia.

BB *St branched*

pyrenàica, DC St branched petals 8–10, obtuse, smaller than in *A vernalis* lower lvs with long branched petioles, upper ones sessile, the numerous lobes always entire July Gn 39, p 269 Gn W 5 533 **A Ircutiàna,** DC., a form with some radical lvs., lobes dentate.

volgénsis, Stev (*A volgénsis,* Hort.) Much like *A vernalis,* but st branched lvs scale-like at base, petioled or sessile above fls like *A pyrenaica,* but sepals pubescent on under side April Volga region.

amurénsis, Regel & Radde A beautiful species, with broad yellow fls, not much cult in Amer., has many Japanese varieties B M 7190 G M 40 169, 48 212 Gn 52 6, 67, p 207, G C III 29 175 and III 37. 188, J H. III 50 299 (fl. pl.). K. C. DAVIS.

ADÓXA (Greek, *without glory,* i.e., *humble* or *obscure*) *Adoxàceæ,* but by some authorities placed in *Caprifoliaceæ* and formerly in *Araliaceæ* **A. Moschatéllina,** Linn., the Moschatel, is the only species. It is an inconspicuous herb 3–5 in. high, bearing tubers beneath the ground, with biternate lvs., and small greenish fls It occurs in England, Cent. Eu., and northward, and in subalpine and arctic regions in N. Amer It is scarcely cult but may occur in rock-gardens, being grown for its musky scent

ÆCHMÈA (from *aichme,* point; referring to the rigid points on the calyx) *Bromeliàceæ* Epiphytic herbs, of about sixty species, natives of tropical South America, grown in choice greenhouse collections.

Flower-cluster arising from a cluster or rosette of long, hard lvs which are serrate, petals 3, tongue-shaped, obtuse or pointed, 2–3 times the length of the spine-pointed calyx-lobes, stamens 6, shorter than the petals, ovary inferior, 3-celled. The fls are subtended by (in the axils of) fl.-bracts; the entire head or fl.-cluster is often reinforced or subtended by conspicuous lf.-bracts, in the compound-infl types, the individual branches are usually subtended by branch-bracts In some species, as *Æ. Lalindei* and *Æ. Mariæ-Reginæ,* the large colored lf.-bracts are the most conspicuous part of the plant In others, as *Æ. Veitchii,* the entire head is the showy part Monogr by Baker, Journ Bot. 1879 129, 161, 226 Includes *Canastrum, Echanostachys, Hohenbergia, Hoplophytum, Lamprococcus, Pironneava, Pothuava,* and some of the species have been referred to *Billbergia, Cryptanthus, Guzmannia, Tillandsia, Chevaliera,* and others

The æchmeas are closely allied to the billbergias, from which they are distinguished by smaller flowers, which are little exserted from the calyx and not widely expanding, short filaments and small anthers, sharp-pointed sepals and conspicuous sharp-pointed flower-bracts

For culture, see *Billbergia*

INDEX

cærulescens, 8
calyculata, 6
coelestis, 12
discolor, 10, 11
distichantha, 1
fasciata, 7
fulgens, 10
Lalindei, 2
lodigesii, 9
Mariæ-Reginæ, 3.
miniata, 11
spectabilis, 13
Veitchii, 4
Weilbachii, 9.

A *Fls 2-ranked on the branchlets.*

1 **distichántha,** Lem Lvs 2–3 ft long, with a dilated base 4–5 in. long and half as wide, the blade rigid and channelled, edges prickly scape 1–1½ ft., fls in a bipinnate panicle 4–7 in. long and half as wide, the petals tongue-shaped and red-purple, longer than the obtuse-cuspidate sepals, fl.-bract pocket-like, ¼in. long. Brazil B M 5417 J F 3 269.

AA *Fls multifarious,—in several or many rows on the spike or branchlets.*

B *Infl simple*

C *Ovary compressed or flattened*

2 **Lalíndei,** Lind. & Rod Large (3–4 ft.), with long and broad spine-edged lvs spike very dense, greenish white, from the color of the aggregated calyces, the fls subtended by many deflexed, showy red, long-pointed, entire bract-lvs., corolla green, not exserted Colombia I H 30 481. —Striking

3 **Mariæ-Reginæ,** Wendl Smaller than the last in all its parts petals blue-tipped when young, fading to crimson like the bracts, half as long again as the mealy cuspidate sepals, fl.-bracts entire, small, not showy bract-lvs toothed Costa Rica. B M 6141 Gt 49 1477. —One of the best species.

4. **Veitchii,** Baker. Lvs. spotted, serrate petals pale, a little longer than the sepals, fl.-bracts con-



127. Adonis vernalis. (×½)

spicuous, toothed, scarlet bract-lvs greenish, erect, serrate, not encompassing the infl S Amer B M. 6329 G Z 23, pl 30 —Referred to Ananas by Bentham & Hooker

CC *Ovary terete (cylindrical).*

D *Head oblong*

5. **Líndenii,** Koch (*Hoplophỳtum Líndenii,* Morr). Lvs. dilated and entire at base, the blade minutely toothed and 2–3 ft long, the tip broad-rounded and short-cuspidate petals lemon-yellow, twice as long as sepals. Brazil. B.M 6565

DD *Head globose*

6 **calyculàta,** Baker (*Hoplophỳtum calyculàtum,* Morr). Lvs about 1 ft long, with an oblong, dilated base, the blade minutely toothed and rounded at the tip, but terminated with a minute cusp scape shorter than the lvs , with several deciduous lanceolate bract-lvs , petals tongue-shaped, not ½in. long, bright yellow, fl.-bracts small, entire, reddish S Amer

7. **fasciàta,** Baker (*Bullbérgia fasciàta,* Lindl *B rhodocyànea,* Lem.) Lvs 1–2 ft long, with an oblong entire clasping base, the blade strongly toothed and the back marbled with whitish cross-lines, the tip rounded



128 Æchmea miniata var discolor (×⅓)

and mucronate. scape 1 ft high, floccose, the several bract-lvs pale red and erect, petals 4/4in long, pink. Brazil B M 4883 B R 1130 F S 3 207 —Infl. sometimes forked

BB *Infl. branched (or compound).*

C *Fls pedicellate*

8 **cæruléscens,** Baker Lvs 1½–2 ft long, with small prickles panicle 4–5 in long, 2-pinnate, with lax few-fld crowded branches, petals blush red, ½in. long fl.-bracts none or minute S. Amer Gt 1871: 694 —Produces white berries

CC *Fls sessile.*

D *Sepals blunt.*

E *Floral bracts large*

9. **Weilbachii,** F Didr Lvs rather short, overtopped by the red-stemmed and red-bracted scape: panicle narrow, 1-pinnate, the fls rather crowded, blue and red S Amer R H 1871 170

Var **leodiénsis,** André. Lvs violet and spotted: fls. shorter. Brazil

EE *Floral bracts minute or wanting*

10 **fúlgens.** Brongn (*Æ discolor,* Hort) Lvs broad, with small distant teeth, with a broad cuspidate end panicle large, simple above, branched below, glabrous, bearing numerous fls ; petals blue-tipped. exceeding the rich red calyx; fl.-bracts minute or none: branch-bracts yellowish S Amer. B M 4293.

11. **miniàta,** Baker Lvs serrate with numerous close small teeth panicle branched throughout, fls numerous, petals blue, ovary red Var **discolor,** Hort , Fig. 128, has the lvs purple or violet-brown on the back. Brazil.

DD. *Sepals pointed or awned.*

12 **cœléstis,** Morr Lvs linear, the margins with few minute spines or almost smooth panicle branched below, simple above, fls about 10 lines long, sepals white, petals blue Brazil

13 **spectàbilis,** Brongn Lvs linear, the margins armed with stout spines panicle laxly pyramidal, fls about 1¼ in long, sepals pale rose, petals white, purple at apex Venezuela and Colombia R H 1875 311

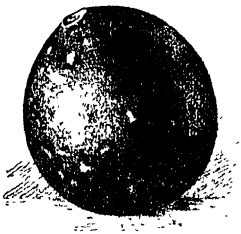
Æ aurantiaca, Baker=Canstrum aurantiacum —*E Barberi,* Baker Corolla pale yellow Honduras —*Æ beauclérsis,* Regel Lvs much dilated at base, whitish below, black-toothed petals light blue calyx and rachis red, panicle branched Brazil Gt 34 1202 —*E. bromelifolia,* Baker Dense spike lvs whitish below, 3-4 ft long, serrate or spinescent fls light yellow S. Amer —*Æ Cornu,* Carr =E nudicaulis — *E Drakeana,* Andre Lvs whitish, finely dentate spike simple and lax, fls long-tubular, light blue, bracts and ovaries coral-red berries rose, becoming blue S Amer R H 1885, p 101, dense —*E crenicharis,* Morr =Gravisia exsudans —*Æ Fürstenbergii,* Morr —Streptocalyx Fürstenbergii —*Æ gigas,* Morr Floral lvs crimson fls in a dense infl , sepals white, lepidote, corolla pale green Brazil B M 8107 — *Æ glomerata,* Hook =Hohenbergia stellata, Schult — *E Hystrix,* Morr Lvs lepidote, whitish, crowded spike oblong, dense, fls purple, tomentose Guiana — *E lanceolatacea,* C H Wright Fls distichous, paniculate, the sepals awned, green, the petals deep violet Grenada B M 8005 — *E macracantha,* Brongn —= E Schiedeana —*E Mahónii,* Hook Panicle 3-pinnate, dense, petals bright red lvs spiny, 1½–2 ft Guiana B M 5235 — *E mexicana,* Baker Lvs long and large, fine-toothed panicle 2-pinnate, long and lax, the peduncles nude, petals crimson Mex — *E miniata,* Hort =Bullbergia thyrsoidea(?) — *E myriophylla,* Morr Allied to *Æ distichantha* Lvs narrow, 2–3 ft., spiny, silvery-scaly on the back fls red, the petals fading blue Trop Amer B M 6939 — *E nudicaulis* Griseb Lvs long and straight, brown-toothed bract-lvs subtending spike large, brilliant red, petals yellow Trop Amer R H 1885 36 (as *E. Cornu,* which is a form with shorter and denser spike) — *E paniculigera,* Griseb Lvs large and long panicle 1–2 ft long, with few-fld branches scape tall, reddish, downy, fls purple Trop Amer — *E Schiedeana,* Schlecht (*E macracantha,* Brongn) Lvs large rigid, strongly armed panicle 3-pinnate, pubescent fls pale yellow Mex Gt 43 p 175 — *E serrata,* Mez Panicle very dense, bipinnate, fls distichous, sessile, sepals spinulose, petals violet, mucronate Martinique R H 1907 129—*Æ zebrina*=Billbergia zebrina

L H B
GEORGE V NASH †

ÆGLE (from Latin *Ægle,* one of the Hesperides) *Rutàceæ,* tribe *Citreæ* A small tree, often spiny, having hard-shelled frs lvs deciduous fls pentamerous with numerous free stamens, ovary with 10 or more cells, ovules numerous in each cell, cells of the fr without pulp vesicles, filled with gum, seeds woolly and in germination the cotyledons remain hypogeous the first foliage lvs are opposite —Only one species is now recognized

Mármelos, Correa (*Cratèva Mármelos,* Linn *Bèlou Mármelos,* W F Wight) Fig 129 The bael fruit of India A handsome tree native to N India, but widely cult throughout the Peninsula as well as in Ceylon, Burma, Siam and Indo-China The trifoliolate lvs , borne on wingless petioles, are thin in texture, probably owing to the fact that they are deciduous Although not so hardy as the deciduous trifoliate orange of China and Japan, the bael fruit tree is said to endure a considerable degree of cold (20° F or lower) in the drier parts of N W India The fr is greenish yellow, globular, or nearly so, varying from 2–6 (usually 4–5) in in diam The fr of the wild tree is considerably smaller than that of the cult. form The hard shell, ⅛in thick, is filled with the pale orange, aromatic pulp in which occur 10–15 long, narrow cells containing the seeds imbedded in transparent tenacious gum These cells correspond to the segms of an orange, while the pulp is made up of the pith and the greatly thickened fleshy membranes separating the

cells. Ill Roxb., Pl. Corom , pl. 143 Wight, Ic , pl 16 Bedd , Fl Sylv , pl. 161. Benth. & Trim , Med Pl , 55. Bonav , Oranges and Lemons of India and Ceylon, Atlas, pl 242, 243. The ripe fr is much esteemed by the Hindus, many of whom consider it the best of the citrous frs , the European residents in India often become very fond of it.



129 Ægle Marmelos (×⅓)

Watt says (Dict of Econom Prod of India, 1 123) "The fruit, when ripe, is sweetish, wholesome, nutritious, and very palatable, and much esteemed and eaten by all classes The ripe fruit, diluted with water, forms, with the addition of a small quantity of tamarind and sugar, a delicious and cooling drink" The famous botanist, Roxburgh, says (Flora Indica, 2 580) "The fruit is nutritious, warm, cathartic, in taste delicious, in fragrance exquisite, "

On the other hand, W R Mustoe, Superintendent, Government Archeological Gardens, Lahore, India, writes (in a letter to D G Fairchild, dated Lahore, Dec 3, 1908) "The fruit is greatly prized for eating by the natives, but can scarcely be looked upon as palatable to the white man except as a sherbet, " Sherbet is made from the mashed pulp, which is diluted with a little water, and then strained into milk or soda-water and sugared to taste Sometimes a little tamarind is added to give a subacid flavor All Indian medical authorities agree that the bael fruit has a most salutory influence on the digestive system The ripe fruit is mildly laxative and is a good simple remedy for dyspepsia The unripe fruit is a specific of the highest value for dysentery, but so mild that it can be given to children without danger The bael fruit tree is widely cultivated in India and is found in nearly every temple garden It is dedicated to Siva, whose worship cannot be completed without its leaves This promising fruit tree is now being tested at several points in the warmer parts of the United States

Æ Bárteri Hook f = Balsamocitrus paniculata, Swingle —*Æ decándra*, Naves = Chætospermum glutinosa Swingle —*Æ glutinósa*, Merrill—Chætospermum glutinosa, Swingle - *Æ sepiaria*, DC = Poncirus trifoliata, Raf

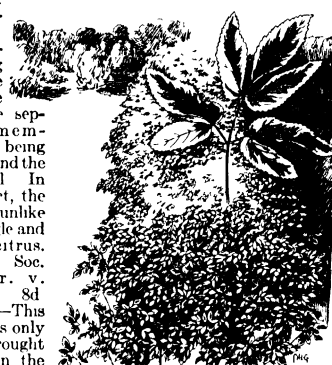
WALTER T SWINGLE



130 Æglopsis Chevalieri (×½, fl ×½)

ÆGLÓPSIS (*Ægle, opsis*, appearance) *Rutàceæ*, tribe *Citreæ* A small spiny tree, having simple persistent lvs with short, wingless petioles, and frs with a thin rather hard shell the fls are pentamerous with 10 stamens, ovary 6–7-celled, ovules numerous in each cell cells of the fr without pulp vesicles, filled with gum The seeds are smooth, and in germination the cotyledons remain hypogeous, the first foliage lvs are opposite Only one species is known

Chevalièri, Swingle Fig 130 A large shrub or small spiny tree growing near the coast in Côte d'Ivoire, Trop W. Afr , probably occurring also in Liberia The spines occur singly alongside of the axillary bud and are long, slender and straight (See Fig. 130) The fls are borne in small, more or less branched panicles composed of 4–40 fls. The fruits are globose or slightly pyriform, deep orange, with a thin, hard shell ⅛in. thick Inside of this shell are 6 (rarely 5 or 7) cells filled with large sublenticular seeds imbedded in a fragrant mucilage These cells correspond to the segms of an orange and are triangular in outline, occupying almost the whole space, the separating membranes being very thin and the pith small In this respect, the fr is quite unlike frs of Ægle and Balsamocitrus. Ill Bull Soc. Bot Fr. v. 58 Mém 8d pl 2, 3 —This species was only recently brought to light in the collections of the Muséum d'Histoire Naturelle at Paris It is reported as growing in swamps near the sea If it is able to resist brackish water it may prove to be a stock of value on which to graft citrous frs as most, if not all, of the species of Citrus are very sensitive to salty soils (alkali) Trees of this species are growing in the greenhouses of the Jardin des Plantes at Paris and in those of the U S Dept of Agric Young seedlings are being grown for trial as stocks on which to graft other citrous frs



131. Ægopodium Podograria var. variegatum.

WALTER T SWINGLE.

ÆGOPÒDIUM (*aix*, goat, and *podion*, a little foot; probably from the shape of the lfts) *Umbellíferæ*. GOUTWEED. Coarse, hardy herbaceous perennial, with creeping rootstocks, biternate lvs , sharply toothed, ovate lfts , white fls in umbels frs. ovate, glabrous, with equal filiform ribs, and no oil-tubes

Podogrària, Linn , var **variegàtum,** Hort Fig 131. Twelve to 14 in —A rapid-growing variegated form of this European weed, which makes attractive mats of white-margined foliage Common in yards, and planted as edging and mats against buildings and in shady places. Prop readily by division, and of simplest cult.

N. TAYLOR †

AERÁNTHUS Certain species described under this genus are treated in *Angræcum*

AËRIDES (Greek, *air-plant*). *Orchidàceæ* Epiphytic hothouse orchids

Stems leafy, without pseudobulbs· lvs distichous, coriaceous or fleshy, the persistent sheaths covering the

st.. fls. borne in simple or compound lateral clusters; sepals about equal, spreading, the dorsal broader than the lateral; petals similar to the dorsal sepal; lip erect, or bent in, attached to the foot of the column, spurred at the base, the spur hollow, pollinia 2.—Species about 30, distributed from Malay Archipelago to India, E. Asia and Japan.

Nearly all the species of this genus are from the East Indies and therefore require the warmhouse treatment, with a minimum of 65° F in winter As they have no pseudobulbs, but an erect, evergreen stem, they must never be allowed to become perfectly dry. Ample drainage of charcoal and broken pots is very essential, with a surfacing of moss, preferably sphagnum, renewed each year, the usual peat fiber being omitted. The best-known species is *A. odoratum* and is often seen in collections flowering freely. *A Fieldingii* is also an interesting plant, as the spikes grow to the length of 18 inches, are dense-flowered, and known as the "fox-brush orchid," the color being a beautiful rose-pink *A. Lawrenciæ* is another fine plant, from the Philippines but not yet common in gardens.—Propagation is effected only by cutting off the top of the plant and setting it down in another pot, and waiting for the other part to send out shoots. The roots are mostly aerial, and no attempt must be made to confine these to the pots. If the size pot used is large, it should be perforated at the sides to admit of a free circulation of air. (Orpet.)

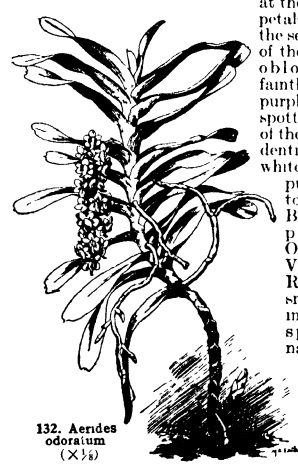
INDEX.

affine, 12
Amesianum, 5
Augustianum, 10
Ballantineanum, 4
birmanicum, 1
Brookei, 15
cornutum, 1.
crassifolium, 11.
crispum, 15
cylindricum, 18.
Dayanum, 2.
Ellisii, 2
expansum, 8.
falcatum, 8
Fieldingii, 13.
Godefroyanum, 12
Houlletianum, 9
Japonicum, 17
Larpentæ, 8
Lawrenciæ, 5
Lawrenceanum, 5
Leanum, 6
Leonæi, 8
Lindleyanum, 15
Lobbii, 12
maculosum, 14
majus, 1
mitratum, 19
multiflorum, 12
odoratum, 1
purpurascens, 1.
quinquevulnerum, 3
radicosum, 16
Rœbelinii, 3
roseum, 12
rubrum, 16
Sanderæ, 2
Sanderianum, 5
Savageanum, 7
Schroederi, 14
suavissimum, 4
vandarum, 18
virens, 2
Warneri, 15.

KEY TO THE SPECIES.

A *Lvs flat, keeled*
- B *Middle lobe of the lip incurved between the larger lateral lobes*
  - C *Spur curved*
    - D *Fls 1½ in long or less*
      - E *Lateral lobes of the lip white*
        - F *Length of fls 1 in or more*
          - G *Lip not spotted or with few spots, fls crowded, concealing the stem* — 1 **odoratum**
          - GG *Lip usually much spotted, fls not crowded, revealing the stem* — 2 **virens**
        - FF *Length of fls less than 1 in* — 3 **quinquevulnerum**
      - EE *Lateral lobes of the lip lemon-yellow* — 4. **suavissimum**
    - DD *Fls exceeding 1½ in long* — 5 **Lawrenciæ**
  - CC *Spur straight*
    - D *Raceme much longer than the lvs; middle lobe of the lip ovate-triangular* — 6 **Leanum**
    - DD *Racemes as long as the lvs, middle lobe of the lip linear-oblong* — 7 **Savageanum**
- BB. *Middle lobe of the lip spreading, not incurved*
  - C. *Sts long lvs. numerous, 5 in. or more long*
    - D *Lateral lobes of lip large, usually falcate or lunate*
      - E. *Spur short, conic*
        - F *Sepals and petals white* — 8 **falcatum**
        - FF. *Sepals and petals tawny yellow* — 9. **Houlletianum**
      - EE *Spur long, cylindric*
        - F *Shape of spur straight* — 10 **Augustianum**
        - FF *Shape of spur recurved or hooked* — 11 **crassifolium**
    - DD *Lateral lobes of lip smaller or wanting*
      - E. *Racemes drooping or pendulous*
        - F *Middle lobe of lip entire*
          - G *The spur straight*
            - H *The middle lobe of lip cordate, obtuse* — 12 **multiflorum**
            - HH *The middle lobe of lip deltoid, acuminate* — 13 **Fieldingii**
          - GG *The spur incurved or hooked* — 14 **maculosum**
        - FF *Middle lobe of lip serrate, lateral lobes small* — 15 **crispum**
      - EE *Racemes erect or ascending* — 16 **radicosum**
    - CC *Sts short lvs few, 4 in long or less* — 17 **japonicum**
- AA. *Lvs terete or semiterete, grooved on the upper surface*
  - B *Fls few, white, 2 in or more across* — 18 **vandarum**
  - BB *Fls numerous, less than 1 in across, the lip violet* — 19 **mitratum**

1 **odoràtum,** Lour (*A cornùtum*, Roxbg) Fig. 132 Lvs 6–8 in long, up to 2 in broad racemes nodding, equaling or longer than the lvs, fls about 1 in long, fragrant; sepals and petals white, with a carmine spot at the obtuse apex, the petals narrower than the sepals, lateral lobes of the lip erect, round-oblong, white, or faintly tinged with purple, and somewhat spotted, middle lobe of the lip linear-oblong, denticulate or entire, white, with a median purple line India to Cochin China B M 4139 Gn 49, p 158 F C 2 75 O R 6 273, 8 217 Var **birmánicum,** Reichb f Fls smaller, with lines instead of apical spots, and the narrow middle lobe of the lip with few marginal teeth Var **purpuráscens,** Hort Racemes larger, and the sepals and petals tipped with dull amethyst G C II 16 597 Var **màjus,** Hort. Racemes and fls larger



132. Aerides odoratum (×⅛)

2 **vìrens,** Lindl Lvs up to 10 in long and 1¼ in broad racemes longer than the lvs, fls over 1 in long, fragrant, sepals and petals white, with a bright purple apical spot, broadly oval, obtuse, lip deeply 3-lobed, the oblong lateral lobes much the larger, erect, white, purple-spotted below, the middle lobe oblong, small, incurved, purple, or white with a median purple stripe, spur green-tipped Java P M. 14·197 B R 30 41 Var **Éllisii,** Hort (*A. Éllisii*, Hort.). Sepals and petals white, flushed with rose, the tips amethyst-purple Var **Dayànum,** Hort Racemes longer, with large bright fls. Var. **Sánderæ,** Hort. A form in which the fls. are pure white.

3 **quinquevúlnerum,** Lindl. Lvs up to 1 ft long and 1½ in. broad. racemes commonly longer than the lvs.; fls usually less than 1 in long, sepals and petals obtuse, oval-oblong, white, tipped with amethyst and with a few purple spots below; lip 3-lobed, the erect lateral lobes triangular-oblong, white, faintly purple-dotted, the middle lobe oblong, deep amethyst, the spur incurved green Philippine Isls P M. 8 241. Var.

Rœbelínii (*A Rœbelínii*, Reichb. f.). Differs in the denticulate petals which shade to green at the base, and in the rose-colored middle lobe of the lip. Philippine Isls

4 **suavíssimum,** Lindl. Lvs. up to 10 in. long and 1½ in. broad, racemes longer than the lvs., fls. fragrant, somewhat crowded, sepals and petals white, flushed with lilac, tipped with rose-lilac, the dorsal sepal broadly oval, the lateral larger; lip 3-lobed, the erect lateral lobes rounded-oblong, lemon-yellow, purple-spotted, the middle lobe linear-oblong, paler than the lateral lobes. Malacca. C. O., pl. 6. J. F. 2, pl. 213. Var **Ballantineànum,** Veitch. Blooms a little earlier: racemes shorter, the sepals and petals amethyst-tipped.

5 **Láwrenciæ,** Reichb. (*A. Lawrenciànum*, Hort.) Lvs. up to 1 ft. long and 2 in. broad, racemes equaling or longer than the lvs., fls. over 1½ in. long, fragrant, sepals and petals white, amethyst-tipped, lip deeply 3-lobed, the denticulate lateral lobes hatchet-shaped, white, the middle lobe oblong, amethyst, the spur green, incurved. Philippine Isls. Gn. 35: 485. G. C. III. 20: 629, 30: 435. Var **Amesiànum,** Kranzl. A more robust plant, with fls. of a more intense color. Var **Sanderiànum,** Hort. Differs in its narrow lvs. and yellowish fls.

6 **Leànum,** Reichb. f. Lvs. up to 10 in. long and 1½ in. broad, racemes longer than the lvs., fls. less than 1 in. long, sepals and petals rose-purple with a white base, lip 3-lobed, the lateral lobes round, incurved, and nearly inclosing the small, ovate-triangular, deep purple middle lobe, spur straight, green-tipped. India.

7 **Savageànum,** Veitch. Lvs. up to 10 in. long and 1¼ in. wide, racemes equaling the lvs., fls. less than 1 in. long, sepals and petals with the white base dotted with purple, the upper portion crimson, lip crimson-purple, the erect lateral lobes round-oblong, the middle lobe linear-oblong, small, incurved, spur straight, greenish.

8 **falcàtum,** Lindl. & Paxt. (*A. Larpéntæ*, Hort. *A. expansum*, Reichb. f.). Lvs. up to 8 in. long and 1½ in. broad, racemes equaling or exceeding the lvs., fls. about 1¼ in. long, sepals and petals white, tipped with amethyst-purple, lip 3-lobed, the spreading lateral lobes falcate, light amethyst, the middle lobe deep amethyst, broadly obovate, notched, denticulate, spur short, greenish. Upper Burma. Var **Leònæi** (*A. Leònæi*, Reichb. f.). Differs in having the middle lobe of the lip larger and of deeper color, and in the dotting of the lateral lobes and of the base of the sepals and petals. Rangoon.

9 **Houlletiànum,** Reichb. f. Resembles *A. falcatum*, but differs in its smaller fls., arranged in shorter and denser racemes, the sepals and petals tawny yellow, tipped with purple, the lip white, striped and spotted with purple, the middle lobe fimbriate. Cochin China. C. O., pl. 3. I. H. 29: 455. R. B. 21: 205. R. H. 1891: 324.

10 **Augustiànum,** Rolfe. Lvs. up to 8 in. long and 1¼ in. broad, racemes longer than the lvs.; fls. 1–1½ in. long, sepals and petals rose, round-oblong, obtuse, lip 3-lobed, the oblong lateral lobes falcate, rounded or truncate at the summit, the broadly oblong middle lobe crenulate, somewhat bilobed at the apex, spur straight. Philippine Isls. G. C. III. 7: 233.

11 **crassifòlium,** Par. & Reichb. f. Lvs. up to 8 in. long and 2 in. wide, racemes longer than lvs., fls. loosely arranged, 1–1½ in. long, sepals and petals rose-purple, paler at the base, lip 3-lobed, the lateral lobes rose-purple, nearly lunate or crescent-shaped, the broadly ovate middle lobe deep rose-purple, spur curved, greenish at the tip. Burma. G. C. II. 8: 493. C. O., pl. 1.

12. **multifidrum,** Roxbg. (*A. affine*, Wall. *A. rœseum*, Paxt.). Lvs. up to 10 in. long, less than 1 in. broad: racemes longer than the lvs., fls. about ¾ in. long; basal portion of the oval-oblong petals and dorsal sepal white, with a few purple spots, the remainder light amethyst, the nearly orbicular lateral sepals white, faintly flushed; lip light amethyst, deeper in the middle, cordate, obtuse, spur straight, short. B. M. 4049. Gt. 8: 267. J. F. 2: 200. Var **Lóbbii,** Veitch (*A. Lóbbii*, Hort.). Differs from the type in its much-crowded lvs., and in the fls. which are more numerous and more highly colored. I. H. 15: 559. Var **Godefroyànum,** Veitch (*A. Godefroyànum*, Reichb. f.). Lvs. longer: fls. a little larger and more highly colored than in the type. R. B. 17: 169.

13 **Fièldingii,** Lodd. FOX-BRUSH ORCHID. Lvs. up to 10 in. long and nearly 2 in. broad, infl. racemose, sometimes paniculate at the base, longer than the lvs.; fls. about 1½ in. long, crowded, petals and dorsal sepal white, suffused with rose, or the basal portion sometimes white and dotted with purple, obovate, the lateral sepals white, tipped with pale purple, broadly oval, lip white, suffused with rose, deltoid or trowel-shaped, acuminate, the small lateral lobes inrolled over the mouth of the small white spur which is amethyst, mottled with white. Sikkim and Assam. B. H. 1876. 18, 19. A. F. 22: 883.

14 **maculòsum,** Lindl. Lvs. up to 10 in. long and nearly 2 in. broad, infl. longer than the lvs., often paniculate at the base, fls. about 1½ in. long, the sepals and petals white, the upper portion stained and spotted with amethyst, oval-oblong, lip clawed, the blade amethyst, deeper in the middle, ovate-oblong, obtuse, with 2 small white tubercles at the base, spur incurved, short, green-tipped. India. Var **Schroèderi,** Veitch. Differs from the type in its more robust habit, its longer lvs., and the darker markings of the sepals, petals, and middle of the lip. G. C. II. 13: 493, 17: 341. J. F. 1: 54.

15 **crispum,** Lindl. (*A. Broòkii*, Batem.). Lvs. up to 8 in. long and 2 in. broad, infl. several times longer than the lvs., racemose, or sometimes paniculate at the base; fls. about 2 in. long, the sepals and petals white, faintly flushed with rose-purple on the back and on the surface at the apex, lip 3-lobed, the erect, small lateral lobes white, streaked with rose-purple on the surface, round-oblong, the middle lobe deep amethyst, white at the base, broadly ovate, the sides reflexed, serrate; spur small, curved. S. India. B. M. 4427. F. S. 5. 438. Gn. 4, p. 85. B. R. 28: 55. F. S. 1: 42. G. C. III. 36: 134. Var. **Lindleyànum,** Hort. Infl. paniculate at the base; fls. larger than in the type, the lip with the lateral lobes greenish and the middle lobe rich amethyst bordered with white. Neilgherry Hills. Var. **Wárneri,** Hort. Differs in having the lvs. shorter and narrower than in the type, and in its longer racemes of smaller fls., the middle lobe of the lip deep rose with a white border.

16 **radicòsum,** Reichb. (*A. rùbrum*, Hort.). Lvs. up to 10 in. long and 1½ in. broad, infl. longer than the lvs., racemose, or sometimes paniculate at the base, fls. about 1¾ in. long, the sepals and petals light rose-purple, deeper spotted, lip 3-lobed, the small erect lateral lobes round, rose-purple, the middle lobe deep rose-purple, oblong, acute, spur curved, short. India.

17 **japónicum,** Reichb. f. Lvs. up to 4 in. long, few: racemes longer than the lvs.; fls. about 1 in. long, fragrant, sepals and petals greenish white, the lateral sepals bordered with brownish purple, lip 3-lobed, the lateral lobes small, the middle lobe obovate-spatulate, crenulate, white, with a median dark violet ridge and a few paler spots, spur straight, obtuse. Japan. B. M. 5798. I. H. 29: 461.

18 **vandárum,** Reichb. f. (*A. cylíndricum*, Hook.). St. slender, round, lvs. terete, grooved on the upper surface, up to 8 in. long: fls. single or in few-fld. racemes, white, about 2 in. long, sepals and petals undulate, the former obovate-oblong, the latter nearly rhomboidal, lip 3-lobed, the lateral lobes linear-falcate, the middle

lobe broadly obcordate, spur subulate. Himalayan region. B.M. 4982. J.H. III. 34.417. O.R. 13.60.

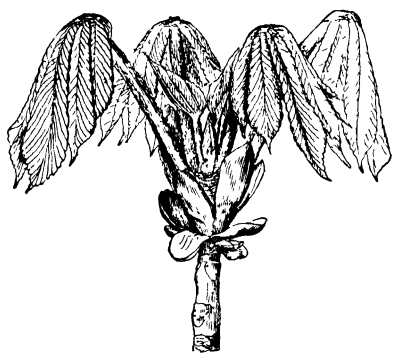
19. **mitrâtum,** Reichb f St short, with a few semiterete lvs 6–15 in long, deeply grooved on the upper surface. racemes from below the lvs and shorter than them, ascending or nearly erect, fls ¾in long, sepals and petals white, flushed with mauve at the apex; lip amethyst, spur miter-shaped, short. Burma. B.M. 5728.

A Micholitzii, Rolfe A recently intro species, allied to A. odoratum Light rose-purple fls and a rather short spur Annam. O R 1904 181 —*A cylindricum*, Lindl Resembles A vandarum in habit and foliage Fls about 1½ in across, the sepals and petals waxy white, sometimes tinged rose, the lip white, the side lobes purple-streaked, the middle lobe yellow with a crimson tip India G C. III 17 393 —4 *Duquésnei*, Hort Fls white dotted with rose —*A Emerica*, Reichb Fls 1 in long, the sepals and petals white, amethyst-blotched at apex, the side lobes of lip purple-spotted, the middle lobe small, narrowly oblong, acute, amethyst, spur incurved B M 6728 —*A Thibautianum*, Reichb. Racemes longer than the lvs fls rose with an amethyst lip, spur curved

GEORGE V NASH.

ÆRUA (said to be from the Arabic name) *Amarantàceæ*. A genus of 10 species of Trop Asiatic and African herbs or shrubs, allied to Achyranthes, with perfect or imperfect fls, the perianth segms short and hyaline, stamens 5 or 4, sterile filaments intervening; fls. very small, usually in clusters, white or rusty

sanguinolénta, Blume (*A. sanguínea*, Hort) Lvs 1½–2½ in. long, opposite or alternate, ovate-acuminate,



133. Opening foliage of Æsculus Hippocastanum.

soft-pubescent, pale beneath Java —Cult. for its dark red lvs Not common and at present perhaps confined to botanic gardens

N. TAYLOR.†

ÆSCHYNÁNTHUS: *Trichosporum*

ÆSCULUS (ancient name of some oak or mast-bearing tree) Including *Pàvia Hippocastandceæ* HORSE-CHESTNUT BUCKEYE Trees or sometimes shrubs, cultivated for shade and for the conspicuous bloom of some species

Winter-buds large with several pairs of outer scales: lvs opposite, long-petioled, digitate, deciduous; lfts. 5–9, serrate: fls symmetrical in terminal panicles, calyx campanulate to tubular, unequally 4–5-toothed, petals 4–5, with long claws, stamens 5–9; ovary 3-celled, with 2-ovuled cells fr. a large 3-valved caps., usually with 1 or 2 large seeds, seeds large, brown, with a large pale hilum —About 20 species in N. Amer , E. Asia, Himalayas and Balkan Peninsula

The buckeyes are deciduous trees and shrubs, with large, digitate leaves and red, white or yellow flowers in showy terminal panicles They are cultivated for their showy flowers and handsome foliage, and some species make excellent shade trees. The large seeds are not edible

Some species, as *Æ Hippocastanum* and *Æ. carnea* are popular shade and street trees They leaf early and soon give a dense shade The shrubby species are well adapted for borders of larger groups or as solitary clumps on the lawn, particularly *Æ parviflora*, with its slender panicles of white flowers, similar in habit and effect but with bright scarlet flowers, are *Æ discolor*, *Æ georgiana* and *Æ splendens* Most of the species are hardy North, but the Californian and Himalayan species are suitable only for the southern states They grow best in loamy and moist soil

Propagation is by seeds to be sown in autumn or stratified, or by side-grafting and budding on common species, and the shrubby forms also by layers, *Æ. parviflora* is propagated also by root-cuttings

INDEX

Arguta, 8
atro-sanguinea, 11, 13.
austriaca, 14
Baumannii, 1
Briotii, 2
Buckleyi, 8
californica, 4
carnea, 2
chinensis, 5
discolor, 14.
discolor, 1
Ellwangeri, 11
flava, 9
flavescens, 14
flore-pleno, 1
georgiana, 10
glabra, 8
Henkelii, 1
heterophylla, 1
Hippocastanum, 1.
humilis, 13
hybrida, 12
incisa, 1
indica, 7
intermedia, 2
laciniata, 1
lutea, 9
Lyonii, 12
macrostachya, 10
Memmingeri, 1
mollis, 14
nana, 13
octandra, 9, 14
ohioensis, 8
parviflora, 16
Pavia, 11, 13, 14
pendula, 13
plantierensis, 2
pumila, 1
pyramidalis, 1
rubicunda, 2
rubra, 13
Schirnhoferi, 1
sinensis 3
splendens, 15
subcarnea, 13
turbinata, 3
umbraculifera, 1
variegata, 1
versicolor, 12
Wheltleyi, 11
Wilsoni, 6
wurtzburgensis, 11

A. *Winter-buds resinous claws of petals not longer than calyx, stamens exserted*

B. *Lfts sessile petals 5, calyx campanulate, 5-lobed, stamens 5–8 fr globular (Hippocastanum)*

C *Lvs glabrous beneath*

1 **Hippocástanum,** Linn COMMON HORSE-CHESTNUT Fig 133 Large tree, 60–80 ft lfts 5–7, sessile, cuneate-obovate, acuminate, obtusely serrate, nearly glabrous panicles 8–12 in long, very showy, fls white, tinged with red, ¾in long fr echinate May N Greece, Bulgaria H.W 3 47 F E 13, pl 13 (habit) — Many garden forms, the most important are Var **Baumánnii,** Schneid (var *flòre-plèno*, Lem), with double white fls I H 2 50 F S 7, p 75 B H 4, p 133 G M 44 613 A.G 32 271 (habit) Var **Schirnhôferi,** Rosenth , with double yellowish red fls W I G 1882 101 Var **pùmila,** Dipp , dwarf form Var **umbraculífera,** Rehd , with compact round head M D G 1903 188 Var **pyramidàlis,** Nichols , with compact, narrow, pyramidal head Var **laciniàta,** Leroy (var *dissécta*, Hort , var *heterophylla*, Hort), lfts laciniate Var **incìsa,** Dipp Lfts short and broad, deeply and doubly serrate to incisely lobed Var **Hénkelii,** Henkel, is little different, only the lfts are narrower and the habit more pyramidal Var **variegàta,** Loud , lvs variegated with yellow Var **Memmíngeri,** Bean Lvs sprinkled with white —The horse-chestnut is one of the most popular of shade trees on the continent of Europe, and is also much planted along roads and in parks and private grounds in this country It is particularly adaptable for bowers and places where seats are desired, as the top stands heading-in and makes a very dense shade It is the first of all shade trees to burst into leaf When smaller, more formal trees are desired, var. *umbraculifera* should be planted The double-fld forms are to be recommended for the longer duration of their fls and for the absence of the fr. which is of great, often annoying, attraction to the small boy In dry situations, the planting of the horse-chestnut should be avoided, as the foliage is likely to suffer, particularly in dry seasons, from drought and heat

2. **cárnea,** Hayne (*Æ. Hippocástanum* × *Pàvia A. rubicúnda,* Loisel, *Æ intermèdia,* André) Tree, 20–40 ft lfts mostly 5, nearly sessile, cuneate-obovate, crenate-serrate, nearly glabrous panicles 5–8 in. long, fls varying from flesh-color to scarlet. fr. with small prickles Garden origin B R. 1056 L B C. 13.1242 F S 2229–30. F.E 23 607 (habit) —Common in parks and on roadsides. Handsome and desirable; the foliage is darker and of firmer texture than that of the preceding species and resists drought better Many garden forms, according to the different shades in coloring; one of the best is var **Briôtii,** Nichols (*Æ rubicúnda* var. *Briôtii,* Carr), with bright scarlet fls. R H 1878: 370 Also var **plantieréensis,** Rehd (*Æ plantieréensis,* André), with yellowish white fls tinged with pink and fading to pink and with bluntly serrate lfts , is very handsome.

CC *Lvs pubescent beneath, at least while young*

3 **turbinàta,** Blume (*Æ sinénsis,* Hort , not Bunge) JAPANESE HORSE-CHESTNUT Tree, 70 ft petioles and young branchlets pubescent, lfts 5–7, cuneate-obovate, crenate-serrate, pubescent beneath when young. panicles 6–10 in long, dense and rather narrow, pubescent, fls yellowish white, with a red spot, less than ½in long fr verrucose June Japan G C III 5:717, 31:187 S I F 1.71 —The lvs are larger than those of the preceding species, but the individual fls are smaller and less strongly marked with red Hardy at the Arnold Arboretum

BB *Lfts stalked petals 4, calyx 2-lipped, stamens 7–9: fr pear-shaped, smooth* (*Calothyrsus*)

C. *Petals nearly equal, oblong-obovate to oblanceolate.*

D *Corolla about 1 in long*

4 **californica,** Nutt CALIFORNIA BUCKEYE. Tree with broad top, 30–40 ft lfts 5–7, petioled, oblong-lanceolate, cuneate or obtuse at the base, sharply serrate, glabrous, 4–6 in long panicles 3–8 in long, rather dense, fls white or pale rose-colored, 1 in long, petals of equal length Calif B M 5077 R H 1855, p 150. Gn 49, pp 490, 492 S S 2 71, 72 F S 13 1312 G C. III 31 186 G M 55 577 (habit)

DD *Corolla much less than 1 in long*

5 **chinénsis,** Bunge Tree, to 60 ft lfts 5–7, short-stalked, oblong-obovate to oblong-oblanceolate, acuminate, cuneate at the base, glabrous beneath, except sparingly hairy on the veins, closely serrulate, 4–7 in. long fls less than ½in long, white, in elongated cylindric panicles fr subglobose, slightly depressed at the apex, with thick walls, seeds 1 in across or less with the hilum occupying about one-half of the seed May, June N China G C III 52 316, 317 —Recently intro by the Arnold Arboretum and probably hardy N

6 **Wilsonii,** Rehd Tree, to 80 ft lfts 5–7, stalked, oblong-obovate to oblong-oblanceolate, acuminate, rounded or broadly cuneate at the base, densely grayish pubescent beneath while young, 4–9 in long· fls about ½in long, the upper petals with a yellow spot, in cylindric panicles 6–12 in long fr ovoid, somewhat pointed at the apex, with thin walls, seeds 1½ in across with the hilum occupying one-third or less of the seed May, June W and Cent. China —Recently intro by the Arnold Arboretum, but proved tender in Mass , probably hardy south of New York, and a tree highly to be recommended for its very large spikes of white fls.

CC. *Petals unequal, about 1 in. long, the upper ones marked red and yellow, oblanceolate, the lateral ones with oval or obovate blade.*

7 **indica,** Colebr Tall tree, to 60 ft lfts. 5–9, obovate-lanceolate, short-stalked, finely serrate, cuneate at the base, glabrous or nearly so beneath, 6–10 in long panicle to 15 in. long, narrow; fls about 1 in long with white unequal petals, the upper with yellow blotch, the lower tinged rose Himalayas B M 5117. G C 33:139; 36 206 Gn 76, p. 399 —A handsome tree with large foliage and showy fls , hardy only in the southern states

AA. *Winter-buds not resinous claws mostly longer than the 5-toothed calyx.*

B *Fls yellow to scarlet, petals 4, stamens included or somewhat exserted lfts petioled* (*Pavia*)

C. *Petals villous at the margin (interspersed with glands in the hybrid).*

D. *Color of fls. yellow, margin of petals without glands.*

8 **glàbra,** Willd (*Æ ohioénsis,* Michx *Pàvia glàbra,* Spach *P pállida,* Spach) OHIO BUCKEYE Small tree, 15–30 ft lfts 5, oval or cuneate-obovate, finely serrate, smooth panicles 5–6 in long, fls greenish yellow, petals of nearly equal length, their claws as long as the calyx, stamens exserted fr echinate May. Pa. to Ala and Iowa B R 24 51 S S 2 67, 68 F E 29: 773 (habit) Var **Búckleyi,** Sarg (*Æ glàbra* var. *arguta,* Rob partly) Shrub lfts 6–7, obovate-lanceolate, unequally serrate, more acuminate, finely pubescent beneath Has been confounded with the true *Æ. arguta,* Buckl

9 **octándra,** Marsh (*Æ flàva,* Ait *Æ lùtea,* Wang *Pàvia lùtea,* Poir) SWEET BUCKEYE Large tree, 40–90 ft lfts 5, oblong-obovate or elliptical, cuneate,



134. Æsculus georgiana. (×⅓)

equally serrate, smooth or pubescent beneath panicles 4–6 in long; petals yellow, very unequal, their claws longer than the calyx, stamens 7, shorter than the petals fr smooth May, June Pa. to Ga and Iowa L B C 13 1280 S S 2 69, 70. G W. 7, p 145 (habit)

DD. *Color of fls. red or yellow tinged more or less with red*

E. *Margin of petals without glands, villous*

10 **georgiàna,** Sarg Fig 134 Shrub, to 6 ft lfts 5, stalked, oblong-obovate, long-pointed, finely and often doubly serrate, pale yellowish green beneath and quite glabrous fls 1¼ in long, in dense panicles 5–6 in long, calyx narrow-campanulate, red, petals red and yellow, very dissimilar, the lateral ones broad, usually rounded at the base; stamens 7, shorter than the petals, villous below the middle May, June Ga S T S 2 197.—This is the only species of the *Æ octandra* group with red and yellow fls · it is very handsome and has proved perfectly hardy at the Arnold Arboretum

11 **wœrlitzénsis,** Koehne Tree· lfts obovate-oblong, yellowish green beneath, sparingly hairy along the midrib and bearded in the axils, otherwise quite glabrous with 17–20 pairs of veins fls 1–1¼ in long, in

panicles 4–5 in long; calyx tubular, wider above the middle, petals red, the lateral ones with an oblong-oval or oblong-obovate blade gradually narrowed at the base; stamens as long as the lateral petals May Of garden origin Var. **Ellwángeri,** Rehd (*Æ Pàvia* var. *Whitleyi*, Ellwanger & Barry, not Hort Angl *Æ Pàvia* var. *atrosanguínea*, Hort.). Lfts slightly hairy on the whole under surface while young, with 20–27 pairs of veins: fls darker red, calyx narrower, not widened above the middle Origin unknown —Very similar to *Æ Pavia*, but easily distinguished by the villous margin of the petals

EE. *Margin of petals with hairs and glands: fls. yellow and reddish*

12 **hýbrida,** DC. (*Æ. octándra* × *Pàvia*, *Æ versicolor*, Wender. *Pàvia hýbrida*, Spach *Æ.* or *P Lyonii*, Hort). Intermediate between *Æ octandra* and *Æ. Pavia*. Lfts pubescent beneath along the veins, short-petioled, minutely crenulate-serrate. calyx narrow-campanulate, red or yellow or reddish, stamens pubescent toward the base origin. , W D B 2.164 (as *Æ Pavia*) —Several forms of this hybrid are in color of the fls from yellow, slightly tinged with red, to nearly red Here belong also several forms cult in gardens as *Æ discolor* and *Æ Pàvia* var *argùta*, Lindl , with red fls (B R 993).

CC *Petals only glandular, not villous on the margin, red, or red and yellow.*

D *Lvs glabrous beneath or only slightly pubescent along the midrib.*

13 **Pàvia,** Linn (*Pàvia rùbra*, Poir. *P. Michauxii*, Spach). RED BUCKEYE. Shrub or small tree, 4–20 ft lfts oblong or elliptical, acute at both ends, finely serrate, smooth or pubescent beneath panicles 4–7 in long, loose, fls purplish to dark red, calyx tubular, petals very dissimilar, stamens mostly 8, nearly as long as the petals fr smooth May, June Va to Fla. and La L B C. 13 1257 S T S 2 199 —Many garden forms, as var **hùmilis,** Moullef (*Æ hùmilis*, Lodd *Æ Pàvia* var *nàna*, Dipp *Æ. Pàvia* var *péndula*, Hort *Æ rùbra* var *hùmilis*, Loud) Low shrub, sometimes prostrate, 2–4 ft lfts coarsely and unequally serrate, slightly pubescent beneath, chiefly along the veins fls red, calyx dark red B R 1018 Var **atrosanguínea,** Rehd Fls very dark red Var **sublacinìata,** Wats (*Pàvia atropurpùrea*, Spach) Lfts. narrrower oblong, deeply serrate fls dark red W D B. 2 120 There are also forms with variegated lvs

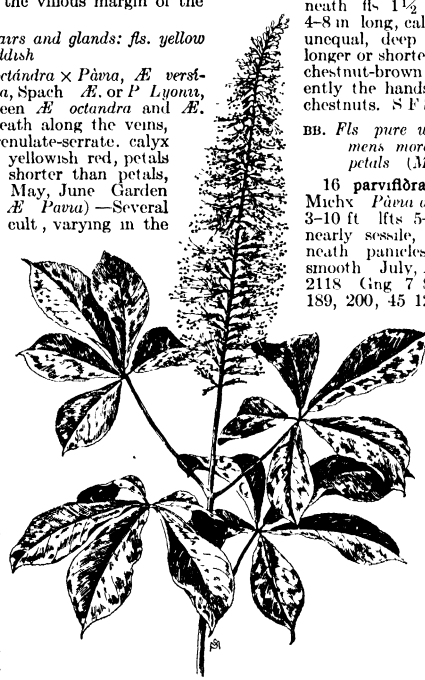
DD *Lvs tomentose or densely pubescent beneath.*

14 **discolor,** Pursh (*Æ Pàvia* var *discolor*, Torr. & Gray *Æ octándra* var *hýbrida*, Sarg , partly) Shrub or small tree, to 30 ft · lfts 5, elliptic to oblong-obovate, acuminate, finely crenately serrate, whitish tomentose beneath panicles 6–8 in. long, rather narrow; fls. 1¼ in long; calyx tubular, deep scarlet like the axis of the panicle; petals very unequal, scarlet and yellow in the typical form; stamens at least longer than the shorter pair of petals: fr smooth; seeds light yellowish brown May, June Ga to Texas and S Mo. B R 4:310 S S 13:622 S O B 1:39 (as *Æ Pavia*). Var **móllis,** Sarg (*Æ móllis*, Raf *Æ austrìna*, Small). Fls deep scarlet A very handsome variety with its long and rather slender racemes of bright scarlet fls It has proved hardy at the Arnold Arboretum Var. **flavéscens,** Sarg Fls yellow This is the yellow-fld. Texan buckeye formerly referred to *Æ octandra*

15 **spléndens,** Sarg A shrub, 8–12 ft lfts 5, lanceolate to oblanceolate, acuminate, finely and often doubly crenulate-serrate, densely hoary pubescent beneath fls 1½ in long in many-fld panicles 4–8 in long, calyx tubular, bright red, petals unequal, deep scarlet; stamens usually 7, longer or shorter than the petals seeds dark chestnut-brown May, June Ala —Apparently the handsomest in flower of all horsechestnuts. S F S 2 200.

BB. *Fls pure white, small, petals 4–5; stamens more than twice as long as the petals* (*Macrothyrsus*)

16 **parviflòra,** Walt (*Æ macrostàchya*, Michx *Pàvia alba*, Poir) Fig 135 Shrub, 3–10 ft lfts 5–7, elliptical or oblong-ovate, nearly sessile, finely serrate, pubescent beneath panicles 8 16 in long, narrow fr. smooth July, Aug Southern states B M 2118 Gng 7 81 G C II 8 653, III 31 189, 200, 45 123 Gn 63, p 299, 75, p 568 M D G 1897 305 Gn M 9 76 A F 24 533, 28 724 (habit), 34 190 —One of the handsomest plants for a lawn clump



135. Æsculus parviflora. (×⅓)

Æ arguta, Buckl (Æ glabra var arguta, Rob) Allied to Æ glabra Shrub, 1 5 ft lfts 7–9, lanceolate to obovate-lanceolate, sharply and often doubly serrate, pubescent beneath fls light yellowish green Texas S T S 2 198 — Not in cult , the plant that is cult under this name is E glabra var Buckleyi — *Æ hushii*, Schneid Supposed hybrid of Æ glabra and discolor Tree, to 30 ft lfts oblong-obovate, finely and bluntly serrate, pubescent below calyx pink, petals pink and yellow, glandular and villous at the margin fr slightly tuberculate Ark Hardy at the Arnold Arboretum —*Æ glaucéscens*, Sarg Related to Æ octandra Shrub, to 10 ft Lfts larger, glabrous and glaucescent beneath fls larger fr smaller Ga S T S 2 196 —*Æ humilis*, Koehne, not Lodd Related to Æ discolor and possibly variety Low shrub lvs tomentose beneath fls red and yellow Of unknown origin — *Æ marylándica*, Booth Supposed hybrid of Æ glabra and octandra Of unknown origin —*Æ neglécta*, Lindl Near Æ octandra, but petals veined with purple toward the base of the blade the lfts are glabrous beneath Of unknown origin B R 12 1009 —*Æ Párryi*, Gray Similar to A californica Lfts small, obovate, canescent-tomentose beneath calyx 5-lobed Calif G F 3 356

ALFRED REHDER.

ÆTHEOPÁPPUS. *Centaurea*

ÆTHIONÈMA (*aitho*, scorch, and *nema*, filament; probably referring to appearance of stamens) *Cruciferæ* Dwarf, shrubby herbs for the hardy herbaceous border, or rockery Less common than Iberis

The genus differs from Iberis in having all its petals equal, and from Lepidium in having its four stamens longer, winged and toothed Fls various shades of pink, purple, or red, in crowded terminal racemes. W. B Hemsley, in Gn 9, pp 108, 109

Æthionemas dislike moist or stiff soil or shady places; but in light, sandy loam, on dry and sunny slopes, they are compact and branchy, and when once fairly established will last for many successive years without replanting or renewal, while, under the opposite conditions, the plants grow feeble and lanky, and may die after a year

or two They keep fully as well as the candytufts in water, and can be cut with longer and straighter stems.

Propagation is by seeds in spring or by cuttings in summer, annual and biennial kinds by seeds

A *Perennial*

coridifŏlium, DC (*Ibèris jucúnda,* Schott & Kotschy). Branches numerous, thick, 4–6 in high. lvs. crowded, short, nerveless, linear or linear-oblong, acute or obtuse fls rosy lilac, smaller and later than in the next, in dense, short, rounded racemes Chalky summits of Lebanon and Taurus B M 5952 —Good for edging *Æ. pulchellum* was sold under this name for many years

grandiflŏrum, Boiss & Hohen Branches 1–1½ ft., prostrate lvs usually longer than in *Æ coridifolium,* more linear and more acute fls as large as those of *Arabis alpina,* rose-colored, in slender, elongated racemes, petals 4 times as long as the sepals Persia Gn 9 108 Useful in the rock-garden

pulchéllum, Boiss & Huet Similar to *Æ coridifolium,* but more diffuse and trailing Fls smaller and brighter-colored, petals 2½ times as long as the sepals Persia Gn 25 320

iberídeum, Boiss St cespitose, ascending, rough lvs glaucous, bunched, oblong or linear-lanceolate, narrowly acute at the base fls large and showy, white, racemose, flowering from June to Sept E. Medit region —Not well known in Amer

AA *Annual*

cappadŏcicum, Spreng (*Æ Buxbaùmi,* DC) Six to 8 in lvs oblong or linear-oblong, spatulate, glaucous fls racemose, the racemes crowded, corolla pale red. June Orient

Æ dùbia Bunge 10 in high fls pale, rosy lilac Mts of Armenia GN 63 109 *Æ persicum,* Hort Stout, erect, shrubby, dwarf fls deep rose —Best of dwarfs Intro 1892, by J W Manning N TAYLOR †

ÆXTÓXICON (Greek, *aix,* goat, and *toxicon,* poison) *Euphorbiàceæ* Trees, rarely cult Younger parts covered with deciduous scales lvs alternate, simple, leathery fls with petals and disk, in short clusters fr fleshy, 1-seeded The single species from the Chilian coast (*Æ punctàtum,* Ruiz & Pav.), and known there as tique, palo muerto, acietunillo and olvillo, is listed once in the U S Dept of Agric inventories of seeds and plants intro J B S NORTON

AFZÈLIA (named for Adam Afzelius, of Upsala, and once resident in Sierra Leone) *Leguminòsæ* A small genus of unarmed trees, in Afr and the Pacific Isls fls with vexillum much exceeding calyx and clawed, the lateral and anterior petals scale-like or wanting, perfect stamens 7, staminodia 2 **A. bíjuga,** Gray Tree lvs abruptly pinnate, the lfts mostly in 2 pairs, ovate. fls in small terminal panicles pod oblong and flat, 5–8 in long by 2 in wide, seeds compressed-orbicular, 1 in or more in diam Described from the Fiji Isls, but apparently widely distributed in Oceanica Apparently not cult, but it is the "ifit," used in Guam as a cabinet-wood and for general construction purposes.

AGALLÒCHA *Eriocaulàceæ*

AGÁLMYLA (*agalma,* ornament, and *hule,* wood; an ornament to the woods in which they grow wild) *Gesneràceæ* A genus of 3 species of tender climbers from Java and Sumatra which may be grown in a basket like Æschynanthus (Trichosporum) Fls in axillary bunches, the corolla 5-lobed, oblique, but scarcely 2-lipped. lvs. simple, alternate

A longistyla, Carr., is considered a synonym of the next, but apparently has a longer style R H 1873 270 —*A staminea,* Blume SCARLET ROOT BLOSSOM St rooting from the lower surface lvs alternate, with an abortive one opposite the base of each petiole 4–8 in long, blade as long, ovate, serrate fls in large axillary sessile fascicles of 12–14, stamens exserted B M 5747 P M. 15 73 F S 4 358. N TAYLOR †

AGANÍSIA (Greek, meaning *desirable*) *Orchidàceæ.* Epiphytes grown on blocks

Stems short, finally forming pseudobulbs, arising from a creeping rhizome lf 1· fls few, in an erect raceme from the base of the pseudobulb, sepals and petals nearly alike, spreading, lateral lobes of the lip short or obsolete, the middle lobe broad, spreading, entire or 2- or 3-lobed, pollinia 4 —Species 2, natives of S Amer. For culture and propagation, see article on Orchids

cyànea, Reichb (*A tricolor,* N E Br *Acacàllis cyànea,* Lindl.) Pseudobulbs ovoid, up to 2 in long, 1- or 2-lvd lvs narrowed to a short petiole, up to 6 in long raceme of 4–7 fls over 2 in wide, sepals and petals pale mauve, especially the latter, lip with a rose-purple reniform limb and a fringed claw Brazil Lind 1 45 —Very rare in cult Needs a high temp

pulchélla, Lindl. Pseudobulbs ovoid, barely 1 in. long, 1-lvd lvs 3–5 in long, narrowed into a long petiole raceme of 4–6 fls about 1½ in broad, sepals and petals white, lip with the lower part nearly round, concave, spotted with red, the upper part larger, broadly ovate, yellow in the center Guiana. B R 26 32 — Very rare in cult

A tenóptera, Nichols Fls blue, nodding, the sepals and petals tipped white, the white lip with the lateral lobes red-streaked, the middle lobe transversely oblong, with 2 red bars Peru B M 7270 GEORGE V. NASH

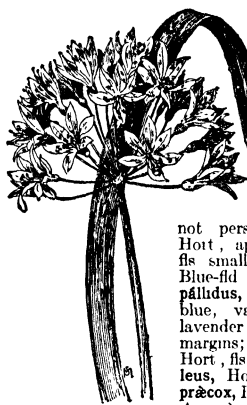
AGAPÁNTHUS (*agape,* love, and *anthos,* flower). *Liliàceæ.* Conservatory plants, with tuberous rootstocks, blooming from late spring to fall, but mostly in summer

Plant robust and tall (dwarf forms) scape simple, fls in 2-bracted umbels, in shades of blue and varying to white, perianth with 6 wide-spreading divisions, nearly regular, stamens 6 pod many-seeded, seeds flat, winged above foliage usually evergreen, but vanishing early in some of the forms S Afr —Probably only one species, although several have been described

In this country, agapanthuses are usually grown in tubs (the roots are likely to burst pots), and are flowered in summer in the conservatory, window-garden, living-room, or set in protected places in the open The plant is kept dormant during winter, as in a frame or light cellar, only enough life being maintained to prevent the leaves from falling When in bloom, give abundance of water Plants will bloom many years if given a large enough tub, not allowed to become overcrowded in the tub, and supplied with manure-water, sending up many clusters each year Good results can also be obtained in single pots It forces well If kept dormant until spring, plants may be bedded in the open, or massed in vases, for summer bloom —Propagation is effected by dividing the roots (and rarely by seeds). Old roots break up more easily if soaked in water a few hours When dormant, the plant will stand a few degrees—usually 10° or less—of frost.

umbellàtus, L'Her AFRICAN LILY. LILY-OF-THE-NILE (although native to Cape of Good Hope region) Fig 136 Lvs 2 ft. long and numerous, thick, narrow scape rising 2–3 ft. from the lf.-rosette, bearing an umbel of 10–30 handsome blue fls., perianth funnel-shaped, 1½–2 in long, with short tube B M 500 —One of the best known of half-hardy liliaceous plants Very variable in the wild, and many of the forms have been intro to cult Tall or giant forms Var **multiflŏrus,** Voss (var *máximus,* Hort *A multiflòrus,* Willd.), taller than the prevailing forms, the bright blue large fls as many as 30–60 in an umbel, the lvs broader, Var. **gigantèus,** Hort., a very robust form (to 4 ft.)

with 150–200 dark blue fls Dwarf forms· Var **minor,** Hort., very small, with slender narrow lvs (½in or less broad) and deep blue fls which are 1 in or less long; var. **Mooreànus,** Hort , 1½ ft., lvs short and upright, fls. dark blue, and as large as in *A. umbellatus* itself; hardy, var **Leichtlinii,** Hort , 1½ ft , fls. bright hyacinth-blue in a very compact umbel Variegated forms Var **variegàtus,** Hort , lvs. white with sparse green stripes, rather small, var **aùreus,** Hort , lvs striped yellow White-fld forms Var **álbidus,** Hort , fls pure white, rather small but many, the lvs usually not persisting; var. **Saintpaùlii,** Hort , apparently similar to last fls smaller than in *A umbellatus* Blue-fld forms of usual habit Var **pállidus,** Hort , fls pale porcelain-blue, var **Weillighii,** Hort , fls lavender with indigo-blue lines and margins; var **Saundersoniànus,** Hort , fls dark blue; var **atrocærùleus,** Hort , fls dark violet; var **præcox,** Hort (var *minimus,* Lindl *A præcox,* Willd), is an earlier form, blooming in June or even earlier and by some regarded as a distinct species, the lvs narrower than in the type, fls smaller and 30–40 in the umbel, pale blue, with narrow perianth segms , and the peduncle or scape short, var **flòre plèno,** Hort , a double-fld blue form, the fls long-lasting Very recent introductions are Var. **globòsus** (*A globòsus,* Bull), a dwarf-growing form, producing dense globular umbels on long scapes, the fls about 1 in across, the outer segms lilac-blue shaded white and the inner ones emarginate and darker, the lvs deciduous, var **insignis** (*A insignis,* Bull), tall, the basal part of the arching lvs milk-white, the fls very numerous on long slender pedicels and drooping in the very large umbel, pale lavender Gn 64, p 67. G M 46, p 423 G.W 1903, p 529, 531; var **cauléscens** (*A cauléscens,* Spreng), fls. blue, lighter inside, long-pedicelled and the outer ones nodding, the root with thickened fibers, intro by Carl Sprenger of Naples. Gt. 50.1487. L. H B.



136. Agapanthus umbellatus.

AGAPÈTES (Greek *agapetos,* beloved or lovable, referring to the beauty of the plant) *Ericàceæ,* subfamily *Vaccinioideæ* Shrubs sometimes cultivated for their handsome flowers and attractive foliage.

Evergreen plants, often epiphytic and with the sts. thickened at the base lvs alternate, or irregularly whorled, short-petioled or sessile, entire or slightly toothed fls in axillary fascicles or short racemes, rarely solitary; calyx-tube turbinate, with 5-lobed limb, corolla tubular to campanulate, with 5, usually curved lobes, stamens 10, with short filaments, anthers produced into 2 long beaks opening at the apex by a pore or slit, ovary 5-celled, inferior fr a juicy or dry berry with many seeds —About 30 species from the southern Himalayas to N. Austral , chiefly in the humid mountain forests at elevations of 3,000–6,000 ft.

The several species in cultivation are highly ornamental shrubs with handsome lustrous foliage and showy usually scarlet or bright red clustered flowers They are sometimes grown in warm greenhouses in Europe, but apparently none of them is in the American trade.

They grow best in a porous soil consisting of peat, leaf-mold, fibrous loam and plenty of sand; the smaller kinds are suitable for growing in baskets on account of their epiphytic nature. Out-of-doors they could be grown only in warmer temperate regions, in localities in which the air possesses sufficient humidity and in partial shade

Propagation is by cuttings of half-ripened wood under glass in the warm greenhouse

A buxifòlia, Nutt Branches and calyx hairy lvs obovate-cuneate, crenately serrate, glabrous, about 1 in long fls axillary, 1–2, cylindric, bright red with spreading lobes Himalayas B M 5012 G C III 27 197 —*A glàbra,* Clarke (Thibaudia glabra, Griff) Glabrous lvs oblong-lanceolate, rounded at the base, sometimes elliptic, obscurely crenate, about 5 in long fls several, axillary, tubular, ventricose below the middle, ¾in long, white, greenish toward the apex, pink at the base Himalayas Gn 10 p 539 —1 *macrántha,* Benth & Hook (Thibaudia macrantha, Hook) Plant glabrous lvs lanceolate, long acuminate, 3-4 in long fls in 2-3-fld clusters, outside of the axils, pendulous urceolate, 5-ribbed, 2 in long, yellowish white, marked with red wavy transverse lines E India B M 4566 F S 6 640 J F 1 95 G C III 15 501 R H 1852 81 R B 26 J81 —*A Mùderi,* Hemsl Lvs oblong-lanceolate, usually whorled at the end of the branches, entire, glabrous, 2 3½ in long fls in short axillary, 6 9-fld racemes, cylindric, scarlet or orange-red, 1½ in long, lobes reflexed, narrow, yellow within Himalayas B M 7928 —1 *setígera,* D Don (Thibaudia setigera, Wall) Lvs oblong or lanceolate, about 4 in long, usually whorled fls in lateral clusters, deep red, usually hairy, ¾in long pedicels and calyx hairy Himalayas Wight Icon 1180, 1181 (as Vaccinium verticillatum and V. Wallichianum) —*A speciòsa,* Hemsl Glabrous lvs ovate-oblong, subcordate at the base, slightly serrulate, 3-4 in long fls 3 6, axillary, cylindric-urceolate, 5-ribbed, deep crimson, 1½ in long Probably from Burma G C III 41 237 —1 *variegàta,* D Don (Thibaudia pulcherrima, Wall A pulcherrima, Benth & Hook) Tall shrub, glabrous lvs elliptic-lanceolate, 6 8 in long fls on the old wood in many-fld dense clusters, cylindric-campanulate, 5-angled, pale red marked dark red, 1 in long Himalayas B M 4303 F S 3, pt 7 1-2 ALFRED REHDER

AGÁRICUS A genus of fleshy fungi, considered under *Mushroom*

AGARÍSTA: *Leptosyne*

AGATHÆA: *Felicia*

ÁGATHIS (*agathis,* glome, the flowers in clusters) *Pinàceæ* Tender Australian dioecious conifers, allied to Araucaria, yielding dammar resin

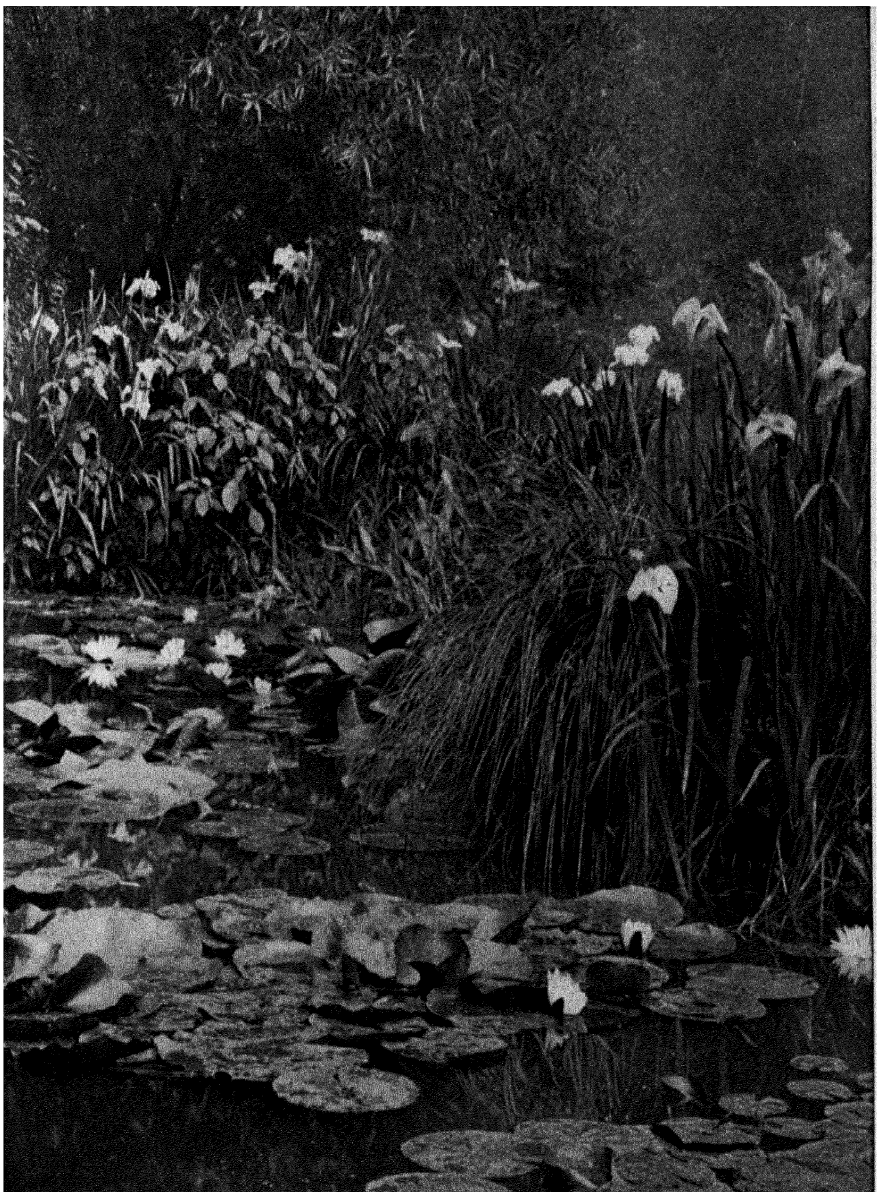
Leaves coriaceous, not needle-like, usually broad, petioled or almost sessile, opposite or alternate cones axillary, ovate or globular, composed of persistent, bractless scales Distinguished from pines and firs by the broad-parallel-veined lvs —Not uncommon in botanic garden collections where they are grown in the temperate house

robústa, Hook (*Dammara robusta,* C Moore *D Brównii,* Hort) Branches somewhat verticillate, horizontal lvs broad, ovate-lanceolate, obtuse, short-stalked, 3½–4 in long, 2–3 in wide cones oval, 3–4 in. long, 2–3 in wide tree reaching 130 ft in Austral —Cult. in Calif

australis, Salisb (*Dammàra australis,* Lambert). The KAWRI PINE Tree, 120–150 ft lvs sessile, linear oblong, rarely elliptic, alternate, or opposite on the branchlets, 1½–2 in. long, ½ ¾in wide staminate catkins solitary, cones almost spherical, 2–3 in. diam New Zeal G F 2 583 Lambert, Pinus 2 44 —Cult outdoors in Calif , but not very successfully Kawri gum, much used in the manufacture of varnish, is the partly fossilized resin of *A australis* It is found 5–6 ft below the surface of the ground, in the northern part of New Zeal , where there were vast forests of this tree in ages past

orientàlis, Lambert Fig 137 Tree, 100 ft lvs opposite or alternate, entire, coriaceous, glaucous, 2–4 in. long, 1½ in wide, sometimes a little falcate staminate catkins 2 in long: cones globular or turbinate, solitary, peduncled, and axillary E. Indies Lambert, Pinus 2.43. B M. 5359 —Cult outdoors in Calif. and in greenhouses elsewhere. Both this and the preceding intro by Franceschi of Santa Barbara, Calif (as *Dammara orientalis.*) N TAYLOR.

AGÀVE (Greek, *agauos,* admirable). *Amaryllidàceæ.* Important decorative and economic plants from hot



VI. A good example of aquatic gardening, with water-lilies and Japanese iris.

American deserts, the most familiar of which is *A. americana*, the CENTURY PLANT, or AMERICAN ALOE

Stem short or wanting lvs mostly in a close rosette, usually stiff and more or less fleshy, persisting from year to year, the margins mostly armed with teeth and the apex tipped with a usually pungent spine· fls in spikes (Littæa) or panicles (Euagave); perianth 6-parted, more or less funnel-shaped, stamens 6, mostly long-exserted, style 1, stigma capitately 3-lobed, ovary inferior, 3-celled; seeds numerous, flat, thin, black —Some species flower but once and die, others occasionally, while others flower from year to year The number of species is fully 300, and more than 325 have been described, largely from the Mexican tableland, although each island of the W. Indies possesses its peculiar species One of the largest collections is at Kew, where there are 85 named species The largest collections in the U S are at the Botanical Garden of Washington and the Missouri Botanical Garden, where there are about 75 species each Amateurs often cult a greater number of species than are described in this account.

The most complete monographs of the genus as a whole are by General von Jacobi, in the Hamburg Garten Zeitung, 1864–1865, of which a limited number of reprints with supplements were issued in book form, and by J G Baker in the Gardeners' Chronicle, 1877, with excellent small illustrations, which was amplified in his Handbook of the Amaryllideæ, 1888. Several of the natural groups composing the subgenus Euagave have been monographed and illustrated in the Reports of the Missouri Botanical Garden, one of which also contains a monograph of the species known to occur in Lower California The half-hundred West Indian species are figured and monographically treated in the eleventh volume of Memoirs of the National Academy of Sciences Engelmann has published a monograph of the species of the United States, first classified on flower characters, in the Transactions of the Academy of Science of St Louis, Vol III

Agaves are essentially fanciers' or amateurs' plants. This noble group of plants has never received the attention it deserves, and yet no genus of plants in America furnishes so many suitable decorative plants Sir Joseph Hooker places it next to the palm and aloe, but the former is a great family of 1,100 species While in the United States one thinks of the agaves only as decorative plants, yet in Mexico, their native home, they are the most useful of plants Many species furnish fiber, others soap, while still others produce the two great Mexican drinks, *pulque* and *mescal* Pulque, which is a fermented drink, is derived from several species, especially *A atrovirens* Mescal, which is a distilled drink, is usually not obtained from the same species as pulque, although there is a general belief to the contrary The species from which is made most of the mescal used in Mexico is unknown —The species vary so much in size and form that they can be used in a great many ways. Some of the smaller species are suitable for the house, and even some of the larger species are so used. The larger species are well adapted for vases in large gardens and grounds, along walks, terraces, and the like. These plants, coming, as they do, from arid or even desert regions, where they have a hard struggle to exist, can be grown with little or no care, but they respond very quickly to good treatment. —The species are propagated in various ways, some produce suckers at the base, or even underground shoots; others give off buds from the stem, which fall off and take root, or may be detached and planted, while not a few produce bulblets in the flower-clusters, and sometimes in great abundance. Nearly all may be produced from seed, but as most of the species flower only after a long interval, and many have not yet been known to flower in cultivation, this latter means of propagation cannot be relied upon. In cultivation, fruit is set very sparingly or not at all without artificial pollination, although this can be accomplished with very little trouble (J N Rose)



137 Agathis orientalis. (×⅙)

The agaves are not at all difficult to grow The soil should be principally loam and sand, and if any vegetable soil be given it should be in small quantities. Good drainage and firm potting are necessary To grow small plants of the large-leaved kinds into good-sized specimens quickly, they should be plunged out in a sunny spot in spring, taking care that the pots are large enough so that they will not require repotting in the fall Nearly all of the large-growing kinds are easily increased from suckers, which, when the plants are grown in a pot-bound condition, are produced very readily They should be taken off from the parent plant only when furnished with sufficient roots to give them a start Some kinds are raised only from seeds, which, when freshly gathered, germinate in a few weeks (G W Oliver)

The classification of the agaves is very perplexing. This is partially owing to the number of species, to the scarcity of preserved study material, and to the infrequency of flowering in many species In fact, many species have never been known to flower The most usable characters for classification are to be found in the leaves, of which the end-spine and marginal prickles are very characteristic, and, although such an arrangement is more or less artificial, it is the most satisfactory in naming a collection From a botanical point of view, however, the inflorescence shows the true relationship of the species In this way the genus is usually divided into three groups or subgenera. These are: First, *Euagave*, having a paniculate inflorescence, with candelabra-like branches Second, *Littæa*, having a dense spike of usually paired flowers (The section *Littæa* has been considered by some a good genus, but it seems to connect with the first section through certain species) The third section, *Manfreda*, is very different from the above, and is now considered as a distinct generic type, and so treated here Manfredas are all herbaceous, appearing each year from a bulbous base the leaves are soft and weak, dying down annually, while the in florescence is a slender open spike, with solitary flowers from the axils of bracts

INDEX.

abortiva, 33.
adornata, 48.
albicans, 30.
alboda, 11.
altissima, 21.
americana, 19, 21.
amœna, 11.
amurensis, 43
anacantha, 2
ananassoides, 8
angustifolia, 1
angustissima, 48
applanata, 13, 14
artichaut, 40
atricha, 49
atrovirens, 19.
attenuata, 28
auricantha, 11
Baker, 5
Beaucarnei, 39
Bauleriana, 10
Besseriana, 6.
Besseriana, 6.
Bigutii, 48
Bonapartea, 49.
Bonnetii, 11.
Bonnetiana, 11, 18.
Boscii, 49
Bottern, 34
bracteosa, 55.
brevifolia, 47.
brevis, 2
bulbifera, 9
candicans, 6.
candida, 6.
caribæa, 32.
Celsiana, 31.
Celsii, 31
chapensis, 33.
chihuahuana, 15
chloracantha, 32.
coarctata, 18.
coccinea, 12
cochlearis, 19.
cochleata, 11.
cœrulescens, 36.
Cohniana, 54
compacta, 11, 47
compluviata, 19
concinna, 6
Considerantii, 44
Cooki, 1
Corderoyi, 5
cornuta, 43
Couesii, 14
crassispina, 19
crenata, 11
Crouchers, 11
ctenophora, 30
cuculiata, 11
cyanea 10
cyanophylla, 10
dasylirioides, 53
dealbata, 51, 53.
decipiens, 4
densa, 33, 47

INDEX, CONTINUED.

densiflora, 31, 33.
depauperata, 47.
deserti, 25.
DeSmettiana, 8, 42.
Duguetii, 43.
diplacantha, 39.
distans, 39.
echinoides, 51.
elegans, 11.
Ellemeetiana, 29.
elliptica, 28
elongata, 6
ensifera, 37
ensiformis, 51.
europæa, 21.
falcata, 52
ferox, 17
filamentosa, 47.
filifera, 47, 48.
flaccida, 12.
flavescens, 6.
fourcroydes, 3.
fragilis, 41
Franzosini, 20.
Funkiana, 36
geminiflora, 49
Ghiesbrechtii, 41
Ghiesbreghtii, 41, 42
gigantea, 6
Gilbeyi, 40
glauca, 6, 51
glaucescens, 28, 32.
Goldmaniana, 16
gracilipes, 14
gracilispina, 19.
grandibracteata, 11.
grandidens, 41
grandidentata, 41.
granulosa, 42
Guingnardi, 11, 28
Hanburii, 40
Hartmanni, 46
Havardiana, 14
Haworthiana, 10
heteracantha, 36, 38.
histrix, 51
horrida, 39, 40, 42.
Houghii, 54
Houlletiana or *Houlletii*, 2
huachucensis, 14
hybrida, 43
hystrix, 6, 51.
inermis, 36
Inghamii, 40
integrifolia, 6.
intrepida, 53.
ixtli, 2, 3.
ixtlioides, 1, 3
Jacquiniana, 1.
juncea, 49
Karwinskii, 5.
Kerchovii, 39
Killischii, 40
Knightiana, 48.
Kochii 43
lætevirens, 21.
lævior, 40.
lævis, 2
lanceolata, 11.
latiuncta, 41.
latifolia, 4, 6, 28, 43
latissima, 19, 28
laxifolia, 4
Lecheguilla, 36.
Leguayana, 41.
Lemairei, 39
Leopoldii, 11, 47, 48
lepida, 30
linearis, 6
longifolia, 3, 6, 22, 43, 47.
lophantha, 37.
lucida, 10.
lurida, 1, 10.
macracantha, 6
macrocantha, 6
macrophylla, 12
macrodonta, 39
Maigretiana, 42
major, 6, 39, 43, 47.
Mangueii, 9.
Mapisaga, 19.
Marcusii, 14.
marginata, 1, 19, 21
maritima, 48
marmorata, 23
massiliensis, 21, 33
Maximiliana, 43
medio-picta, 3, 21, 30, 43
melliflua, 19.
mesotulo, 36
mexicana, 9, 19, 22
micracantha, 30, 32, 42
Millen, 21, 22.
minima 3
minor, 47.
miradorensis, 8.
mitis, 32
mitræformis, 18.
Morganii, 42.
multiflora, 33
multilineata, 36.
nana, 6, 51.
neglecta, 7.
Newberryi, 27.
Nickelsiæ, 44.
nigrescens, 36.
nigrispina, 6.
Nissoni, 36.
Noah, 15
obscura, 41.
oligophylla, 6
orbicularis, 11.
Orcuttiana, 16
Ortgiesiana, 48.
Ottonis, 33
Ouwelghemiana, 30
ovalifolia, 11
pachycantha, 16.
pallida, 8
Palmeri, 24
parrasana, 15.
Parryi, 14
parviflora, 46.
Patonii, 15
paucibracteata, 28.
paucifolia, 6, 50.
Peacockii, 40.
perbella, 37, 43.
perplexans, 46
Pfersdorffii, 35, 43
picta, 22.
Pilgrimii, 42
polyacantha, 33.
polyphylla, 10.
Poselgeri, 36
potosina, 19.
princeps, 48.
Pringlei, 26
prolifera, 3
pseudofilifera, 47.
pugioniformis, 6
pulverulenta, 11.
purpurea, 51.
quadrata, 11.
quotifera, 19.
ramosa, 21
recurva, 50.
recurvata, 7.
Regelii, 40.
Regeliana, 8, 40
rhombodea, 11.
Richardsii, 51.
rigida, 2, 3, 7.
rigidissima, 39.
robusta, 47.
Roezlei, 50
Rœzliana, 40.
Rohanii, 41
Romani, 35, 47
rosea, 51
rotundifolia, 11.
rupicola, 32
Salmdyckii, 33.
Salmiana, 19.
Sargentii, 1.
Saundersii, 11.
schidigera, 48.
schiedigera, 48.
Schottii, 45
Scolymus, 12.
Sebastiana, 16.
serrulata, 45.
Shawii, 16
silvestris, 3.
Simonii, 11.
Simsii, 11.
sisala, 2.
sisalana, 2.
spectabilis, 21.
spicata, 54.
spiralis, 4.
squalidens, 41.
stenophylla, 36
streptacantha, 11
striata, 21, 50, 51.
stricta, 51.
subdentata, 29.
subfalcata, 6
subintegra, 39.
subundulata, 28.
sulfuryensis, 6.
superba, 1.
tæniata, 37.
Taylori, 33, 47, 49
tehuacanensis, 11, 18
tequilana, 4.
tetragona, 36.
Todaroi, 23.
torta, 13
Toumeyana, 45.
Treleasei, 45
triangularis, 39.
Troubetskoyana, 23.
uncinata, 33
undulata, 23
univittata, 37
utahensis, 27
Vanderdonckii, 43.
variegata, 47.
vera-cruzis, 9.
vera-cruz, 9.
vera-cruz, 9
veræ crucis, 9.
Verschaffeltii, 11.
vestita, 48
Victoriæ Reginæ, 44.
Villæ, 43
Villarum, 45, 47.
Woodrowii, 1.
virginica, 11.
viridis, 6, 22.
vivipara, 1, 7.
Whitakeri, 19.
Wightii, 1.
Wislizeni, 15.
Wolkensteinii, 33.
Woodrowii, 1.
Wrightii, 49
xalapensis, 35.
xylonacantha, 43.
yuccæfolia, 54.
Zapupe, 4.
zonata, 19.

A. *Infl. a candelabrum-like panicle.* (*1–26.*) *Subgenus* EUAGAVE.

B. *Lvs. dagger-like or sword-shaped spine not decurrent: fls. rather large, greenish, long-lobed, ill-smelling, often followed by bulbils, seeds very large Trunk often developed.*

C. *Fls. urceolately contracted in throat.*

1. **angustifòlia,** Haw. (*A. lùrida,* Jacq. *A. Jacquiniàna,* Schult. f. *A. ixtlioides,* Hook. *A. Wightii,* Prain. *A. vivípara,* Auct.). Short-trunked lvs. 3 x 16–24 in., gray-green, with flat spine and slender-cusped prickles: infl. few-branched; fls 1½–2 in., segms and ovary ¾in each, tube ½in.: caps subglobose, strongly stipitate and beaked Cent Amer (?) Jacq, Obs Bot. 4, pl 1 Targioni Tozzetti, Ann Firenze 2, pl 6 B M. 5097, 5893 Wight, Icon. Pl Ind Or. 2024 Rep Mo. Bot. Gard. 19, pl. 29–34. Proc. Amer. Phil. Soc 49, pl 32. Mem. Nat Acad 11, pl 106–109 A form with white-margined lvs. is var. **marginàta,** Trel (*A vivípara variegàta* and *A. supérba,* Hort.), Wiesner Festschr., pl 8, and a variant of this with the body color gray-green is var **Woodròwii,** Trel (*A. Woodròwii,* Wats., and *A Coòkei,* Woodrow), Rep Mo Bot Gard 19, pl. 35. A dwarf form of the unvariegated type is var **Sárgentii,** Trel, Rep. Mo Bot Gard. 22, pl. 100–103

2. **sisalàna,** Perr (*A anacántha,* Terr *A brèvis,* Hort. *A Houlletiàna* or *Houllétii,* Hort *A lævis,* Hort *A. ixtli sisalàna,* Hort *A rígida progressàna,* Boyd *A rígida sisalàna,* Auct *A sisàla,* Perr *A sisalàna inérmis,* Rivière *A sisalàna yashquìa,* Perr.). Nearly trunkless lvs 4 x 60 in, becoming green, with shallow-grooved spine and typically no prickles infl ample, fls 1¾–2½ in, ovary, segm and tube about equal caps rare Yucatan or Chiapas(?) Perrine, Senate Doc 300, pl 1, 2, 4 Dodge, Rep Fiber Invest 3, 5, 9, with pl Rep Mo Bot Gard 7, pl 54–56 Proc Amer Phil Soc 49, pl 32 Mem Nat Acad 11 pl. 113–115 —The yaxci, green agave or sisal hemp most commonly cult outside of Yucatan largely distributed to growers from Trop Fla where Perrine intro. it about 1835 and, as in some of the W Indies, it has become naturalized It has been crossed by Trabut with *A. vera-cruz* under the name "potosina"

3 **fourcroỳdes,** Lem (*A ixtli elongàta,* Auct *A. ixtlioides,* Lem *A longifòlia,* Auct *A rígida, A. rígida elongàta* and *A rígida longifòlia* of most writers). Trunk 3–6 ft lvs 3–4 x 60–90 in, gray, with round-grooved spine and slender curved prickles infl ample, fls 2¼–2½ in, ovary 1–1¼ in, segm and tube 1¾ in each caps obovoid, slightly stipitate and beaked Yucatan Proc Amer Phil Soc 49, pl 32 Wiesner Festschr, 349 Mem Nat Acad 11, pl 110 112 — The sacci, gray agave or henequen, largely grown for fiber in Yucatan A form with greenish white median variegation is var **mèdio-pícta,** Trel, Wiesner Festschr, pl 12 The shorter-lvd but similar cheiem of the Yucatan coast is **A. ixtli,** sometimes called *A silvéstris* or *A prolífera,* and a related plant has been called *A minima* A large-lvd. poorer form of *A fourcroydes* is known as chucumel, and a shorter-lvd form of this as babei

4 **decípiens,** Baker (*A laxifòlia,* Baker. *A latifòlia,* Auct *A spirális,* Hort.) Trunk 6–8 ft lvs 2–4 x 36–50 in, green, rather soft and somewhat outcurved, with round-grooved spine and slender prickles from green prominences infl ample, fls 2¼ in, ovary 1⅛ in, segm. and tube ¾in each caps pyriform Yucatan Dodge, Rep Fiber Invest 3, 5, 9, pl Rep Mo Bot Gard 7, pl 57–59 B M 7177 —The false sisal, extensively naturalized, if not indigenous, in Fla This and *A Karwinskii* deserve the name arborescent, in the genus Agave

The tequila mescals (*A tequilàna,* Web, etc.), grown in W Mex for the preparation of a distilled beverage, and the zapupes (*A. Zapupe,* Trel, etc.), grown for fiber in E. Mex, are closely related to the preceding group.

cc *Fls. slenderer, not urceolate.*

5. **Karwínskii,** Zucc (*A Corderoỳi,* Hort. *A. Bàkeri,* Ross). Trunk 9–12 ft lvs 1–1½ x 15–30 in., green, with openly grooved spine and stout upcurved prickles: infl. rather ample; fls 2–2¼ in; ovary 1 in., segm and tube about ¾in. each caps oblong, brown, stipitate and beaked. S. Mex Ross, Icon Panorm, pl 2 Rep. Mo. Bot. Gard. 18, pl. 29–31 MacDougal, N. A. Deserts, pl. 23

6. **macroacántha,** Zucc. (*A. macracántha,* Auct *A. Bessereriàna,* Jacobi. *A Besseriàna,* Auct *A pugioniformis,* Zucc. *A. flavéscens,* Salm. *A subfalcàta* and *A. lineàris,* Jacobi. *A. paucifòlia* and *A oligophylla,* Baker. *A. intagrifòlia,* Baker?). Nearly trunkless lvs 1 x 8–20 in., yellowish gray-green, glaucous, with flat-grooved spine and slender-cusped heavy-based prickles: infl. rather sparse, fls 2 in; ovary 1 in, segm and tube ¾in each caps. oblong, gray, stipitate and beaked S. Mex Rep Mo. Bot. Gard 18, pl. 18–26 —At one time a great favorite and, like *A. Verschaffeltii,* collected in a large range of forms designated by descriptive varietal names: *viridis; cándida, cándicans, glaùca; nigrispina; elongàta, longifòlia, hystrix* (B M 5940), *nàna; latifòlia, gigantèa, màjor, concinna* or *sudburyénsis*

BB. *Lvs. lanceolate, large, rather firm than fleshy, scarcely repand: spine not decurrent fls rather large, greenish, fetid, often followed by bulbils Nearly trunkless.*

7 **neglécta,** Small (*A. vivípara,* Bartram *A recurvàta* and *A. rigida recurvàta,* Hort) Lvs gracefully outcurved, 6 x 36 in, glaucous, with slender round-grooved spine and very minute prickles infl ample; fls 2 in., ovary 1 in, segm ¼in, tube ½in: caps obovoid, scarcely stipitate or beaked. Trop Fla Rep Mo. Bot Gard 7, pl 60, 61 Dodge, Rep Fiber Invest 5, 9 ff G C III 31, supp Feb. 1 Bartram, Travels Map.

8 **miradorénsis,** Jacobi Lvs. rather straight, 3–4 x 30–35 in, glaucous, with slender narrowly grooved spine and, toward the base, very minute prickles infl. ample; fls 2¼ in; ovary 1 in, segm ¾in, tube ½in. E Mex. G W 5, p 143 —*A ananassoides, A. De-Smettiàna, A pállida* and *A Regeliàna,* not now recognized, were based by Jacobi apparently on specimens from Sartorius' ranch, El Mirador, in the state of Vera Cruz, from which, though ascribed to Brazil, *A miradorensis* is believed to have come All are close to if not quite the latter, over the accepted name of which *A DeSmettiana* has priority

9 **vèra-crùz,** Mill (*A bulbífera,* Bonpl *A Mangùa,* Desf *A mexicana,* Lam, which in part is *Furcrèa cubénsis* and the uses of which in large part pertain to *A atróvirens A vèra-crúcis,* Haw, sometimes spelled *vèræ-crúcis A. vèra-crùx,* Mill) Lvs nearly straight, 6–7 x 50 in, glaucous, somewhat cross-banded, rather fleshy, concave, with short heavy gray spine and oblique rounded deltoid prickles somewhat raised on green prominences infl ample, fls 2¾–3 in, ovary 1¼–1½ in, segm ¾–1 in, tube ¾in caps oblong, prominently stipitate, scarcely beaked Mex (?) G C II 19, p 149 —The blue aloe, extensively planted and more or less established in Amoy, India, Mauritius and Peru, and, as *A mexicana,* in Italy It has been hybridized with *A sisalana*

10 **lùrida,** Ait (*A lépida,* Dietr *A lùcida,* Schiede). Lvs thinner, flatter and more curving, with slenderer spine and smaller scarcely elevated prickles infl. slighter and sparser Mex (?) Zuccarini, Act Acad Carol Leop 16, pt 2, pl 49–51 B M 1522(?) Ref Bot 307(?) —Less frequently seen than the preceding, with which it is confused. Perhaps including the now scarcely recognized *A Beauleuriàna,* Jacobi, *A. cyànea,* Hort, *A. cyanophylla,* Jacobi, *A. Haworthiàna,* Roem, and *A. polyphylla,* Koch

BBB. *Lvs short and broad, fleshy rather than hard, repand: spine somewhat decurrent fls. rather large, yellowish, with lobes often shorter than the tube, and followed by bulbils. Nearly trunkless.*

11 **Verschaffèltii,** Lem. Lvs obovate-oblong, acuminate, 3 x 6–8 in., glaucous, with flexuous or twisted, flat-grooved, red-brown spine and long rusty teeth on large fleshy prominences infl rather slight and sparse: fls. about 2¼ in.; ovary 1¼ in, segm. ½in, tube ¾in: caps. oblong, very stoutly stipitate, beaked. S Mex. Ref. Bot. 306, 328 Lyon Hort. 1880, 267. Gt 346 J. Verschaf., Cat 1866–7, 1869 f. I H 15: 564 —Extremely variable, the original introducer announcing "as many varieties as there are plants," and 33 named forms having been catalogued once in the Lyon garden The more distinct, which have received mostly descriptive specific names, are var. **crenàta** (*amàna, cochliàta, élegans*), var. **cuculiàta** (*Croùcheri, Simsii*), var **Leopóldii,** var. **pulverulénta,** var **quadràta,** var **Saundérsii** (*virginica glaùca*), etc., and such minor forms as *albida, auricántha, compácta, lanceolàta, orbiculàris, ovalifòlia, rhomboidea, rotundifòlia* and *streptacántha. A tehuacanensis,* Karw, is the earliest published name for the species but no description was given *A Bonnetii,* Hort, seems to be this, but *A Bonnetiana,* Hort, is referred to *A. mitræformis,* which accompanies *A Verschaffeltii* about Tehuacan —Extensively used in hybridization, and crosses are reported with *A attenuata* (× **A. Guignárdii**), *A. densiflora, A micracantha* or *micrantha, A schidigera, A Tonelliana* or *Tonneliana* or *heteracantha Tonneliana, A Vanderweyana,* or *Vanderweynen* (× **A. Simonii** × **A. grandibracteàta**) and *A. xylonacantha* or *xylinacantha.*

12 **Scólymus,** Karw (*A coccinea,* Roezl? *A. flúccida,* Jacobi?) Lvs oblanceolate, rather acute, 3–4 x 12 15 in, green or (when it is *A. potatorum*) slightly glaucous, with nearly straight, flat-grooved, dull brown



138. Agave Franzosinii (No. 20)

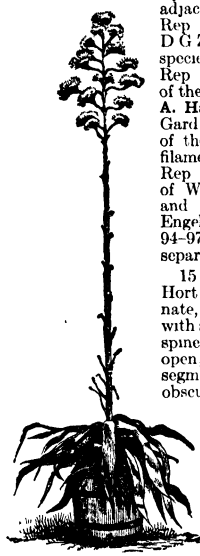
spine and small prickles on moderately low, fleshy prominences: infl. fairly large but loose, fls. 2 in; ovary 1¼ in, segm ½in, tube ¼in: caps. oblong, somewhat stipitate S Mex G W 2, p 603 —Much of the "*coccinea*" of gardens is *A macroculmis,* Tod, a member of the subgenus Littæa

BBBB. *Lvs rather oblong, very rigid, gray or glaucous, scarcely repand spine decurrent: fls. rather large, yellow, rarely followed by bulbils. Nearly trunkless*

13 **applanàta,** Jacobi Lvs lance-oblong, acute, 4–6 x 40–60 in when mature but commonly seen of much smaller size, glaucous, with broad open gray or purplish spine and rather large more or less connected prickles infl 25–30 ft; fls 2½ in., ovary 1¼ in, segm. ¾in, tube ½in E. Mex G C II. 7, p. 717 D G Z 1903, p 528. Tod, Hort. Pan. pl. 30. Rep Mo Bot. Gard 22, pl 73, 74

14 **Párryi,** Engelm (*A. applanàta Párryi,* Mulford. *A. Marcùsii,* Hort.). Lvs oblong, acute, 2–4 x 10–12

in , glaucous, with nearly straight openly grooved spine and smaller prickles. infl. 10–15 ft , fls 2¼ in., ovary 1⅛ in., segm ½–¾in , tube ½in caps oblong, beaked but scarcely stipitate Ariz , New Mex and adjacent Mex G C. II 12, p 237. Rep Mo Bot Gard 22, pl 91–93 D G Z 18, p 3.—Closely related species are **A. huachucénsis,** Baker, Rep Mo Bot Gard 22, pl 87–89, of the Huachuca Mts , with broad lvs ; **A. Havardiàna,** Trel , Rep Mo Bot. Gard 22, pl 84–86, of the great bend of the Rio Grande, with deep-seated filaments, and **A. gracílipes,** Trel , Rep. Mo. Bot. Gard 22, pl 98, 99, of W Texas, with slender peduncls and small seeds, etc. **A. Couèsii,** Engelm , Rep Mo Bot Gard 22, pl 94–97, on flowering proves scarcely separable



139. Agave americana in flower (No 21)

15 **Wislizènii,** Engelm (*A Nòah,* Hort) Lvs broadly ovate, acuminate, 4–6 x 8–10 in , gray, concave, with somewhat curved round-grooved spine and slender prickles. infl 12 ft , open, fls 2–2¼ in , ovary 1¼ in , segm ¾in , tube ½in . caps slender, obscurely stipitate N Mex Rep Mo Bot Gard 22, pl 75–79 — A more glaucous and repand plant from the same region is **A. parrasàna,** Berger, Rep Mo Bot Gard. 22, pl 80, 81 Thicker-lvd. related New Mex forms are **A. chihuahuàna,** Trel , Rep Mo Bot Gard 22, pl 82, 83, and **A. Patònii,** Trel , Rep. Mo Bot Gard 22, pl 90.

BBBBB. *Lvs similar, somewhat repand spine decurrent and the large teeth often confluent fls in compact clusters, large, yellow, not followed by bulbils. Trunk elongated but leafy*

16. **Shâwii,** Engelm Lvs ovate or lance-ovate, acuminate, 3–5 x 8–20 in , green, glossy, with slender, flexuous, openly grooved spine and large, hooked, connected, garnet-red prickles infl 10 ft , congested, fls. 2½–3½ in , ovary 1¼–1½ in , segm and tube ¾in · caps oblong, thick-walled S W Calif and adjoining Low Calif Trans Acad St Louis 3, pl 2–4 Rep. Mo Bot Gard 7, pl 44, 22, pl 19–21 —Related Low. Calif species are **A. Orcuttiàna,** Trel , Rep Mo Bot Gard 22, pl 22, with similar spine and **A. Sebastiàna,** Greene, Rep Mo Bot Gard 22, pl 23–26, with straight spine; and **A. pachyacántha,** Trel , Rep Mo Bot. Gard 22, pl 27, 28, and **A. Goldmaniàna,** Trel , Rep Mo Bot Gard 22, pl 29–31,—with heavier-based teeth and thin-walled caps. in all

BBBBBB *Lvs large, fleshy rather than firm, usually repand fls openly paniculed, large, yellow, rarely followed by bulbils Nearly trunkless*

c. *Spine large and long-decurrent*

17. **férox,** Koch Lvs broadly oblanceolate, wavy, suberect with outcurved concave acuminate tip, 12 x 48 in., green, deeply repand, with large grooved spine and great prickles on high green prominences· infl 20 ft ; fls. 3¼ in , ovary 1½ in , segm 1 in , tube ¾in. Cent. Mex G C III 15, p 328, III 20, p. 525; III 43, p. 379. G W. 2, p 603

18. **mitræfórmis,** Jacobi (*A coarctàta,* Jacobi ? *A Bonnetiàna,* Hort.?). Lvs obovate-oblanceolate, acuminate, 12 x 30 in , grayish-zoned, rather repand, with large grooved spine and moderately large gray chestnut-tipped prickles on green prominences. infl. 15–20 ft., fls 2½ in ; ovary 1½–1¾ in , segm ½in , tube ½in S Mex Karsten & Schenck, Veg. Bilder, pl 47. Anales Mus Nac Mex 2, pl 1 Publ Carnegie Inst. 99, pl 20 —This is *A tehuacanensis,* Koch, Karwinski's plant of that name being apparently a form of *A. Verschaffeltii* A yellow-margined, variegated agave, listed under *A mitræformis* by the Belgian dealers about 1876, appears to be *A atrovirens marginata* A cross with *A densiflora* is said to have been effected.

19 **atròvirens,** Karw Becoming enormous lvs. lanceolate, 12 x 80–100 in , dark green or (when it is *A Salmiàna,* Jacobi) gray, outcurved-ascending, with large, narrowly grooved spine and moderate gray prickles from low widened bases infl 20–30 ft , fls 3½ in , ovary 2 in , segm 1 in , tube ½in S Mex D. Gart Mag 1867, p 28 , f Contr U S Nat Herb 5, pl 31–33 S H 4, p 281 Pop Sci Monthly, 70, p 210–216. Œsterr Gart Zeit 1911, p 252 Prometheus 20, p. 24 Journ N Y Bot Gard 8, p 10 Modern Mex 17, p 26 28 Proc U S Nat Mus 33, p 577, etc —The principal pulque species cultivated on the plains of Apam Numerous varieties are figured by Segura, El Maguey, 4 ed , pl 1–9 Vast confusion exists in current literature the names *A americana* and *A. mexicana* are often applied to this, and it is difficult to account elsewhere for the many new Latin names given to pulque magueys by Blasquez, and to a number of young garden plants by Jacobi A yellow-margined variety (also listed as belonging to *A mitræformis*) is var **marginàta,** Trel A very large- and concave-lvd unvariegated form is Var **cochleàris** (*A latissima,* Jacobi *A Whitakeri,* Hort) Other important pulque or agua-miel species are about the City of Mexico, **A. Mapisàga,** Trel (maguey mapisaga) with narrow small-prickled lvs , about Durango, **A. compluviàta,** Trel (maguey verde), with green-zoned deeply gutter-shaped lvs , and **A. quiotífera,** Trel (maguey cenizo), with ashen lvs , about San Luis Potosi, **A. gracilíspina,** Engelm (*A potosina,* Web), with slender spine, and **A. crassíspina,** Trel , with stout spine, and about Monterey, **A. melliflua,** Trel (maguey manso), with elongated ashen lvs , and **A. zonàta,** Trel (maguey verde), with broad green-zoned lvs

20 **Franzosìni,** Baker Fig 138 Lvs lanceolate, 12 x 80 100 in , roughish, white, recurved-ascending, with large narrowly grooved spine and dark or gray prickles infl green, in striking contrast with the lvs ,



140 Agave americana, as commonly grown in greenhouses. The yellow-margined form (No 21)

30 or 40 ft ; fls 3½ in , ovary 1¾ in , segm 1 in , tube ¾in Mex (?) B M 8317. G W 2, p 603. G C III. 12, p 177.

cc *Spine little if at all decurrent.*

D. *Fls. and fr much as in the preceding Not bulbiferous.*

21 **americàna,** Linn (*A altíssima,* Zumag *A europæa,* Vis *A. ramòsa,* Moench *A spectábilis,* Salisb.).

Figs 139, 140. Lvs lanceolate, 6–8 x 60–80 in , smooth, gray, ascending with outcurved ends, with rather short and stout recurved round-grooved very shortly decurrent spine obliquely flattened at base, and moderately large gray prickles on prominent marginal elevations· infl 20–30 ft , rather slender, fls 2½–2¼ in , ovary 1¼ in , segm 1 in , tube ½in. Mex (?). Established around the Medit. Gt. 24.825; 27, p 307, 41, p 269 Penzig, Fl Latt Med , pl 140 Reichb , Ic. Fl Germ , pl 374 B H 9, p 308 R H 1875, p 152 Journ N Y Bot Gard 11, pl. 79, 81 Adamovic, Pflanzenw Dalmat , pl 1 Abhandl Hamburg Kolon Inst. 6, p 64 G W 8, p 337 Proc Am Phil Soc 49, pl 32 —The plant more commonly cult in this country as *A americana* has narrower, more hooked lvs , as in the next, but grayer and with the short recurved spine scarcely decurrent and round at base, var **Milleri,** Baker (*A Milleri,* Haw ? *A virginea,* Mill ? *A latévirens* and *A americàna latévirens,* Hort ?) Variegated forms of this, frequently grown, are var **marginàta** in yellow- or white-margined forms, var **striàta** variously lined with yellow or white, and var **mèdio-pícta** with a broad median yellow band Wiesner Festschr , pl 6 A reputed hybrid between *A americana* and *A donsiflora* is × **A. massiliénsis,** Hort Deleuil

22 **pícta,** Salm-Dyck (*A lonqifólia pícta, A mexicana pícta,* and *A Milleri pícta,* Hort.). Lvs linear-lanceolate, ascending with recurved ends, at length 6–8 x 100 in , smooth, dark green with bright white or yellow marginal variegation, slightly glaucous when young, with needle-like, straight, narrowly grooved spine and moderate prickles on somewhat prominent marginal elevations infl tall and rather slender, fls 3 in , ovary 1½ in , segm 1 in , tube ½in . caps oblong, stipitate and beaked Mex (?) G W. 8, p 337 Wiesner Festschr , p 312, pl 7 Pop Sci Monthly, 70, p 210 Proc Amer Phil Soc 49, pl 32 —Green seedlings (var. **víridis**) occur on the Riviera and are in limited cult.

DD. *Fls. rather small, yellow, shallow-tubed caps thin-walled, small Not bulbiferous*

23 **marmoràta,** Roezl (*A Todaròi,* Baker *A Troubetskoyàna,* Hort *A undulàta,* Tod) Lvs broadly lanceolate, outcurving, 10–15 x 72 in , very rough, green- and gray-banded, with rather short and stout recurved narrowly grooved spine and large rough rusty brown prickles often from prominent marginal elevations infl ample, fls golden, 1½ in , ovary ¾in , segm. ½in , tube ¼in caps short, stipitate S Mex

DDD *Fls moderately long, creamy, deep-tubed caps firm, elongated Not bulbiferous*

24 **Pálmeri,** Engelm Lvs lanceolate, ascending, 3–4 x 18–30 in , blue-green, somewhat glaucous, with long, slender, open-grooved spine and slender, hooked garnet-purple or gray prickles, often on marginal elevations infl ample, fls. leathery, 2–2¼ in ; ovary 1 in , segm ½in , tube ¾in.: caps oblong, not stipitate Ariz and New Mex Rep Mo Bot Gard 7, pl 48–52 Journ N Y Bot Gard 5, p 178.

BBBBBBB *Lvs triangular, thick and stiff, rather small fls. small, yellow, shallow-tubed, not followed by bulbils. Trunkless*

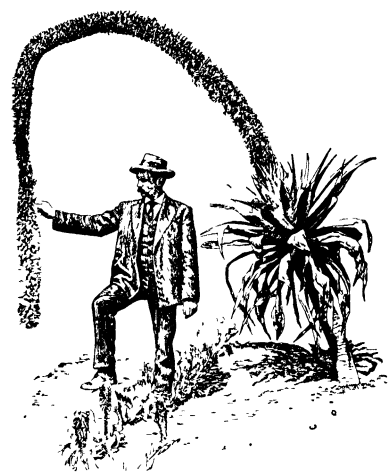
25 **desérti,** Engelm. Cespitose lvs triangular-lanceolate, falcately erect, 2 x 6–12 in , gray, with slender, gray-brown, grooved spine and friable teeth infl slender, sparse, fls yellow, 1¼ in , ovary flask-shaped, ½in , segm ½in , tube ⅓in caps oblong, scarcely stipitate. Colo desert, Calif. Rep Mo Bot Gard. 7, pl 33, 34, 22, pl. 41, 42

26 **Pringlei,** Engelm Cespitose· lvs triangular-oblong, ascending, 2 x 6–16 in , gray, with slender, drab, grooved spine and rather firm teeth· fls. 1½–2 in., ovary 1–1¼ in , segm ½in , tube ¼in. Mts of N. Low. Calif. Rep. Mo. Bot. Gard. 22, pl. 44.

AA *Infl. spike-like, the fls usually in pairs though exceptionally clustered on very short branches. bulbils very rarely following the fls. (27–55) Subgenus* LITTÆA

B *Lvs triangular-lanceolate, thick and stiff, rather small: fls often clustered on short branches, cup-shaped, small Trunkless*

27 **utahénsis,** Engelm (*A Newbérryi,* Engelm). Cespitose lvs erect-spreading, 1–2 x 6–12 in , gray, with slender, grooved, gray spine and rather small and friable gray teeth infl 5–15 ft , with simple or forked branches 1–2 in long, fls 1–1¼ in , ovary flask-shaped, ⅝in , segm ⅜in , tube ⅛in · caps. thin-walled,



141 **Agave attenuata** (No 28)

small, not stipitate Grand Cañon region. Pop Sci. Monthly, 1911, p. 11. G F 8, p 384. Rep. Mo. Bot. Gard 7, pl 32

BB *Lvs moderately large, thin, unarmed or at most very minutely denticulate, neither filiferous nor horny-margined Trunk well developed in the first. fls open, rather small*

28 **attenuàta,** Salm-Dyck (*A glaucéscens,* Hook) Figs 141, 142, 143 Trunk 1–5 ft , sometimes prostrate lvs broadly oblanceolate, spreading, with recurved tips, 6–10 x 25–30 in , glaucous, thin, entirely unarmed infl 5–10 ft , usually recurving, its very short stalk closely covered by bracts, fls paired, about 2 in , ovary flask-shaped, ¾–1 in , segm ¾in , tube ¼in Exceptionally produces large bulbils among the caps after flowering Mex F E 31, p 1172 B B M 5333. J H III 42, p 392 R H 1876, p 149 Erfurter Führer 7, p 70 G F 10, p 95 Rep Mo. Bot Gard 9, pl 31 G C III 8, p 560, III 17, p 455, III 45, suppl pl Pharm Journ 70, p 706 —Varies in a form with sterile base of spike longer and sparsely bracted, and fls in clusters of 6–8, var **paucibracteàta,** Rep Mo Bot Gard 11, pl 7 The varietal names *elliptica, latifólia, latissima* and *subundulàta* have been applied to garden forms A cross with *A Verschaffeltii* is × **A. Guignárdii,** Hort , a cross with *A xylonacantha* is listed

29 **Ellemeetiàna,** Koch Nearly or quite trunkless. lvs lanceolate, spreading, 6 x 24 in or more, glaucous, thin, unarmed infl 5–10 ft , erect, the rather short sterile base closely covered by linear bracts, fls paired,

greenish white, 1¼ in ; ovary flask-shaped, ⅝in., segm. ⅝in , tube nearly suppressed; filaments very long, 2¾ in. E. Mex. G.C. II. 8, p. 748; III. 47, p 201. B M 7027 Ref Bot 163. —With lvs very minutely denticulate it becomes var. **subdentàta,** the distinctness of which from *A pruinosa* is not clear Reported crossed with *A. micracantha.*



142. Flowers of Agave attenuata.

BBB. *Lvs moderately large, variously fleshy but usually flexible, neither filiferous nor horny-margined, teeth never large fls moderate, often with recurved segms Nearly trunkless.*

C. *Spine slender and weak.*

30 **álbicans,** Jacobi (*A. micracántha albidior,* Salm-Dyck *A Ousselghemiàna,* Jacobi). Trunkless, cespitose lvs oblanceolate, 4 x 12–15 in , spreading, glaucous, thin, with small, needle-shaped, narrowly grooved spine and close-set, minute, brown prickles connected by a papery margin: infl scarcely 3 ft , rather few-fld above the middle, fls. paired, reddish green, nearly sessile, 1¼–1½ in; ovary ½–1 in , segm. ½in , tube ¼in · caps prismatic-ovoid, small. Mex (?) B M 7207 Bull Soc. Tosc. Ort 3, p 303. Lyon Hort 22, p 363 ¡With recurved long black prickles, and fls 2¼ in long, it is var **ctenóphora,** Trel A beautiful form with milk-white median variegation is var **mèdio-pícta,** Trel (*A. micracántha pícta, A micracántha variegàta, A Ousselghemiàna álba-pícta, A Ousselghemiàna pícta,* and *A. álbicans variegàta,* Auct), Wiesner Festschr., pl 10. Hybrids are reported between this species and *A. maculata* and *A xalapensis*

31 **Célsii,** Hook (*A Celsiàna,* Koch *A densiflòra glaucophýlla,* Hort ?). Lvs. broadly oblong, 4 x 12–18 in or more, glaucous, with slender weak spine and very irregular close-set, often multiple, prickles, fleshy except at the very tip infl about 4 ft , densely fld at top; fls reddish or yellowish green, 1½–2 in ; ovary and segm ¾in , tube ½in : caps small. B M 4934. R H 1861, p 335 Gn. 12, p. 213.—A hybrid with *A. Salmiana* is reported

32 **micracántha,** Salm-Dyck (*A. glaucéscens,* Otto ?). Cespitose lvs broadly lanceolate, spreading, 3–5 x 15–25 in , grayish green, with slender weak spine and small, close-set, dark prickles infl about 10 ft , the rather short sterile base densely bracted, fls brownish green, 1½ in , ovary ½–¾ in , segm ½ in , tube ¼ in. E Mex (?) Ref Bot 327 Gt 37, p 115.—Hybrids are reported with *A Ellemeetiana, A. Sartorii, A. Verschaffeltii, A xylonacantha* and *A. xylonacantha micracantha A mìtis,* Salm-Dyck, and *A. rupícola,* Regel, are closely related and *A chloracántha,* Salm-Dyck. (*A caribæa,* Hort), differs chiefly in its greener lvs., with pale prickles

cc. *Spine moderate but strong, round-grooved.*

33. **polyacántha,** Haw. (*A. abortiva,* Terr.? *A. chapénsis,* Jacobi.? *A chapénsis porrécta,* Hort. *A. dénsa,* Hort ? *A. densiflòra,* Hort ? *A multiflòra,* Hort. *A Ottònis,* Jacobi? *A. Salmdýckii,* Baker? *A. uncinàta,* Jacobi? *A Wolkensteinii,* Hort.?) Cespitose lvs lanceolate, upcurving, 2–5 x 10–24 or 36 in , soon green, with narrow-grooved strong spine and rather small and close-set brown or gray prickles: infl. 4–5 ft.; fls. about 2 in ; ovary ¾in., segm. and tube ½in. S. Mex (?). B.M. 5006. G.W. 2, p. 604. Journ Soc Hort Bas. Rhin. 3, p 324. Gn. 12, p 396. R.H 9, p 517 G C. II 3, p 502 Hybrids are reported between *A chapensis* and *A. xylonacantha* and *xylonacantha latissima* and with "*Dasylirion gracilis;*" *A. densiflora* and *A. americana* (× **A. massiliénsis**); *A densiflora* and *A. geminiflora* (× **A. Táylori**),—G C. II 8, p 620; *A. densiflora* and *A mitræformis; A. densiflora* and *A. Verschaffeltii,* and *A. densiflora* and *A xylonacantha.*

ccc *Spine stout, openly grooved*

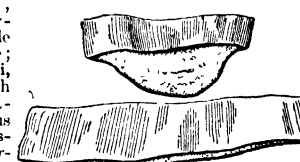
34. **Bottèrii,** Baker Lvs oblanceolate, outcurved-ascending, 6–8 x 24–30 in , green, with flat-grooved strong spine and short, broad, blackish close-set prickles infl. scarcely 5 ft , fls reddish or yellowish green, 2 in ; ovary ¾in , segm and tube ⅝in each Mex (?). B.M. 6248 G C II 8, p 264.

35 **xalapénsis,** Roezl Lvs lanceolate, spreading, 2–5 x 10–30 in , nearly green to decidedly glaucous, with very openly grooved heavy spine and moderately long, heavy, rather close-set red to blackish prickles infl 5–10 ft ; fls 2 in ; ovary ¾in , segm 1 in , tube ¾in · caps ¾ x 1½ in , slightly constricted at base. E Mex Monatsschr f Kakteenk 14, p 151 R H 1875, p 276 Reported hybrids are *A xalapensis × filifera* (× **A. Romànu,** Hort), *A xalapensis × Ousselghemiàna, A xalapensis × Salmiana,* and *A. xalapensis × xylonacantha* (× **A. Pfersdórffii,** Simon)

BBBB *Lvs fibrous and often rigid, the sometimes very large teeth connected by a detachable horny margin· fls. moderate, with soon erect segms. At most short-trunked*

C. *Teeth rather small. lvs elongated, rather thin but stiff*

36 **Lechegúilla,** Torr (*A multilineàta,* Baker *A Poselgèri,* Salm *A tetrágona,* Hort) Lvs triangular-oblong, concave, falcately ascending, 1 x 16–24 in , green or bluish but not glaucous, pale-banded ventrally and dark-lined on the back, with flattened gray-brown spine and recurved slender prickles joined by a very narrow straight margin infl 3–12 ft , glaucous, fls ¾–1½ in ; ovary flask-shaped, ½in , segm ½in , tube ⅛in W. Texas and southward, in a number of forms of which the southernmost, from below San Luis Potosi, with broader lvs and heavier prickles, is **A. mesotílo,** Hort. It furnishes the greater part of the ixtle or lechuguilla fiber of New Mex usually ascribed to *A heteracantha* Pop Sci Monthly 70, p 223 Bot Bound 1, pl 34, 39 Rep Mo Bot Gard 7, pl 31, 13 pl 42 Bull. Univ Texas 60, pl 3, 6 —Closely allied forms, frequent in European gardens, are **A. cœruléscens,** Salm-Dyck (a hybrid of which with *A Victoriæ Reginæ* is reported), differing chiefly in being very glaucous, and its var. **stenophýlla** with lvs over 4 ft long, **A. Funkiàna,** Koch & Bouché, with flatter, more oblong, rather glaucous lvs, which furnishes the ixtle of Jaumave; **A. Nissònii,** Baker, with thin, yucca-like, glaucous lvs.; **A. nigréscens** (*A. heteracántha nigréscens,* Hort), with thick, dark blue-green, long-triangular, often undulate lvs , sometimes almost or quite unarmed on the margin, when it is the form **inérmis.**



143 Cross-sections of leaf of Agave attenuata.

37 **lophántha,** Schiede Lvs lanceolate, spreading, 1½–2 x 12–18 in , green, glossy, with openly grooved brown spine and variously hooked rather small prickles joined by a narrow, nearly straight margin· infl. 9–15 ft.;

fls 1½ in , ovary ¾in , segm ⅝in , tube ⅛in E Mex G W 8, p. 337 With prominent and persistent pale band on the upper face it is var. **univittàta** (*A. univittàta*, Haw. *A. ensifera*, Jacobi? *A. tæniàta*, Hort ?) Ref Bot 215 B M 6655 G C. II, 7, p 368 —Crosses of *A univittata* with *A xylonacantha* are reported, of which × **A. perbélla,** Hort , is said to be one, *A pulchérrima*, Hort , in part, seeming to be another writing for the same.

38 **heteracántha,** Zucc. Like *A lophantha* but lvs. somewhat sinuate and with variously hooked less equal and closer prickles The median band is often prominent S Mex G.W 2, p 605 G C II 7, p 369. Gt. 19, pl 639 —Most of what is called *A heteracantha* is *A. Lecheguilla.*

CC. *Teeth often large: lvs either broad or thick.*

D. *Margin nearly straight.*

39 **Kerchòvei,** Lem Lvs triangular, spreading, 3–4 x 16–20 in , thick, gray-green, not lined beneath, with channeled gray spine and large spreading triangular teeth joined by a rather wide margin infl dense and heavy, 18 ft S Mex G C. II 7, p 527.—Formerly much grown in a number of dissimilar types var **Beaucárnei** (*A Beaucárnei*, Lem , *A Lemàirei*, Hort , *A Kerchòvei coarctàta*, Hort), with very short lvs ; var **macrodónta,** with larger and more hooked teeth, var **dístans,** with more separated teeth which have a well-developed accessory basal cusp in f **diplacántha,** and var **màjor,** with a short branching trunk Related forms with shorter lvs and slenderer, sparser infl are **A. triangulàris,** Jacobi (*A Kerchòvei brevifòlia*, Hort , *A hórrida triangulàris*, Baker), Karsten & Schenck, Veg Bilder pl 46, with prickles much as in *A Kerchovei*, and its var **rigidíssima** (*A rigidíssima*, Jacobi), with small prickles lacking in f **subintègra.**

40 **Rœzliàna,** Baker (*A hórrida làvior*, Hort) Lvs. ovate-lanceolate, spreading, 2–4 x 12–16 in , rather thick, green, broadly pale-striped above, not lined on the back, with grooved brown and then gray spine and moderately large teeth joined by a moderate margin. infl not very heavy S Mex G C 1871, p 74, II 7, p 528 F 1870, p 42 —Presents as extreme forms. var. **Inghamii,** Baker (*A Gilbeyi longifòlia*, Hort , *A Inghami* and *A Inghami gigantea*, Hort), with broad, often concolorous lvs and large prickles, known when dwarfed as var **Gilbeyi** (*A Gilbeyi* and *A hórrida Gilbéyi*, Hort), Gt 23, p 89, 27, p 84 Neubert's Gart. Mag 50, p 15 G C 1873, p 1305, and var. **Peacóckii** (*A Killischii*, Hort ?, *A Peacóckii*, Croucher), B M. 7757 G C 1873, p 1400, with narrowly triangular-lanceolate lvs , sometimes entire The names *Regeliàna*, *Regèlii* and *Regèlii macrodónta*, identified by Jacobi with *A triangularis*, seem also to have been applied to this; and the now unrecognized *A árturchaut*, *A hórrida nàna* and its f *làvior* and *A hórrida pygmæa* of gardens may belong here. *A. Hanbùrii*, Baker, suggests a possible hybrid of this.

41 **Ghiesbréchtii,** Koch (*A. Ghiesbréghtii*, Auct. *A. grándidens*, Hort ? *A grandidentàta*, Hort.? *A frágilis*, Jacobi ? *A squálidens*, Hort ?). Lvs lanceolate, 3–4 x 10–12 in , upcurved-spreading, little if at all striped, with unrolled spine and moderate prickles joined by a moderate margin S Mex (?) G C II 7, p 621 —The typical clear green form varies into an equally large or longer-lvd form with smaller, closer-set prickles, var. **Leguayàna,** Baker (*A Leguayàna*, Hort , or, with wider margin, f. *latecincta*), and a more compact and concave lvd , blue-green form, var. **Rohànii,** Baker (var *obscùra*, Jacobi). A cross of *A. filifera* and *A. Ghiesbrechtii* is reported.

42 **hórrida,** Jacobi Lvs. oblanceolate-oblong, spreading, flat, rather thin, about 3 x 12 in , glossy green, neither striped nor lined, with flat-grooved short spine and large irregular prickles often with accessory cusps, joined by a heavy margin infl moderately slender, fls yellowish or purplish green, 1¾ in , ovary and segm ¾in each , tube ¼in Cent Mex B M 6511. F 1870, p 42 —Forms occur with larger revolute-margined lvs var **Maigretiàna** (*A Maigretiàna*, Jacobi *A granulòsa*, Scheidw), G W 2, p 593 S H 4, p. 299. G F. 2, p. 115, or with smaller prickles, var. **micracántha,** Baker, Rep Mo. Bot. Gard. 7, pl 62, 63. The names *A. De Smetiana* (*A De Smettàna*, Jacobi, being a form or ally of *miradorensis*), *A Ghiesbreghtii hórrida*, *A Mòrganii* and *A. Pilgrimii* have been applied in gardens to forms of this or one of the two foregoing, not now recognized

DD *Margin with prominent fleshy hummocks under the teeth*

43. **xylonacántha,** Salm-Dyck, also written *xylacántha*, *xylinacántha* and *xylynacántha* (*A arnurénsis*, Jacobi. *A. Kòchii*, Jacobi *A Kochii amurénsis*, Ellem) Lvs. oblong, concave, tortuously spreading, 2–5 x 12–24 in., rough, dull gray-green, dark-lined beneath, with flexuous channeled gray spine and very large often multiple prickles saddling large green prominences, joined by a moderately heavy margin infl rather slender, fls 1½ in , ovary ¾in , segm ⅝in , tube ⅛in E Mex B M 5660 G C II 7, p 527 Lyon Hort 1879, p 207 — Extensively hybridized, some of its offspring recognizable in their scabrid green-lined oblong lvs with green prominences going into the bases of the large unequal teeth with *attenuata* or *attenuata subdentata*, *chaapensis*, *densiflora*, *filifera* (× **A. Villàrum,** Hort , × **A. Villæ,** Pirotta, × **A. hýbrida,** Vill), *micracantha*, *univittata* (*A armata*, Hort.? *A aspera*, Tod ? Terraciano, Primo Contr pl 3, 5, × **A. hýbrida,** Versch), *A xylonacantha vittata* and *A xylonacantha hybrida* (× **A. perbélla,** *A xylonacantha perbella*, Hort), G C. II 7, p. 527, *Verschaffeltii* and *xalapensis* (× **A. Pfersdórffii,** Sim) At one time, several varieties were listed *cornùta* or *longifòlia*, the more typical form, *latifólia macracántha*, variously spelled, *major*, *Maximiliàna*, *tórta* and *Vanderdónckii*. A rare form with median variegation is var **mèdio-pícta.**

BBBBB *Lvs 3-sided, short and very stiff, the detachable horny margin toothless: fls. as in the preceding. Trunkless.*

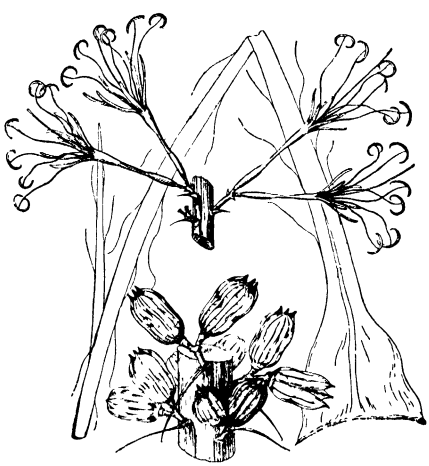
44 **Victòriæ Reginæ,** Moore (*A Considerántii*, Duchartre). Lvs in a globose cluster, triangular-oblong, acutely 3-angled, 1–2 x 6–8 in , dark green, with a short black triangular spine and gray margin decurrent on the edges and keel infl 10–12 ft , rather slender but compact, fls 1¼ in , ovary ⅝in , segm. ⅝in , tube ½in caps small N E Mex G C 1875, p 484, 1880, p 788, II 18, p. 841, III 1, p 806 R H. 1875, p 429; 1890, p 392, 1897, p 100 G W 2, p 592; 10, p. 213 G Z 20, p 88, 135. Peacock, List of Succ Pl pl S H 4, p 287 I H. 28, pl p. 413. Lyon Hort. 22, p 371; 31, p 146 R B. 1876, p 16. G M 6, p. 196. Gn 8, p 351, 22, p 448, 460, 48, p 117 Gt. 1878, p. 74 Journ N Y. Bot Gard. 7, p. 163. —Deleuil is said to have effected a cross with *A. cærulescens* Differing in its fewer-lvd more open rosettes and in the triple spines at apex of the lvs is **A. Nickélsiæ,** Hort Both agree with the following filiferous species in having the lvs. white-marked by adherent cuticle, and with the preceding marginate species in their detachable horny border, and in fls.

BBBBBB. *Lvs. fleshy-fibrous, toothless (sometimes with minute prickles at base), the margin typically shredding away in fibers, as in Yucca: fls. nearly as in the group of A. micracantha. Trunkless*

45. **Schóttii,** Engelm Cespitose: lvs linear-triangular, ¼ x 6–12 in , with scarcely grooved spine and few long slender threads infl 4–6 ft , slender; fls somewhat curved, yellow, scented as in Polianthes, 1¼–1½ in , ovary and segm ⅜in each, tube ⅝in : caps. ½ x

⅝in. S. Ariz. B M 7567. Rep Mo Bot Gard 7, pl 29. —With denticulate lf-bases it is var. **serrulàta,** Mulford Rep Mo Bot. Gard 7, pl 29 A plant approaching *A parviflora,* from the Pinal Mts of Ariz, with concave lvs 2–4 in long, fls ⅝in long with ovary ⅜in, segm. ⅛in. and tube ½in, and ovoid caps, is **A. Toumeyàna,** Trel, Rep Mo Bot Gard 5, pl. 32, 7, pl. 30 A species of the Santa Catalina Mts., Ariz, with lvs as in *A Lechegualla* but filiferous instead of marginate, and fls nearly as in *Schottii,* is **A. Trelèasei,** Toumey, Rep. Mo. Bot. Gard 12, pl. 31a, 32, 33.

46 **parviflòra,** Torr. Small and compact: lvs. ascending, oblong, ¼ x 2 in, with flat spine and few short coarse outcurved threads, the dilated base denticulate: infl 2–3 ft, very slender, fls greenish white, ⅝in; ovary ⅜in, segm. ½in, tube ½in caps very small Ariz to Sonora Boundary Pop Sci Monthly, 1911, p 7 Rep Mo Bot Gard 5, pl 32, 7, pl 30 —A similar New Mexican plant with narrowly triangular falcate lvs and grooved spine is **A. Hartmaìni,** Wats A less dwarf



144. Agave angustissima. (No. 48)

plant with lvs resembling small forms of the following but denticulate at base, sometimes cult. as *A. parviflora,* is **A. perpléxans,** Trel

47 **filífera,** Salm-Dyck (*A. pseudofilifera,* Ross & Lanz). Lvs somewhat upcurved-spreading, oblong-lanceolate, 1–1½ x 8–24 in, with openly grooved spine and rather sparing thin marginal threads infl rather stout and dense, 10–15 ft, fls maroon, 1½ in, ovary and segm. ⅝in each, tube ½in E Cent Mex G C II. 7, p 303, III 21, p. 167 I H 7 243 Lyon Hort 1879, p 208, 1900, p 371, 1909, p 147 Gt 36, p. 544. Neubert's Gart. Mag 39, p 307 G.W. 6, p 79, 1907, p 9 Ref Bot, 164 Rep Mo Bot Gard 11, frontisp. Icon Sel Hort Thenensis, pl 144 —Varies into a number of forms var **filamentòsa,** Baker (*A filamentòsa,* Salm-Dyck, *A filifera latifòlia, longifòlia, robùsta* or *major, Bonapártea* or *Lattæa filamentòsa*), G C. 34. p. 101, with large lvs, var **compácta** (vars. *brevifòlia, compácta, dénsa, depauperàta* and *mìnor,* Hort.), with short broad lvs; f. **variegàta** (*A filifera supérba,* Hort.), in which the dingy cuticular stripes of the type (var. *viridis* or *immaculata*) are brighter and more persistent. **Hybrids** are reported with *geminiflora* (× **A. Táylori**), *Ghiesbrechtii, schidigera* (× **A. Leopòldii II,** *A filifera Leopòldii,* J H 1893, p 334), *xalapensis* (× **A. Romànii**) and *xylonacantha* (× **A. Villàrum**).

48. **schidígera,** Lem. (*A filifera adornàta, A. adornàta, A. filifera pannòsa, A. filifera schidigera, A schiedigera, A. schiedigera princeps, A. princeps, Lattæa Rézlii?*) Lvs narrowly oblong, spreading, about ½ x 12 in, with flattened spine and rather wide shaving-like marginal threads Cent Mex I H 330 B M 5641 G W 2, p 592 S H 4, p 297 —A number of closely allied forms are rather frequently mentioned or encountered in cult with narrow, often reddened lvs and stalked fls, **A. Ortgiesiàna** (*A schidigera Ortgiesiàna* and *A. marítima,* Hort), with sessile or nearly sessile fls and mostly very curly and numerous marginal threads, **A. angustíssima,** Engelm (*A Bigelòvii* or *Diguètii,* Hort) Fig 144 G F. 6·5 (adapted in Fig 144), **A. vestíta,** Wats, A. G 1892, p 609, and **A. Knightiàna,** Drum, B R 1145 Actes Soc. Linn Bordeaux 16, pl Reported hybrids are *A schiedigera* or *princeps* with *filifera* (× **A. Leopòldii II**) and *A. schidigera* × *Verschaffeltii*

49. **geminiflòra,** Gawl (*A Bonapártea, A Bósci, A. geminiflòra filamentòsa, A júncea filamentòsa, Bonapártea filamentòsa, B flagelliformis, B juncea, Dracæna Bósci, D filamentòsa, Lattæa* or *Lattèa* or *Lattæa geminiflòra,* and *Yúcca Bósci,* Hort) Lvs very many, biconvex, long, gracefully recurving, narrowly linear, scarcely ¼in wide, with fine marginal threads W. Mex (?). Occasionally found in a threadless form, var. **àtricha.** Diet Sc Nat 62, pl 55 F S 7, p 6 Reichenbach, Icon 3, pl 209, 210 Bibl Ital 1816, pl. Journ of Sci 1817, pl 1 G W 7, p 548 Hybrids are reported with *A densiflora* (× **A. Táylori,** Hort *A. geminiflora Taylori,* G C II 8, p 620 Mn. 7), and *A filifera* (**A. Wrightii,** Drum, B M 8271)

BBBBBBB. *Lvs. hard-fibrous, closely striate-grooved, at most scabrous margined fls rather small with tube and segms about equal Trunkless*

50. **striàta,** Zucc (*Bonapártea júncea rigidifòlia, B. rigida, B rigidifolia, B striàta* and *B tenuifolia,* Hort) Lvs many, spreading, rhombically biconvex, ¼ x 24–36 in, gray, with needle-shaped brown spine infl about 10 ft, fls greenish, 1¼ in, ovary ½in, protruding into the tube, segm ½in, tube ⅜in Cent Mex B M. 4950 Gt. 29, p 24 Jacobi, Versuch, p 154 G C II. 8, p. 556 G W 10, p 213 With lvs conspicuously recurving it becomes var **recúrva,** Baker (*A. recúrva,* Zucc), G C II 8, p. 556 Jacobi, Versuch, p 158 **A. paucifòlia,** Tod (*A Roèzlii,* Hort) differs chiefly in its fewer lvs one-half wider, Hort Panorm, pl 19 The name *striata* has been applied, as a specific name, to variegated forms of *A americana*

51 **stricta,** Salm-Dyck (*A hístrix* or *hýstrix, A striàta stricta, Bonapártea hístrix, B robùsta, B stricta, Lattæa hístrix, Yúcca hístrix,* Hort) Lvs many, falcately upcurved in a globose cluster, triangularly biconvex, ¼ x 10–14 in, often pale or purplish, with a flattened triangular spine infl 5–10 ft, fls 1¼ in.; ovary ½in, segm ⅜in, tube ½in S Cent. Mex Jacobi, Versuch, p 153. Gt 31, p 56 Gart Mag. 40, p. 309 L de Smet, Cat 1874, pl —Known in a number of forms **purpùrea** with purplish, and **rósea** with rosy foliage of the ordinary type, **glaùca** (*A dealbàta hýstrix, A. hýstrix glaùca* and *glaucéscens, A striàta glaùca, Bonapártea glaùca, B striàta pulveruléntа, Lattæa dealbàta, L glaùca,* Hort), with long, and **nàna** (*A dealbàta brevifòlia, compacta mànor* and *nàna,* etc), with short, prunose lvs. A closely related form with flat rhombic lvs with flatter spine, and short-tubed fls. is **A. echinoides,** Jacobi (*A striàta echinoides, A ensiformis?, A hýstrix Ruchárdsii?, A Ruchárdsii?, A. striàta Richardsii, Dasylírion júnceum?,* Hort) Gn. 19, p 372

52 **falcàta,** Engelm. Lvs moderately numerous, falcately ascending, 3-sided, with slender 3-sided spine· infl 3-9 ft , fls purplish, 1 in , ovary ⅜in , segm. ¼in , tube ½in N Mex —The "guapilla," furnishing an important part of the ixtle of N Mex

53 **dasylirioides,** Jacobi Lvs moderately numerous, outcurved-ascending, thin and flat, ½ x 10–12 in , pale, with flattened brown spine infl 5-6 ft , recurving, fls 1½ in , ovary and segm ⅝in each, tube ¼-⅜ in · caps slender, ⅜x1 in. S Mex B M 5716 G C II. 8, p 557, III 5, p 804 Lyon Hort 22, p 365. G W 10, p 213 —The more glaucous form is **A. dealbàta,** Lem (*A dasylirioides dealbàta,* Baker) **A. intrépida,** Greenm , of Cent Mex , is very similar

BBBBBBBB *Lvs rather fleshy, long and narrow, unarmed or with minute soft prickles Trunkless*

c *Fls moderate, with narrow segm and slender tube.*

54 **yuccæfòlia,** DC (*A Cohnìana,* Jacobi *A spicàta,* Guss) Lvs few, recurved, with minute slender spine, concave, 1 x 24 in , glaucous, the dry edge minutely denticulate infl 10 ft , fls 1½ in , ovary and segm. ⅝in each, tube ½in caps ⅝ x ¾in Mex Redouté, Lil , pl 328, 329 B M 5213 R H 1860, p 519 Deutsch Gart Mag 1870, 2 pl Gn 12, p 583 —A very similar if distinct plant, from Jalisco, is *A Hoùghii,* Hort , and another is *A yuccæfòlia cæspitòsa,* Terr , Primo Contr , pl 4

cc *Fls rather small, with broad separated segms*

55 **bracteòsa,** Wats Lvs sigmoidally spreading, 3-sided, gray narrowly triangular, 1½ x 20 in , spineless, minutely denticulate infl 3–5 ft , the scape densely covered by narrow outcurved bracts, fls 1¼ in ovary ¾in , segms ⅝in , tube nearly suppressed caps ⅜ x ¾in N Mex G C II 18, p 776

The following names occur as being in cult *A Bakeri,* Hook f Resembles a gigantic crinum in habit Fls with pale green-ish yellow segms Mex (?) Gn 61, p 240 — 4 *carcharodonta* Allied to A Ghiesbrechtii Lvs flatter, narrower and more spiny —4 *Langlàssei,* André General habit as of Furcræa Bedinghaus1 Infl about 3 ft high Mex R H 1901 349 —4 *littoralis* Allied to A Scolymus Stemless Lvs strongly prickly toothed terminated by a stout spine fls greenish yellow —4 *Parolinìana* Stemless fls green-yellow —4 *Watsonii* Allied to A horrida Distinguished by extremely narrow border of the lf Probably Cent Amer —*A Wèberi* Distinguished by almost complete absence of marginal teeth Mex —4 *Wrightii,* J R Drumm Allied to A geminiflora Has been cult under name of A Taylori Trunk short margins of lvs sharp without teeth or prickles pyramidal dark green with cream-white borders Cent Amer B M 8271

WILLIAM TRELEASE

AGDÉSTIS (a mythical hermaphrodite monster, the genus being an anomalous one in its order) *Phytolaccàcex* Tender climbing shrub from Mex and Guatemala Cult in Calif at one time A monotypic genus.

clematídea, Moc & Sesse Lvs alternate, petiolate, cordate fls axillary or in terminal, branched, racemose cymes, white, star-shaped, sepals 4, petals 0 —Grows 40–50 ft in one season and is covered in Sept with masses of small white blossoms in dense racemes, very sweet-scented The red sts come from a tuber which grows half out of the earth, and which is sometimes 100 and 150 lbs in weight These tubers look like solid rocks They are of a gray granite-color To do its best, this plant requires very rich soil and an abundance of moisture Small offsets appear in quantities around the old tubers and furnish good material for prop On account of its ill-smelling foliage, the agdestis cannot be recommended for veranda decoration; but it is a fine plant for covering unsightly objects and outhouses; to be looked for in extreme South

N TAYLOR †

AGÉRATUM (Greek, *not growing old,* first applied to some everlasting) *Compósitæ* Garden annuals

Florets all tubular, blue (rarely pink) or white; pappus of separate or united scales, otherwise like Eupatorium —About 30 species, mostly Trop Am. herbs Two in cult , with opposite, ovate, stalked and crenate-serrate lvs and tassel-like heads in clusters. Mostly loose-growing plants, 1–2 ft high, but with compact, dwarf, and variegated forms Easily grown from seed in the open or started in house or hot-bed They thrive in any garden soil, bloom all summer and, if started late, winter-blooming under glass

conyzoìdes, Linn Involucral scales oblong, abruptly acuminate, sparingly if at all hairy on the back, erose and ciliate lvs blunt or rounded at base, rarely heart-shaped In most warm countries, often weed-like

Houstonìànum, Mill (*A mexicànum,* Sims) Fig 145 Involucral scales lance-linear, attenuate, entire, ciliate, the back finely, densely, and somewhat viscidly hairy· lvs usually heart-shaped at base heads slightly larger than in the last Mex B M 2524 —The better species and more frequent in cult

For so-called *A conspicuum* and *A Lasseauxii, see Eupatòrium glechonophyllum* and *E Lasseauxii* respectively

B L ROBINSON.



145. Ageratum Houstonianum. (×½)

AGLÀIA (Greek, *splendor,* from the order and general appearance). *Meliàceæ* A genus of more than 100 species of tender trees and shrubs from China, with minute, yellow, fragrant fls , said to be used in perfuming certain teas. Prop by cuttings.

odoràta, Lour Ten to 20 ft lvs alternate, 5–7 pinnate fls in axil-lary, branching panicles March–May. Wight. Icones Ind Or 2 511 —Cult sparingly in Calif and under glass in botanic gardens.

AGLAONÈMA (Greek, *bright thread*) *Aràceæ.* Greenhouse herbs grown for foliage and habit

Low plants with an erect st and basal shoots: lvs. with a long sheathed petiole, the blade usually oblong or oblong-lanceolate, with a thick costa and few lateral nerves peduncles in clusters, shorter than the petiole: spathe straight, convolute below, open above, spadix sessile or stalked —About 15 species, of Trop Asia and Afr , allied to Arum, Alocasia and Dieffenbachia, and requiring essentially the same treatment as those genera

These plants are evergreen, often beautifully variegated Aglaonemas may be divided, or cuttings may be taken from plants that become too tall and weak. In either case the cuttings and divisions should be put into the sand-bed previous to potting, to develop new roots All of the kinds will succeed in fibrous loam enriched with rotted manure, with the addition of a moderate quantity of leaf-mold, sand, and some crushed charcoal (G W. Oliver)

pictum, Kunth Dwarf lvs somewhat unequilateral, oblong or elliptic, ovate (4–7 in long and 2–3 in wide), very dark green, blotched with white, the central markings usually extending the whole length of the midrib. spathe white or whitish, 1-1½ in long Sumatra. I H 29 445.

nebulòsum, N E. Br. Somewhat larger. lvs narrower (5–8 in long, 1½ in or less wide), more acuminate, the markings rather more broken and not so continuous along the midrib. I H. 34.24. A.G. 16.361, and



146 Aglaonema costatum. (× ⅛)

F.E 7 961 (as *A pictum*) —This and *A pictum* are confused in the trade Both species deserve more attention than they have received in this country.

costàtum, Veitch Fig 146 Very dwarf and compact lvs heart-shaped, thick, 3 in wide, one-third longer than wide, seldom exceeding 5 in long, dark shining green, with midrib ivory-white and scattering blotches of white Holds its tufted lvs through the winter Moluccas J H III 63 225

A commutatum, Schott Lvs oblong-lanceolate, obtuse at the base, the apex long-acuminate, intense green, marked with spots of a paler green and of white E Indies —*A Roëblinii*, Hort., is "a fine decorative plant, with thick, leathery foliage" (Manda) —*A versicolor*, Hort Lvs obliquely oblong, about 4 in long by half as wide, rounded at the base, the apex acute, irregularly marked with patches of dark velvety green interspersed with paler green and milky blotches E Indies

GEORGE V. NASH.†

AGNUS-CÀSTUS. *Vitex*

AGRIMÒNIA (old name, perhaps a corruption of *Argemone*) *Rosàceæ* AGRIMONY Hardy perennial herbs, natives of the north temperate zone, with alternate odd-pinnate, aromatic and astringent lvs fls. yellow, racemose, with 5 small petals and 5–15 stamens: fr. armed with hooked bristles —Sometimes cult. as woodland or shrubbery plants Not showy. Prop by division of rootstocks in spring

Eupatòria, Linn (*A officinàlis*, Lam) COMMON AGRIMONY Fig 147 Petals twice as long as calyx, latter making a small, lightly adhering bur —Cult. in herb gardens to make a tonic tea, also in wild borders. Native to Eu Grows 2–3 ft high, in little clumps, from a short rootstock Has been confused with our native *A hirsuta*, Bicknell, which is not in the trade

odoràta, Mill Lfts narrower than in *A Eupatoria*, pubescent; lobes more deeply crenate-dentate· petals more than twice as long as the calyx Italy —Occasionally cult in Amer.

N TAYLOR †



147 Agrimonia Eupatoria Flower and bud.

AGROPŸRON (Greek, *agros*, field, and *puros*, wheat) *Gramíneæ*. WHEAT-GRASSES. Perennial grasses, often producing creeping rootstocks

Spikelets 3- to many-fld., sessile, placed sidewise, singly and alternately on the opposite sides of a continuous rachis, forming stiff terminal spikes; glumes equal, usually firm, many-nerved, acute or awned, sometimes nearly as long as the spikelet; lemmas 5–7-nerved, usually more or less awned, the palea ciliate on the keels.—Species 30 to 40 in the temperate regions of both hemispheres The genus differs from Triticum chiefly in being perennial, and in the entire apex of the glumes

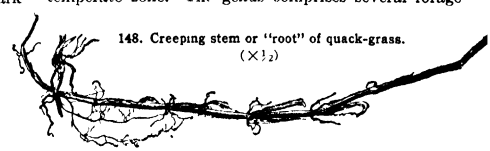
Many of the native species of the western states are important range grasses or furnish nutritious wild hay. One of these, western wheat-grass (*A tènerum*, Vasey) (Dept of Agric Div of Agrost 17 297) has been recently introduced into cultivation and is sold by seedsmen of the northwestern states One species, introduced from Europe, the familiar quack-grass (*A rèpens*, Beauv., Fig 148, also known as couch-grass, quick-grass and quitch-grass), is a troublesome weed in cultivated land, because of its long, creeping rootstocks Though difficult to eradicate, it has value as a forage plant

A. S. HITCHCOCK.

AGROSTÉMMA: *Lychnis.*

AGRÓSTIS (an ancient Greek name for a forage grass, from *agros*, a field) *Gramíneæ* BENT-GRASS Annual or usually perennial grasses with erect or creeping stems and open panicles of small flowers.

Spikelets 1-fld., glumes about equal, acute, lemma shorter and more delicate than the glumes, sometimes awned from the back, palea usually shorter than the lemma, often small or wanting —Species about 100, distributed over the entire world, especially in the north temperate zone. The genus comprises several forage



148. Creeping stem or "root" of quack-grass. (×½)

and lawn grasses and a few ornamental, the panicles being used for bouquets *A nebulosa* is excellent for dry bouquets *A elegans* of gardens is an Aira

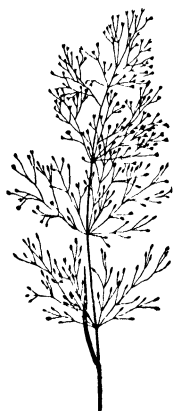
A *Panicle open but not diffuse perennial lawn and pasture grasses*

B *Palea present*

álba, Linn RED-TOP HERD'S-GRASS (locally). Culms erect, 2–3 ft., from a usually decumbent base, producing short rootstocks, sheaths smooth, ligule membranaceous, 2–3 lines long, blades flat, scabrous, rather strongly nerved, acuminate-pointed; panicle oblong or pyramidal, several inches or even a foot in length, spikelets 1–1½ lines long, the glumes scabrous on the keels, lemma awnless, palea one half to two-thirds as long as the lemma. Dept of Agric., Div. of Agrost, 17 187. Ibid B P.I Bull. 68, pl 2 —A common meadow and pasture grass, native of Eu., but abundantly escaped in the northern and central portions of the U S along roadsides and in waste places Var **vulgàris,** Thurb FINE BENT-GRASS. RED-TOP A more delicate grass, about 1 ft high. panicles 1–3 in ; ligule usually 1 line or less Dept of Agric B.P I Bull. 68, pl 3 —This form is commonly used as a lawn grass. Var. **aristàta,** Gray. Similar to var. *vulgaris* but the lemmas bearing an exserted awn from near the base Infrequent. Var **maritima,** Mey. Producing long stolons, panicles narrow, contracted. Dept of Agric B P.I Bull 68. pl. 4 —A native of the sea-coast of N. Amer and Eu. A form of this is cult. as a lawn grass under the name of creeping bent and has received the horticultural name *Agróstis álba* var. *stolonífera*, but is not *A. stolonífera*, Linn.

BB. *Palea wanting.*

canina, Linn. RHODE ISLAND BENT BROWN BENT. Slender, erect, cespitose, ½–2 ft. spikelets 1 line long, lemma bearing about the middle an exserted bent awn Dept of Agric B P I. Bull 68, pl 9 Eu —Cult as a lawn grass, and sparingly escaped Much of the commercial seed under this name is *Agrostis alba* var *vulgaris* The seed of *A. canina* may be distinguished by the absence of the palea.



149. Agrostis nebulosa. (×½)

AA. *Panicle diffuse, the main branches scabrous, long and hair-like, naked below*

B *Plants annual: palea present*

nebulòsa, Boiss & Reut CLOUD-GRASS Fig 149. Culms branched below, slender, 1 ft, blades few and small, ligule 2–3 lines, panicles oblong, about half the plant, delicate, the branches verticillate; spikelets ½ line, long-pedicelled, sometimes awned Spain —Cult for dry bouquets Sometimes called *A capillaris* but is not *A capillaris* of botanical authors

BB *Plants perennial palea wanting*

hiemàlis, B S P (*A scàbra,* Willd) HAIR-GRASS TICKLE-GRASS SILK-GRASS Culms low and delicate, 1–2 ft, blades small and mostly radical, panicles very diffuse, the spikelets borne toward the extremities of the branches Dept of Agric B P I Bull. 68, pl 26 —The panicles break away at maturity and are blown about by the wind. The young panicles are often used for dry bouquets

A minutiflòra See Sporobolus minutiflorus

A S HITCHCOCK.

AGUACATE, ALLIGATOR PEAR, AVOCADO: *Persea*

AILÁNTHUS (from its native name *Ailanto,* meaning *Tree of Heaven*) Syn, *Pongèlion Simarubàcæ* Trees chiefly grown for their handsome large foliage.

Large trees lvs alternate, odd-pinnate, deciduous. fls small, in large terminal panicles, polygamous; sepals and petals 5 or 6; disk small, 10-lobed, stamens 10; carpels 5 or 6 fr consisting of 1–5 distinct oblong samaras with the compressed seed in the middle —Eight or 9 species in Cent and S Asia and in N Austral

These trees are sparingly branched, with large pinnate foliage, inconspicuous greenish flowers in upright panicles followed by winged fruits, the foliage exhales a disagreeable odor when bruised The ailanthus foliage gives a tropical effect when the growth is very strong

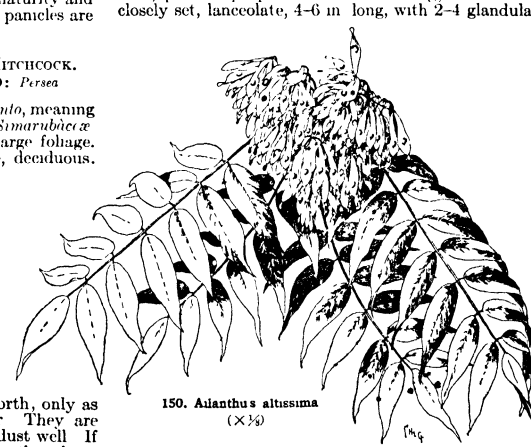
The Chinese species are fairly hardy North, only as young plants are they somewhat tender They are very rapid growers and stand smoke and dust well If plants are cut back to the ground after they have become established (in two or three years after planting), they will throw up very strong shoots and make an excellent screen This practice may be repeated year after year Sumacs, paulownias, basswoods, mulberries, and other fast-growing things may be treated in this way The ailanthus foliage is very like that of the cedrela (which see for illustration of differences) The best known is *A. altissima,* which is often planted as a street tree, particularly in cities, as it resists smoke better than many other trees and is not attacked by insects For street planting, the fertile plant only should be used, because the male exhales a disagreeable odor when flowering, and the pollen is said to cause catarrhal troubles It grows in almost any soil, but best in a light and somewhat moist one

Propagation is by seeds which must be sown soon after ripening, and by root-cuttings It suckers from the roots.

A *Branchlets and petioles glabrous or only finely pubescent lfts glabrous beneath.*

altíssima, Swingle (*A glandulòsa,* Desf) TREE OF HEAVEN Fig 150 Tree, to 60 ft young branchlets minutely pubescent, usually dull yellowish brown lvs 1½–2 ft long, lfts 13–25, stalked, ovate-lanceolate, usually truncate at the base, 3–5 in long, finely ciliate, with 8–10 pairs of veins, glabrous and glaucescent beneath, near the base with 2–4 coarse teeth, each with a large gland beneath samaras 1½ in long June, July. China G C III 2 365 Gn 24, pp 63,65 (habit), 32, p. 330 Mn 10, p 152 (habit) M D G 1901 321 (habit). Var **erythrocárpa,** Rehd (*A erythrocárpa,* Carr *A. ràbra,* Hort) Lvs darker green above and more glaucous beneath fr bright red, very effective in late summer and autumn Var **pendulifòlia,** Rehd Lvs very large, drooping R H 1906, p 545 Var **sutchuenénsis,** Rehd & Wilson (*A sutchuenensis,* Dode) Young branchlets reddish brown, glabrous, lustrous petioles purplish glabrous lfts not ciliate, cuneate at the base, at least in older plants fr about 2 in long W China —In China this species and *A Vilmoriniana* are sometimes planted as the host of a silkworm, *Attacus cynthia,* which produces a coarse silk, inferior to that of the common silkworm As a shade and street tree, it is now much planted in temperate regions and naturalized in some localities

Giráldii, Dode Tree, young branchlets finely pubescent, petioles purplish lvs 2–3 ft long, lfts 33–41, closely set, lanceolate, 4–6 in long, with 2–4 glandular



150. Ailanthus altissima (×⅓)

teeth near the base, undulate at the margin and long-pointed, with 14–15 pairs of secondary veins, dark green above, pale green beneath panicle 8–12 in long. fr 2½ in long. W. China

AA *Branchlets and petioles, at least in young trees, prickly and pubescent lfts pubescent beneath.*

Vilmoriniàna, Dode (*Pongèlion Vilmoriniànum,* Van Tieghem *A. altissima* var *spinòsa,* Bois). Tree, to 50 ft lvs. 2–3 ft long, lfts 17–35, oblong-lanceolate,

4–6 in. long, with 2–4 gland-bearing teeth near the base, glabrous or pubescent above, glaucescent and pubescent beneath panicle to 12 in. long fr about 2 in long W. China R.H. 1904, p 445 Gn 75 p 632 (habit) —Has proved at least as hardy as *A. altissima* at the Arnold Arboretum

A excélsa, Roxb (Pongelion excelsum, Pierre) Tall tree lvs. 3 ft long, abruptly pinnate, lfts 20–28, teeth without glands India. Can be grown only in tropical regions or in the hothouse —*A. flavéscens*, Carr =Cedrela sinensis

ALFRED REHDER.

AÌRA (an ancient Greek name for Darnel). *Gramineæ* HAIR-GRASS Annual grasses with delicate culms and open capillary panicles. Spikelets 2-fld. one or



151. Ajuga reptans var. variegata. (×⅛)

both fls awned from the middle of the back; palea nearly as long as the lemma - Species 6, natives of the Medit region, intro in the Atlantic states and on the Pacific coast Cult for dry bouquets The species have been confused by florists with Agrostis (as *Agrostis elegans*) from which genus they may be distinguished by their 2-fld spikelets

capillàris, Host (*A élegans*, Willd.) Spikelets less than 1 line long, all long-pedicelled

caryophyllèa, Linn Pedicels mostly shorter than the spikelets Dept of Agric Div of Agrost 7 170

A cæspitòsa=Deschampsia cæspitosa —*A fòlius variegàtis* This name is listed in trade catalogues, but the seedsmen report that all failed Probably is Deschampsia cæspitosa

A S HITCHCOCK

AIR-PLANT. In common speech, any plant that grows on the trunk or in the top of another plant is called an air-plant The proper term is *epiphyte* (that is, *growing on a plant*), which see In horticulture, the term air-plant is usually applied to epiphytal orchids, tillandsias, and the like Most of these grow on old bark, perhaps deriving some of their nourishment from the bark, but most of it from the air and rain Air-plants are not parasites,—they do not derive their support from the juices of the host

The term is sometimes applied to plants that make roots from leaves or other parts that are severed and allowed to remain out of the earth Bryophyllum is a leading example, because new plants start from the leaf-edges The dioscoreas and rajanias that bear aërial tubers are sometimes known as air-plants See also *Resurrection Plants*

AJÙGA (*not yoked*· the calyx not bilabiate) *Labiàtæ.* BUGLE-WEED Hardy herbaceous European perennials, creeping by stolons

Height 6–12 in. fls numerous, in whorls, normally blue or purple, with rosy or white varieties; corolla 2-lipped, the upper lip short, the lower spreading —Considerably used in rock-gardens and for border planting Prop by division in spring or by seeds

genevénsis, Linn (*A rugòsa*, Hort. *A. alpìna*, Hort.). St erect, pubescent cauline lvs oblong-elliptic or obovate, narrowed at the base, lower ones petiolate; floral lvs. ovate or wedge-shaped, coarsely toothed, sparsely hairy upper fl.-whorls spicate; lower whorls distant. May, June.

pyramidàlis, Linn St erect cauline lvs obovate, hardly petiolate, in a 4-sided pyramid, floral lvs broadly ovate, the highest often colored, all lvs entire. fl.-whorls usually all spicate.

réptans, Linn St prostrate lvs ovate or obovate, entire or sinuate, shiny —A low, dense, fast-spreading creeper, excellent for covering shady slopes The typical and white-fld forms are less cult than the following Var **rùbra,** Hort More valued for its dark purple lvs. than its blue fls Var. **variegàta,** Hort Fig 151. Lvs. splashed and edged creamy yellow Var **atropurpùrea,** Hort Fls purplish blue May —Useful for carpeting the ground in shady places

A metállica var *crispa*, Hort., intro by Henderson, 1899, is described as dwarf (4–5 in.), with curled, metallic glossy and blue fls in a pyramidal spike —A bedding plant, intro from Germany None of the varieties are so desirable as the typical form —*A Bröckbanki*, Hort., "with fine blue fls," and *A ovalifòra*, Hort., are trade names for blue-fld bugles that are unknown in hort or botanical literature, and it is uncertain to what species they are to be referred

N. TAYLOR †

AKEE: *Blighia*

AKÈBIA (from *Akebi*, its Japanese name). *Lardizabalàceæ*, by some included in *Berberidàceæ* Twining woody plants.

Glabrous twining shrubs lvs half-evergreen, long-petioled, digitate fls monœcious, in axillary raceme, the pistillate at the base, the staminate smaller, at the end of the raceme, sepals 3, stamens 6, carpels 3–12, with sessile stigma fr a large oblong berry with numerous seeds imbedded in a pulp, opening along the inner suture —Two species with several varieties in Japan and China

The akebias are very ornamental, hardy climbing shrubs of graceful appearance, especially adapted for places in which very dense shade is not wanted They require a sunny position and well-drained soil, also valuable in the cool greenhouse for covering pillars and walls, growing best in a sandy compost of loam, leaf soil and peat In Japan, the fruit which is very showy but with us rarely produced, is eaten, and the stems are much used for wicker-work

Propagation is by seeds, by greenwood or hardwood cuttings, and also by root-division and layers

quinàta, Decne Figs 152, 153 Climbing 12 ft or more young branchlets purplish lfts 5, oval or oblong-obovate, entire, emarginate, 1–2 in long fls fragrant, the pistillate purplish brown, about 1 in broad, the staminate smaller, rosy purple, in early spring



152 Akebia quinata flowers.

berry oblong, 3–5 in long, dark purple with glaucous bloom, seeds black. April, May China, Japan. B R 33 28. B M 4864 G F. 4 137 (adapted in Fig 153) A G. March, 1891, figs 5, 7, and plate. G W 10, p 500. Gn 51, p 151 R H. 1853.141. S Z 77.—Hardy, handsome, not attacked by insects or fungi Very graceful and desirable

lobàta, Decne. (*A quercifòlia*, Sieb & Zucc)

Lfts 3, broadly ovate, coarsely crenate, 1–2 in. long: fls in long racemes, smaller than those of *A quinata*. Japan, China B M. 7485 A G March, 1891, p. 140. G W 13, p 438. S Z. 1.78. Var **australis,** Diels. Lfts oval or ovate to ovate-oblong, entire or nearly so, coriaceous —Recently intro from China and probably tender Var **clematifólia,** Ito Lfts. broadly ovate to ovate, entire, of thin texture, to 3½ in long Japan A supposed hybrid of this and the preceding species is *A pentaphylla*, Makino, with 3–5 lfts entire or sparingly crenate ALFRED REHDER

ALÁNGIUM (from the Malabar name) Including *Márlea. Alangiàceæ*, formerly included in *Cornàceæ* Trees or shrubs, rarely grown in temperate regions for their handsome large foliage and fragrant fls A genus of over 20 species of shrubs or small trees of the Old World tropics, with alternate entire or lobed evergreen or deciduous lvs and small, perfect whitish, often fragrant, fls in axillary clusters, calyx small, campanulate, petals 4–10, linear, usually laxly reflexed, stamens 4–30, ovary inferior, style simple, elongated fr a 1-seeded drupe Sometimes cult in Old World gardens, either as stove plants or out-of-doors in warmer regions, but probably not in the American trade.

1 *begoniifolium*, Baill (Marlea begoniifolia, Roxbg) Tree to 60 ft lvs ovate, entire or slightly lobed, acuminate, usually rounded at base, to 8 in long fls ¾in long, in cymes, petals and stamens usually 6 Afr, S and E Asia B R 24 61 E P IV 220b, p 3 —*A decapetalum*, Lam (*A salvifolium* var *decapetalum*, Wang A Lamarckii, Thwait) 30 ft lvs entire, oblong-lanceolate fls fragrant, white, solitary or in 2–8 or 3–8 in the axils, petals 10 Indm E P IV 220b, 10 —*A platanifólium*, Harms (Marlea platanifolia, Sieb & Zucc) Tree lvs roundish in outline, 3–5-lobed, to 8–10 in long fls over 1 in long, in few-fld cymes, petals and stamens usually 6 Japan, China, E P IV 220b, p 23 This seems to be the hardiest species and is probably hardy as far north as Washington, D C ALFRED REHDER

ALBÉRTA (from Albertus Grotus, commonly known as Albertus Magnus, philosopher of the thirteenth century, who wrote concerning plants) *Rubiàceæ* Two species of shrubs or trees, one of which has been introduced as a hothouse or greenhouse subject

Leaves thick, opposite fls rose-colored or purplish, in terminal panicles, calyx 10-ribbed and 5-lobed, often colored in fr, corolla elongated-tubular

mágna, E Mey Bark pale, the young branches reddish brown lvs 1–5 in long, obovate-oblong, obtuse, entire, narrowed into a short, stout petiole, midrib stout panicle terminal, erect, 6 in high and nearly as broad at the base, corolla-tube 1 in long, slightly swelling in upper part, pubescent, lobes 5, small, triangular, recurved Natal B M 7454 G C III. 22 416 Gn 53 130 The other species is *A. minor*, Baill, from Madagascar L H. B.

ALBÍZZIA (after *Albizzi*, an Italian naturalist). *Leguminòsæ* Ornamental woody plants chiefly grown for their handsome foliage and also for their attractive flowers, some are valuable timber trees, closely allied to the acacias

Trees or shrubs lvs deciduous, alternate, bipinnate, lfts usually small and numerous, oblique fls in axillary, pedunceled spikes or globular heads, calyx tubular or campanulate, 5-toothed, corolla small, funnelform, with the segm connate more than one-half, stamens numerous, more or less connate at the base, exserted fr a large strap-shaped pod without pulp —About 25 species in tropical and subtropical regions of Asia, Afr and Austral, 1 in Mex

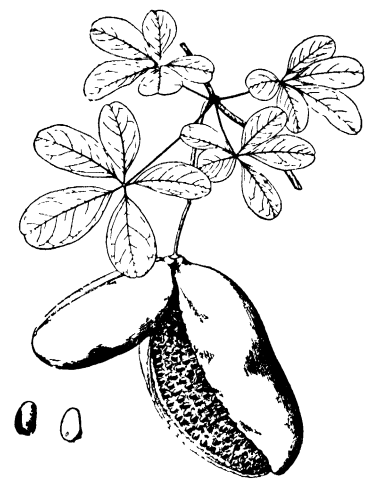
The albizzias are unarmed trees or shrubs with graceful feathery foliage and yellowish, white or pink flowers in summer Most of the species can be grown only in subtropical and tropical regions except *A Julibrissin* which is the hardiest species and can be grown as far north as Washington, D C *A. lophantha* is sometimes grown as a greenhouse shrub.

For cultivation, see *Acacia.*

A. *Fls. in cylindrical axillary spikes lvs. sub-persistent.*

lophántha, Benth (*Acàcia lophántha*, Willd) Shrub or small tree, 6–20 ft lvs with 14–24 pinnæ, each with 40–60 lfts, about 5 lines long, linear, obtuse spikes mostly 2, about 2 in long, yellowish, fls distinctly pedicelled S. W Austral B M. 2108 B R 5 361. L B C. 8 716 —Sometimes cult as greenhouse shrub and flowering in spring, and in the open in the S, it has become naturalized in S Calif Often known as *Acacia speciosa*. There is a var **gigantèa** in the trade.

montàna, Benth Small tree, ferruginously villous: lvs with 14–24 pinnæ, each with 40–80 lfts. linear-



153 Akebia quinata fruit (×⅓)

oblong, 3–4 lines long, obtuse spikes cylindric, 2–3 in long, fls very short-pedicelled Java —Closely related to the preceding species, differing chiefly in its yellowish pubescence and in the short-stalked fls

AA *Fls in globular heads lvs. deciduous.*

B *Stamens united only at the base*

C *Lfts ovate or oblong, obtuse*

D. *The fls pedicelled, in axillary heads*

Lébbek, Benth (*Acàcia Lébbek*, Willd. *A. speciòsa*, Willd) LEBBECK TREE SIRIS TREE WOMAN'S-TONGUE TREE Fig 154 Tall tree lvs with 4–8 pinnæ, each with 10–18 lfts, obliquely oblong or oval, 1–1½ in long, nearly sessile fls greenish yellow, in short-peduncled, axillary heads, 3–4 together Trop. Asia, N Austral.—Planted as a yard tree in American tropics

occidentàlis, Brandegee Small tree, 15–25 ft lvs. with 8 pinnæ, each with 6–10 lfts, oblique-oval, ¾–1½ in long, glabrous fls yellowish, in axillary heads. June, July Mex, Low Calif —Possibly only a variety of *A. Lebbek*, and not indigenous

DD. *The fls. nearly sessile in fascicled heads forming large terminal panicles*

odoratíssima, Benth (*Acàcia odoratíssima*, Willd). Tall tree lvs with downy rachis, pinnæ 6–14, each with 16–50 lfts, oblique-oblong, ¾–1 in long, glaucous beneath heads few-fld, numerous, greenish white E. Indies

procèra, Benth. (*Acàcia procèra,* Willd.). Tall tree: lvs. with nearly glabrous rachis, pinnæ 6–10, each with 12–16 lfts., oblique-oblong, 1–1½ in. long, glabrous heads few-fld., greenish white. Trop. Asia, Austral.

cc. *Lfts. falcate, with the midrib close to the upper edge, acute*

Julibrîssin, Durazz (*Acàcia Julibrîssin,* Willd *A Nèmu,* Willd.). Tree, 30–40 ft rachis of the lvs with a small gland at the base, pinnæ 8–24, with numerous lfts., falcate-oblong, ¼in. long heads pink, slender-peduncled, crowded on the upper end of the branches Warmer Temp. Asia from Persia to Japan Summer S F. 1 51 Var. **rôsea,** Mouillef (*A rôsea,* Carr.) Fls bright pink, dwarfer and hardier than the type. R H 1870 490, 1912, pp 184, 185 F S 21 2199 —This variety is sometimes grown under the name *A Nemu*

Var. **mollis,** Benth (*A móllis,* Boiss *Acàcia mollis,* Wall.). Lfts broader, densely pubescent Himalayas and Abyssinia



154. Albizzia Lebbek.
(×¼)

stipulàta, Boiss (*Acàcia stipulàta,* DC.) Tall tree: young branches with large, persistent stipules rachis of the lvs with many glands, pubescent, pinnæ 12–40, with numerous lfts., oblong-linear, ¼–½in. long, pubescent beneath heads in axillary simple or terminal compound racemes Trop Asia.

BB *Stamens connate into a long, narrow tube*

fastigiàta, Oliver (*Zýgia fastigiàta,* E Mey.) Tree branches and petioles rusty-pubescent, pinnæ 8–14, each with 16–30 lfts., trapezoid-oblong, ⅓–½in. long, pubescent beneath heads in terminal corymbs on the end of the branches Trop Afr

A moluccana, Miq Tree rachis of the lvs with many glands, pinnæ 14, each with 12–40 lfts., obliquely elliptic-oblong, glaucous and pubescent beneath Moluccas —Incompletely known

ALFRED REHDER

ALBÙCA (*whitish,* the color of the first-described species) *Liliàceæ* Tender bulbs from the Cape of Good Hope allied to Ornithogalum, and treated in the same way

Bulb tunicated lvs all radical, flat or terete fls large, yellow, white or green, in single racemes perianth of 3 outer oblong more or less spreading parts and 3 inner shorter connivent segms ; stamens 6, the filaments often winged, stigma 3-lobed: fr a 3-valved caps — S. and Trop Afr and Arabia

There are a good number of species of Albuca (about 30), but few are much known to cultivation, and none of them is apparently planted to any extent in this country. Albucas are late spring and summer bloomers, producing attractive white or yellow flowers In mild climates, they may be carried over winter in a frame or with a good protection of litter. Propagation is by offsets or by seeds. Some of the species are hothouse plants Allied to Urginea, to which the *A. major* of catalogues probably belongs. Numbers of hybrids have been produced

aùrea, Jacq Two ft · bracts yellow· fls 10–30, pale yellow, upright. lvs very narrow, flat. June.

Nélsonii, N E. Br Three to 5 ft. fls 1½ in. long, in a large cluster or spike, almond-scented, pure white with a red-brown stripe down the middle of each segm. (but pure white under glass) lvs long, grooved or concave at base, flat above, pointed July, Aug —Probably the best species yet intro The bulbs are lifted in autumn, or they may be potted up for greenhouse use. It is an excellent plant when well grown. B.M 6649.

L. H. B

ALCHEMÍLLA (from an Arabic name). *Rosàceæ.* Hardy herbaceous perennials, suitable for rock-gardens and front rows of borders

Low (6–8 in.) lvs palmately lobed or compound: fls small, greenish or yellowish, in clusters, petals 0; stamens 1–4, pistils 1–4, becoming achenes included in the persisting calyx —Species 30 or more in Cent and S Amer., Afr., India and elsewhere, largely in mountains

Plants of easiest culture Propagation is effected by division or by seeds *A. arvensis* and *A pratensis* of Europe are naturalized in North America The *A. major* of catalogues is probably a form of one of the species

alpìna, Bieb Lvs digitate, 5–7-cut, lfts usually 7, lanceolate-cuneate, obtuse, serrate at apex, silky hairy beneath, shiny. Eu

serícea, Willd Lvs larger than in *A alpina,* 5–7-nerved, digitate, lfts 7, lanceolate, acute, deeply serrate from the middle to apex, downy beneath. Caucasus

vulgàris, Linn (*A montàna,* Schmidt) LADY'S MANTLE Lvs 7–9-nerved, 7–9-cut, reniform, plicate-concave. North temperate zone L. H B †

ALCHÓRNEA (in memory of Stanesby Alchorne). *Euphorbiàceæ* DOVEWOOD Tropical shrubs or trees with alternate, entire or dentate lvs fls usually dœcious, in elongated slender catkin-like infl., staminate calyx 4-lobed; stamens 8

One species, **A. ilicifòlia,** Muell. Arg., is rarely grown in greenhouses, and is listed by U S Dept of Agric as intro from Austral It is a tall, handsome shrub with thick, holly-like lvs. The wood is useful

J. B. S NORTON.

ALDER *Alnus.*

ALECTORÙRUS (Greek, apparently cock's-tail). *Liliàceæ* An anthericum-like plant, summer-blooming and suitable for outdoor culture, hardy in England. Blooms well in pots One species, **A. yedoénsis,** Makino, of Japan (known also as *Anthericum yedoense,* Maxim., and *Bulbinella yedoensis,* Matsum.), is now intro to gardens It is a perennial glabrous herb with a short and thick rootstock lvs 6–11, 2-ranked, 20 in. or less long fls. many, small, pale rose, racemose along panicled branches on a scape or st surpassing the lvs, perianth bell-shaped, segms 6, stamens 6, in some fls exserted and in others only equaling the segms ; ovary 3-lobed. In Japan it is known as Keibi-ran. B M. 8336. G C. III. 48:352

L. H. B.

ALÉCTRYON (Greek name for the chanticleer). *Sapindàceæ* TITOKI Tall trees, one of which is grown in California

Leaves alternate, pinnate, stipulate, the lfts. entire or toothed fls mostly unisexual, in axillary or terminal panicles, the petals wanting, containing a small lobed disk; stamens 10 or less. fr a hard woody caps, the seeds arillate, with spiral cotyledons —Some 16 species in Malaya and the Pacific Isls.

excélsum, Gaertn. Evergreen, 30–60 ft, with un equally pinnate lvs 4–12 in long, the lfts 4–6 pairs and 2–4 in. long, ovate-lanceolate and acuminate, nearly or quite entire. fls greenish, in a much-branched panicle fr globose, woody; seed large, jet-black and shining, sunk in a large scarlet aril New Zeal —Said to have been in cult in Calif for more than 40 years and to have been sometimes sold for *Nephelium Litchi* (to which it is closely related) In New Zeal it yields a tough elastic timber used for tools and yokes, and the natives extract oil from the seeds L H B

ÁLETRIS (Greek word for *female slave* who ground corn, alluding to apparent mealiness of the fls) *Liliàceæ* Hardy small herbs, sometimes grown in borders

Leaves thin, flat, lanceolate, grass-like, in a spreading cluster, all radical fls small, in a spiked raceme, terminating a slender scape 2–3 ft high, perianth not woolly, but wrinkled and roughened with many points that give a mealy appearance, perianth 6-cleft, stamens 6, inserted at the base of the lobes, style 3-cleft —The aletrises are about 8 in number, in moors, barrens, and grassy places in N Amer, E Asia and Japan They are fibrous-rooted, very bitter herbs, with fls on a naked scape 1-2 ft high July, Aug They prefer a moist but sunny situation Prop slowly by division, or seeds may be used A plant once catalogued as *A japonica* is undetermined

farinòsa, Linn Fls tubular, white, lobes lanceolate-oblong N Amer L B C 12 1161

aûrea, Walt Fls. bell-shaped, fewer and shorter than in *A farinosa*, yellow, lobes short, ovate S. E N Amer B M 1418 (erroneously as *A. farinosa*)

L. H. B.

ALEURÌTES (Greek, *farinose* or *floury*) *Euphorbiàceæ* Tropical trees grown for the oils they yield or sometimes for shade and ornament

Leaves alternate, palmately veined, 3–5-lobed, the long petioles with 2 glands at the apex fls usually monœcious, in lax terminal cymes, sepals 2–3, valvate, petals 5, stamens 8–20, the inner row monadelphous, 1 ovule in each cell of the 2–5-celled ovary fr large, drupaceous, with thick-shelled seeds —Four species, with milky juice, natives of E Asia and Pacific Isls Jatropha and Hevea, are related genera Page 3565

All of the species are cultivated in tropical countries for the drying oil derived from the seeds. These oils are similar to linseed oil, but dry quicker, harder and more waterproof but less lightproof and elastic The seeds of *A. moluccana* yield 60 per cent of oil (kekuna, kelun or bankul oil), which is used for burning or in varnishes The seed or oil is also used to some extent as food and the wood is worked The tree is grown for shade It is said to be easily grown in the tropics up to 2,000 feet altitude It is easily propagated from seeds, which sprout in four to five weeks The oil (wood-oil, tung-oil) of the seeds of the wood-oil trees (*A cordata*, *A Fordii*) is much used, especially in China and Japan, for treating woodwork, cloth, and the like, and for burning Its importation to this country is on the increase, where it is used in varnishes and other products, paints, soaps, linoleum, and so on *A Fordii*, which is the hardier species, has been extensively introduced into the southern states by our Department of Agriculture and is reported to be doing very well.

A cordata is a fine smooth-barked tree, good for shade and will stand high temperature, but not much below freezing *A Fordii* is a very ornamental tree.

The wood-oil trees are usually grown on dry, thin soil not suited to general farming They are grown from seeds, and begin to produce nuts in three to six years. The seedlings are raised in a bed and transplanted when about a foot high or are planted where they are to stand They may also be propagated from hardwood cuttings, which root readily An average tree is said to yield twenty to fifty pounds of nuts with about 24 per cent of oil. The oil is pressed from the seed after roasting The seed is poisonous See Circ 108, U S Bu Pl Ind

A. *Pubescence stellate*

moluccàna, Willd (*A triloba*, Forst). CANDLENUT. CANDLEBERRY TREE VARNISH TREE. Tree with long spreading branches lvs large, ovate-acuminate, short-lobed, rusty pubescent below. paniculate cymes 4–5 in long of many small fls, stamens 15–20, ovary 2-celled fr 2–3 in thick, seeds large, rough and walnut-like —Probably native of Malay region but now widely cult and wild in the tropics In wooded valleys up to 3,000 ft Mem Torr Bot Club 8.117 Blanco Flor Filip 220 —Also known as Belgaum walnut, Indian walnut, kukui and various other native names

trispérma, Blanco (*A sapondria*, Blanco). BANUCALAG Differs from *A moluccana* in having 7–10 stamens, a 3–4-celled ovary, lvs more entire and seeds smooth Philippines —Intro once by U S Dept of Agric The seed used for the drying oil Other native names are balocanad, bagulumbang, calumbang, balucanag. Blanco Flor Filip, 296

AA *Pubescence not stellate*

cordàta, R Br JAPAN WOOD-OIL TREE Twenty-five to 30 ft high lvs broadly ovate, acuminate, 3–5-lobed or toothed petals oblong, ¾in long, hairy at base, stamens 8–10, ovary 3–4-celled fr warty, seeds about the size and shape of large castor beans S. E Asia and adjoining isls, cult especially in Japan, south of 40°, and in Formosa

Fòrdii, Hemsl (*A cordàta*, Muell Arg, in part). CHINA WOOD-OIL TREE Ten to 25 ft high lvs ovate-cordate petals 1 in or more long, orbicular ovate, somewhat hairy, stamens 8–10, ovary about 4-celled fr smooth panicles of reddish white fls in spring fr ripe in Sept Cent Asia —Extensively cult for the oil Perfectly hardy in Cent Fla and resistant to drought

J B. S NORTON

ALEXANDERS. Name applied to *Smyrnium Olusatrum* (Umbelliferæ), the blanched leaf-stalks of which were once used as a salad and pot-herb, but now out of cultivation because of the superior value of celery It is a biennial, native to Europe, with ternately dissected pinnate radical leaves, and small yellow flowers in umbels Seed is sown in late summer or in autumn, and the plants transplanted in rows as they come up in spring The plants are blanched by being banked with earth

ALFÁLFA, LUCÉRNE (*Medicàgo sativa*, Linn) A deep-rooted perennial forage plant of the *Legumindsæ*. The plant grows one to four feet high, bears pinnate leaves with three ovate-oblong toothed leaflets, and small head-like racemes of purple clover-shaped flowers It is native to Europe In the arid parts of the United States it is the staple hay and forage plant, and it is also grown to a considerable extent in the East. Two to six mowings may be made each year from established meadows Fifteen to thirty pounds of seed are sown to the acre, and the seed is preferably sown alone, without another crop. Alfalfa should not be pastured the first year In two or three years it becomes thoroughly established and productive, and it should continue for many years June-grass often runs it out in a cool, moist climate Alfalfa often becomes a weed in waste places See Cyclo Amer. Agric II, for full account.

ALFILARIA. Spelled also *Alfilera* which is the West American, and *Alfillarilla*, the Spanish-American for *Erodium cicutarium*, L'Her *Geraniàceæ* A hairy annual with pinnate lvs, sometimes used for pasture in dry regions See Cyclo Amer Agric. II, p 197

ÁLGA, plural **ALGÆ.** A general name for chlorophyll-bearing thallophytes. They are flowerless plants, allied to the fungi, and generally inhabit water Those occurring in salt water are known as seaweeds. None is cultivated. The green "moss" on flower-pots is made up of algæ

ALGARÒBA is the fruit of *Ceratonia siliqua*

ALHÀGI (its Mauretanian name) *Legumindsæ.* Shrubs grown for their profusely produced red flowers. Spiny plants: lvs alternate, oblong, small, deciduous, entire: fls papilionaceous, red, small, in few-fld. axillary racemes; calyx campanulate, 5-toothed; pods



155. Allamanda cathartica var. Hendersonii. (×⅓)

terete, contracted between the seeds —Three closely related species from Greece and Egypt to the Himalayas.

These plants are low, much-branched shrubs with small and sparse, pale foliage and numerous small red flowers toward the end of the branches Only the following species, which produces the Persian or alhagi manna, is but very rarely met with in collections. It may be cultivated in temperate regions in dry and sunny positions and propagated by seeds and by greenwood cuttings under glass with slight bottom heat, as a desert plant, it is impatient of too much moisture, and needs special attention, particularly in the seedling state

camelòrum, Fisch. CAMEL'S THORN Low, spiny shrub, glabrous or nearly glabrous lvs. oblong, obtuse, ½–1¼ in. long fls red, about ½in. long, on few-fld. axillary racemes, forming panicles at the end of the branches Summer Caucasus to the Himalayas.—Easily distinguished by its glabrousness from the other species, which are more or less pubescent The other species are *A. græcorum,* Boiss , *A maurorum,* Medic.

ALFRED REHDER.

ALÍSMA (derivation doubtful). *Alismàceæ.* A genus of 2 species of hardy aquatics, with small white or pale rose fls on scapes with whorled, paniculed branches. Perennial by a stout proliferous corm Useful in ponds. Prop. by division or seeds According to N. Amer. Flora 17·43, 1905, the native water-plantain is not the same as the Old World species, to which, exclusively, should be applied the name here taken up for the species which has hitherto been considered cosmopolitan, and is now so treated.

Plantàgo-aquática, Linn. (*A. Plantàgo* of authors *A. subcordàtum,* Raf). WATER-PLANTAIN. Lvs variable, but usually broadly cordate-ovate, thinner and narrower when growing under water panicle 1–2 ft. long Common in swales and still waters in U. S ; also in Eu. and Asia.

A nàtans, Linn , is now referred to the monotypic genus Elisma (E natans, Buch) It is native to Eu , and is offered in foreign catalogues Fl white, single, on a long peduncle floating lvs. elliptic and obtuse See *Elisma.*

N. TAYLOR.†

ALKÁNNA, ÁLKANET *Anchusa*

ALKEKÉNGI *Physalis*

ALLAMÁNDA (Dr Allamand, Leyden) *Apocynàceæ* Tropical shrubs, mostly climbers, grown in greenhouses and conservatories, and in the open far south

Leaves entire, whorled fls terminal, large and funnel-shaped, with a flat spreading or reflexed limb, the tube inflated below the throat in which there are 5 hairy scales, stamens 5, the filaments very short, ovary 1-loculed the fr (seldom seen in conservatories) a large spiny globular or oblong pod —About a dozen species in Brazil and 1 in Cent Amer

With the exception of *A violacea* and *A. nerifolia,* all the forms in cultivation are probably forms of one variable species The original name for this is *A cathartica,* and the plants known in the trade as *A grandiflora, A nobilis, A Schottii, A magnifica, A Williamsii* are all referred to it as varieties For garden purposes they are distinct, but botanically the differences are so slight as not to justify their being retained as species *A violacea* is readily distinguished by the color of the flowers, and *A nerifolia* by the swollen base of the corolla

The allamandas comprise several of the finest climbing plants in cultivation and are general favorites wherever grown They are of very easy culture, thriving well under the ordinary conditions of a stove or warm greenhouse A mixture of two parts of strong turfy loam and one part of sharp sand, leaf-mold and charcoal, suits them best Cuttings root readily in a close case in sandy soil in a temperature of 70° F at almost any time of the year, but spring is by far the best time, as the young plants have a long season of growth ahead of them and make better plants than those rooted later. Both old and new wood may be used for propagation, the young growth should be taken off with a heel if possible, whilst pieces of the previous season's wood, which has been well ripened, may be cut up into lengths with two or three joints, in spring, the stems which are removed during the annual pruning may be used for this purpose All the species make most excellent pot-plants, but in order to obtain them at their best they should be planted out in a well-drained border When well established, either in pots or borders, they should be fed liberally with natural or artificial manures, during the whole of the growing season, as all the species without exception, are gross feeders After growth has ceased in late autumn or winter, the plants should be kept nearly, but not quite dry at the roots until February or March, when they should be cut back as far as is necessary, and started in a moist position in the greenhouse Any repotting that they require should be done before the new growths are more than 6 inches long The weaker kinds, as *A. violacea, A cathartica* var. *grandiflora* and var. *Williamsii,* are best grafted on the strong-growing var. *Hendersonii* Spring and summer.

A *Plant bushy, or little climbing: fl swollen at base.*

neriifòlia, Hook A dwarf bush or half climber: sts. terete, woody below, covered with down when young lvs petiolate, 2–5 in a whorl, elliptic or ovate-acuminate, rich dark green above, pale dull green below, midrib and principal veins softly pilose, petiole very short infl short, 1–3 in long; fls yellow on short pale green terete stalks up to ½in. long; bracts ⅛in. long,

green; calyx spreading, lobes unequal, light green, elliptic-ovate, ½in long, corolla rich golden yellow, striped inside the tube with reddish brown, tube 2 in. long, spreading upward with a swollen bulbose greenish base, limb 1½ in diam, lobes orbicular or oval, obtuse ½in long Brazil B M 4594.

AA *Plant mostly tall climbing, in greenhouses usually trained on rafters fl. not prominently enlarged at base.*

B *Fls purple*

violàcea, Gardn (*A Blanchétii*, A DC) A slender-growing climber sts long, slender, terete, green tinted with red on side exposed to the sun, hairy lvs. usually in 4's, almost sessile, elliptic, 4–6 in long, dull green and covered with hispid hairs infl up to 1 ft long, loosely fld., bracts small, ¼in, lanceolate, pale green; fls in pairs, terminating each branch of the cyme, pedicel ½in long, hairy, calyx ⅔in diam, campanulate, lobes ½in long, elliptic-ovate, inner pair smaller than the rest, and lanceolate, corolla bright reddish purple, tube 2 in long, narrow and constricted in the middle, upper part purple-red, middle part greenish yellow, and lower part reddish brown, limb spreading 2–2½ in diam, lobes orbicular, throat rich dark reddish purple shading to yellowish white at the base Brazil B M 7122 —A fine handsome species, quite distinct from all other species and varieties in the color of its fls It is a poor grower on its own roots, but thrives well when grafted on *A. cathartica* var *Hendersonii* or var *Schottii*

BB *Fls yellow*

cathártica, Linn Lvs and calyx glabrous plant tall-climbing lvs rather small, obovate, usually in 4's, and more or less wavy-margined, thin, acuminate fls golden yellow, white-marked in the throat, the lobes acuminate on one angle, 3 in or less across, the tube gibbous or curved S Amer B M 338 P M 8 77 — The type first described, but now rarely seen in cult

Var **nóbilis** (*A nóbilis*, T. Moore) A strong, tall climber, with purple twigs lvs and calyx more or less hairy lvs in 3's or 4's, large, acuminate, very short-stalked fls very large (4–5 in across), nearly circular in outline of limb, bright, clear yellow, with magnolia-like odor Finest fls in the genus Brazil B M 5764

Var **Schóttii,** (*A Schóttii*, Pohl) Strong-growing, suitable for rafters, young shoots and petioles slightly pubescent, the older sts warty lvs in 3's or 4's, broadly lanceolate and acuminate corolla large, rich yellow, the throat darker and beautifully striped Brazil B M. 4351. *A magnífica*, Hort, is a form of this

Var **Héndersonii** (*A Wardleyàna*, Lebas *A Héndersonii*, Bull) Fig 155 Tall and vigorous, free-flowering, excellent for roofs glabrous lvs large, elliptic-ovate, thick and leathery, in 3's or 4's fls large, yellow-orange, with 5 light spots in the throat, the corolla of thick substance, purplish on the exterior when in bud. Gn 29 400 I H 12 452 —The commonest allamanda in this country Intro from Guiana by Henderson & Co, St John's Wood, England, and distributed by Bull about 1865

Var **grandiflòra** (*A grandiflòra*, Hook) St thin and wiry. lvs thin, ovate-lanceolate, pointed, usually in 3's fls somewhat smaller than those of var *A Hendersonii* but larger than *A cathartica*, lemon- or primrose-yellow Brazil. Gn. 39 192 P M. 12.79 —Thrives well when grafted on forms of *A cathartica* Plant rather bushy

Var **Williamsii,** Hort Habit slender, easily trained into bush form or a dwarf climber sts terete, slender, wiry, dull green, bright red on side exposed to the sun, covered with short hairs lvs. elliptic shortly petiolate, usually in 3's or rarely in 4's, rich dark green above, pale dull green below, hairy on both sides, especially along the midrib on the lower side; petiole ½in. long, hairy infl. rather short; fls in pairs at each joint of the cyme; bracts much reduced, barely ⅛in. long, acute; calyx erect, not spreading, sepals unequal, lanceolate, or elliptic, ½in. long, green; corolla yellow, tube only slightly curved 2½ in long, narrow and stalk-like in lower half, then broadening out and becoming campanulate in upper half, upper side of the pouch suffused with reddish brown, limb spreading, 2 in diam, lobes ovate, obtuse, ¾in long, throat deeper shade of yellow and stained with reddish brown Garden origin. Gn 40 468

L. H B
C. P. RAFFILL.

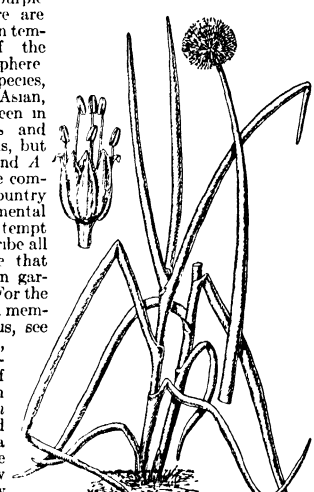
ALLEGHENY VINE *Adlumia.*

ALL-HEÀL *Brunella vulgaris*

ALLIGATOR PEAR, AGUACATE *Avocado, Persea.*

ÁLLIUM (ancient Latin name of garlic). *Liliàceæ.* Bulbous plants, mostly cultivated in the open, but a few of them grown under glass as florist's flowers; and comprising also the onions and their allies

Leaves flat, channelled, or terete and hollow fls in a simple umbel, from a 1–2-lvd usually scarious spathe; stamens and perianth segms 6, the perianth parts distinct or nearly so, 1-nerved, and often becoming dry and persistent, style slender, the stigma either entire or parted —Strong-scented plants, with fls white, yellow, or in shades of purple and rose There are 250–300 species in temperate parts of the northern hemisphere Numbers of species, particularly the Asian, are frequently seen in botanic gardens and choice collections, but only *A Moly* and *A neapolitanum* are common in this country among the ornamental species, and no attempt is made to describe all the species here that are mentioned in garden literature For the vegetable garden members of the genus, see *Chives, Garlic, Leek, Onion, Shallot.* In parts of the northeastern states *Allium vineale* is a bad weed, it has a slender scape sheathed below with hollow thread-shaped lvs, and greenish rose-colored fls (or bulblets in the place of fls).



156 Allium fistulosum. (Plant×⅛)

No special treatment is required by the alliums. Most of the cult forms are hardy spring bloomers, and may be treated the same as other hardy border bulbs. Propagation is by offsets and by the bulblets in the umbel, also readily by seeds.

INDEX.

acuminatum, 10
albopilosum, 14
anceps, 33
ascalonicum, 4
attenuifolium, 28
Bidwellíæ, 30
Bolanderi, 24
bulbellifera, 2
Cepa, 2
cernuum, 16
Cusickii 23
Ellisii, 13
falcifolium, 32
fimbriatum, 31
fistulosum, 3
Geyeri, 20
Hermetis, 9
hæmatochiton, 18
madidum, 22
Moly, 7
multiplicans. 2
neapolitanum, 9
platycaule, 34
Porrum, 6
reticulatum, 19
roseum, 11
Sanbornii, 27.
sativum, 5
scaposum, 21
Schœnoprasum, 1.
senescens, 12
serratum, 29
sibiricum, 1
stellatum, 26
tricoccum, 15
unifolium, 25.
validum, 17.
victorialis, 8

A. *Group I, comprising the vegetable-garden species.*

B. *Lvs terete and hollow*

C. *Plant cespitose (in tufts or clumps) and perennial.*

1. **Schœnóprasum,** Linn. CHIVES or CIVES Lvs. 4-6 in., very many, slender and awl-shaped scapes equaling the lvs, fls. light purple, small and many in a globular head Eu. —The lvs are used for seasoning, growing readily as the herbage is cut Var. **sibíricum,** Hartm., is a large form in northern N Amer.



157 Allium Moly (Plant ×⅛)

CC *Plants not in mats, treated practically as annuals (except perhaps No 6).*

2 **Cèpa,** Linn. COMMON ONION. Tall, with large tubular lvs.· scape glaucous, much overtopping the lvs, swollen near middle, fls white or blush in a large globular head-like umbel. bulb not making many offsets, distinctly rounded at top and bottom Var **bulbellífera,** Bailey, has bulbels in the place of fls.,—the top, tree or Egyptian onion Var **multiplícans,** Bailey, has dividing bulbs,—the multiplier onion. Persia and adjacent regions.

3. **fistulòsum,** Linn WELSH ONION Fig 156 Differs in having no distinct bulb, but only an enlarged base or crown lvs. usually more clustered Siberia. B.M. 1230

4. **ascalónicum,** Linn SHALLOT. Smaller, 1 ft · lvs. many, awl-shaped fls lilac bulbs long and pointed, each one soon separating into many cloves or parts adhering to a common disk. Syria

BB *Lvs not hollow, more or less plane.*

5. **sativum,** Linn GARLIC Plant 12 in or less· lvs. very narrow, keeled fls purple, often replaced by bulbels. bulbs small, breaking up into many small ones that are more or less covered with the dry scales. Eu.

6. **Pórrum,** Linn. LEEK Stout plant, 2 ft. or more: lvs. very broad and strongly conduplicate or keeled: scape arising the second season, fls white or blush: bulb simple and scarcely more than an enlargement of the stalk Eu.

AA. *Group II The garden alliums, mostly exotic.*

B. *Fls yellow*

7. **Mòly,** Linn. Fig. 157 Lvs flat, broad· fls. numerous, in a dense umbel, in early spring. S Eu B.M 499 —Well known, and a favorite for massing; common in rock-gardens. Hardy in the N.

BB. *Fls white or whitish*

C *Lvs very broad, obtuse.*

8. **victoriàlis,** Linn Tall: lvs ovate or broad-oblong, short: fls. greenish white in large heads. Spring. Siberia. B M. 1222 —Hardy

CC. *Lvs. narrow, acute or tapering.*

9 **neapolitànum,** Cyr. Fig 158. Lvs. long and rather narrow, loose-spreading, shorter than the scape fls large, pure white, with colored stamens on long pedicels Eu —Needs protection if grown outdoors Much used for cut-flowers in winter and spring The most popular species *A. Hermèttii grandiflòrum,* recently intro from Holland, is a clear white odorous variety, well adapted to forcing.

BBB *Fls pink, rose, or lilac.*

C *Segms with recurved tips.*

10 **acuminàtum,** Hook Scape 4–10 in · lvs 2–4, not longer than the scape, very narrow umbel many-fld, perianth segms a third longer than the stamens, the inner ones serrulate W Amer.

CC *Segms not recurved.*

11. **ròseum,** Linn Scape 12–18 in lvs narrow, with inrolled tips fls few (10–12), on long pedicels in an open umbel S Eu B M 978

12 **senèscens,** Linn Scape 1–2 ft lvs narrow, erect, often twisted fls rather small, numerous, in a rather dense head Eu B M 1150.

13 **Éllisii,** Hook f Lvs 4–5, 1 ft, 2½ in. wide, glaucous green scape 1 ft, very stout, being ¾in diam, fls rose with white toward the base, wide-spreading, 1½ in or more long and stiff and erect in fr. Persia B M. 7875

14 **albopilòsum,** C H Wright Very robust· lvs strap-shaped, 1¾ in wide, 18 in or less long scape 1 ft as many as 80-fld, fls deep lilac with metallic sheen, the segms nearly 1 in long, rigid after flowering Persia, etc B M 7982 G C III 34 40 —Probably the largest-fld, and most imposing garden species.

AAA *Group III Native alliums, sometimes advertised*

The species in Group II, comprise those that are likely to be in general cultivation Aside from these there are various native species, mostly from western America, which are offered by dealers in American plants These are recorded below.

B. *Bulbs clustered, narrowly oblong scape terete.*

C *Lvs elliptic-lanceolate, 2 or 3.*

15. **tricóccum,** Ait COMMON WILD LEEK Fig 159. Fls. greenish white on scape 4–12 in high in early spring Grows in clumps New Eng to Wis and N C

CC *Lvs linear, flat or channelled*

16. **cérnuum,** Roth Fls rose-colored or white, in open, nodding umbels Alleghanies and W

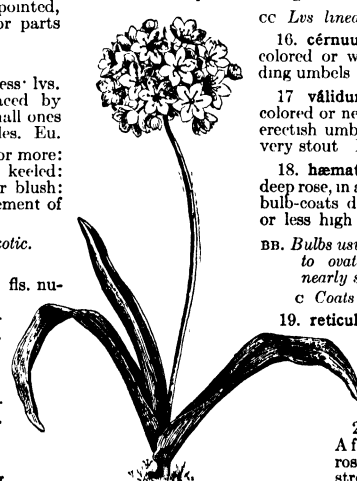
17 **válidum,** Wats Fls rose-colored or nearly white, in dense erectish umbels scape 1–2½ ft, very stout Nev, Calif, Ore

18. **hæmatochíton,** Wats Fls. deep rose, in a small, erect umbel· bulb-coats deep red· scape 1 ft. or less high Calif.

BB. *Bulbs usually solitary, globose to ovate· scape terete or nearly so*

C *Coats of bulbs fibrous*

19. **reticulàtum,** Fraser. Scape 3–8 in, fls white to rose, with thin segms W. Amer. B M 1840, as *A. stellatum.*



158. Allium neapolitanum. (×⅛)

20. **Geyèri,** Wats. A foot high, stouter· fls. rose, with broad acute strongly nerved segms. W. Amer.

CC. *Coats of bulb not fibrous.*

D *Lvs. 2 or several*

E. *Ovary with only 3 crests, or none at all.*

21. scapôsum, Benth Fls white, red-veined, in a loose, few-fld. umbel bulbs dark. scape 1 ft. or more. W Amer



159 Allium tricoccum (×½)

22 mâdidum, Wats. Fls. white or nearly so, in a many-fld umbel bulbs white. scape less than 1 ft., angled Ore.

23. Cûsickii, Wats Fls rather numerous, nearly white: lvs ¼in wide scape 3–4 in Ore

24 Bolânderi, Wats Fls rose, few, the segms serrulate scape 4–10 in Calif

25. unifôlium, Kellogg Lvs. several, narrow and flat: scape stout, 1–2 ft , fls. rose, 10–30, the segms ovate-lanceolate, exceeding stamens and style Calif

EE. *Ovary distinctly 6-crested fls. usually rose-colored.*

F *Scape usually more than 6 in high (in the wild)*

26 stellâtum, Fraser. Bulb-coats reddish scape 6–18 in , pedicels ½–¾in long, stamens and styles exserted W. Amer. B M 1576

27 Sânbornii, Wood Bulb-scales white scape 12–24 in , pedicels shorter, umbel densely many-fld , stamens and styles exserted Calif

28 attenuifôlium, Kellogg Lvs. channelled scape slender, 6–15 in , leafy below, umbel dense, fls nearly white W Amer

FF. *Scape usually less than 6 in high (in the wild)*

29 serrâtum, Wats Lvs very narrow filaments broadened at the base. W Amer.

30 Bîdwelliæ. Wats Scape 2–3 in umbel few-fld , the pedicels ½in. long, filaments filiform. Calif.

DD. *Lf. solitary, linear or filiform scape 2–5 in. high: caps 6-crested*

31. fimbriâtum, Wats Lf filiform and revolute: scape 3 in ; fls deep rose, stigma 3-cleft. S. Calif.

BBB. *Bulbs mostly solitary scape stout, 2-winged: lvs. 2, broad.*

C *Stamens not exserted*

32 falcifôlium, Hook & Arn Fls rose, the segms. minutely glandular-serrate and twice longer than stamens scape 2–3 in W Amer

33. ânceps, Kellogg Fls white, with purplish veins, the segms. little longer than stamens. Calif , Ore.

CC. *Stamens exserted*

34 platycaûle, Wats Fls rose, the segms long-acuminate· scape 3–5 in Calif. B M. 6227 (as *A. anceps*) L. H. B.

ALLOPLÉCTUS (*diversely plaited;* referring to appearance of the calyx) *Gesneràceæ* Tender tropical evergreen shrubby plants, with tubular yellowish axillary fls and opposite lvs ; one of each lf. in the pair smaller than the other, their under surfaces usually reddish or purplish To be grown in the warm-house with similar treatment as that for Gesnera

rèpens, Hook Trailing by means of roots thrown out between the pairs of lvs lvs ovate, coarsely serrate, hairy or smooth calyx pale green, blotched with purple; corolla yellow, tinged red, gaping; tube swollen at the base, limb of 4 spreading segms , the uppermost being twice cut. E Indies B M. 4250.

sparsiflôrus, Mart Erect lvs ovate-oblong, acute entire, petiole and nerves beneath often red calyx of 5 cordate or triangular dark blood or purple sepals, forming a striking contrast to the yellow club-shaped densely hairy corolla; limb of corolla of 5 equal segms. Brazil B M 4216, erroneously as *A dichrous.*

Schlîmii, Planch & Lind Fig 160 Lvs acuminate, rounded or sub cordate at base, oblong, green above, violet or purple-violet beneath fls axillary, in pairs or sometimes more numerous, the calyx spotted with green, corolla yellow-scarlet below, shading upward into a delicate violet above Trop S. Amer. F S 8 827.

A Forgetii, Hort Corolla pale yellow, spurred on the back. Peru N TAYLOR †

ALLSPICE. The dry berry of the Pimento (*Piménta officinâlis,* Lindl), an evergreen tree of the *Myrtàceæ.* The tree grows in the West Indies Jamaica yields much of the product The fresh berry is about the size of a pea It is borne in clusters The word allspice is also applied to various plants with aromatic fragrance, as Calycanthus See *Pimenta*

ALMOND. A name given to the tree and fruit of *Prùnus commùnis,* Fritsch. (*Amýgdalus commùnis,* Linn), of the *Rosàceæ.* It is also applied to certain dwarf ornamental trees or bushes, as flowering almond (see *Prunus*).

The almond has been cultivated from time immemorial. It is thought to be native to the Mediterranean basin Some inquirers have supposed it to be the original of the peach, but this idea is evidently untenable The flowers are peach-like and handsome (Fig 161) The almond nut of commerce is the pit or stone of a peach-like fruit (Fig 162) The fleshy part, which is so thick and edible in the peach, is thin and hard, and it splits at maturity There are two general tribes or races of almonds,—the bitter and the sweet. The former has a bitter kernel, which is used in the manufacture of flavoring extracts and prussic acid It is grown mostly in Mediterranean countries. Of the



160. Alloplectus Schlimii. (×½)

sweet or edible almonds, there are two classes,—the hard-shell and the soft-shell The former is of little value, and is not grown to any extent The soft-shell type produces the edible almonds of commerce Some of the thinnest-shelled forms are known as Paper-shells



161. Flower of common almond

It was once thought that almond-growing could be successfully practised in the peach-growing sections of the East, but late spring frosts, and other difficulties, have caused the effort to be abandoned commercially Individual almond trees are occasionally seen, and they frequently bear profusely They are nearly as hardy as the peach The commercial cultvation of the almond on this continent is confined to western America, and the remainder of this account is therefore written from the Californian standpoint

L H B.

Almond-growing in California has received the attention of horticulturists for half a century, and during the whole of its course the industry has been marked by vicissitudes which, it must be admitted, are not yet ended Two chief sources of difficulty are now clearly discerned to have attended the effort from its beginning, and present knowledge may enable planters to avoid, in the future, errors that have led to much disappointment and loss—the vestiges of which still encumber the ground, though clearing is proceeding rapidly Thus far the almond tree has yielded more firewood than any other single fruit tree which has been largely planted in California, and yet planting has continued, planting and uprooting keeping pace, so that about 1,500,000 trees are annually reported by the county assessors, of which number about two-thirds may be counted of bearing age The California almond product for a series of years is estimated as follows.

1905	2,125 tons	1909	1,650 tons
1906	900 "	1910	2,750 "
1907	750 "	1911	1,700 "
1908	3,000 "	1912	3,000 "

Irregularity in production is mainly due to the occurrence or absence of spring frosts In spite of these facts, the almond will remain an important California product, through the satisfactory performance of trees enjoying favorable environment, which is being generally accepted as a safe guide for current planting.

The two chief sources of failure with the almond are the sterility of many varieties without cross-pollination, and the extreme propensity of the tree for early blooming, with the consequent destruction of the bloom or the young fruit by temperature very little below the freezing point These two evils have been singularly associated historically, and only lately have they been shown to be independent factors and both of them demanding the closest attention from planters At first it was thought that the wide planting of self-sterile varieties by themselves was the cause of disappointment, because, after years of chopping-out or grafting-over old unproductive trees to the Prune d'Agen, for which it is an excellent stock, it was observed, by chance, that the Languedoc variety adjacent to Drake's seedling, of local origin, was heavily laden with nuts when it was sterile without such association Attention was then directed to the growth of seedlings, and a large lot of seedlings of the bitter almond, grown by A T Hatch, exhibited such satisfactory bearing habit and such striking variation toward new types of the soft-shell sweet almond that the growth of new selected California seedlings was seized upon as a panacea for the previously experienced troubles with the almond These new varieties were conceived to be not only self-fertile but hardy, and large plantations were made without due regard to the frosty character of the locations Low valley lands of great area, and some extent of high plateaux, were planted Fine, large trees grew only to lose their crops year after year by frosts from February to April, until the growers cast the trees upon the wood-pile. As a deduction of the experience of several decades, we have arrived at what seems now to be the proper conception of the situation of the almond in California, which is, that the most prolific varieties must be chosen, must be associated for purposes of cross-pollination, and must be planted in places of least liability to frost. There is a factor of some moment in the late-blooming habit of some varieties, which will be considered presently

The soil best suited to the almond is a light, well-drained loam. The tree makes a strong and rapid root-growth, and is more tolerant of drought than any other of our leading deciduous fruit trees For this reason, as well as to avoid frost, it is often desirable to place the almond on the higher and drier lands of the valley—providing the soil is not heavy and too retentive of surplus water in the rainy season The root is most intolerant of standing water, and will quickly die if exposed to it Because of its thrift in light, dry soils, the almond root is used rather largely as a stock for the Prune d'Agen, and to some extent for the peach in the dry valleys

Almond trees are grown by budding into seedlings grown from either the sweet or the bitter hard-shell almonds, the bud being set during the first summer's growth of the seedling, and then either planted out as a dormant bud the following winter or allowed to make one season's growth on the bud in the nursery The tree grows so rapidly, both in root and top, that only yearling trees are used

At transplanting, the young trees are cut back so as to form a low head with only about a foot of clear trunk They are allowed to make free growth during the following summer, and in the following winter are cut back so as to encourage branching on the main limbs within a foot of their attachment to the trunk At the same time, the branches are reduced to four or five in number, symmetrically arranged around the stem and at good distance from each other, so that they shall not unduly crowd each other as they enlarge Another full growth during the following summer and another cutting back the following winter give the trees the vase-form on the outside, with enough interior branches to fill the



162. Almond nuts (×⅓)

inside of the tree without crowding Thus the tree is systematically pruned after each of its first two years' growth in the orchard After that, shortening-in of the branches usually ceases, and the third summer's growth is allowed to stand for fruit-bearing, with only thinning-out of growth to prevent crowding. This thinning-out has to be done from time to time in later years, otherwise the tree becomes too thick, and interior branches dwindle for lack of light The amount of thinning varies in the different climates of the state the greater the heat, the denser the tree for its own protection With the proper adjustment of heat and light, fresh bearing wood may be encouraged in the lower part of

the tree, otherwise it becomes umbrella-shaped, with the fruit wood at the top and bare poles below.

The almond is the earliest bloomer of our common fruits. It puts forth flowers sometimes as early as January, but the usual date is about February 10 for the earliest bloomers in the warmer parts of the state, with the later bloomers at intervals thereafter until April 1. Records of full bloom of a number of varieties widely grown in California, which have been kept at the University of California substation, situated in the Sierra foot-hill region, show the following succession. Commercial, February 27, Sultana and Paper-shell, March 10; King and Marie Duprey, March 11, IXL, March 12, Languedoc, March 19, Nonpareil, March 20, Routier Twin, March 24; Pistache, March 25; Drake and Texas, April 2. Obviously the late bloomers have greater chance of escaping frost, and there is at present some disposition to make this a consideration in selecting varieties for planting. The dates just given show an extreme variation in time of blooming. Some years the intervals are much shorter, but the relation seems to be constant. The crop ripens from August 15 to October 1, according to locality. Early maturity does not follow early blooming—that is, as with other fruits, the first to bloom are not necessarily the first to ripen.

Not less than twenty-five varieties of almonds have been grown to a greater or less extent in California. Varieties of foreign origin have almost wholly given place to selected seedlings of local origin, and of these a very few constitute the main crop at present. These are named in the order of their acreage, as follows: Nonpareil, Ne Plus Ultra, IXL, Drake, Texas Prolific, Languedoc. Of these, the first three occupy not less than three-fourths of the acreage.



163. Bearing habit of the almond

In handling the crop, the local climate modifies methods somewhat, and the growth-habit is also involved. In regions very free from atmospheric humidity in the summer, the hull opens readily and discloses a clean, bright nut, which can be marketed without treatment. Where this is not the case, and the nut is more or less discolored, bleaching in the fumes of sulfur has to be practised. The nut must be dry before sulfuring, or the fumes will penetrate and injure the flavor of the kernel. Sulfured nuts also lose largely in power of germination. The practice is to gather the nuts, dry for a few days in the sun, then spray with water very lightly or with a jet of steam, so that only the surface of the shell is moistened, and then sulfur, and a light color can be secured without penetration of the fumes. The nuts can usually be gathered from the ground as they naturally fall, or can be brought down by shaking or the use of light poles. Some varieties are more easily harvested than others, and the same variety falls more readily in some localities than in others. A greater or less percentage, according also to variety and locality, will have adhering hulls, and for clearing them, locally-invented machines, called almond-hullers, are used. Early rains in some localities are apt to stain the nuts. Such stains cannot be removed by sulfuring, and the nuts have to be crushed and the product marketed as kernels for the use of confectioners. Machinery is also used for this operation, and a considerable fraction of the product reaches the market in this form because of the demand for candied and salted almonds.

The standard of excellence in the almond, from a commercial point of view, as learned by the experience of California producers, is that the kernel must be as smooth, symmetrical and plump as possible. The twinning of kernels, welcome as it may be to searchers for philopenas, results in misshapen kernels, which are very objectionable to the confectioners, who are very large users of almonds. Constancy to single kernels is therefore a good point in a variety.

Large proportion of kernel to shell by weight is also, obviously, an important point to almond-buyers. At the same time, the shell may be so reduced in strength as to break badly in shipping in sacks and in subsequent handling. Incomplete covering also exposes the kernel to the sulfur and to loss of flavor. The ideal is such degree of thinness of shell as can be had with complete covering of the kernel and durability in handling.

Careful comparison of the proportion of kernel weight to gross weight of the popular California varieties, as compared with a leading imported variety, was made by a committee of the California Horticultural Society, with the following result. From one pound of each of the following varieties the net weight of kernels in ounces was: Imported Tarragona, 6½, California Languedoc, 7½, El Supremo, 7½, Drake, 8¼, IXL, 9, Commercial, 9¼, La Prima, 9½, Princess, 9½; Ne Plus Ultra, 10, King, 10; Paper-shell, 11; Nonpareil, 11 to 13.

EDWARD J. WICKSON.

ALMOND, DEMERARA: *Terminalia Catappa*

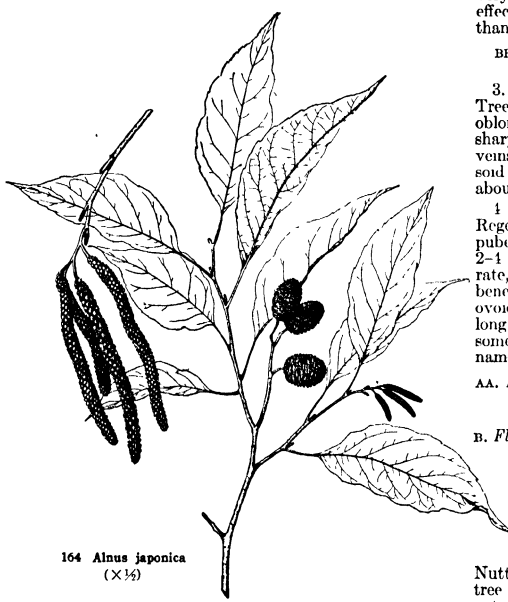
ALMOND, FLOWERING: *Prunus*

ÁLNUS (the ancient Latin name) *Betulàceæ*. ALDER. Ornamental woody plants grown chiefly for their foliage, some species are valuable as timber trees.

Trees or shrubs. lvs. alternate, deciduous, short-petioled, usually serrate or dentate. fls. monœcious, apetalous, in catkins, staminate ones elongated, each bract with 3 fls.; stamens 4 in each fl., with short filaments not divided at the apex, pistillate catkins short, each bract with 2 fls.; styles 2, the pistillate catkins developing into a ligneous, generally ovoid cone with persistent, 5-lobed scales fr. a small nutlet.—About 30 species in the northern hemisphere, in Amer. south to Peru. Monograph by Winkler in Engler's Pflanzenreich: Betulaceæ 101 (1904).

The alders are deciduous trees or shrubs with medium-sized leaves and pendulous staminate catkins in spring before the leaves; the short pistillate catkins developing into woody cones about ½ to 1 inch long and usually arranged in small racemes. The profuse male catkins are pleasing in early spring. The wood is valuable for its durability in water; of the native species, *A. rubra* is the most important timber-tree, in the Old World, *A. glutinosa* and *A. japonica*. Most species are suitable for planting on damp soil, where they grow rapidly, but *A. cordata* prefers a drier situation; also *A. japonica*, *A. incana* and *A. tinctoria* grow well in drier situations.

Usually propagation is by seeds gathered in the fall and well dried; sown in spring with but slight covering, and kept moist and shady, they germinate soon, a slight covering with moss, taken off when the seedlings appear, will be useful. At the end of the same year or the following spring, the seedlings are transplanted, usually into rows 1 to 2 feet apart and 6 inches from each other. After two years, they may be planted where they are to stand The shrubby species, also *A glutinosa*, grow from hardwood cuttings placed in moist and sandy soil, also from layers, and *A. incana* from suckers. Rarer kinds are grafted on common potted stock in early spring in the propagating-house; grafting out-of-doors is rarely successful.



164 Alnus japonica
(×½)

INDEX.

Alnobetula, 1.
aurea, 12
barbata, 12
communis, 12
cordata, 7
cordifolia, 7
denticulata, 12.
firma, 3, 4, 6.
glauca, 8
glutinosa, 12
imperialis, 12
incana, 8, 9.
incisa, 12
japonica, 6
laciniata, 8, 12
maritima, 5
Mitchelliana, 2
oblongata, 5, 12
oregana, 10
oxyacanthifolia, 12
pendula, 4
pinnatifida, 8
pyrifolia 7
rotundifolia, 12
rubra, 10
rubrinervia, 12.
rugosa, 11
serrulata 11.
tiliacea, 7
tiliæfolia, 7
tinctoria, 9
undulata, 1
viridis, 1, 2
vulgaris, 8, 12
yasha, 3

A. *Pistillate catkins terminal, inclosed during the winter in the bud, opening in spring fr with broad membranous wing winter-buds sessile with 2 or more unequal scales* (*Alnobetula*)

B. *Lvs ovate or elliptic, with 5–10 pairs of veins*

1. víridis, DC (*A. Alnobétula*, Hartig *A undulàta*, Willd.). EUROPEAN GREEN ALDER. Shrub, 2–6 ft.. lvs. elliptic or ovate, to round-ovate, acute, usually narrowed at the base, sharply serrulate, 1–2½ in long, glutinous while young, bright green above, pale green and glabrous beneath or pubescent on the veins staminate catkins 2–3½ in long; pistillate catkins with glabrous or puberulous peduncles: cones 3–4, oblong, slender-peduncled. March, April. Mts. of Eu. L.B.C. 12:1141. H W. 2·14.

2 **Mitchelliàna,** Curt. (*A. víridis* of most American authors) AMERICAN GREEN ALDER. Shrub, 2–10 ft : young branchlets glabrous or sparingly pubescent. lvs. elliptic or ovate-elliptic, acute or obtuse, rounded or subcordate at the base, 1½–3 in long, densely serrulate, glutinous while young, with impressed veins above, reticulate beneath and glabrous staminate catkins 2–3 in long, pistillate catkins with pubescent peduncles· cones 3–6, oblong, slender-peduncled March, Apr. Mts of N E Amer , west to Brit Col , south to N. C. —Hardy shrub with handsome bright green foliage, very aromatic when unfolding and of very pleasant effect in spring with its long male catkins; handsomer than the preceding species.

BB. *Lvs. ovate-oblong to ovate-lanceolate, with 12–24 pairs of veins.*

3. yâsha, Matsum. (*A firma* var *yásha*, Winkl). Tree, to 30 ft young branchlets pubescent. lvs. ovate-oblong, 2–4 in long, acute, usually rounded at the base, sharply and irregularly serrate, with 12–18 pairs of veins, pubescent on the veins beneath cones 1–3, ellipsoid or sub-globose, ¾in long, on slender peduncles about 1 in. long. Japan J C.T. 16·2

† **péndula,** Matsum (*A firma* var. *multinérvis*, Regel) Tree, to 30 ft , or shrub young branchlets pubescent. lvs oblong-lanceolate, acute or acuminate, 2–4 in long, irregularly and often nearly doubly serrate, with 18–24 pairs of veins, pubescent on the veins beneath, at maturity nearly glabrous cones 3–5, ovoid, about ½in long, in pendulous racemes, 1–2 in. long Japan S I F 2 12 J C T 16 3 —Very handsome alder, still rare in cult ; the plant cult under this name is usually the preceding species

AA. *Pistillate catkins axillary, appearing in autumn: winter-buds with 2 equal scales, stalked.* (*Gymnothyrsus*)

B. *Fls opening in the fall from catkins of the same year: lvs not plicately folded in the bud.*

5 maritima, Nutt (*A. oblongàta*, Regel, not Ait nor Willd) Tree, to 30 ft lvs cuneate, oblong or obovate, shining above, pale green beneath, glabrous, remotely and crenately serrate, 2–4 in long cones 2–4, large, on short, stout peduncles Del , Md S S 9·458 G F 4 269. Nutt , N Amer S 1 10 —Ornamental shrub or small tree with handsome shining foliage, attractive in autumn with its male catkins

BB *Fls opening in early spring before the lvs , from catkins formed the previous year and remaining naked during the winter*

C. *Lvs. not plicate in the bud, green beneath, veins arching cones 1–6, long-stalked.*

6. japónica, Sieb & Zucc (*A firma*, Hort , not Sieb & Zucc) Fig 161 Tree, 50-80 ft lvs cuneate, oblong-lanceolate, acuminate, sharply and irregularly serrulate, glabrous at length, bearded in the axils of the veins beneath, 2–6 in long cones 3–6, peduncled Japan. G F. 6 345 (adapted in Fig 164) S I F 1·19 —Tall, pyramidal tree with dark green foliage, the largest and perhaps the most beautiful of all alders.

7. cordàta, Desf. (*A cordifòlia*, Ten. *A. tiliàcea*, Hort) Small tree, 20–50 ft · lvs cordate, ovate or roundish, acuminate, 2–4 in long, bearded in the axils beneath, glandular when young cones 1–3, ovoid, about 1 in. long, peduncled, nutlets with narrow wing. Italy, Caucasus L B C. 13:1231. G C. II 19:285 — Round-headed tree with handsome, distinct foliage, changing orange-yellow in autumn, resembling that of a linden or pear, therefore sometimes called *A. tiliæfòlia* or *A. pyrifòlia*, in gardens. Not quite hardy N.

cc. *Lvs. plicate in the bud, the veins going straight to the points of the larger teeth. cones 4–10, short-stalked or sessile.*

d. *Under side of lvs glaucous, not bearded: cones sessile or short-stalked.*

8. **incàna,** Willd Shrub or tree, to 60 ft : branches pubescent lvs. oval or oblong-ovate, acute, 1¼–4 in long, doubly serrate, pubescent or nearly glabrous beneath. cones 4–8, mostly sessile, ½in long. Northern hemisphere, in different varieties. H W. 2.13.

Var. **glaùca,** Ait. (*A. glaùca,* Michx.). Shrub, to 12 ft.: lvs. often nearly glabrous beneath. N. Amer , Eu. Em 251.

Var. **vulgàris,** Spach Tree, to 50 ft.: lvs. usually densely pubescent beneath cones 1 in long. Eu , Asia.

Var. **pinnatífida,** Spach (var *laciniàta,* Hort.). Lvs. pinnately lobed or cleft, with dentate lobes.

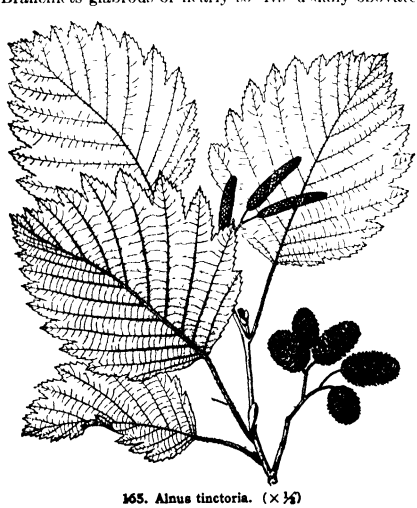
9. **tinctòria,** Sarg (*A. incàna* var *tinctòria,* Hort) Fig 165 Tree, to 60 ft young branchlets glabrous or slightly pubescent lvs. broadly ovate, 4–6 in long, membranaceous, coarsely doubly serrate, slightly lobed, glaucous and rufously pubescent on the veins beneath. Japan G F 10·473 (adapted in Fig 165) S I F 1 19 (as var *glauca*) —Handsome ornamental tree of very vigorous growth, with large foliage

10 **rùbra,** Bong. (*A. oregàna,* Nutt.). Tree, 40–50 ft lvs oblong-ovate, 3–5 in. long, crenate-serrate, slightly lobed, revolute on the margin, nearly glabrous beneath, petioles and veins orange-colored cones 6–8, oblong. W. N. Amer. S S. 9:451 Nutt., N. Amer. S. 1 9

dd. *Under side of lvs. green or brownish green, usually bearded.*

e. *Cones upper sessile*

11. **rugòsa,** Spreng Smooth Alder Shrub, to 25 ft . young branchlets pubescent or nearly glabrous lvs ovate or broadly elliptic to obovate, acute or obtuse, 2–5 in long, doubly serrate and often slightly lobed, beneath covered more or less with brownish pubescence or glabrous cones 4–10, the upper sessile, the lower short-stalked, ovoid, about ½in long E N Amer Mx 3 4 Var **serrulàta,** Winkl (*A serrulàta,* Willd) Branchlets glabrous or nearly so lvs usually obovate, obtuse, finely and doubly serrulate, glabrous or nearly glabrous beneath. Em. 248 —By most European botanists this variety is considered a distinct species, but, though the extreme forms seem quite distinct, they are connected by all kinds of intermediate forms. In flower, *A. rugosa* is easily distinguished from *A. incana*



165. Alnus tinctoria. (× ⅓)



166 Alnus glutinosa. (× ½)

by the pistillate catkins which are upright in *A. rugosa,* nodding in *A incana*

ee. *Cones all distinctly peduncled.*

12. **glutinòsa,** Gaertn (*A rulgàris,* Hill. *A rotundifòlia,* Mill *A communis,* Desf) Black Alder. Fig. 166 Tree, to 70 ft lvs. orbicular or obovate, rounded or emarginate at the apex, 2–5 in long, irregularly obtusely serrate, with 5–7 pairs of veins, nearly glabrous beneath, glutinous when unfolding cones distinctly peduncled. Eu , N Afr , Asia, naturalized in some localities in N. Amer H W 2 12 H T 1.30 —A vigorously growing tree with dark green, dull foliage, valuable for planting in damp situations Commonly planted in many forms Var **aùrea,** Versch Lvs yellow I H. 13 490 Var **denticulàta,** Ledeb. (*A oblongàta,* Willd.). Lvs usually cuneate, serrulate S Eu Var **barbàta,** Callier (1 *barbàta,* C A Mey). Lvs ovate, acute, pubescent on the veins beneath Caucasus Var. **imperiàlis,** Desf Lvs deeply pinnately lobed with lanceolate or nearly linear lobes Var **incìsa,** Willd. (var. *oxyacanthifòlia,* Spach) Lvs small, deeply incised, like those of *Crataegus oxyacantha* Var **laciniàta,** Willd. Lvs pinnately lobed, lobes oblong Var. **rubrinérvia,** Dipp Lvs large and shining, with red nerves and petioles pyramidal tree of vigorous growth, very handsome

1 *acuminata,* HBK Tree lvs, usually ovate and pubescent beneath, doubly serr, to Cent Amer , north to Ariz —*A cremastógyne,* Burkill Tree young branchlets glabrous, lvs oblong-obovate, glabrous, sharply serrate, 3–4 in long cones cylindric, solitary on slender peduncles, about 1 ½ in long W China —Recently intro , probably not hardy N —*A firma,* Sieb & Zucc (A Sieboldiana, Mats) Allied to A yasha Tree lvs ovate, or ovate-oblong, acute, rounded at the base, with 10–15 pairs of veins, 3–5 in long. cones about 1 in long, solitary on a peduncle ½–1 in long Japan S I F 2 12 —*A fruticòsa,* Rupr. (A viridis var sibirica, Regel) Allied to A viridis Shrub lvs broadly ovate or elliptic-ovate, usually rounded at the base, nearly doubly or sinuately serrate Siberia, Coreа —*A hirsùta,* Turcz (A incana var hirsuta, Spach) Allied to A tinctoria Tree, young branchlets, and petioles tomentose lvs suborbicular to elliptic, acutish, denticulate and slightly lobed, ferruginously tomentose beneath Japan, Manchuria —*A jorullènsis,* HBK Allied to A acuminata Lvs. oblong-lanceolate, coarsely dentate Cent Amer —*A mollis,* Fernald Closely allied to A crispa Shrub or small tree branchlets pubescent lvs pubescent beneath, 2–4 in long N E Amer , west to Lake Winnipeg, south to Mass —*A nitida,* Endl Tree, to 100 ft lvs ovate to ovate-oblong, short-acuminate, not plicate, 3–4 in. long, entire or remotely serrulate, bright green and lustrous

above, glabrous male catkins very slender, to 6 in long cones 2–4, pedunculed Himalayas B M 7051 —*A oblongifólia*, Torr Tree, 20–30 ft.: lvs oblong-ovate, cuneate, doubly serrate, 2–3 in long strobiles ½–1 in long, pedunculed N Mex and Ariz S S 9 457 — *A occidentalis*, Dipp =A tenuifolia.—*A. orientalis*, Decne (A barbata, Hort , not C A Mey A firma, Hort , not Sieb & Zucc A macrophylla, Hort) Allied to A cordata Tree lvs ovate-oblong, obtusely or crenately serrate, 2–5 in long, glabrous, with 8–10 pairs of veins. cones ovoid, glutinous, ½–1 in long, nutlets without wing Asia Minor —*A pubescens*, Tsch (A glutinosa × incana) Lvs roundish-ovate or obovate, irregularly serrate, pubescent beneath Natural hybrid —*A rhombifólia*, Nutt Tree, 60–80 ft lvs cuneate, oval or ovate, 2–3½ in long, finely serrate, yellowish green and puberulous beneath strobiles oblong, pedunculed W N Amer S S 9 456 —*A Sieboldiàna*, Mats =A firma —*A sinuàta*, Rydb (A sitchensis, Sarg) Allied to A viridis Shrub, 3–16 ft lvs slightly lobed, serrulate, glabrous, thin W N Amer S S 14 727 — *A Spæthii*, Callier (A japonica × subcordata) Tree lvs ovate-lanceolate, sharply serrate, violet-purple when unfolding Of garden origin *A subcordàta*, C A Mey Tree, 30–50 ft lvs ovate or oblong-ovate, rounded at the base, 2–6 in long, crenately or doubly serrate, glabrous or sometimes pubescent beneath cones about 1 in long nutlets with a narrow wing Caucasus —*A tenuifólia*, Nutt (A incana var virescens, Watson A occidentalis, Dipp) Small tree, occasionally 30 ft lvs ovate, 2–4 in long, slightly lobed and doubly serrate, green and nearly glabrous beneath W N Amer S. S 9 455

ALFRED REHDER.

ALOCÀSIA (name made from *Colocasia*) *Aràceæ* Warmhouse foliage plants, with green, veined and mottled, large hanging leaves.

Stem thick, short or assurgent, densely marked with lf.-scars. lvs with long sheathed petioles, the blade, when young peltate, when old usually sagittate-cordate, the basal lobes commonly more or less united sathe with the tube much shorter than the blade, ovoid or oblong, convolute, the blade oblong, usually boat-shaped, spadix shorter than spathe —Stove foliage plants from E. Asia, comprising about 40 species, in addition to many hybrids Related to Caladium and Colocasia, from which separated by technical fr. characters. See Monogr by Engler in De Candolle's Monographiæ Phanerogamarum, Vol. II



167 Alocasia Sanderiana

The species of alocasia grown in greenhouses have foliage of great beauty and coloring and rank high amongst ornamental foliage plants The leaves are remarkable for their coloring, markings, size and shape, some of them being of a rich metallic coloring while others are green and green-and-white with prominent veining. Alocasias are propagated by suckers or cuttings of the rhizomes, placed in small pots containing a mixture of light fibrous peat and sand in equal proportions, and plunged in a close frame or propagating-box with bottom heat They may also be grown from seeds sown in 4-inch pots, in a light peaty soil in a temperature of 75° F The month of March is the best time for propagating and potting The evergreen species (as *A cuprea*, *A longiloba*, *A Lowii*, *A. Regina*) thrive best in a compost of two parts fibrous peat and sphagnum moss and one part lumps of fibrous loam, to which should be added a sprinkling of silver sand and a few nodules of charcoal to keep the whole sweet The herbaceous species (as *A macrorhiza*) do best in good fibrous loam to which one-third of well-rotted cow-manure or pulverized sheep-manure has been added Perfect drainage of the pots is absolutely necessary, and, in potting, the evergreen species should be coned up 2 or 3 inches above the rim of the pot, and finished off with a surfacing of live sphagnum moss The season of active growth begins about the first of March, when plants should be given a temperature of 70° at night, with a rise of 15° by day, and the atmosphere must be kept in a humid condition. They should be given a position free from drafts and direct sunlight They require an abundance of water at the roots as the leaves develop, and are greatly benefited by an occasional watering of clear liquid sheep- or cow-manure. To secure the best development of the leaves, heavy syringing should be avoided, but frequent spraying on all fine days with an atomizer sprayer is very beneficial Towards winter the humidity of the atmosphere and the supply of water to the roots should be reduced with the evergreen species, and gradually withheld altogether as the leaves mature, with the herbaceous species The temperature during winter should not fall below 60°. (E J Canning)

INDEX.

argyræa, 13
bataviensis, 13
Chantrieri, 13
Chelsonii, 13
cuprea, 12
gigantea, 6
gigas, 13
illustris, 13
intermedia, 13
Jenningsii, 13
Johnstonii, 13
La Sallıana, 13
Landeni, 5
longiloba, 6
Lowii, 7
Luciana, 13
macrorhiza, 11
Marshallii, 13
metallica, 12
mortefontainensis, 13
princeps, 1
Pucciana, 13
Putzeysii, 8
Regina, 13
Sanderiana, 2
Sedenii, 13
Thibautiana, 9
Van Houttei, 13
variegata, 11
Veitchii, 10
Villeneuvei, 4
violacea, 13
zebrina, 3

A *Lvs distinctly notched or undulate on the margin*

1 **princeps,** Nichols Lvs sagittate, the basal lobes narrow and spreading, the margins deep-sinuate, upper surface olive-green, with darker veins, the under lighter colored, with brown veins and margin, petioles brown-spotted, slender E Indies

2 **Sanderiàna,** Bull Fig 167 Lvs long-sagittate, with deeply notched margin, the basal lobes wide-spreading, deep glossy green with metallic reflection, with prominent white margins and veins, petioles brownish and striped Philippines Gng 6 84 G Z 28, p 267 J H III 45 173 —One of the best of recent introductions Runs into various forms, and has entered largely into cult hybrids

AA *Lvs plain and entire on the margin*

B *Markings chiefly on the petioles, the blades green.*

3 **zebrina,** Koch & Veitch Lvs triangular-sagittate, the margin somewhat repand, the front lobe oblong-triangular, cuspidate, the basal lobes obtuse, petioles beautifully marked with large zigzag bands of green Philippines F S 15 1541–2

4 **Villeneúvei,** Lind & Rod Lvs sagittate-ovate, the veins of lighter green and prominent, basal lobes very unequal, petioles spotted with chocolate-brown Large Borneo I H 34 21 —Named for de Villeneuve, Brazilian ambassador to Belgium

BB. *Markings or coloration chiefly on the lf.-blades.*

C *Veins and midrib light yellow.*

5 **Lindenii,** Rod Lvs cordate-ovate, long-pointed, 8–12 in. long, bright green, with yellowish veins curving off from the midrib and vanishing near the margin, petioles nearly white New Guinea I H 33 603 — Bruised lvs emit a strong odor.

CC. *Veins and midrib white or silvery.*

D *Midrib and primary nerves not bordered*

6 **longiloba,** Miq (*A gigantèa*, Hort) Petioles 2 ft , greenish white, mottled purple; blade sagittate, 18 in. long, the basal lobes very long and erect, the upper surface green, with silvery or gray bands along veins and midrib, the under surface light purple. Java.

7. **Lòwii,** Hook. Petioles 2–3 ft , rose-color; blade narrow-ovate, 18 in long and a third as wide, long-pointed, the basal lobes long-acute, upper surface olive-green, with very distinct silvery bands, under surface rich purple Borneo . H F III 9 pl 6 F S 21:2204. B.M. 5376. A.F. 11:559 (as var. *grandis*).

DD. *Midrib and primary nerves bordered with pale or gray-green*

8 **Putzèysii,** N E Br Much like *A longiloba* lvs broader (oval-sagittate), dark metallic green, prominently veined and bordered white, the petioles pale red-purple, under surface dark purple Sumatra I H 29 139 G C II 19 501 —More brilliant than *A longiloba*, and has wider spaces between the veins

9 **Thibautiàna,** Mast Petioles 3 ft, greenish, blade 2 ft long and 18–20 in broad, ovate-cordate, the basal lobes broad and rounded, olive-green, with broad silvery



168 Alocasia cuprea. (×⅛)

veins and rib, the under surface deep purple Borneo. G C III 17 485 I H 28 419 G Z 25, p 265

10 **Veitchii,** Schott Resembles *A Lowii*, Hook, in shape and ground-color, but the midrib and primary veins are bordered with gray-green, the secondary veins whitish and the petiole green-striped Java. B.M 5497 (as *A Lowii* var *picta*)

cc Veins white and lf blotched and mottled

11 **macrorhìza,** Schott Large, reaching 10 or 15 ft: lf-blades 3 ft long, long-sagittate and pointed, the lobes short and obtuse, margin often somewhat wavy, the midrib very broad and conspicuous, the blotches or patches of green and white (in the var *variegàta*, G W. 15, p 339, which is the common form) very striking. Ceylon I H 8 305 One of the commonest species. Lvs sometimes almost white

ccc Veins dark or purple, or the lf dark-colored

12 **cùprea,** Koch (*A metallica*, Schott) Fig 168 Petioles 2 ft or less long, green, blade ovate and peltate, 18 x 12 in, notched at the base and cuspidate at the point, dark metallic green with darker rib and veins, the under side rich purple Borneo B M 5190 I H. 8:283 G 19:413 F S 21 2208 9 Lowe, 60 Gn. 50 336 —One of the best, and common

13 **Regìna,** N E Br Lvs thick, ovate-cordate, obtuse or cuspidate, the basal lobes short and nearly or quite obtuse, the ribs and veins beneath pubescent, somewhat fleshy, dark green above with darker veins and brown-purple beneath, petioles terete, pubescent spotted purple. Borneo I H 32:544 —Several cult. varieties and hybrids are in the trade in this country *A argyræa*, Sander, lvs large, dark green with a silvery sheen, hastate-lanceolate (G W 15 342), hybrid of longiloba × Pucciana, *A bataviènsis*, petiole dark purple, lf-blade dark green, *A Chantrièri* (raised by Chantrier Bros, Mortefontaine, France), hybrid of cuprea × Sanderiana, with long wavy lvs, purple below and prominently white-veined (I H 35.64 R H 1887, p 465), *A Chélsonii*, cuprea × longiloba, with lvs purple below and green above, *A gigas*, much like Villeneuvei, *A intermedia*, hybrid by Veitch 25 years ago (G 2 61 G W 15, p 341 F 1869, p 80), *A La Sallèana*, *A. Lucèana*, Thibautiana × Putzeysi, with lvs dark green above and whitish veins and margins, purple beneath (I H 34 27), *A montefontanènsis*, Lowii × Sanderiana; *A Pucciàna*, Putzeysi × Thibautiana, *A Sèdenii*, cuprea × Lowii, with ovate-peltate lvs purple beneath and white-veined above (I H 24 292), *A. Van Houttei*.

The following names are also in our trade *A illùstris*=Colocasia antiquorum, *A Jénningsii*=Colocasia affinis, *A Jóhnstonii*=Cyrtosperma Johnstonii, *A. Marshàllii*=Colocasia Marchallii, *A violàcea*=Colocasia antiquorum(?)

The following may be expected to appear in the American trade *A Augustiniana*, Land & Rod Lvs peltate and wavy, green above and below, ith pale nerves, the petioles brown-spotted, allied to *A zebrina* I H 33 593 New Guinea(?) —*A. Curtisii*, N E Br Petioles 3 ft or less, purple-barred lf-blade 20 in or less, and half as wide, shining green and gray-ribbed above, deep purple beneath Penang —*A Desmetiana*, Hort Lvs elongated, heart-shaped and sinuate, petiole spotted —*A fèmina*, N E Br Lvs peltate, the blade 2 ft or less long and nearly half as broad purple beneath, green and light-veined above, petioles 5 ft or less, barred I Indies —*A grándis*, N E Br Large lvs 2 ft or less long, ovate-sagittate, half as broad, black-green below, bright green above, petioles 4 ft or less, blackish E Indies —*A guttàta* N E Br, var *imperàlis*, N E Br Lvs sagittate, acute, 1½ ft or less long and half as broad, purple beneath, brown-green and dark-blotched above Borneo I H 31 541 —*A indica*, Schott 6 ft or more, stout and fleshy, lvs often 3 ft across, ovate-cordate, bright green on both sides E Indies F S 21 2206 (as *A. plumbea*) —*A Márgarita*, Land & Rod Lvs slightly peltate, wavy, shining green with blackish midrib, the veins and brownish petioles pubescent New Guinea I H 33 611 —*A margináta* Said to have come from Brazil Lvs 2 ft or less long and very broad, slightly wavy, rounded and short-pointed, pale green, striped and mottled with purple, petioles brown-marked —*A Micholitziàna*, Hort Lvs arrow-shaped, velvety, the margins wavy, the midrib white Malaysia G C III 51 Suppl May 25, p XVI —*A odòra*, Koch Forming a trunk lvs sagittate-ovate, the margin slightly undulate, up to 3 ft long on long petioles J H III 42 393 —*A. plúmbea*, Hort =*A* grandis(?) —*A reversi*, N E Br Dwarf and compact, the petioles 6 in long, blade less than 1 ft long, bright green with rib and nerves olive-green B M 7498 Philippines —*A Rodigasiàna* André *A* Thibautiana × *A* Regina —*A Sanderiana* var *gandavensis*, Rod Lvs wavy-margined, purple and blotched beneath I H 43 65 —*A scabriuscula*, N E Br Lvs spreading, not deflexed, sagittate and not peltate, shining green above and paler beneath Borneo —*A sinuata*, N E Br Lvs sagittate and sinuate, dark green above with lighter areas and whitish green below Philippines —*A speciósa*, Hort G 22 171 —*A Watsoniana*, Hort =A Putzeysi —*A Warrinana*, Mast Lvs erect, toothed, not sagittate, lanceolate and long-pointed, dark green, petioles purple-spotted, winged G C III 23 243 F E 10 886. Gn 55 183 Celebes.

L H. B

GEORGE V. NASH.†

ALÒE (Arabic name) *Liliàceæ*, tribe *Aloineæ* Acaulescent or variously caulescent perennial succulents

Leaves often large, usually crowded in rosettes or along end of stems red or yellow, often paler-striped, straight, tubular (Fig 169), with short straight limb, equaled or surpassed by the stamens —Afr, especially in the Cape region, 1 species about the Medit and extensively naturalized in all warmer parts of the world, and 1 in China Plants of the coolhouse, best planted out in a well-drained place in summer, when they flower prettily



169 Flowers of an aloe.

The generic or scientific name Aloe is a Latinized form of an Arabic name As an English word it is pronounced in two syllables, thus Al-oe. Popularly this word is loosely used, the common American aloe being *Agave americana*, the commonest "century plant." The "bitter aloes" of commerce is a resinous juice much used as a laxative The best quality is called "Socotrine or Zanzibar aloes," a product of *A Perryi*, which was known by the Greeks of the fourth century B C to come from the island of Socotra The "Barbadoes

aloes" is the product of *A vera*, a species much planted in the West Indies. Genera allied to Aloe are Apicra, Gasteria, Haworthia, Pachidendron, and Phylloma. The group is difficult for the botanist, there being few authentic specimens in the herbaria, because of the large size of the plants, the infrequent flowering, and the difficulty of suitably drying them Monograph by Alwin Berger in Das Pflanzenreich, 1908, hft 33

Propagation is by seed, which usually is not true to name, and by suckers or cuttings well dried-off Branching for this purpose may be induced by scaring the crown of old plants Hybrids between the different species and with related genera are easily secured and interesting



170. A good pot plant of aloe, showing the offsets.

Aloes are much cultivated as decorative plants, being amongst the most popular of desert and succulent plants for their stiff, harsh and rugged habit Fig. 170. They are often grouped about large public buildings, where they emphasize certain architectural features. Large collections are to be seen only in botanic gardens and in the collections of a few fanciers The largest dealer has nearly one hundred kinds, but grows only five or six kinds in quantity

Old plants of Aloe will keep healthy for several years in the same pots without a renewal of soil, and flower freely at the same time. The soil most suited to their needs is sandy loam three parts, lime rubble and broken brick one part, with a little decayed manure to strengthen the mixture Very firm potting is necessary Drainage is a more important item than soil, and must be perfectly arranged to enable the surplus water to run freely from the soil Broken bricks are preferable to pieces of pots, large pieces for the bottom of the pot or tub, and smaller pieces above, till the last layer is quite fine. Some of the species need freer rooting conditions than others. *A ciliaris* will grow from 5 to 7 feet in a season *A abyssinica* is of robust growth, and differs from most others in the color of the flowers, which are pure yellow, the others being mostly orange and orange-scarlet. *A. plicatilis* makes an ornamental tub plant when 4 or 5 feet high Except during the period in which the species are in active growth, they need very little water, the principal idea being to keep the soil sweet and porous even when in growth. At all times the air of the house should be as dry as possible, full sunshine not hurting them. Propagation is by seeds, suckers and cuttings The arborescent kinds should be rooted after they have completed growth Dust over the cut part of the cutting with powdered charcoal and dry in sunshine before putting it in to root Insert singly in as small pots as they will go into, and plunge in a sand-bed Very little moisture is necessary while rooting. (G. W. Oliver)

INDEX.

abyssinica, 23, 25
acuminata, 6.
africana, 40
agavefolia, 22.
albispina, 33
albo-cincta, 12
albopicta, 25
arborea, 38
arborescens, 38.
aristata, 5.
Atherstonei, 39
aurantiaca, 28
Bainesii, 49
bamanguaiensis, 15
barbadensis, 21
Barberæ, 49
Bavrin, 15
Beckingham, 5
Beguinii, 5
Bolusii, 40
Borttiana, 12
brachyphylla, 13
brevifolia, 35
Camperi, 23.
candelabrum, 41
chinensis, 21
Chudoma, 5
ciliaris, 27
Commelinii, 33
commutata, 19
Cooperi, 1
cornuta, 25
cyanea, 6
de Laetia, 27
Derbetzii, 12
Desmetiana, 10

INDEX, CONTINUED.

dichotoma, 48.
distans, 35
distincta, 13, 50
drepanophylla, 44
echinata, 6
elegans, 24
elongata, 21
erecta, 25.
Eru 25
erythrocarpa, 46
ferox, 47
flabelliformis, 50
Flanagani, 27
flava, 21
flavispina, 33
frutescens, 38
fruticosa, 38
fulgens, 43
Galpinii, 46
glauca, 9, 25
grandidentata, 20
Greenii, 17
Grusonii, 6
Hanburiana 12
Haworthia, 10
Henzei, 6
Hildebrandtii, 29
Hookeri, 25
horrida, 47
Hoyeri, 11
humilis, 6
imbricata, 10
incurva, 6
indica, 21
inermis, 30
insignis, 6
Kirkii, 31
kniphofioides, 4
Littecoccinea, 6
Lanzæ, 21
Lapairii, 5
latifolia, 13
leiophylla, 5
leptophylla, 12
linguiformis, 50
longiaristata, 5
Lugardiana, 15
Luntii, 30
Lynchii, 12.
Macilenta, 6
Macowanii, 28
macracantha, 14.
macrocarpa, 16
maculata, 18, 25
maculosa, 13
major, 16
micracantha, 2
minima, 3
mitræformis, 35
mitriformis, 33, 34, 35
montana, 48
mortolensis, 10
muricata, 9, 47
natalensis, 38
nobilis, 34
Nowatnyi, 5
obscura, 18
officinalis, 21
oligospila, 12
pachyphylla, 33
pachythyrsa, 38
paniculata, 12
parvifolia, 5
parvi-punctata, 25
Pazii, 12
Peacockii, 23
perfector, 5
perfoliata, 6, 11, 13, 18, 21, 35, 36, 37, 38, 47
Perryi, 26
picta, 18
platyphylla, 15
plicatilis, 50
pluridens, 39
pratensis, 8
prorumpens, 5
pseudoferox, 47
pseudopicta, 18
punctata, 10
purpurascens, 37
Quehlii, 5
ramosa, 37
Rebutii, 10
rhodacantha, 9
rhodocincta, 12
rubescens, 21
rubroviolacea, 42
Saimdyckiana, 43
saponaria, 13, 18.
saxigena, 36
Schmidtiana, 1.
Schimperi, 12
Schænlandii, 12.
semiguttata, 6.
serrulata, 11.
Simoniana, 5.
sinuata, 37
smaragdina, 10
soccotrina, 36, 37.
sororia, 32
speciosa, 45
spicata, 25
spinosissima, 6
spinulosa, 33
stenophylla, 12
striata, 12
striatula, 28
suberecta, 6
subferox, 47
subtuberculata, 6.
succotrina, 36
supralævis, 46
Tidmarshii, 27
Todari, 6
tricolor, 19
Uerniæ, 38
umbellata, 13
variegata, 10
Varvarii, 43
vera, 21, 36
virens, 7
viridifolia, 38
vulgaris, 21, 23
Winteri, 43
xanthacantha, 33
xanthostachys, 47.
zebrina, 15
Zeyheri, 49

A. *Lvs clustered, rather few and thin, flaccidly erect, linear, concave, smooth, finely serrulate st very short infl unbranched, fls oblong or narrowed upward, stamens included (1–4)*

B. *Raceme short, peduncels elongated, fls with distinct segms.*

C. *Lvs 2-ranked.*

1 **Coöperi,** Baker (*A Schmidtiana*, Regel) Somewhat cespitose lvs 1·2 x 12·40 in., faintly striate, somewhat white-blotched infl 1–2 ft high, fls nodding, 1¼–1½ in long, yellowish or greenish white, rosy at base, with distinct green-tipped segm Cape B M 6377 Gt 970 Lyon Hort 22, p 305 Wood & Evans, Natal Pl 41

CC. *Lvs spirally arranged*

2 **micracántha,** Haw Lvs ½ x 18 in infl 1 ft high; fls nodding, 1¼–1½ in long; red, the distinct segm green above or tipped and lined with green. Cape. B M 2272 Salm, Aloe §21, f 1

3 **mínima,** Baker Lvs ¼ x 6–8 in infl 6–12 or even 30 in high; fls spreading, ¾–1¼ in long, greenish white or the distinct segm. rosy tinged Cape Hook Icon. 2423. Wood, Natal Pl 338

BB. *Raceme elongated; peduncels short; fls. spreading or ascending· lvs. spirally arranged.*

4 **kniphofioides,** Baker Lvs ¼ x 12–15 in infl. 2 ft high, fls ascending, 1¼ in long, pale red, with very short segm and long tube. Cape. Hook. Icon. 1939.

AA. *Lvs spirally rosulate (3-ranked in A variegata), fleshy, acute or pungent stamens little protruded (5–26)*

B. *Plants small lvs 3–8 in. long: st never tall infl. racemose; peduncels long; fls nearly cylindrical*

C. *The lvs. bristle-tipped, soft-toothed and warty: raceme rather short.*

5. **aristàta,** Haw. (*A. longiaristàta*, R. & S). Lvs. erect, triangular-lanceolate, ¾ x 3–4 in., with a whip-

like apical thread, white-warty in transverse lines on the back and with rather small close white marginal teeth infl 1–1½ ft high, fls. 1¼ in long, reddish yellow, the moderately long tube somewhat constricted above the base Cape Gt 1883, p 151. Salm, Aloe §15, f. 7. Lyon Hort 22, 307 Berger 61.—In aspect resembling Haworthia Varies in a nearly smooth-lvd form, var **leiophýlla,** Baker, and a gray-lvd form with 2-ranked tubercles, var **parvifòlia,** Baker. Hybrids are: *A* × *prorúmpens,* Berger, *A* × *Beguinæ,* Hort, *A* × *perfóctior,* Berger, *A* × *Chludòmii,* Beguin, *A.* × *Lapaixii,* Radl, *A.* × *Quéhlii,* Radl, *A* × *Nowátnyi,* Radl, *A* × *Bedinghausii,* Radl, and *A.* × *Simonvàna,* Deleuil All are known or believed to be crosses with species of the related genus Gasteria

CC. *The lvs not bristle-tipped, rather coarsely toothed, sometimes warty*

D *Teeth pale, racemes rather long.*

6 **hùmilis,** Haw (*A perfoliàta húmilis,* Linn.) Lvs. suberect, rather incurved, triangular-lanceolate, ¾ x 4 in, gradually acute, somewhat striate, sharply white-tuberculate, at least on the back, and with rather close large white marginal teeth infl 1½–2 ft high; fls 1½ in long, red or yellowish, the green-tipped segm distinct nearly to the base. Cape Salm, Aloe §15, f 1.—With somewhat the habit of Haworthia Varies from the narrow green-lvd type into glaucous forms of this, with rather thicker lvs, var **incúrva,** Haw (*A incúrva,* Haw), B M 828, Salm, Aloe §15, f 3, and rather thin, more concave lvs, var **echinàta,** Baker (*A echinàta,* Willd), Salm, Aloe §15, f 2, Berger 64, 65, and one with purplish lvs, var **macilénta,** Baker, as well as a broader-lvd glaucous large form, var. **suberécta,** Baker (*A suberécta,* Haw *A acuminàta májor,* Salm-Dyck), which is sometimes white-mottled, var **semiguttàta,** Haw, a moderately large broad-lvd form, var **acuminàta,** Baker (*A acuminàta,* Haw, *A suberécta,* Haw), B M 757, and a small blue-glaucous form with closer prickles and smaller warts, var **subtuberculàta,** Baker (*A subtuberculàta,* Haw) Hybrids are *A* × *insignis,* Brown (*A humilis* × *A drepanophylla*), *A* × *spinosissima,* Hort (*A humilis echinata* × *A arborescens pachythyrsa*), *A* × *cyánea,* Hort (*A. húmilis incurva* × *A arborescens frutescens*), *A* × *Todàri,* Borzi, (*A Todari præcox,* Borzi,) *A* × *Grusònii,* Henze, Monatschr Kakteenk 11, p 57 (*A humilis* × *A Schimperi*), *A* × *Hénzei,* Hort (*A Grusonii* × *A variegata*), and perhaps *A* × *lætecoccínea*

7 **vírens,** Haw Lvs curved, spreading, triangular, about 1 x 8 in, somewhat mottled or also lined, not warty, with rather distant, coarse, white, marginal teeth infl about 2 ft high, fls 1½–2 in long, red, the tube longer than the paler green-tipped sometimes very short segm Cape B M 1355 Salm, Aloe §15, f 8 Berger 62, 63 Journ et Fl des Jard 1832, 20.

DD. *Teeth dark racemes short.*

8 **praté-sis,** Baker Acaulescent lvs erect-spreading, 1–2 x 4–6 in, acute, striate, with large chestnut or blackish prickles on the margin and toward the top of the back. infl. 1½ ft. high, fls. 1¼–1½ in long, yellowish red, the distinct segm. green-tipped. Cape. B.M 6705 Berger 67.

9 **glaùca,** Mill (*A. rhodacántha,* DC.) Shortly caulescent· lvs erect-spreading, 1½–2 x 6–8 in, acuminate, somewhat white-lined, with close strong reddish prickles on margin and back at apex: infl 2–2½ ft. high; fls 1¼ in. long, red, the nearly distinct segm. somewhat paler and green at tip Cape. Salm, Aloe §17, f. 2 DC, Pl. Gr 44. B M. 1278.—This pale-lvd., always strongly armed species varies in a distinctly caulescent less glaucous form with even larger prickles, var. **muricàta,** Baker (*A muricàta,* Schult., *A glaùca spinósior,* Haw).

CCC. *The lvs. not bristle-tipped* ***or warty,*** *minutely toothed or merely rough-edged pedicels rather short.*

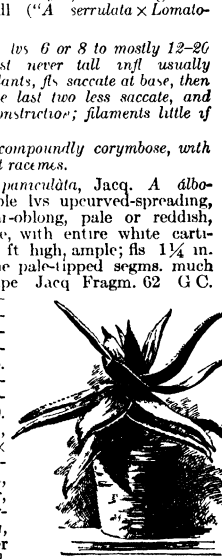
10 **variegàta,** Linn (*A punctàta,* Haw.). At length with a leafy st 6–9 in high lvs green, ascending, in 3 close oblique ranks, about 1 x 2–5 in, triangular, v-shaped, abruptly acute, crossed by bands of elongated white blotches, edged and keeled by cartilaginous warty, or toward the tip serrate rather than toothed, white borders infl about 1 ft high, fls 1¼–1½ in long, red, the green-nerved segms rather shorter than the nearly cylindrical tube Cape B M 513. DC, Pl Gr 21. Salm, Aloe §20, f 2 Berger 68. G Z 4 92. Wien Ill Gart Zeit 1901, p 122 Gt. 29, p 25. Mordaunt, Hb 2 90 Lyon Hort 21, p 62, 22, p 307. Deutsch Tiefsee-Exped 2 124 F E 8 98.—In habit resembling Haworthia Varies in a form with broader lvs with smaller less banded blotches, var **Hawórthii,** Berger Hybrids *A* × *smaragdina,* Hort (*A variegata* × *Gasteria candicans*?), *A* × *Rebùtii,* Hort (*A variegata* × *Gasteria,* sp), *A* × *Desmetiàna,* Hort (*A. variegata* × *humilis echinata minor*), *A* × *imbricàta,* Hort (*A variegata* or *A serrulata* × ?), *A* × *mortolensis* (*A variegata* × *Gasteria acinaciformis*)

11 **serrulàta,** Haw (*A perfoliàta serrulàta,* Ait). Fig 171 At length short-std lvs somewhat glaucous, rather spirally arranged and spreading, 2 x 8 in, ovate, nearly flat above, with scattered elongated white blotches and serrulate white margin and keel infl 1½ ft high; fls 1½–2 in long, red, the green-nerved segms scarcely equaling the somewhat constricted tube. Cape B M 1415. Salm, Aloe §20, f 1 Berger 68. Hybrids *A* × *Hóyeri,* Radl (?*A serrulata* × *Lomatophyllum borbonicum*?)

BB. *Plants moderately large lvs 6 or 8 to mostly 12–20 in long, smooth st never tall infl usually branched on strong plants, fls saccate at base, then constricted, or in the last two less saccate, and undened above the constriction; filaments little if at all exserted*

C. *The lvs unarmed infl compoundly corymbose, with very short racemes.*

12 **striàta,** Haw (*A paniculàta,* Jacq. *A álbocincta,* Haw) Nearly simple lvs upcurved-spreading, 4–6 x 15–20 in, triangular-oblong, pale or reddish, somewhat prunose, striate, with entire white cartilaginous margin infl 2–3 ft high, ample; fls 1¼ in. long, red or yellowish, the pale-tipped segms. much shorter than the tube Cape Jacq Fragm. 62 G C. III 36 423 Berger 69.—Varies in a form with red-margined lvs, var **rhodocincta,** Hort (*A Hanburiàna,* Naudin), G W 3, p. 553, and a form with white-blotched lvs, var **oligospeila,** Baker, B M 5210. Hybrids *A* × *Schimperi,* Tod, Hort Pan 16, *A* × *Bortiàna,* Terr, *A* × *Schænlándii,* Baker; *A* × *Páxii,* Terr; *A* × *Lynchii,* Baker, G C III 29: 199; *A.* × *Derbýtzii,* Hort; *A* × *leptophylla,* Brown, B M. 7624, Berger 70, and a narrower-lvd form of it, var **stenophýlla,** Baker Unnamed hybrids with *A saponaria* are known, and *A.* × *Schimperi* has been recrossed with *A. striata.*



171. Aloe serrulata. (No 11)

CC. *The lvs. toothed infl simply corymbose, or unbranched when poorly developed.*

D *Racemes short*

13. **saponària,** Haw (*A perfoliàta saponària,* Ait. *A. saponària minor,* Haw *A distícha,* Mill *A* × *maculósa,* Lam. *A. umbellàta,* Salm.-Dyck *A. umbellàta mìnor,*

DC.). Cespitosely clustered· lvs ascending or spreading, lance-oblong, acuminate, 2 x 6–8 in , often reddish, glaucous, faintly striate, with pale blotches more or less in transverse bands, the large, marginal, confluent teeth brown infl 1½–2½ ft high, commonly branched, fls. 1½–1¾ in. long, red, the paler more or less green segms. much shorter than the tube Cape Wood & Evans, Natal Pl. 100. B M 1460. DC , Pl Gr 98, Salm, Aloe §23, f. 1 Berger 71, 72 Lyon Hort 22, p. 305 Lam , Encycl. 236.—Varies in a dwarf form with lvs scarcely 4 in long, var **brachyphýlla,** Baker, and a larger greener-lvd form, var **latifòlia,** Haw. (*A. latifòlia,* Haw. *A. saponària màjor,* Linn. *A. umbellàta màjor,* DC.) Salm, Aloe §23, f. 3. B M. 1346.

DD. *Racemes more elongated.*

14 **macracántha,** Baker Simple, becoming caulescent· lvs recurving, lance-oblong, 3–5 x 12–18 in , striate and irregularly somewhat white-blotched, with large, yellow-brown, distinct marginal teeth infl 1–2 ft. high, fls 1¾ in long, greenish yellow or orange, the segms half as long as the tube Cape B M 6580.

15 **zebrina,** Baker. (*A platyphýlla,* Baker *A. Lugardùna,* Baker *A Baùmii,* Engl & Gilg *A. bamangwatènsis,* Schoenl) Somewhat clustered lvs erect-spreading with recurved acute tips, 2½ x 6–12 in , lance-oblong, often reddish, dull, at first pruinose, striate and with elongated pale blotches more or less in transverse bands, the sinuate margin with confluent large red- or brown-tipped teeth infl 3–4 ft high, fls 1¼ in long, red, the nerved segms shorter than the tube Trop Afr Baum, Kunene-Sambesi Exped , 90. G C. III 35 226 B M 7948 Berger 75

16 **macrocárpa,** Tod. Cespitose lvs spreading, gradually pointed, 2 x 8–15 in , broadly triangular-oblong, pale, striate, mottled in transverse bands, with irregular, small, confluent, brown-tipped · marginal prickles infl 2 ft high, fls 1 in long, light red, the nerved segms shorter than the tube Trop Afr Tod , Hort Pan 9 Berger 76.—A larger Abyssinian form, with fls becoming 1¼ in long, is var **màjor,** Berger

17. **Greènii,** Baker Lvs spreading, concave, acute, 3 x 15–18 in , lance-oblong, glossy green, striate and with elongated pale blotches confluent in irregular cross-bands, the sinuate margin with confluent, moderately large, frequently paired, brown upcurved teeth infl 1½–4 ft high, fls 1–1⅛ in long, dull red, the segms much shorter than the tube Natal B M 6520

18 **obscùra,** Mill (*A perfoliàta obscùra,* Ait *A. saponària obscùra,* Haw *A pícta,* Thunb. *A pícta màjor,* Willd *A maculàta,* Desf) Lvs in a compact rosette, 2½–3 x 8 in , triangular-lanceolate, green, striate and with scattered small pale blotches, the sinuate, narrowly cartilaginous margin with rather short and close red-tipped teeth· infl simple or forked, 2½–3 ft. high, fls. 1¼ in long, red, the nerved segms about equaling the tube Cape region DC , Pl. Gr. 97 B M 1323 Salm, Aloe §23, f. 2 Dillenius, Eltham. 15. Allgem. Deutsch Gart. Mag 6.17. Hybrid: *A* × *pseudopícta,* Berger

19. **commutàta,** Tod Lvs. as in *A. saponaria* but with somewhat recurved apex and weaker green-based prickles, 1½–2 x 6 in infl few-branched, 3 ft high; fls. campanulately widened, 1⅛ in long, light red, the nerved segms. shorter than the tube Cape region(?). Tod , Hort. Pan 18. Berger 77 —Varies in a form with the reddish lvs scarcely ½in wide and more conspicuously white-banded, var. **trícolor,** Berger (*A trícolor,* Baker) B.M. 6324.

20. **grandidentàta,** Salm -Dyck Lvs recurved-spreading, 2½–3 x 12–18 in , lance-oblong, pale, striate and with elongated pale blotches confluent beneath into transverse bands, the sinuate margin with rather distant, large, smoky teeth: infl. 2–3 ft high, fls. 1⅛ in. long, rosy, the segms about equaling the campanulately widened tube Cape region Salm, Aloe §23, f. 4. Berger 77.

BBB. *Plants rather large lvs. 15–80 in. long, smooth: st rarely tall (6 ft. in one form of A. Èru) infl. usually simply paniculed or subcorymbose, fls. not succate*

21 **vèra,** Linn (*A perfoliàta vèra,* Linn *A elongàta,* Murr. *A barbadénsis,* Mill *A. vulgàris,* Lam *A. flàva,* Pers) Cespitose, the sts at length 1–1½ ft. high lvs suberect or spreading, gradually narrowed from the base, pale, 2–3 x 12–20 in , irregularly white-blotched and narrow when young and 2-ranked on offsets, the repand margin with weak pale prickles. infl 2-3 ft high, often simple, fls 1 in long, yellow, the segms about equaling the oblong tube Medit region and intro generally through the tropics Fiori & Paoletti, Fl Ital 1, p 206 Sibthorpe, Fl Graeca, 341. Salm, Aloe §18, f 2 Stephenson & Churchill, Med. Bot , 109 Bentley & Trimen, Med Pl 282 Berger 84. —The source of "Barbados aloes." Varies in a large Arabian form with broader lvs , taller infl , and fls shading into orange, var **officinàlis,** Baker (*A. officinàlis,* Forsk , *A rubescens,* DC), DC , Pl Gr. 15, a smaller Asiatic form with red-tinged fls , var. **chinénsis** (*A indica,* Royle *A chinensis,* Baker), B M 6301, and a hardier garden form of this, var. **Lánzæ,** Berger (*A Lánza,* Tod), Tod , Hort Pan 39. Berger 84

22 **agavefòlia,** Tod Little caulescent or cespitose: lvs recurved-spreading, concave, gradually narrowed, rather thin, 3 6 x 18 20 in , with scattered, small, oblong, pale blotches, the margin with large triangular hooked prickles infl 3 ft high, paniculed, fls 1–1¼ in long, dull red, the green, pale-margined segms about equaling the constricted tube Trop Afr Tod , Hort. Pan 23

23 **abyssínica,** Lam (*A vulgaris abyssínica,* DC. *A abyssinica Peacockii,* Baker *A Peacockii,* Berger & Schum *A Camperi,* Schweinf) Scarcely clustered, acaulescent lvs at first ascending, gradually narrowed, rather sharp-pointed, 4–6 x 12–30 in , pale, not mottled, with rather small, confluent, deltoid, reddish marginal prickles infl 3 ft high, dichotomously few-branched; fls 1¼–1½ in long, yellow or orange, the segms rather shorter than the slightly narrowed tube Trop Afr Salm, Aloe §18, f 1 DC , Pl Gr 27 B M 6620. Berger 87, 88

24 **élegans,** Tod , differs mainly in having more elongated racemes

25 **Èru,** Berger (*A abyssinica,* Baker) St branched, scarcely 2 ft high lvs recurving, very fleshy, 1½–3 x 16–34 in , pale, somewhat glossy, with elongated white blotches, the repand margin with large reddish-tipped teeth infl 3–6 ft high, dichotomously branched, fls campanulate, scarcely ½in long, yellow or orange, the segms longer than the slightly constricted tube Trop. Afr —Several minor forms occur—**maculàta, erécta, glaùca, párvi-punctàta,**—and two large forms have been described, var **cornùta,** Berger (*A spcàta,* Baker, *A albopícta,* Hort), Benth & Trimen, Med Pl 284, and var **Hoókeri,** Berger (*A abyssínica,* Hook), B M 7712, respectively short-std and with a trunk 6 ft. high

26. **Pérryi,** Baker. Trunk about 1 ft high, simple; lvs spreading, gradually narrowed or acuminate, 2–2½ x 15 in , pale green or reddish, somewhat striate but not mottled, the margin with rather small and close brown-tipped prickles infl 1½ ft. high, somewhat paniculed, fls 1 in long, reddish becoming yellow, the green-tipped segms much shorter than the slightly constricted tube Socotra B M 6596 —This is now held to be the source of "Socotra aloes," long attributed to *A. succotrina.*

AAA. *Lvs rather numerous, spirally arranged on a lengthened st, acute or pungent (27–39)*

B *The lvs rather separated, not armed on the back.*

C. *St. weak lvs thin, finely prickly on the margin, distinctly separated, with perfoliate striate sheaths: infl short, racemose*

27 **ciliàris,** Haw St elongated, scrambling, more or less verticillately branched lvs elongated lanceolate, striate, coarsely white-denticulate, spreading, about 1 x 3–6 in infl. 6–8 in. high; fls 1⅛ in long, bright red, the greenish segms much shorter than the cylindrical tube, stamens little protruding Cape. Salm, Aloe §25, f 1 Berger 9, 97 Henslow, S Afr Pl p 269. —Varies into a smaller-lvd. form with nearly entire lf -bases and smaller fls, var **Tidmarshii,** Schoenl, and a form with broader lvs, var **Flánaganii,** Schoenl. Hybrids *A.*×*de Làtii,* Radl (*A ciliaris* × *succotrina*).

28 **striàtula,** Haw (*A Macòwanii,* Baker *A. aurantiaca,* Baker) Resembling *A ciliaris* lvs longer, narrowly triangular, minutely denticulate. fls from reddish becoming yellow or orange, with longer segms. and long-protruding stamens Cape. Monatsschr. f. Kakteenk 16, p 4. Berger 99, 100.

CC *St stouter lvs rather fleshy and close: infl. taller, paniculed*

29 **Hildebrándtii,** Baker St slender, elongated lvs lanceolate-attenuate, 2 x 6–9 in, somewhat thick, glaucous, sometimes white-blotched as are the short sheaths, with rather small yellow marginal teeth infl 1½ ft high, nearly sessile, fls 1 in long, red with more or less yellow- or green-marked segms about equaling the somewhat constricted tube. Trop. Afr B M 6981 Berger 104

30 **inérmis,** Forsk (*A Lúntii,* Baker). St short lvs recurved-spreading, gradually narrowed, 2 x 12 in, fleshy, very pale green or reddish, blade and sheath mottled with white at least when young, entire infl 2–3 ft high, open, fls 1 in long, rosy, with green-lined yellowish segms shorter than the somewhat constricted tube Arabia B M 7448 Berger 105.

BB *The lvs more fleshy, with short, nearly concealed sheaths infl often paniculed*

C *Racemes elongated lvs not armed on back*

31 **Kirkii,** Baker St short lvs crowded, lanceolate-acuminate, 2 x 9–12 in, somewhat thick, glossy, green or reddish, with rather coarse confluent reddish marginal teeth infl 2 ft high, fls 1⅛ in. long, light red with yellowish base and greenish segms shorter than the cylindrical tube Zanzibar B.M. 7386.

CC *Racemes short lvs more or less armed on back as well as margin*

D *Erect lvs elongated.*

32 **sordìria,** Berger Lvs elongated, triangular, 2½ x 18 in, dull green, brown-striate, with variable whitish marginal teeth alternately larger and smaller. infl about 2 ft. high; fls 1⅛ in long, light red, with segms longer than the tube. Cape.

DD *Prostrate lvs. short and broad infl. often forked.*

33. **mitrifórmis,** Mill (*A xanthacántha,* Salm-Dyck). Fig. 172 Lvs upcurved, ovate, acute, 2–3 x 4–6 in., glaucous, somewhat prickly toward the tip beneath, with large and strong yellow or brown marginal teeth: infl 1 ft or more high; fls 2 in. long, bright red with recurving, paler, nearly distinct segms. Cape DC, Pl Gr 99 B M. 1270. Salm, Aloe §24 f 3. Berger 108 — Very polymorphic, the broad-lvd typical form, with dorsal teeth on the keel only, varying into a form with smaller marginal teeth, those on the back continuing to the apex, var **pachyphýlla,** Baker; another, in which they stop short of the apex, var **xanthacántha,** Baker (*A. xanthacántha,* Willd.). Salm. Aloe §24, f. 4, and a third with acuminate lvs, var **Commelínii,** Baker (*A Commelínii,* Willd *A mitrifórmis humilior,* Haw), Salm. Aloe §24, f 5 narrower-lvd forms with short and broad yellow teeth, var **flavíspina,** Baker (*A. flavíspina,* Haw), Salm, Aloe §24, f 2, or long subulate white teeth, var **albíspina,** Berger (*A albíspina,* Haw) and a variant of the type with scattered teeth over the back of the broad lvs, var. **spinulòsa,** Baker (*A spinulòsa,* Salm), Salm, Aloe §24, f. 6. Berger 109.

34 **nóbilis,** Haw (*A mitrifórmis spinòsior,* Haw). Lvs lance-deltoid, 2 x 4–6 in, green, somewhat prickly toward the tip beneath, with large, strong, confluent, white marginal teeth infl 2 ft high; fls 1½ in long, red, with recurving distinct segms. Cape. Salm, Aloe §24, f. 7 Berger 109



172 Aloe mitriformis (No. 33)

35. **dístans,** Haw (*A mitræfórmis angústior,* Lam. *A perfoliàta brevifolia,* Ait *A brevifólia,* Haw *A. mitrifórmis brevifolia,* Sims *A mitrifórmis humilior,* Willd) Branched and prostrately spreading lvs ascending, broadly ovate, acute, 2 x 3–3½ in, glaucous, somewhat mottled below and prickly toward the tip beneath, with strong, dark-tipped yellow marginal teeth infl 1½ ft high, fls 1¼ in. long, red, with recurving greenish segms about as long as the cylindrical tube. Cape. Salm, Aloe §24, f. 1. B M 1362. Berger 107.

AAAA *Lvs numerous, elongated, succulent, acute or pungent, spirally crowded at end of the prominent, sometimes tall trunk (36–49)*

B. *Stamens scarcely protruded. fls. narrow lvs. smooth.*

C *Trunk scarcely 4 ft high infl usually racemose*

36 **succotrìna,** Lam (*A soccotrìna,* DC. *A perfoliàta soccotrìna,* Ait *A socotrìna,* Steph & Church. *A. vèra,* Mill.). Scarcely cespitose, the dichotomously branched st at length 3–4 ft high· lvs falcately upcurved, gradually narrowed, pale or glaucous, sometimes white-blotched toward the base, 1½–2 x 15–20 in, the margin serrate with small connate white prickles infl 2 ft. high, fls 1¼ in long, light red, the

distinct segms green-nerved Cape. DC., Pl Gr. 85. Salm, Aloe §22, f 1. B M. 472. Stephenson & Churchhill, Med Pl 110 Berger 113 —Varies in a form with more armed, broader, shorter and straighter lvs., var. **saxígena,** Berger.

37 **purpuráscens,** Haw (*A sinuàta,* Thunb.? *A. perfoliàta purpuráscens,* Ait *A socotrìna purpuráscens,* Ker *A ramòsa,* Haw) Cespitose, nearly acaulescent· lvs upcurved, gradually tapered, green, sometimes more or less striate, and white-dotted on the back below, 2½ x 18–20 in , the margin with moderately long connate hooked purplish teeth infl 3 ft high, fls 1½ in long, light red, the distinct segms paler and green-nerved Cape Salm, Aloe §22, f 2 B M 1474 Berger 113 Winkler, Pharm Waarenk 182

cc *Trunk finally 10–20 ft high: not cespitose*

D *Infl a simple or forked raceme*

38 **arboréscens,** Mill (*A perfoliàta arboréscens,* Ait *A arbòrea,* Medikus *A frutcòsa,* Lam ? *Caterìta arboréscens,* Medikus *A arboréscens Millen,* Berger). Trunk simple, finally 10–15 ft high, clothed at top with the withering lvs : lvs sinuately spreading, gradually narrowed, dull green, 2 x 24 in , the repand margin with rather long cartilaginous white prickles infl elongated, fls about 1½ in long, red, with distinct segms Cape(?) B M. 1306 Bot Repos 468 Berger 115.—Varies into numerous forms, green-lvd , with shorter trunk and long lvs , var **Ucriæ,** Berger (*A. Ucriæ,* Terr), Salm, Aloe §26, f 3 G W 10, p 13. Berger 116, 117, or shorter lvs , var **viridifòlia,** Berger, —Berger f 117, or glaucous or blue-lvd , with branched infl , var **natalénsis,** Berger (*A natalensis,* Wood & Evans), Berger 115, or simple infl with normal fls , var **frutéscens,** Link (*A frutéscens,* Salm-Dyck), Berger 120. or fls 2 in long, var **pachythýrsa,** Berger Berger 118, 119

39 **plùridens,** Haw (*A Atherstònei,* Baker). Trunk unbranched, finally 8–10 ft high lvs as in the preceding but glossy and somewhat striate, 2½ x 16 in.: infl branched, fls 1½ in long Cape. Berger 121

DD *Infl a candelabrum-like forking panicle, with upcurved nearly sessile fls.*

40 **africàna,** Mill (*A africàna angùstior,* Sims. *A. Bolùsii,* Baker *Pachydéndron africànum,* Haw *P. princìpis,* Haw *P angustifòlium,* Haw). Trunk simple, finally 20 ft. high lvs few, rather separated, sinuately spreading or recurved, triangular-oblong, glaucous, 2½-3 x 20 24 in , with rather large triangular horny marginal teeth infl 2 ft high, fls 1½ in. long, yellow, with segms shorter than the oblong tube. Cape. Salm, Aloe §27, f 2 B M. 2517 Berger 128.

41 **candelàbrum,** Berger, differs chiefly in having the fls red Cape

BB *Stamens much longer than the rather ample short perianth not cespitose*

C *The lvs smooth, toothed infl racemose or forked.*

42 **rubroviolàcea,** Schweinf Not branched, scarcely 3 ft high lvs spreading, acuminately triangular, purplish-prunose, 4 x 24 in , the reddish margin with rather distant curved dark-pointed moderate teeth infl often forked, 2 ft high, fls 1½ in long, light red, the segms rather longer than the tube. N. Afr B M. 7882 Berger 122, 123 Hybrids. *A. rubroviolacea* × *A. supralævis*

43 **Salmdyckiàna,** Schult. Branching, low. lvs arcuately spreading, gradually tapered, glaucous, 3 x 30 in., the yellowish margin with rather large cartilaginous teeth infl 2–3 ft high, paniculate, fls 1¼–1½ in. long, red, the green-tipped segms nearly distinct S. Afr. Salm , Aloe §27, f. 1 Berger 125, 126 — Varies in a less dense form with stouter trunk, var. **fúlgens,** Berger (*A. fúlgens,* Tod.), Tod., Hort. Pan

33. Hybrids: *A.* × *Winteri,* Berger (*A Salmdyckiana* × *A. arborescens frutescens*), *A.* × *Varàrii,* Borzi (*A. Salmdyckiana* × *A cæsia?*).

44 **drepanophýlla,** Baker Trunk slender, simple, 9–12 ft. high. lvs. very narrowly lanceolate-attenuate, glaucous, 1–1½ x 24–36 in., the cartilaginous margin minutely denticulate infl 1½ ft high; fls scarcely 1 in long, from red becoming whitish, green-lined, with nearly distinct segms. Cape Berger 127

45 **speciòsa,** Baker Taller, 18–25 ft high, branching lvs very numerous, spreading, gradually tapered, blue, the rosy margin with minute prickles fls 1¼ in long, from rosy becoming whitish, green-nerved, the segms about equaling the tube. N Afr Berger 124.

CC *The lvs often armed on one or both faces, toothed at nearly simple infl paniculately forked.*

46 **supralævis,** Haw (*A Galpìnii,* Baker *Pachydéndron supralæve,* Haw) Not branched, 3–6 ft high lvs numerous, upcurved, lanceolate, glaucescent, 4–6 x 20–30 in , prickly on the back only, the marginal teeth rather large, reddish brown infl 3 ft or more high; fls 1–1¼ in long, red-orange, becoming yellower, with segms longer than the tube. Cape Salm, Aloe §27, f 6 Berger 129, 130 —Varies in a form with few if any prickles on the backs of lvs , var **erythrocárpa,** Berger Berger 130

47 **férox,** Mill (*A perfoliàta férox,* Ait *A muricàta,* Haw *A hórrida,* Haw *A pseudoférox,* Salm-Dyck *A subférox,* Spreng *Pachydendron férox,* Haw *P pseudoférox,* Haw) Exceptionally forked, 3–10 ft high lvs numerous, curved, lanceolate, glaucous, becoming reddish, 4–5 x 28 in , more or less prickly on both faces, the purplish margin with rather large red-brown teeth infl 4 ft high, fls 1¼ in long, greenish yellow, with smoky-tipped segms longer than the rather narrow tube Cape region B M 1975 Berger 131, 132. Salm, Aloe §27, f 5 —Varies in a whiter-lvd. form with brighter yellow black-tipped fls , var. **xanthostáchys,** Berger

CCC. *The lvs smooth, prickly-margined trunk very large, dichotomously branched, not cespitose infl. tripartite*

48 **dichótoma,** Linn (*Rhipidodéndron dichótomum,* Willd) Stout flat-topped tree, 25–30 ft high, repeatedly forked as in *Dracæna Draco* lvs nearly flat, recurved-spreading, lanceolate, glaucous, 2–3 x 6–10 in , the yellow-brown margin minutely prickly infl 1 ft or more high, fls very stout, 1¼ in long, yellow, with broad, nearly distinct segms Cape G C 1873, p 712, 1874, p 567. Berger pl 1 and f 135 —Varies in a smaller-fld form with shorter stamens, var **montàna,** Berger (*A montàna,* Schinz)

49 **Bainèsii,** Dyer Large flat-topped tree, 30–60 ft high, copiously branched lvs concave, recurved-spreading, elongated, green, 2–3 x 24–36 in , the pale margin with rather small teeth infl 1 ft or more high; fls 1¼–1½ in long, yellowish red, with segms shorter than the tube Cape region G C 1874, p 568 B M. 6848 Berger 136, 137 —Varies in a broader-lvd form with minute marginal prickles, var **Bárberæ,** Baker (*A Bárberæ,* Dyer. *A. Zèyheri,* Hort), G C. 1874, p. 568

AAAAA. *Lvs. rather few, strictly oblong, succulent, 2-ranked, minutely prickly near the very obtuse tip only st stout, evident infl unbranched, fls. oblong, stamens scarcely protruded*

50. **plicátilis,** Mill (*A disticha plicátilis,* Linn. *A linguifórmis,* Linn *A flabelliformis,* Salisb. *Kumàra disticha,* Medikus. *Rhipidodéndron distichum,* Willd *R. plicátile,* Haw.). Somewhat repeatedly forking, 3–10 ft. high, not cespitose. lvs flat or 2-edged as in Gasteria, ascending, glaucous, 1–1½ x 8–16 in , the narrow cartilaginous margin minutely somewhat denticulate

upward: infl 1–3 ft high, fls 1½–2 in long, red, with segms scarcely equaling the tube. Cape B M. 457. DC., Pl Gr 75, Jacq, Schoenbr 423. Salm, Aloe §28, f 2 Medic. 4. Berger 139, 140.

A Cámeronii, Hemsl Fls almost cinnabar-red, passing into yellow toward the top L Trop Afr B M 7915 —*A Campylosíphon*, A Berger Pale yellow fls E Trop Afr —*A Chabaudii*, Schoenl Allied to A stricta Lvs bordered with small prickles, outer segms of fls pale brick-red with whitish wings at apex Trop Afr G C III 38 102 —*A decóra*, Schoenl A dwarf species having red fls tipped with green S Afr G C III 38 3865 — *A Lástii*, Baker Fls pale yellow, greenish at top Zanzibar —*A laxiflóra*, Hort Very lax arrangement of fls which are orange-red in lower part and yellow at apex Cape Colony G C III 39 130, desc —4 *Marlóthii*, A Berger Extremely spiny lvs and nearly horizontally spreading fl-spikes British Bechuanaland — *A Orpénse*, Schoenl Lvs lined with white spots and markings on both surfaces fls red, tipped with white S Afr G C III 38 3865 —*A palludiflóra*, A Berger A stemless plant lvs armed on margins with sharp spines fls pale flesh-color S Afr B M 8122 —*A péndens* A shrubby species fls drooping, dull yellowish red S Arabia B M 7857 —1 *rubrolutea*, Schinz Unbranched st 8 ft high or more lvs armed or margins with brown deltoid and somewhat hooked spines fls bright red Trop S W Afr B M 8263

WILLIAM TRELEASE

ALONSÒA (Alonzo Zanoni, Spanish official at Bogota) *Scrophulariàceæ* ALONSOA Tropical American plants, cultivated as annuals in the open, or grown for the attractive winter bloom in pots.

Flowers showy plant of good habit: corolla very irregular and turned upside down by the twisting of the pedicel, bringing the larger lobe uppermost, stamens 4: lvs (at least below) opposite or in 3's —About a dozen species, many of which have been in gardens at one time or another



173. Alonsoa incisifolia. (×¼)

Alonsoas are tender, and need protection from frost Seeds are usually started under glass in the North, although plants bloom well from seeds sown directly in the open Use only finely prepared soil For winter bloom, plants are propagated by cuttings or seeds, the latter being sown in late summer

incisifòlia, Ruiz & Pav (*A urticæfòlia*, Steud *Célsia urticæfólia*, Sims, B M 417) Fig 173 About 2 ft high, erect lvs ovate to oval-lanceolate, long-stalked, deeply cut-toothed fls nearly ½in across, very irregular (somewhat hood-shaped), scarlet, with protruding organs, on slender axillary peduncles, upper limb of corolla 2–4 times longer than calyx, anthers 2–3 times shorter than filaments Also a white-fld. variety. Peru —A greenhouse shrub.

Warscewiczii, Regel (*A incisifòlia* var *Warscewiczu*, Boiss *A. grandiflóra*, Hort *A compácta*, Hort.) Fls large, the plant herbaceous or nearly so and treated as a garden annual lvs cordate or cordate-lanceolate, double-toothed: calyx-lobes blunt, upper lobes of corolla 4–5 times as long as calyx, and anthers 3–4 times shorter than the crooked filaments, the fls. light cinnabar-red or scarlet-red (and a white variety) Peru — Apparently the commonest alonsoa in gardens, 2–3 ft, readily grown from seeds as a half-hardy subject; July till autumn, useful also for winter bloom Plant very bushy, with mostly reddish brown branches

acutifòlia, Ruiz & Pav (*A myrtifòlia*, Roezl) Plant stout but bushy, 20–30 in.: lvs broad-lanceolate, sharply simple-toothed pedicels single, glandular hairy (as also the calyx), fls larger than *A Warscewiczu*, the limb or lip 3–4 times as long as the calyx, anthers long, several times exceeding the filaments, color of fls cinnabar-red Peru Var **cándida,** Voss (*A albiflóra*, Hort.), fls white Grown as a garden annual, and also in pots for winter bloom

linearis, Ruiz & Pav (*A. linearifòlia*, Steud. *A. linifòlia*, Hort.) Plant bushy and much branched, 12–20 in lvs linear, pointed, entire or finely toothed, often fascicled or crowded fls scarlet. Peru Var **grácilis,** Hort (*A pùmila*, Hort.), is a smaller graceful form. Cult as garden annual and also in pots indoors

A caulialata, Ruiz & Pav Lvs less cut than in A incisifolia fls smaller st 4-angled Peru —1 *intermedia*, L B C 1456=A linearis —*A linifòlia*, Roezl Plant 1½ ft or less high lvs lanceolate or narrower, entire fls bright scarlet Peru —4 *Mathewsii*, Benth Lvs lanceolate, toothed fls scarlet, in terminal racemes Peru Greenhouse

L H B

ALOŸSIA *Lippia*

ALPINE PLANTS. In gardening, a term used to designate those plants that thrive in imitated alpine conditions,—in cool places of short-growing season and abundant cold-water supply in the growing and blooming period, and soil conditions approaching those of mountains, in practice, alpine-gardening is a form of rock-gardening

The cultivation of alpine plants in some parts of the United States must always be attended with difficulty Wherever, as in the coastal plain region of the Atlantic seaboard, the summers are long, dry and hot, it is almost impossible to cultivate many of the most desirable alpines

A study of the natural environmental habitats of alpines is the very best way to arrive at really valuable ideas upon their cultivation Excluding all those alpines of apparently little definite habitat preference, such as the snowdrop, daffodil, poet's narcissus, trailing myrtle, Christmas rose, and Scotch pink, all of which are true alpines, but also tolerant of quite ordinary garden conditions, there is a large class, some hundreds of species, that will grow only in situations approximating their native habitat These plants, some of which are perhaps the most beautiful flowers in cultivation, grow usually in a region having long, rigorous winters, a growing season averaging 100 to 120 days, and a constant supply of moisture which, on account of its source in the snow above the vegetation-line, is always nearly ice-cold

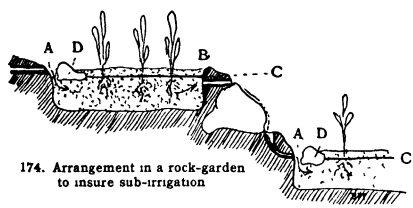
It is true of most of these alpines that they grow among the rocks, and, as we shall see presently, this is a factor that must be reckoned with Many of them grow in the open sun and are exposed to violent, often bitter, winds Others again are on north-facing slopes, where the sun rarely, if ever, reaches them A partial list of alpines given below will show the preference of some of the more common species with regard to the exposure to sunlight

Localities in the United States and Canada where alpine gardens may be tried with a fair measure of success.

One of the basic requirements of most true alpines is a short growing season. The Atlantic seaboard from Nova Scotia southward, east of the "fall line" (the flat, usually somewhat sandy, regions between the eastern fringe of the Alleghanies and the sea, such as southern Long Island, southern New Jersey and all south of it except parts of Virginia, North Carolina, South Carolina, and Georgia), has an active growing

seasen of 170 days and upward This is computed by adding the days from the last frost of spring to the first frost of autumn At New York, the season is 210 days, at Philadelphia, 220 days, and of course constantly increasing southward

On account of this long growing season and also because of the dry, hot character of the winds, it is almost impossible, without great expense, to maintain an alpine garden in this region The same is true of the coastal part of the Pacific coast, and in the Mississippi Valley up to about St Louis. This is, of course,



174. Arrangement in a rock-garden to insure sub-irrigation

a general statement, and peculiarly favorable local conditions within the areas specified may be found, where the attempt can be made But it is extremely doubtful whether any really good alpine garden can be maintained within this area permanently without a great maintenance expense, in the way of constantly supplying new plants, keeping the garden regularly cooled down by water and the like

As one goes back from the coast, even a few miles, there is a marked change in the climate, and particularly noticeable is the constantly diminishing length of the growing season Near Hartford, the Highlands of the Hudson, northern New Jersey and Pennsylvania, the growing season averages from 138 to 120 days, more or less As a general rule it may safely be stated that anywhere east of the Mississippi where elevations of 1,000 feet or greater are found, an alpine garden is permissible except in the southern Alleghanies, where greater elevations must be sought This length of the growing season is easily computed for all parts of the country, as indicated above, and wherever we find an active growing season of 100 to 140 days, it would be profitable to make an alpine garden In the East it will be found that the short season is almost always correlated with elevations in excess of 1,000 feet and in the West at several times that altitude.

Position of the alpine garden.

So far as our purpose is concerned, there are three classes of alpine plants (*a*) those that require full sunlight, (*b*) shade-inhabiting species, and (*c*) those that are apparently indifferent as to exposure To meet all these conditions within a single garden is not always possible, and a selection of plants must therefore be made, unless one is fortunate enough to have a situation that combines these requisites As a general rule it is better at some distance from a dwelling, stable, or garage, both architecturally and culturally. No class of plants is quite so wild as alpines, and the more secluded the garden, and the greater the suggestion of sequestered nature the better A screen of evergreens or other trees, and a northward-facing slope, insuring good drainage, is perhaps the best all-round combination that one could desire If the garden is at a slight elevation above the immediate surroundings, so much the better, although this is not absolutely essential Southern or western exposures are to be avoided unless the garden is at least 4,000 feet above the sea in the East, and from 6,000 to 8,000 feet in the West. It should also be arranged so that drainage will not be entirely down through the soil as in ordinary gardens, but rather so that the water can trickle from the roots of those above to those below. This is often best attained by a judicious use of rocks, which will be considered later.

Making the garden.

Having decided that one lives within the area in which it is safe to begin the installation of an alpine collection, the next most important consideration is to give the plants the requisite local condition Nearly all of them require good rich soil, at least 18 inches deep, preferably deeper. Even those species that grow in the crevices of the rocks in their native habitat do so not because they "like" such situations, but most probably because no more favorable place is available

In preparing the soil, it is well to remember that at least one-third of the mixture should be fine rotted leaf-mold mixed with equal parts of loam and sand The latter is quite necessary in order to insure perfect drainage It has been stated that some alpines will thrive in situations that approximate our bogs in having a high humic acid content But most of the species thrive where the drainage is good and the soil is sweet, not sour

If for no other reason than to insure perfect drainage, it is best to construct the garden in a series of terraces with walks of more or less irregular outline between, as taste and convenience dictate Avoid all semblance of formality in the arrangement of these terraces, as artificiality or formalism in the alpine garden are quite the least desirable features to be sought

The terraces, or any modification of them, are best held in place by a more or less free use of rocks The placing of these requires great skill and taste, as their purpose must be twofold—to add a sense of naturalness to the garden and to make suitable pockets in which to grow the plants While it is true that many alpines, such as *Thalictrum aquilegiafolium*, *Clematis recta*, *Aconitum Lycoctonum*, *Digitalis ambigua*, *Polemonium cæruleum*, *Gentiana asclepiadea*, and *Delphinium elatum*, with many others, can be grown without the use of rocks, it is true, on the whole, that most alpines grow better and seem more at home when rocks are part of their environment Just what part the rocks play in the home economy of the plants is not very well understood, but the readiness with which they conduct the water to the roots, and their tendency to keep the soil cool both suggest themselves as possible benefits.

For such species as *Phlox Douglasii*, *Cassiope Mertensiana*, *Polemonium montrosense*, and all plants of their type whose natural home is at elevations from 10,000 to 12,000 feet, care must be taken to insure almost constant sub-irrigation of cool water In their native habitats, such plants have their roots constantly in the icy water of the substratum, and any conditions that do not approximate this will make failure almost certain.

An arrangement for insuring this sub-irrigation is figured in Fig 174, diagramatically The pocket of soil in the rocks having been filled with the proper soil mixture, the water may be let in at *a*, with a rock just in front of the pipe to insure the water's downward passage (*d*). With the bottom made water-tight by concrete or rocks and clay, and the outlet regulated at *b*, a definite water-level can always be maintained at *c* The outlet can be arranged as indicated to flow either over the surface of the rock below or in a pipe behind it If the water for this plan comes from a cool spring, so much the better The smallest stream of water is sufficient, as it is not the water itself with which one is aiming to supply the plants, so much as the cooling of the soil, rocks and atmosphere that ensues from a gentle flow of water through and around the soil and rocks.

Such measures are not necessary for all alpines, but a few species must be grown under conditions approximated by these methods The expense of installing and maintaining such construction, however, is relatively great.

as compared with the simple arrangement of the rocks in pockets, overhanging ledges, nooks, and so forth, which is all that is required for the great majority of alpines A common and particularly undesirable method of procedure is to tumble a great mass of rocks together, usually utterly without form or definite purpose except to look "artistic," then pile soil amongst them and plant the whole mass If the idea is constantly kept in mind that the rocks are for use primarily, that they are cultural necessities, and that plants naturally grow between, and among, and often half underneath them,—then the final result is likely to be beautiful, because they are useful and have been placed with an eye to their sole *raison d'etre* in the alpine garden, which is to be a home for alpine plants

In placing the rocks, indeed in the arrangement of the garden generally, it is better to avoid situations in which the drip from overhanging trees or other objects will fall on the plants No plants are specially benefited by drip, and alpines, particularly those having tomentose leaves, will suffer from such treatment

Plants for the alpine garden

Unfortunately, very few American dealers carry anything like an adequate stock of alpine plants, and only the commonest and best-known species are to be found in the American trade This has had the effect of restricting the popularity of alpine gardening in this country, and, furthermore, all the alpine gardens of any size have had to seek in Europe for the large variety of species that constitute a well-stocked collection Many European firms, particularly in England and France, have specialized in alpines At least 1,000 species are offered by one continental dealer alone A common but altogether unsatisfactory method, and one that has resulted in numberless failures, is the attempt to import plants direct from these dealers The time of transit, the highly specialized character of the cultural requirement of alpines, and the lack of attention during transit, all operate to make such shipments costly and usually unsuccessful

The best and most satisfactory method is to buy seeds of the plants to be cultivated The initial cost is less than one-fifth and the personal satisfaction in having grown one's stock of plants more than offsets the time spent in this work The seeds should be imported early in the spring or even in the late winter for those with greenhouse facilities Sow the seeds in pans or boxes in a light soil of leaf-mold and sand in about equal parts It is best partially to shade the seeds and very young seedlings for a few days Pot up when the seedlings are stout enough to stand the transfer, which of course, varies with different species If it is inconvenient to place them in their permanent home the first year, they may be repotted and then the pots plunged in ashes in the frame With proper shading from the intense sunlight, and a plentiful supply of cool water so that the ashes are kept moist and cool, they will grow very well under these conditions for the first year. Many of the species can be grown always with this treatment if one has no garden ready for them The shading for these frames is easily made of ordinary plasterer's lath, the strips being placed about one inch apart and the whole shade arranged so as to be about 2½ feet above the surface of the ground

Of all the genera cultivated as alpines, the most important are the gentians, saxifrages, sedums, a few dwarf primulas and the pinguiculas These are much better known abroad than in North America, but many of the best of them can be grown in this country Among the gentians, Correvon of Geneva classifies them for cultural purposes as follows

1 Calcareous-soil gentians requiring sun. *alpina, angustifolia, Clusii* and *Kochiana*
2 Sphagnum-moss species. *bavarica, Rostani, septemfida*
3 Marshy-ground species *angustifolia* (also in group 1) *asclepiadea, Pneumonanthe*
4 Peaty sand and sandstone with peat in it *alba, Bigelovii, cilvata, frigida, Parryi, pumila, Wallichiana*
5. Of indifferent habitat preference *brevidens, cruciata, dahurica, decumbens, macrophylla, Olweri, Saponaria, scabra, stramina, Weschniakowi*

Among the saxifrages only the dwarf, usually perennial, kinds are grown as alpines In moist, rocky places in the alpine garden the following species of pinguicula will be useful *P vallisneriifolia, P. grandiflora*, with purple and blue flowers and *P alpina* with white flowers *P. vulgaris* and *P lusitanica* may be grown in general situations in the "alp"

It is often necessary to make a definite selection of species for a sunny or shady place, as most of our alpines cannot be grown without reference to the amount of sunlight For those who can arrange only for a rather sunny situation, in which the amount of shade is not sufficient to keep the soil and rocks cool, the following will be found helpful.

ALPINES FOR SUNNY SITUATIONS.

NAME	Color of flowers	Height	Time of flowering
Acana species	Grown for gray foliage	Creeping, 3–4 in	
Acantholimon glumaceum	Rose	3 in	Summer
Achillea argentea	White	4 in	Summer
A rupestris	White	3 in	Summer
A umbellata	White	6 in	Summer
Æthionema, various sp	Pink	About 1 ft	Summer
Ajuga reptans atropurpurea	For purple foliage	9 in.	
Alyssum, various sp	Yellow and white	6 in.	Spring
Androsace, various sp	White and rose	3–6 in	Spring and summer
Arenaria montana	White	6 in	Spring and summer
Armeria, various sp	Rose and white	6–12 in	Summer
Aster alpinus, vars	Various, not yellow	About 9 in	Summer and early autumn
Callandrinia umbellata	Red	6 in	Summer
Dwarf campanulas	White, blue and purple	3–12 in	Spring and early summer
Ceratostigma plumbaginoides	Blue	8 in.	Autumn
Corydalis lutea	Yellow	6 in	Spring
Cyananthus lobatus	Blue	4 in	Summer
Dianthus (Alpine pinks)	White to rose	5–12 in	Spring and summer
Draba aizoides	Yellow	3 in	Spring
Dryas octopetala	White	Creeping	Late spring



175. Alpine-gardening,—good rock-work in a cool and protected place

ALPINES FOR SUNNY SITUATIONS, continued

NAME	Color of flowers	Height	Time of flowering
Erigeron Villarsii	Pale violet	12 in	Summer
Erodium, various sp	White and red	6–10 in	Summer
Gentiana, various sp	Blue	6–18 in	Spring and summer
Gypsophila, dwarf sp	White to pink	6–12 in	Summer
Hedera conglomerata	Both grown for evergreen foliage	6–8 in	
H minima			
Iberis, various sp	White	6 in	Summer
Iris, dwarf bearded sp	Various	6–15 in	Spring and early summer
Leontopodium alpinum	White	6 in	Summer and autumn
Linum flavum	Yellow	12 in	Summer
Macrotomia chrysides	Yellow	10 in	Summer
Morisia hypogæa	Yellow	3 in	Spring and early summer
Nepeta Mussinii	Blue	12 in	Summer and autumn
Noccæa alpina	White	3 in	Spring and summer
Papaver alpinum, vars.	Various	6 in	Spring
Platycodon, various sp	Blue	8–15 in	Spring
Saponaria ocymoides	Red	Creeping	Summer
Silene, various sp	White and red	5–15 in	Summer and autumn
Tunica Saxifraga	Pinkish white	3–5 in.	Summer
Veronica incana	Blue	6 in	Summer
V cupressoides	Ornamental foliage	10 in	
Zauschneria, various sp	Scarlet	12–18 in	Autumn

The foregoing list is, of course, not a complete one, but it will serve as a guide for the beginner Many of these will also stand a partially shaded place, some of them prefer such situations, but all of them will grow in the open sunlight if the pitch of the ground is not too great toward the south or southwest.

ALPINES FOR SHADY SITUATIONS

NAME	Color of flowers	Height	Time of flowering
Adonis, various sp	Yellow	6–12 in	Spring
Anchusa myosotiflora	Blue	12 in	Summer
Anemone alpina	White	18 in	Summer
A sylvestris	White	12 in	Spring
Aquilegia glandulosa	Blue and white	12 in	Early summer
A cærulea	Blue and white	15 in	Summer
Arenaria balearica	White	2–4 in	Summer
Auricula, various sp	Various	4–7 in	Spring
Dodecatheon sp	White to purple	12 in	Spring and early summer
Eomecon chionantha	White	18 in	Summer
Epimedium, various sp	Ornamental foliage	6–12 in	
Erinus, various sp	White and rose	3 in	Spring and summer
Galax aphylla	White	12 in	Summer and autumn
Helleborus niger	White	12 in	Winter
Iris cristata	Blue	4 in	Spring
Linaria Cymbalaria	Lilac	3 in	Summer
L pallida	Violet	2 in	Summer
Omphalodes verna	Blue	6 in	Spring
Ourisia coccinea	Red	9 in	Spring and early summer
Parnassia palustris	White	6 in	Summer
Polemonium humile	Blue	6 in	Spring and summer
Polygonum affine	Rose	6 in	Summer
Primula Sieboldii, various forms	Various	6–9 in	Spring
Ramondia pyrenaica	Blue	4 in	Spring
Rodgersia, various sp	Ornamental foliage	3–6 in	
Saxifraga Geum (and allies)	Various	12–18 in	Spring and summer
Shortia galacifolia	White	6 in	Spring
Soldanella alpina	Blue	4 in	Spring
Thalictrum minus adiantifolium	Ornamental foliage	6–12 in.	
Trillium, various sp	White and pink or purple	6–8 in	Spring

ALPINES FOR SHADY SITUATIONS, continued.

NAME	Color of flowers	Height	Time of flowering
Uvularia grandiflora	Yellowish green	12 in	Summer or late spring
Vancouveria hexandra	Ornamental foliage	6–8 in	
Viola, various sp	Blue and white	3–9 in	Spring
Waldsteinia fragarioides	White	3–6 in	Spring

To these may be added the native species that grow naturally in America at elevations in excess of 1,500 feet, such as *Coptis trifolia*, *Cornus canadensis*, *Clintonia borealis*, *Tiarella cordifolia*, *Trillium grandiflorum*, *Claytonia caroliniana*, *Dalibarda repens*, *Polemonium VanBruntiæ*, various terrestrial habenarias, *Mitella nuda*, *Arenaria grænlandica*, and many others

The plants both for shaded and sunny situations will grow better if there is a liberal top-dressing of leafmold and sand, about half and half, applied each spring It will be noted that all the plants listed in both lists are perennials Most natural alpines are of this type, the shortness of the growing season precluding the possibility of the full development of an annual

For those who wish to go into the growing of alpines more extensively, a partial list of the alpine genera together with an indication of the number of species that are to be found in the principal European trade catalogues is appended Many additions will suggest themselves as the alpine gardener becomes better acquainted with those listed below and their relatives:

LIST OF THE CHIEF ALPINE GENERA

The figures indicate approximately the number of species in each genus that are alpines

Achillea, 5
Aconitum, 6
Adenostyles, 2.
Æthionema
Aira
Ajuga
Alchemilla.
Allium
Allosurus
Alsine, 6
Alyssum, 2
Androsace, 7
Anemone, 6
Anthemis
Aposeris
Aquilegia, 3
Arabis, 7
Arctostaphylos, 2.
Arenaria, 5
Aretia
Armeria
Aromicum, 3
Artemisia, 4
Asplenium, 6
Astrantia
Atragne
Azalea
Betonica
Braya, 2
Bupleurum, 2
Calamintha
Calluna
Campanula, 8
Cardamine, 2
Carex, 20
Centaurea, 3
Cerastium, 3.
Cerinthe
Cirsium
Crepis, 5
Crocus
Daphne
Dianthus, 5
Doronicum, 2.
Draba, 6
Dryas
Epilobium, 4
Epimedium
Erigeron
Eriophorum, 2
Eryngium
Euphrasia
Festuca, 2
Galium, 3
Gaya
Gentiana, 17
Geranium, 3
Geum, 3
Globularia, 2
Gnaphalium, 4
Gymnadenia
Hedysarum
Helianthemum
Helleborus
Heracleum, 2
Horminum
Hieracium, 10
Hypericum
Hutchinsia
Iberis
Imperatoria.
Juncus, 6
Kobresia
Laserpitium
Lasiagrostis
Leontodon, 4.
Lilium
Linnæa
Listera
Lonicera
Lomatogonium.
Luzula, 5
Lychnis
Malaxis, 2.
Montia
Möhringia
Myosotis
Myricaria
Nardus
Nigritella
Oxyria
Oxytropis, 7
Pæderota, 2
Papaver, 2
Pedicularis, 5
Petasites, 2
Pistrocallis
Phaca, 4
Phleum, 2
Phyteuma, 10
Pimpinella
Pinus
Plantago, 3
Poa, 5
Polygala, 2
Polygonum, 2
Potentilla, 14
Primula, 12
Ranunculus, 14.
Rhinanthus
Ribes, 2
Rosa, 3
Rubus
Rumex, 3
Sagina
Salix, 12
Saponaria
Saussurea, 2
Saxifraga, 30.
Scabiosa
Scirpus
Sedum, 7
Selaginella, 2
Sempervivum, 5.
Senecio, 8
Sesleria, 3
Sibbaldia
Silene, 6
Soldanella, 4.
Sorbus.
Soyeria.
Stachys
Stellaria
Thalictrum, 6.
Trifolium, 6
Valeriana, 7.
Veronica, 6
Viola, 5
Wulfenia.

The literature on alpine-gardening, in English, is very meager. Any good book of the flora of high mountain regions, —and there are a dozen or more excellent

works on the flora of the Alps, — will aid in the way of suggesting new species that may be grown A good but rather out-of-date book on the making and culture of alpine gardens is A Kerner's "Die Cultur der Alpenpflanzen" A useful work containing many cultural hints is H S Thompson's "Alpine Plants of Europe, with Cultural Hints" The first International Congress of Alpine Gardens met at Naye, Switzerland, in 1904. As yet nothing except administrative reports of this convocation has been published. N. TAYLOR

ALPÍNIA (Prosper Alpinus, an Italian botanist) *Zingiberàceæ* Stove herbs, cultivated both for leaves and the racemes or panicles of flowers

Many-std leafy plants, with ginger-like rhizomes fls in spikes or panicles terminating the leafy sts, often showy, calyx wide-tubular or nearly bell-form, the tube short and the 3 points or parts erect, corolla of 3 parts, stamens reduced to 1 pollen-bearing organ, and 1 or more staminodia, one of the staminodia being showy and longer than corolla and notched or toothed fr a 3-celled caps —About 150 species in Polynesia, Japan,



176 Alpinia mutica

and E India Some of the cult forms have undoubtedly been referred to Alpinia without knowledge of the botanical characters, and their botanical position is therefore doubtful Monogr. in Engler, Pflanzenreich, hft 20 (1904)

Alpinia contains many handsome species but only a few are common in cultivation They are tropical plants and require a moist air and a temperature of 55° to 60° F A mixture of two parts loam, one part leaf-mold, and one part dried cow-manure forms an excellent compost While growing, they need an abundance of water, and the large-growing kinds require large pots or tubs After flowering, allow them to rest in heat, but do not dry them off The plants are propagated by division in the spring *A. nutans* is grown for its handsome flowers and attains a height of 12 or 13 feet *A. vittata* is popular on account of its variegated foliage *A. mutica* has very showy flowers, but is apparently little known in the trade (Robert Cameron)

A *Foliage striped plants of doubtful botanical position*

vittàta, Bull (*Amòmum vittàtum*, Hort) Lower: lvs distichous, lanceolate, with pale green or creamy yellow bars or stripes between the nerves fls red, in axillary spikes S Sea Isls A F 8 787 Gn 4, p 25

álbo-lineàta, Hort A plant 3–4 ft high, with broad bands of white and pale green on the elliptic-lanceolate lvs

Sánderæ, Sand. St ascending lvs very short-stalked and 5 in or less long, 1¼ in or less broad, tapering both ways, rich shining green, regularly and closely striped in broad bands of white leading from the midrib to the margin New Guinea G C III 33 248 (suppl.). 1903 Probably a variegated form of *A. Rafflesiana*, Wall.

tricolor, Sand St erect lvs oblong-acuminate, 10 in long, 1¼ in wide, green with white or creamy yellow stripes. Solomon Isl G C III 33 249 (suppl).

AA *Foliage green, not striped.*

nùtans, Roscoe (*Zerúmbet speciòsum*, Wendl). SHELL-FLOWER Striking plant, reaching 10–12 ft., with long, lanceolate glabrous long-veined lvs fls orchid-like, yellow with pink, sweet-scented, in a long, drooping, terminal, spike-like raceme E Indies G C III 19 301 I H 43, p 259 B M 1903 P M. 13 125 R H 1861 51 —Fine for foliage masses, and an old favorite Said to grow 20 ft high in S Calif in rich soil and with plenty of water, and to bloom continuously

mùtica, Roxbg Fig 176 A handsome strong species lvs very short-stalked or sessile, long-lanceolate and pointed fl with large bright yellow lip veined crimson, the outer segms oblong and white *A. mutica*, Hook f, B M 6908, is probably not the *A. mutica* of Roxburgh E Indies Excellent free-flowering species

Allùghas, Roscoe Strong, 3½–7 ft lvs sessile or nearly so, lanceolate or linear-lanceolate, short-acuminate, 1½ ft or less long, 3–4 in broad fls small, crowded, greenish white, the lip cuneate, pink, emarginate India Spring

calcaràta, Roscoe Slender, 3–5 ft lvs sessile, narrowly linear-lanceolate and attenuate-acuminate fls medium in size, greenish white, the lip variegated with red and yellow on a lighter ground India Fall

Many kinds of these interesting ornamental plants are likely to find their way into choice collections Some of them are as follows *A. gigantèa*, Blume, reported in S Calif, very tall, even to more than 20 ft, with very large nodding panicle *A. japónica*, once catalogued in U S, but not known whether it was the *A. japonica* of Thunberg —*A. longepetiolata*, coming from W Trop Afr, of robust habit, 6 ft lvs elliptic the uppermost linear, wing-petioled fls white or rose in terminal panicle purple-spotted —*A. magnifica*, Roscoe —Phæomeria magnifica —*A. Vieuenhuizu*, Valet (*A. borneensis*, Valet), distinct species, 4–6 ft lvs 2 ft or less long fls purple-lipped, in panicles 12 in long fr large Borneo. —*A. officinarum*, Hance Supplying the radix Galangæ minoris" of pharmacists, once used as an aromatic stimulant by Arabs and Greeks rhizome thick, creeping, the sts tuberous at base lvs narrowly lanceolate, long-acuminate fls white in simple spike, the lip red-nerved China B M 6995 —*A. pumila*, Hook f Lvs from root-stock, 6 in or less, on petioles 2–4 in fls in short spike, 1 in long, pink, the lip recurved, on a very short scape China B M 6832 *A. Schumanniana*, Valet (*A. fimbriata*, Gagn) 3–5 ft lvs lanceolate, 18 in long, 1½ in broad fls purple in spikes, handsome Formosa —*A. zingiberina*, Hook f 4–5 ft lvs oblanceolate, oblong, cuspidate, 12 in or less long, 3 in broad fls greenish, the lip white veined crimson, in panicles Siam B M 6944

L H B

ALSEUÓSMIA (*alsos*, grove, and *euosme*, fragrance). *Caprifoliàceæ* A group of 4 species of tender New Zealand shrubs, usually glabrous Lvs alternate or opposite, with minute tufts of hair in the axils of the veins beneath fls fragrant, green or red, axillary, solitary or in clusters, corolla tubular or funnelform fr a purple, many-seeded berry — Perhaps not cult. outside botanic gardens

A. macrophylla, A Cunn NEW ZEALAND HONEYSUCKLE 6–10 ft lvs 3–6 in long, elliptic or oblanceolate, acute, serrate, or entire, petiolate fls in small axillary clusters, drooping, 1½ in long, creamy with dull red streaks, corolla lobes recurved, toothed, the tube cylindric B M 6951

N TAYLOR.

ALSIKE *Clover* and *Trifolium*

ALSÍNE (Greek for *grove*, where some species grow) *Caryophyllàceæ* A few species of Alsine are in the market, mostly for rock-gardening There is much difference among botanists as to the standing of the genus Alsine Some persons refer it to Arenaria, others make it a tenable name to replace Stellaria, and Pax in Engler and Prantl's Pflanzenfamilien retains it for about sixty species, mostly in the temperate and cold parts of the northern hemisphere, and distinguishes both Arenaria and Stellaria; for the purposes of this Cyclopedia it seems to be desirable to follow the Index Kewensis disposition, and the few cultivated species are therefore accounted for under *Arenaria*.

ALSÓPHILA (Greek, *grove-loving*). *Cyatheàceæ*. Tree ferns, grown in choice large conservatories, and in the open in warm countries.

Alsophilas have simple or forked free veins, round sori, and no indusia. Numerous species are found in the tropical regions of both hemispheres The species of Alsophila are very similar in appearance to the tree ferns placed in the genus Cyathea and are probably not generically distinct.



177 Pinna of Alsophila australis

Of the different species of alsophila, only one is in general commercial use *A australis* is a very graceful and rapidly growing tree fern, with finely divided fronds of a pleasing shade of light green, with the stipes thickly covered with light brown, hairy scales It is grown from spores, which can be obtained only from old and large specimens, and which, like the spores of most commercial ferns, will germinate very freely if sown on a compost consisting of finely screened soil, leaf-mold and sand in equal parts To develop a good crown of fronds in old specimen plants which may look starved, the stem may be covered to any thickness consistent with good appearance with green moss, which may be attached with thin copper wire, and which, if kept continually moist, will soon be thickly covered with fine roots Alsophilas should be grown in a temperature of 60° F, and the soil should never be allowed to become very dry. (Nichol N. Bruckner.)

A. *Lvs bipinnate; rachises merely fibrillose.*

Rebéccæ, F. Muell. Lvs ample, from 8 in or so high; pinnæ 12–15 in. long, with 20–30 pinnules on each side, which are 2–3 in long and serrate or crenate throughout Austral G Z. 28, p. 2

AA. *Lvs tripinnatifid or tripinnate, rachises armed with spines*

B. *Segms long, strongly curved, pinnules tapering to a slender point*

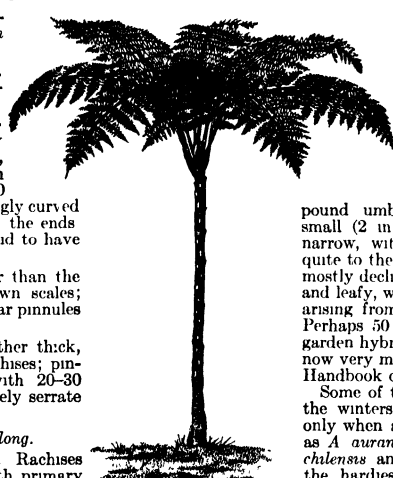
excélsa, R Br Lvs coriaceous, with more or less woolly rachises, pinnæ 6–10 in wide, with crowded pinnules, which are provided with about 20 pairs of segms which are strongly curved and more or less enlarged at the ends Norfolk Isl and Austral —Said to have a trunk 60–80 ft high.

Coòperi, F Muell Smaller than the last rachises with pale brown scales; pinnæ spear-shaped, with linear pinnules 4–5 in. long Queensland

lunulàta, R Br. Lvs. rather thick, herbaceous, from smooth rachises; pinnules close, 5–6 in long, with 20–30 pairs of segms, which are finely serrate throughout.

BB. *Segms. ½in. or less long.*

australis, R. Br. Fig 177. Rachises straw-colored; lvs ample, with primary pinnæ 18 in. long, 6–10 in wide; pinnules deeply pinnatifid, with segms. broadest at the base, ovate-oblong and sharply serrate. Tasmania and Austral



178 Alsophila oligocarpa.

fèrox, Presl (*A. aculeàta*, J Smith). Rachises brownish. pinnæ 12–18 in. long, pinnules narrow, 3–4 in long, ⅛–½in wide, with 15–18 pairs of segms. which are narrow and slightly serrate. Trop. Amer.

AAA. *Lvs quadripinnatifid.*

oligocárpa, Fee Fig 178 Rachises smooth, grayish straw-colored, pinnules 1½–2 ft long, the segms ligulate, deeply pinnatifid, with blunt lobes; sori median, 4–6 on the lower lobes Colombia

A Baroùmba, Hott Recently intro Not so elegant as A Loubetiana, but of interest for its majestic dimensions Congo Free State —*A congoensis*, Hort Large handsome fronds, with prominent yellow midrib pinnæ deeply and regularly cut —*A incàna*, Hort A magnificent tree fern with black spiny petioles Congo R B 34 172, —*A Loubetiana*, Hort A decorative tree fern with broad lvs rachis hairy brown S H 4 153

L M UNDERWOOD
R C BENEDICT †

ALSTÒNIA (Dr Alston, once professor of botany at Edinburgh) *Apocynàceæ* Two trees of this genus are introduced in southern Florida and southern California for outdoor planting

Corolla-tube cylindrical, usually swollen at the base, the parts spreading, usually twisted in the bud, anthers inclosed in the tube —Between 30 and 40 species of trees or shrubs of E India and Austral, with small white fls in terminal cymes, and simple entire lvs in whorls or opposite *A scholaris*, R Br, is the devil-tree or pali-mara of India, the bark of which is medicinal. Trees yield caoutchouc

macrophýlla, Wall A tall tree, with milky juice lvs 6–12 in long, 2½–3 in wide, oblanceolate or elliptic-lanceolate, obtusely acuminate, nerves 16–20 pairs cymes numerous, the fls small, corolla-tube glabrous, the throat villous, ovary glabrous Malaya

scholàris, R Br Tree, 50–90 ft lvs 4–8 in long, 1–1½ in wide, coriaceous, usually 4–7 in a whorl, obovate or elliptic-oblong, white beneath, with 30–60 veins fls pubescent, subcapitate, ovary hirsute. Wight Icones Ind Or 2 422 Rheede Hort Malab 1 45 —Intro by Montarioso Nursery, Santa Barbara, Calif, in 1910 Tropics. N. TAYLOR.†

ALSTRŒMÈRIA (Baron Alstrœmer, friend of Linnæus). *Amaryllidàceæ* ALSTREMERIA. Coolhouse and stove plants, with tuberous roots, treated as bulbs, and some of them also grown in the open for summer bloom

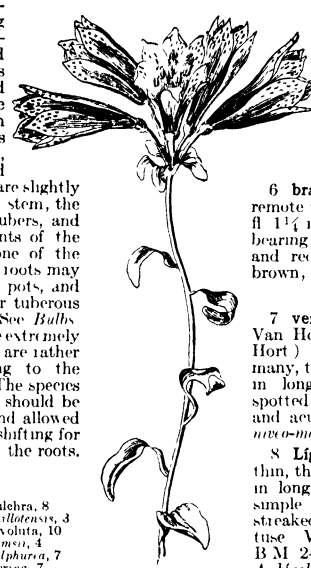
Showy tall or slender plants with the red, purple or yellow blossoms in simple or compound umbels terminating the st fls. small (2 in or less long), comparatively narrow, with 6 segms, parted nearly or quite to the ovary, often irregular, stamens mostly declined, stigma 3-cleft; sts slender and leafy, weak, or even disposed to climb, arising from a root of thickened fibers — Perhaps 50 species in S Amer There are garden hybrids. The alstremerias are not now very much grown Monogr. by Baker, Handbook of the Amaryllideæ.

Some of the alstremerias have survived the winters in Washington of late years only when a heavy mulch has been given, as *A aurantiaca* and its form *A aurea*, *A. chilensis* and its forms. Evidently among the hardiest are *A brasiliensis* and *A. pulchella*, although some of the others have

not been tried For outdoor planting, alstremerias are at their best in a partly shaded position, and at all times during their growth the roots must have an abundance of water In fact, there is little use in attempting their cultivation out-of-doors when these conditions cannot be given —In colder climates, the alstremerias can be grown very successfully by planting out in spring, and, as soon as they die down, lift, and keep over winter in a place from which frost is excluded An annual lifting, or, when grown in pots, an annual shaking-out, should be given, because they increase to such an extent that the younger and smaller crowns are apt to take the nourishment from the large flowering crowns The largest ones ought to be separated from the smaller ones, and either grown in pots or planted outside when the proper time arrives In this way the genus will become much more popular than it now is either for cutting or for the decoration of the border —The best soil is largely composed of vegetable humus, when this is not to be had old well-decayed cow- or stable-manure should be incorporated with the soil When they are planted outside, the tubers should be put deep in the ground, and the soil should be well worked for at least 15 inches The tubers are slightly egg-shaped, attached to a common stem, the roots are from the ends of the tubers, and also from near the growing points of the crowns —For greenhouse work one of the best is *A. Pelegrina* var *alba* The roots may be potted up in autumn in large pots, and treated as other tender late winter tuberous or bulbous plants are treated See *Bulbs* Some of the Van Houtte hybrids are extremely pretty, but, with the others, they are rather unsuitable for pot culture, owing to the peculiar formation of the roots —The species are easily raised from seeds, which should be sown rather thinly in deep pans, and allowed to remain without pricking off or shifting for the first season, also by division of the roots. (G W. Oliver)

INDEX

alba, 3
aurea, 5
aurantiaca, 5
bicolor, 8
brasiliensis, 6
caryophyllacea, 8
chilensis, 2
Flos-Martinii, 8
hæmantha, 4
Hookeri, 8
Ligtu, 8
ligtu, 5
nivео-marginata, 7
Simsii, 4
sulphurea, 7
tigrina, 7
versicolor, 7
violacea, 9



179 Alstrœmeria pulchella (×½)

pulchella, 8
quitotensis, 3
revoluta, 10

A *Lvs of fl-st (or scape) broad, oblong or oblong-spatulate*

1. **pulchélla,** Linn f (*A psittacina*, Lehm). Fig 179 Sterile st a foot or less long, with aggregated petioled lvs flowering st 2–3 ft, with scattered lvs fls in a simple umbel, on pedicels 1–1½ in long, long funnel-shaped, the segms unequal, dark red and tipped with green and spotted inside with brown, stamens nearly as long as limb Brazil Fig 179 is of the *A psittacina*, B M 3033 —An old garden plant

2 **chilénsis,** Cree CHILIAN LILY Stout, 2–4 ft lvs scattered, obovate or spatulate, or the upper becoming lanceolate, twisted at the base, fringed, somewhat glaucous fls large, rose or red (or varying to whitish), the two lower segms longer and straighter, umbel with 5 or 6 2-fld. peduncles. Chile

AA *Lvs. of fl-st lanceolate (at least the lower ones).*

B *Fls. purplish or red.*

3 **Pelegrina,** Linn. Fl-st. stout, a foot or less high lvs about 30, thin, ascending, 2 in or less long and ½in or less wide fl. 2 in or less long, lilac, the outer segms broad and cuspidate, the inner ones spotted red-purple: umbel few-rayed, normally simple, but becoming compound in cult Also a pure white variety (*A alba*, Hort) *A quitotensis*, Hort, is a robust cult form. Chile B M 139 Gn 46, p 472. L B C 13.1295.

4 **hæmántha,** Ruiz & Pav (*A Simsii*, Spreng) Fl-st 2–3 ft lvs crowded and thin, somewhat stalked, 3–4 in long and ¾in or less wide, the upper becoming linear, glaucous beneath fls 2 in or less long, bright red tipped green, the inner ones with red-purple spots on a red-yellow ground, umbel very compound, the branches 4–6 in long A white-fld. variety is cult Chile. B M. 2353 (as *A pulchella*).

BB *Fls yellow or yellowish.*

5 **aurantìaca,** Don (*A aurea*, Hort). Fl-st 2–4 ft. high lvs nearly 50, thin, somewhat petiolate, slightly glaucous below, 3–4 ft long and ½in wide. fls 10–30, in a compound umbel, the perianth bright yellow, outer segms tipped green and inner ones spotted brown —There is a form with pale, unspotted fls Chile. B M 3350 (as *A aurea*). Gn 26. 540 *A lutea*, Hort, is probably a form of this species

6 **brasiliénsis,** Spreng St 3–4 ft lvs. remote thickish, oblong-lanceolate, 2 in long. fl 1½ in long, in a 5-rayed umbel (each ray bearing 1–3 fls), the segms oblong-spatulate and reddish yellow, the inner ones spotted brown, stamens shorter than segms. Brazil

AAA *Lvs of fl-st linear*

7 **versícolor,** Ruiz & Pav (*A peruvìana*, Van Houtte *A sulphùrea* and *A tigrìna* Hort) Fl-st short (1 ft or less high) lvs many, the lower ones about 1 in long fls 1 in long, in a nearly simple umbel, yellow spotted purple, the segms all oblanceolate and acute A marginate 1-fld form is var. *nivео-marginàta* Chile.

8 **Ligtu,** Linn Fl-st 1½–2 ft lvs 20–30, thin, the lowermost becoming lanceolate, 2–3 in long fls 1½ in long, in a nearly or quite simple umbel, whitish, lilac or pale red, streaked purple, the inner segms often obtuse Var **púlchra,** Baker (*A pulchra*, Sims, B M 2421 *A Flòs-Mártinii*, Ker, B R 731 *A bicolor*, L B C 15 1497), has narrower and longer lvs, and all the segms acute or cuspidate Chile Common and variable in cult *A Hoòkeri*, Lodd, is a form of *A Ligtu* The *A Ligtu* of B M 125 is *A caryophyllèa*, Jacq, with long-clawed, very unequal segms in two sets or lips, red and red-striped Brazil

9 **violàcea,** Phill St 1–2 ft. lvs scattered and spreading, 1 in or less long, those on sterile shoots larger, ovate-oblong and 5-nerved fls on forked pedicels in a 5-rayed umbel, 1½–2 in long, bright lilac, the outer segms obovate, truncate and with a short cusp, the inner oblong-acute, spotted Chile

10. **revolùta,** Ruiz & Pav Fl-st 1 ft or more lvs. crowded, linear, 1½ in or less fls 6–12, purplish, ¾in. or less, the segms oblanceolate-clawed, reflexed or spreading from the middle in full bloom, the inner segms yellowish and spotted Chile. L H B

ALTAMIRANÒA (named for Dr F Altamirano, late Director of the Instituto Medico Nacional, of the City of Mexico) *Crassulàceæ* Low, much-branched perennials with the habit and foliage of Sedum, but with the petals united into a distinct tube On account of the tubular fls, some of the species were first described

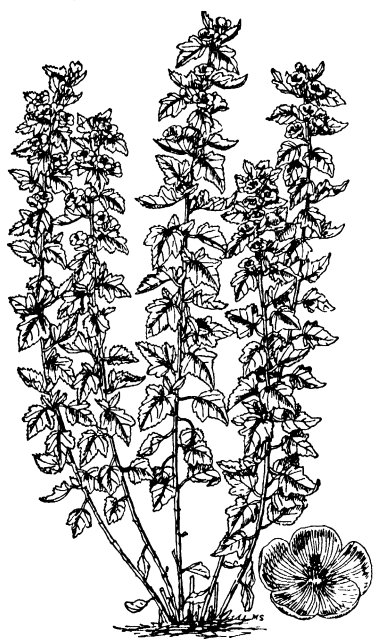
as Cotyledon, with which they have little else in common. None of the species is especially attractive, but all of them develop at the base or on the branches curious rosettes of lvs Twelve specimens are known, of which 5 have been grown in Washington greenhouses and the New York Botanical Garden **A. elongàta,** Rose, has puberulent sts. and lvs. and white fls.; **A. calcícola,** Rose, is more or less glaucous, with turgid lvs and greenish-yellow fls ; **A. Gòldmanı,** Rose, is glabrous, with linear lvs and pale yellow fls ; **A. Bâtesii,** Rose, is glabrous, with linear lvs. and fls. purplish or becoming so, **A. scopulina,** Rose, is glabrous, with linear lvs and pure white fls J. N ROSE

ALTERNANTHÈRA *Telanthera.*

ALTHÆA (Greek, *to cure*) *Malvàceæ* Tall annual, biennial or perennial herbs, grown in the open garden The flowering shrubs known as altheas are forms of *Hibiscus syriacus*

Flowers axillary, solitary, or racemose in the axils or at the summit of the st , with 6–9 bracts below the calyx, but otherwise as in Malva —About 15 species in the temperate regions of the world

officinàlis, Linn MARSH MALLOW Fig 180. Erect, 3–4 ft , downy lvs ovate, often heart-shaped or 3-lobed, frequently undivided, tomentose fls 1 in across, blush or rose, clustered in the axils of the lvs Perennial,



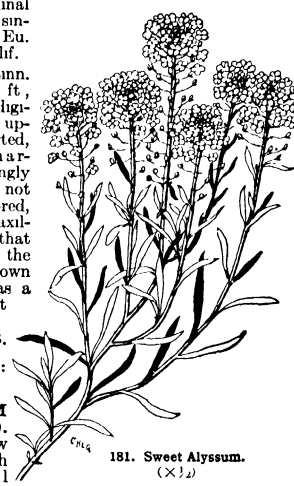
180. Althæa officinalis. (Plant × $\frac{1}{10}$). **Marsh Mallow.**

in marshes. E Eu , and occurring in this country as an escape —Root used for mucilage and for other purposes, also medicinal The root of commerce has its brown outer covering removed Rarely cult., but occasionally escaped in marshes near the coast.

rósea, CAV HOLLYHOCK, which see for culture St strict and spire-like, hairy· lvs large and rough, rounded-heart-shaped, wavy-angled or lobed· fls large and nearly sessile, in a long wand-like raceme or spike, in many forms and colors. Biennial. China. B M. 3198.

ficifòlia, CAV. ANTWERP HOLLYHOCK. Biennial, 3–6 ft lvs 7-lobed, toothed: fl. lemon-yellow or orange, large, in terminal spikes, showy, single or double Eu. —Grown in Calif.

cannabina, Linn. Perennial, 5–6 ft , branching lvs digitately 5-parted, upper ones 3-parted, the lobes narrow and strongly toothed fls not large, rose-colored, on many-fld axillary peduncles that are longer than the lvs Eu —Grown sometimes as a border plant It yields a fiber L H B.



181. Sweet Alyssum. (× $\frac{1}{2}$)

ALUM-ROOT: *Heuchera.*

ALÝSSUM (classical name). *Cruciferæ* Low plants with many small clustered flowers, grown in the open and often used in rock-gardens.

Plants branching, often tufted fls. white or yellow, sometimes varying to rose, filaments often notched fr. a small orbicular pod, with 1 or 2 wingless seeds in each of the 2 compartments, valves of pod nerveless, flattened at the margins —As many as 100 species in middle Eu , Medit region and the Caucasus

The sweet alyssum is one of the commonest annuals, grown both in the open and forced in benches, beds or pots It is of the easiest culture, either indoors or out. The compact varieties are most prized for pot culture. Under glass, it requires temperature of a carnation house It will stand considerable frost in the open, and may be sown early, it blooms all summer, and until killed by winter Useful for window-gardens and baskets For winter bloom, sow seeds late in August or in September When blooms begin to fail, cut back the plant, and it will bloom again

The perennial alyssums require no special treatment. They are usually propagated by dividing the roots; also by cuttings and seeds.

INDEX.

alpestre, 5	maritimum, 1	pyrenaicum, 3.
argenteum, 9.	Moellendorfianium,	rostratum, 8
Benthami, 1	11	saxatile, 6
compactum, 1, 6	montanum, 10	serpyllifolium, 5
flore-pleno, 6	*odoratum,* 1	spinosum, 2
gemonense, 7	podolicum, 4	variegatum, 1, 6.
giganteum, 1	procumbens, 1.	*Wierzbickii,* 8

A. *Fls white; annuals or perennials.*

1 **marítimum,** Lam (*A odoràtum,* Hort) SWEET ALYSSUM Fig 181 A low, spreading, light green annual, with lanceolate or linear entire lvs , tapering to the base, and small honey-scented fls in terminal clusters, which become long racemes Eu Many cult vars var **Bénthamii** or **compáctum,** a dwarf and compact form, not over 6 in high, var. **variegàtum,** with pale white-edged lvs., var **gigantèum,** robust, broad-lvd., var. **procúm-**

bens, of spreading habit, and various horticultural forms with trade names.

2 **spinòsum,** Linn A woody-stemmed little perennial, with lanceolate acute silvery lvs, spiny fl. branches, and very small numerous fls Eu —Rockwork, 3–6 in A rose-colored form is reported.



182 Alyssum saxatile (×¼)

3 **pyrenàicum,** Lapeyr Dwarf, shrubby, not spiny lvs obovate, tomentose fls white with brown anthers Pyrenees Perennial

4 **podólicum,** Bess (*Schweréckia podólica,* Andrz & Bess) Dwarf lvs in rosette, lanceolate, 2-toothed on margins· fls white, short-pedicelled, petals entire Early spring S. Russia Perennial

AA *Fls yellow or orange perennials*

B. *Lvs ½in or less long*

5 **serpyllifòlium,** Desf (*A alpéstre,* Linn ?) Dwarf (3–4 in high), somewhat woody at the base, with rough-hoary lvs, and pale yellow fls in racemes Eu. Intro. 1892

BB *Lvs mostly 1 in or more long.*

6. **saxátile,** Linn. Golden-tuft Fig 182 A foot high, woody at base lvs oblanceolate or ovate-lanceolate, entire or wavy, hoary-tomentose fls golden yellow, numerous, in little compact clusters Eu B M 159 A F 5 37 —Common in rockwork, making a spreading mat, blooming in early spring There are many forms of this standard rock plant Var **compàctum,** Hort, dwarf Var **flòre-plèno,** Hort, double-fld Var **variegàtum** Hort (*A variegàtum,* Hort), has parti-colored foliage, very attractive

7 **gemonénse,** Linn Less hardy than the last· lvs lanceolate, grayish, velvety fls lemon-yellow st woody at base Eu

8. **rostràtum,** Stev (*A Wierzbickii,* Heuff) About 20 in lvs 2 in long, broad-oblong, pointed, hairy fls deep yellow, in dense heads, in summer Asia Minor

9. **argénteum,** Vitm Fig 183 Dwarf and dense grower, 15 in or so lvs oblong or spatulate, silvery beneath, some of the tufted fls yellow, in clustered heads, all summer, beginning later than those of *A. saxatile* Eu

10 **montànum,** Linn. Tufted alpine, 2–3 in high, more or less herbaceous, pubescent. lvs obovate fls. yellow, fragrant, in a simple raceme Eu.

11 **Mœllendorfiànum,** Asch. Sts ascending. lvs with stellate hairs on both sides, from spatulate to subovate, obtuse fls yellow, in elongated many-fld racemes, the pedicels nearly horizontal and bractless fr. nearly orbicular Bosnia

Many other species of alyssum are likely to be found in choice rock-garden collections *A alpestre,* Linn 3 in, grayish fls yellow, in simple raceme —*A atlánticum,* Desf =A montanum —*A Bertolónii,* Desv =A argenteum —*A cuneifólium,* Tenore=A montanum —*A dasycárpum,* Steph Annual fls yellow —*A diffúsum,* Tenore=A montanum —*A macrocárpum,* DC Shrubby, somewhat spiny, 8 in lvs oblong, silvery fls white —*A orientále,* Ard 1 ft lvs lanceolate, toothed, downy fls yellow, in corymbs —*A tortuósum,* Rupr 6 in, st twisted lvs narrow, hoary fls. yellow, in corymbs.

L H B

ALŸXIA: *Gynopogon.*

AMAGLŸPTUS *Hemiraphis.*

AMANÎTA. *Mushroom*

AMARABÒYA (native name). *Melastomàceæ* A genus of only 3 species of tender shrubs from Colombia, which are showy both in foliage and flower. Lvs large, opposite, sessile, with 3 prominent nerves, brownish red beneath fls large, cymose; petals usually 6, stamens 12–15 For cult, see *Pleroma* Not known to be in American trade Considered by some as a section of the much larger genus Blakea.

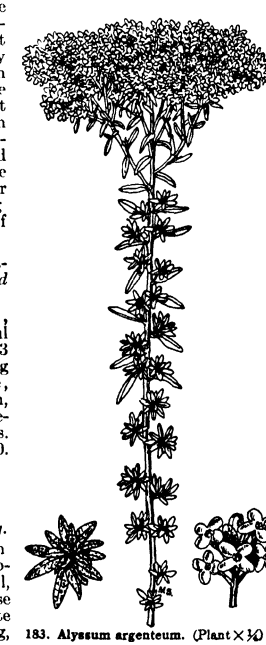
A amábilis, Linden Lvs 10–12 in long, 8 in broad· fls white, margined carmine, stamens white, style red, exserted I H 34 9 —4 *prínceps,* Linden Fls carmine, stamens white, styles white. I H 34 4 —4 *splêndida,* Linden Fls 6½ in across, petals narrower at the base than in the other species, stamens yellow, style red, exserted I H 34 34 —Perhaps the showiest of all the Melastomaceæ

N Taylor.†

AMARÁNTUS (Greek, *unfading,* in allusion to the lasting character of the calyx and floral bracts). *Amarantàceæ* Amaranth Coarse annual plants, grown for colored foliage and the showy flower-clusters, related to the cockscomb

Plants tall and erect or spreading or even prostrate: lvs alternate, entire, petioled fls very small congested in terminal or axillary spikes or glomerules, each fl subtended by 3 chaffy bracts, petals 0, sepals 3–5, persistent, stamens 2–5 fr a small 1-seeded utricle — Some 45–50 species, mostly weedy plants, widely distributed Some of the pigweeds are of this genus, as *A retroflexus,* sometimes known as beet-root and red-root, *A hybridus, A graecizans (A albus),* one of the tumble-weeds, *A spinosus, A blitoides* and *A. Palmeri,* spreading eastward along railroads

The amaranths are usually planted as open-air annuals, and they require no special treatment They thrive best in a hot and sunny place In very rich soil the leaves become very large but usually lack in bright coloring Seeds may be sown in the open or in frames The dwarf and compact varieties, which often have beautifully variegated foliage, may be grown in pots or used for bedding Give plenty of room.



183. Alyssum argenteum. (Plant×½)

A *Lvs linear-lanceolate, long and drooping.*

salicifòlius, Veitch Graceful pyramidal habit, 3 ft lvs 5–8 in long and ¼in wide, wavy, bronze-green, changing to orange-red Philippines. G C I 1871 : 1550. F S 19 1929

AA *Lvs broad, mostly ovate.*

B *Spikes drooping.*

caudàtus, Linn Love-lies-bleeding Fig 184 Tall, robust and diffuse (3–5 ft) lvs ovate to ovate-oblong,

stalked, green spikes red, long and slender, naked, in a long and drooping panicle, the terminal one forming a long, cord-like tail Also vars with yellowish and whitish panicles Tropics G W. 6 709.—Common, and an old favorite Var. **atropurpùreus,** Hort Foliage blood-red Var. **albiflòrus,** Hort Spikes white or greenish white Var **gibbòsus,** Hort Plant not large fls red, clustered in more or less separated fascicles or heads.



184 Amarantus caudatus (×⅛)

BB *Spikes erect*

hypochondrìacus, Linn PRINCE'S FEATHER. Tall and glabrous lvs oblong-lanceolate, acute. spikes blunt, aggregated into a thick, lumpy terminal panicle, of which the central part is elongated bracts long-awned —An old garden plant, with the heavy heads variously colored, but mostly purple Lvs usually purple or purple-green Trop Amer Cult in many forms and sometimes a weed in old grounds Considered by some to be a form of *A hybridus,* Linn [*A hybridus* var *hypochondriàcus,* Rob) Var **sanguíneus,** Hort (*A cruéntus,* Hort , not Willd) Entire plant blood-red Var **viréscens,** Hort Lvs green above, purplish beneath Var **víridis,** Hort Plant green, except the floral parts Var **racemòsus,** Moq Lateral fl -branches elongated, light-colored There are other garden forms

paniculàtus, Linn. (*A hybridus* var *paniculàtus,* Uline & Bray) St. usually pubescent lvs oblong-ovate to ovate-lanceolate, broader than in the last spikes thinner than in the last, acute or acutish, and in an open, more graceful terminal panicle bracts sharp-pointed but not long-awned Trop Amer — Common, and sometimes a weed Var **speciòsus** (*A speciòsus,* Sims, B M 2227) Stout, large, erect plant (3½-4½ ft), with sts and lvs reddish or purple-green panicle dark red-purple, handsome Var **cruéntus,** Moq (*A cruéntus,* Linn , not Hort) Lateral fl -branches spreading-nodding, blood-red Var **sanguíneus,** Moq Lateral branches long, slender, often nodding at the tip fls and some or all the lvs blood-red Var **flavéscens,** Voss. Panicles large and branched, yellowish or greenish.

gangèticus, Linn Usually a lower plant, 3 ft or less and often only 1 ft , with thin, ovate-pointed lvs , and fls in short, glomerate, interrupted spikes, both terminal and axillary Tropics —Very variable Cult by Amer Chinese (Fig 185) as a pot-herb under the name of hon-toi-moi, with green lvs (Bailey, Bull 67, Cornell Exp Sta) Various dwarf and compact bedding forms are common Used more for foliage than for fl -panicles. Var **melanchólicus,** Voss (*A. melanchólicus,* Linn) Lvs variously colored, sometimes mostly in two colors (*A bicolor,* Hort), and also in three colors (*A tricolor,* Hort). lvs long-petioled, broadly to narrowly lanceolate. Here belong the JOSEPH'S COAT group of the bedding amaranths

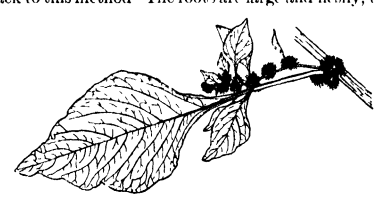
Many Latin-form names are in the catalogues, probably all of which are referable to above species or are hybrids of them, as *A spléndens,* a form of A gangeticus var melancholicus. *A speciòsus aùreus,* to A paniculatus var flavescens, *A Hénderi,* probably a hybrid with A salicifolius, or a var of it, with long-drooping, brown lvs , and tall, pyramidal stature, *A Gordonii,* or Sunrise, with bronzy banded lvs and brilliant scarlet lvs on top. *A supérbus,* lvs blood-red above and crimson beneath, probably one of the melancholicus forms, *A Dussi,* Spreng , with lvs and fls bright colored, and suggested as a var of A spinosus, which is a smooth weedy species with 2 spines in the axils of the narrow-ovate or rhomb-ovate lvs —*A Huttonii,* Veitch=Celosia

L H B

AMARÝLLIS (classical name) *Amaryllidàceæ* Summer- or autumn-blooming bulbous plant (March and Apr at the Cape), the leaves usually appearing later

Plant stout, producing many strap-like lvs ; fls large, fragrant in a few- to several-fld umbel, perianth with a short ribbed tube, the divisions oblong or lanceolate, the filaments distinct and no scale between them, stamens on the throat of the tube fr a globose caps , opening irregularly —One species, from Cape of Good Hope In gardens, the hippeastrums (winter and spring bloomers) are known as Amaryllis

In dealing with the culture of amaryllis, it is customary to speak of the genus in its horticultural sense, —to include hippeastrum and related things Such is the understanding in the following cultural directions There are two widely differing methods of cultivating the amaryllis to produce showy flowers in the spring months,—the border method and the pot method Any one trying both of these methods will soon come to the conclusion that they differ not only in method, but in flower-producing results The first method is to plant the bulbs in a prepared border after they are done flowering, say about the middle of May. The border should have perfect drainage, and, if convenient, be on the south side of a house or wall, fully exposed to the sun during the greater part of the day The bulbs are set out in rows, necessarily with as little disturbance of the roots as possible, because, if they are bulbs that have undergone similar treatment the previous year, by the middle of May they have made a considerable number of new roots, besides, the foliage also has gained some headway, and may be considered as in actual growth In planting, carefully firm the soil around the old balls, give one watering, and on the succeeding day, after the surface of the soil has been raked over, cover to the depth of 2 inches with half-decayed cow-manure With frequent waterings during the summer and the removal of weeds, they will need no more attention until the approach of cool weather, when they should be lifted, sized, and potted, however, at this season, if wet weather has predominated, some of the bulbs will be in a semi-dormant state, while the majority will yet be in active growth Here is the drawback to this method The roots are large and fleshy, they



185. Amarantus gangeticus (×⅛)

take up considerable room in a 6- or 7-inch pot, and the soil cannot be evenly distributed amongst them, neither can it be made as firm as it should be The result is the partial decay of the roots and leaves, and in the spring, when the flower scapes appear, they are developed at the expense of the bulb, through having insufficient roots to take up nourishment from the soil. The flowers are small, few in number, and do not show what the plant is capable of Partly to ameliorate these

conditions, the bulbs in active growth at lifting time may be heeled-in on a greenhouse bench until they gradually ripen, taking care that some of the soil is retained on the roots, otherwise the ripening process is altogether too rapid, so that the roots and leaves suddenly lose their robust nature, become flabby, and eventually die For this method, it can be said that a larger number of bulbs can be grown with less trouble than by the pot method, but neither bulbs nor flowers compare in size with those kept in pots the year round For the purpose of merely increasing stock, the outdoor method is to be preferred —Most of the kinds are naturally evergreen, potting under those conditions is best done either after the plants have made their growth in the fall or after they have finished flowering in April When done in the fall, they are allowed to remain rather dry during the winter, this will keep the soil of the original ball in a sweet condition until the time arrives to start them into growth, which may be anywhere after the first of January, or even earlier if necessary They will winter all right, and keep their foliage, in a brick frame in which the temperature is not allowed to fall below 45° F By the beginning of February, in a structure of this sort, they will be showing flowerscapes, and should then be taken to a position in which more heat and light can be given A weak solution of cow-manure will much help the development of the flowers When in bloom, a greenhouse temperature, with slight shade, will prolong the flowering period After flowering, the greatest care should be taken of the plants, as it is from that period till the end of summer that the principal growth is made A heavy loam, enriched with bone-dust and rotted cow-manure, suits them well —The seeds of hippeastrums should be sown as soon as ripe, covered very lightly with finely sifted leaf-mold, and, if this shows a tendency to dry too quickly, cover with panes of glass until germination takes place As soon as the first leaves are developed, they should be potted in the smallest sized pots and kept growing —In the propagation of varieties, it will be found that the large bulbs make two or more offsets each season, these should not be detached until it is certain that they have enough roots of their own to start with after being separated fom the parent If a well-flowered specimen clump is desired, the offsets may be allowed to remain attached to the parent, they will, in most cases, flower the second year under generous treatment —*Amaryllis Belladonna* and the plant known as *A longifolia* (really a crinum) are hardy in the District of Columbia, *A longifolia* thrives even in damp, heavy soils, with no protection, and flowers abundantly each year *A Belladonna* needs a warm, sheltered spot, with deep planting This popular autumn-blooming plant succeeds best where it can remain out-of-doors all the year It seems to thrive in fairly rich sandy loam A position facing south near the wall of house or by the side of a greenhouse seems to suit its requirements In rather dry soils where frost does not penetrate deeply, it is not necessary to lift the tubers each year (G W Oliver)

Belladónna, Linn BELLADONNA LILY Fig 186 Scape 2–4 ft, with a 2-lvd dry spathe or involucre just underneath the umbel fls on short pedicels, lily-like, short-tubed, and flaring, with pointed segms 2–3 in long, and 6 deflexed stamens, fragrant, normally rose-red, scape solid lvs strap-shaped, canaliculate and acute B M 733. Gn 33 268, 47, p 46, 49, p. 276, 54, p 414 G C III 24 315 —An old favorite, with many Latin-named garden forms There are varieties ranging from white to red, and varying in shape and size of fls, many of them receiving Latin descriptive names Var **purpùrea,** Hort Fls purple, at least on the limb Var **pállida** (*A pállida*, Red), has pale flowers Var **blánda,** Voss (*A blánda*, Gawl B M 1450), is a large form, with white fls, fading to blush Var. **rósea perfécta,** Hort Excellent blooms, satiny rose and white-striped: fls late, at the time the lvs appear, the segms pointed Gt 45, p 443 Var **spectábilis tricolor,** Hort. Fls showy, in large umbels, rose-color, white inside, highly perfumed Gt 45, p 358 Var **máxima,** Hort Strong grower, with many large rose-colored fls G M. 45·303 Var **Párkeri** (*A Párkeri*, Hort) Probably hybrid of *Brunsvigia Josephinæ* and *Amaryllis Belladonna* umbel circular, with as many as 30 blooms, fls deep rose with white and orange at base inside, and orange on outside of tube 3 ft, handsome also a white-fld form G C III 50 211 Gn 75, p 460

See Brunsvigia for *A gigantea* and *A orientalis*, Crinum for *A longifolia* and *A ornata*, Hippeastrum for *A aulica*, *A equestris*, *A fulgida*, *A Johnsonii*, *A Leopoldii*, *A pardina*, *A procera*, *A. Reginæ*, *A reticulata*, *A vittata* Lycoris for *A aurea*, *A Hallii*, and *A radiata*, Nerine for *A Sarniensis*, Sprekelia for *A formosissima*, Sternbergia for *A lutea*, Vallota for *A purpurea*, Zephyranthes for *A Atamasco*, *A candida* and *A rubescens* The following trade names probably belong to other genera most likely to Hippeastrum *A crocea*, *A Graiesiana*, *A macrantha*, *A refulgens* L H. B.

AMASÒNIA (after Thomas Amason, early American traveler) *Verbenàceæ* About a half-dozen species of under-shrubs of Trop Amer Fls yellow or sulfur-colored in racemose or paniculate clusters, calyx 5-cleft, corolla 5-cleft, almost 2-lipped May be treated as warmhouse species of Clerodendron



186 Amaryllis Belladonna

calycìna, Hook f (*A punicea*, Hort not Vahl *Tabernæmontana punicea*, Hort) Lvs 6–12 in long, elliptic, acuminate, coarsely irregularly toothed or sinuate, glabrous, except the floral ones fls 1½–2 in long, drooping, calyx nearly 1 in long, red B M 6915 Gn 27 130 R B. 20 13

A erécta, Linn A slender, sparingly branched shrub lvs alternate and whorled, 4–5 in long, oblong, crenate-serrate, dark green above, paler beneath fls white, racemosely paniculate, bracts scarlet Guiana

N TAYLOR †

AMBRÒSIA (a classical name) *Compósitæ* About fifteen species of weedy evil-smelling herbs, mostly American The common ragweed is *A artemisiæfolia*, Linn The kingweed of western wheatfields, and also of low waste places, is *A trifida*, Linn Probably none is cultivated, the listed *Ambrosia mexicana* probably being of some other genus, very likely an artemisia

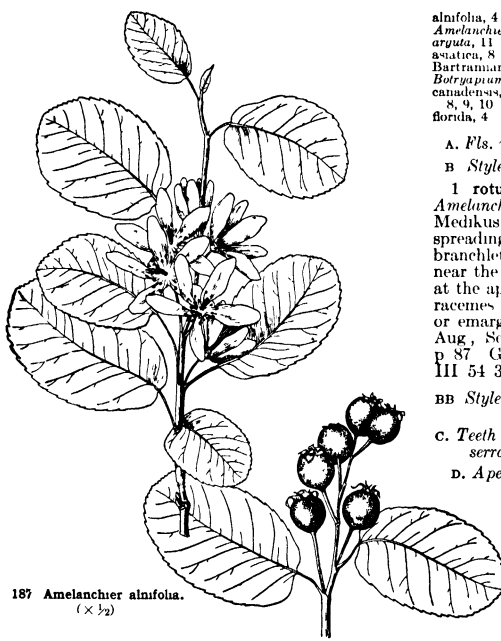
AMBROSÍNIA (Giacinti Ambrosini, an Italian). *Aràceæ* A dwarf perennial tuberous herb of Italy and Algeria

Spathe boat-shaped, lying on the earth, the mouth gaping, spadix included fr a many-seeded berry — Half-hardy, planted in the open or in pots, and blooming in the fall A single species

Bássii, Linn Three or 4 in lvs 2 or 3, overtopping the spathe, the lf-blade ovate or ovate-elliptic, obtuse often retuse spathe ¾in long, tipped with a brown tail, divided lengthwise, the anthers being in one compartment (which has a hole to admit insects), and the solitary ovary in the other, thus preventing automatic close pollination B M 6360 —There is a narrow-leaved form (var **angustifòlia,** Guss), a spotted-leaved form (var. **maculàta,** Engler), and a form with pale green reticulations (var **reticulàta,** Engler) Propagation is by seeds started inside or in frames, or by division in spring L H B

AMELÁNCHIER (said to be a Savoy name) *Rosàceæ* SHAD-BUSH JUNEBERRY Ornamental woody subjects chiefly cultivated for their profuse white flowers appearing in early spring, some species also grown for their fruits

Deciduous shrubs or small trees. winter-buds conspicuous, pointed, with several imbricate scales lvs alternate, petioled, serrate fls in racemes terminal on short branchlets, rarely solitary, calyx-tube campanulate, adnate to the ovary, with 5 persistent lobes, petals 5, stamens 10–20, styles 2–5, ovary inferior, 2–5-celled, each cell with 2 ovules and subdivided fr a berry-like pome, juicy, with a cavity at the top —About 20 or 25 species, most of them in N Amer , 2 in Mex , 4 in Eu , and W Asia, and 1 in E Asia The species are closely related and often difficult to distinguish,



187 Amelanchier alnifolia. (× ½)

especially as numerous spontaneous hybrids apparently occur For a detailed treatment of the species of E. N Amer , see Wiegand in Rhodora 14, p 117 (1912) In trade catalogues, they are sometimes confused with Aronia, which is easily distinguished by its compound corymbose infl , 5-celled mealy fr and by the midrib of the lvs being glandular above

The amelanchiers are deciduous shrubs or trees with simple, suborbicular to oblong serrate leaves, rather small white flowers in racemes followed by purplish or bluish black berry-like fruits They are very desirable for ornament, producing a profusion of white flowers in early spring, and range from shrubs only a few feet high, as *A. humilis* and *A stolonifera*, to trees attaining 40 feet in height, as *A canadensis* and *A lævis* The latter species is perhaps the most beautiful, the white color of the pendulous loose racemes being enhanced by the red bracts and the bronzy red color of the unfolding leaves; the other species are pure white when blooming, the young leaves being covered by a whitish tomentum *A. humilis* and *A stolonifera* and also *A. sanguinea* seem to be the best for fruit, which ripens later than the others, there is also a large-fruited form of *A. lævis* See *Juneberry*

All the species mentioned below are hardy North and thrive upon a variety of soils and succeed well in dry climates, some, as *A sanguinea*, *A humilis* and *A. rotundifolia* show a preference for calcareous soil and grow well in dry situations, while others, as *A oblongifolia* and *A Bartramiana* prefer moist and swampy soil

Propagation is by seeds sown soon after ripening or stratified and sown in spring and the stoloniferous species also by suckers, rare kinds are sometimes budded in summer on a common species or on Cratægus

INDEX

alnifolia, 4
Amelanchier, 1.
arguta, 11
asiatica, 8
Bartramiana, 11
Botryapium, 7, 9
canadensis, 2, 4, 7, 8, 9, 10
florida, 4
grandiflora, 2
humilis, 3
japonica, 8
lævis, 10
oblongifolia, 7
obovalis, 7
oligocarpa, 11
ovalis, 1, 5, 6
oxyodon, 4
pumila, 4
rotundifolia, 1, 2.
sanguinea, 2
sinuata, 8
spicata, 2 3, 5, 6.
stolonifera, 5
vulgaris, 1

A. *Fls. in racemes lvs folded in bud, petioles slender.*

B *Styles free, very short, not exceeding the calyx-tube.*

1 **rotundifòlia,** Dum -Cours , not Roem (*A. Amelanchier*, Sarg *A vulgàris*, Moench *A ovàlis*, Medikus, not Borkh) SERVICE-BERRY Upright or spreading, rather stiff-branched shrub, 2 8 ft young branchlets tomentose lvs oval to obovate, serrate from near the base, subcordate at the base, usually rounded at the apex, 1–2 in long, woolly beneath when young racemes many-fld , petals linear-oblanceolate, obtuse or emarginate fr bluish black, bloomy May, fr in Aug , Sept Cent and S Eu B M 2430 H W 3, p 87 G C II 9 793 M D G 1900 497 (habit) J H. III 54 395.

BB *Styles more or less connate at the base, about as long as the stamens*

C. *Teeth of lvs about 4 7 to ¹₂in , lvs rather coarsely serrate, veins usually straight and close together*

D. *Apex of lvs acute or acutish, blade densely woolly beneath when young*

2 **sanguínea,** DC (*A rotundifòlia*, Roem., not Dum -Cours *A canadénsis* var *spicàta*, Sarg , in part *A spicàta*, Rob & Fernald, not Koch) Slender shrub sts solitary or few together, to 8 ft high lvs orbicular-oval to oval-oblong, rounded or subcordate at the base, 1⅓–2¼ in long, serrate nearly to the base. fls on a loose, usually nodding raceme; petals ½in long, summit of ovary densely woolly fr rather large, nearly black, bloomy, juicy and sweet Maine to Minn and Ala May, fr. in Aug , Sept B B 2 238 (as *A rotundifolia*) —Var. **grandifòra** (forma *grandiflora*, Wiegand) Fls large; petals ¾in long and nearly ¼in wide

3 **hùmilis,** Wiegand (*A spicàta* of many writers, not Koch) Stiffly upright shrub, 1–4 ft , stoloniferous and forming patches lvs oval-oblong or oval, subcordate or rarely rounded at the base, 1–2 in long, serrate to below the middle racemes many-fld , rather dense and upright, fls small; petals oblong-obovate, about ⅛in. long: fr. nearly black, bloomy, juicy and sweet May; fr. in Aug Vt to Alberta, south to N Y and Iowa.

DD. *Apex of lvs. rounded or truncate blade very soon glabrous*

4. **alnifòlia,** Nutt (*A canadénsis* var *alnifòlia*, Torr & Gray) Fig 187 Shrub with rather stout upright branches, to 10 ft lvs broadly oval to oval-truncate or subcordate at the base, 1–1¾ in. long,

coarsely and sharply toothed rarely below the middle, floccose-tomentose at first, very soon becoming glabrous. racemes many-fld, upright, short and dense, slightly tomentose at first, fls rather small, petals oblong to narrowly oblong, ½–½in long, sepals short summit of the ovary woolly fr nearly black, bloomy. May, fr. in July Mich to Ore and Wash S S 4 196 S F 1 185, 5 415 G M 52 143 (habit) Var **flòrida,** Schneid (*A flòrida,* Lindl *A oxyodon,* Koehne) Lvs and racemes glabrous or nearly so from the beginning B R 19 1589 Var **pùmila,** Schneid (*A canadénsis* var *pùmila,* Nutt.) Glabrous like the preceding var, but very low and stoloniferous.

CC. *Teeth of lvs 7–15 to ½in, lvs finely and closely serrate.*

D. *Lvs tomentose when young.*

E. *Apex of lvs obtuse, rounded or sub-acute*

F. *Top of ovary woolly lvs generally oval.*

5 **stolonífera,** Wiegand (*A spicàta,* Brit & Brown, in part, not Koch *A ovàlis* of many authors, not Medikus) Upright stoloniferous shrub, 1–4 ft high, forming patches lvs oval, rarely oval-oblong or orbicular, rounded at the base or rarely subcordate, 1–2 in long, finely serrate, usually quite or nearly entire on the lower third, glabrous above, densely white-tomentose beneath when young racemes short, dense, upright, tomentose or nearly glabrous, fls small, petals obovate-oblong, about ⅛in long, top of ovary woolly fr purplish black, bloomy, juicy and sweet May, a few days later than *A laevis,* fr in July Newfoundland and Maine to Va

6 **ovàlis,** Borkh (*A spicàta,* Koch, *Crataegus spicàta,* Lam.) Bushy shrub with numerous sts, to 12 ft lvs oval to obovate, sometimes oval-oblong, 1½–2½ in long, serrate to the base, white-tomentose beneath when young racemes upright, woolly, petals obovate, ⅛in long, top of ovary woolly fr bluish black, with the sepals upright and slightly spreading M D G 1900 496.—This is possibly a hybrid between the preceding and the following species, much cult in Eu

FF *Top of ovary glabrous or nearly so lvs generally oblong*

7 **oblongifòlia,** Roem (*A canadensis* var *oblongifòlia,* Torr & Gray *A Botryàpium,* Brit & Brown, in part *A obovàlis,* Ashe) Shrub, with slender upright sts growing in rather dense clumps, but not stoloniferous, to 25 ft lvs oblong to obovate-oblong, usually rounded at the base, and rounded or acute at the apex, 1¼–2½ in long, very finely serrate nearly or quite to the base, white-tomentose beneath when young racemes short, dense and upright, silky-tomentose, petals obovate-oblong to oblanceolate or linear, about ⅛in long; top of ovary glabrous or sometimes slightly woolly, fr nearly black, with bloom, sweet May, with *A laevis,* fr in June Maine to S C.—S S 4 195 Em 2 503 (lower figure) B M 7619 G C III 21 333 D G M 1900: 497 (habit).—This differs from all other species except *A ovalis* and *A Bartramiana* in having the sepals on the immature fr upright or only slightly spreading; in the other species they are recurved

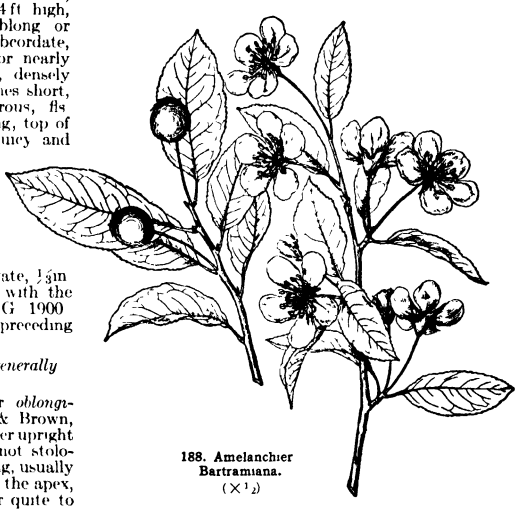
EE *Apex of lvs very acute or shortly acuminate.*

8 **asiática,** Endl (*A canadénsis* var *asiática,* Miq *A. japónica,* Hort.). Shrub or tree, to 40 ft, with slender spreading branches lvs ovate to oblong-elliptic, acute, rounded or subcordate at the base, 2–3 in long, finely serrate all around, densely white or yellow tomentose beneath when young racemes rather dense, nodding, woolly, top of ovary woolly fr bluish black May, fr. in Sept Japan, Korea S Z 1.42 S I.F 1 47 Var **sínica,** Schneid Lvs less tomentose, often finally glabrous, smaller, usually serrate only above the middle. China.

9. **canadénsis,** Medikus (*A. Botryàpium,* Borkh. *A. canadénsis* var *Botryàpium,* Torr & Gray *A canadénsis* var *tomentúla,* Sarg.) SERVICE-BERRY Bushy tree, fastigiately branched st solitary or few, sometimes shrubby lvs generally obovate, less often ovate, oval or oblong, acute or acuminate, usually cordate at the base, 1½–3½ in long, sharply serrate quite or nearly to the base, densely white-tomentose beneath when young, less so above, tomentum usually partly persistent racemes rather dense, nodding, silky-tomentose, petals linear or linear-oblong, about ½in long; top of ovary glabrous or slightly hairy fr maroon-purple, tasteless May, early, before the lvs, fr in June. Maine to Iowa, Mo and south to Ga and La. S S. 4· 194 B R. 14 1174 Gn 73, p 239 (habit; may be *A. oblongifolia*).—This is the only species with the lvs. tomentose on both surfaces when young.

DD *Lvs quite glabrous.*

10 **lævis,** Wiegand (*A canadénsis,* Gray, not Medikus). Irregularly branched tree, with spreading



188. Amelanchier Bartramiana. (×½)

branches, to 40 ft, sometimes shrubby· lvs oval-ovate to ovate-oblong, short-acuminate, subcordate or rotundate at the base, rarely broadly cuneate, 1½–2½ in long, sharply serrate nearly to the base, quite glabrous and purplish when young racemes slender, many-fld, drooping, glabrous or nearly so, lower pedicels very long, in fl about 1 in, in fr sometimes 2 in long, petals oblong-linear, about ½in long, top of ovary glabrous fr purple or nearly black, bloomy, juicy and fairly sweet May, fr in June From Newfoundland to Mich and Kans, south to Ga and Ala Em 2 503 (upper figures) H T 212 M D G. 1900 494, 195 G 16 18, 31 343 (habit) G M. 44.306 (habit).—This is the most graceful and the handsomest species in bloom, differing from all other species in the purplish young foliage and the drooping racemes

AA *Fls solitary or 2 or 3 at the end of the branchlets; petals broad, obovate lvs imbricate in the bud, flat when unfolding, petioles short, less than ½in. long*

11 **Bartramiàna,** Roem (*A oligocárpa,* Roem. *A argùta,* Nutt.) Fig 188 Shrub, to 8 ft.. lvs. elliptic

to elliptic-oblong, acute or rounded at the apex, cuneate at the base, 1¼–2 in long, sharply serrate to below the middle or nearly to the base, glabrous when young fls 1–3, pedicels glabrous, ½–1 in long; petals about ½in. long, top of ovary woolly fr purplish black, bloomy May, fr in July and Aug Swamps Labrador to Mich. and Minn., south in the mts. to Pa. G.F. 1.247 (adapted in Fig 188)

A. Cusickii, Fernald Shrub, to 10 ft lvs suborbicular, about 1½ in. long, glabrous or nearly so fls large, petals oblong, about ¾in. long fr scarlet, finally black Ore and Wash to Idaho —Not in cult, but ought to be intro, as it has the largest fls of all — *A. utahensis*, Koehne Dwarf shrub with small obovate lvs scarcely 1 in long, pubescent on both sides racemes short, with very small fls. Utah and Ariz —Not in cult, the plant cult under this name belongs to another species, to which could not be determined

ALFRED REHDER.

AMÉLLUS (for the river Mella) *Compósitæ* Nine or 10 Cape of Good Hope annual and perennial herbs allied to Aster. Lvs. hairy, oblong, opposite below: heads solitary and terminal or lateral, fls blue-rayed, pappus single. **A. Lychnitis,** Linn, sometimes grown as an evergreen glasshouse plant, has linear-lanceolate hoary lvs and showy blue or violet fls. Summer bloomer, a few inches high.

AMHÉRSTIA (Countess Amherst and her daughter, Lady Amherst, promoters of botany in India) *Leguminòsæ* A monotypic genus comprising **A. nóbilis,** Wall, one of the noblest of flowering trees, native to India, where it reaches a height of 40 ft and more. Fls. gaudy red, 8 in. long, with wide-spreading petals, the upper ones gold-tipped, and colored petal-like bracts, in long, hanging racemes lvs pinnate, nearly 3 ft. long. The tree first flowered in Eng. in 1849. It requires hothouse treatment The fls last only 2 or 3 days. Demands rich, loamy soil, and abundant moisture during the growing season, after which the wood must be ripened firm Propagation is by seeds, more often by cuttings of half-ripened wood under a glass, with bottom heat of about 80°. Thrives well in the open in Jamaica. B.M. 4453 F.S 5.513–516

N. TAYLOR.†

AMIANTHIUM: *Zygadenus*

AMÍCIA (named for J B. Amici, Italian physicist, born 1786) *Leguminòsæ* Woody plants, one of which is known in cultivation as a half-hardy greenhouse subject, or in the open in warmer regions.

Straggling pellucid-dotted shrubs, or sub-shrubs, with alternate abruptly pinnate lvs and few lfts fls. rather large, papilionaceous, yellow, in axillary or terminal racemes or rarely solitary, calyx with 2 very large upper segms and very small lateral segms.; stamens equal fr very narrow, compressed, jointed —About 5 species in the mts of Mex to Bolivia

Zygomèris, DC Eight feet, pubescent. lfts 2 pairs, obcordate or wedge-shape, mucronate fls large, pale yellow with purple on the keel pod 2-jointed. Mex. —Intro. in S. Calif; unusual in greenhouses L. H. B.

AMMÒBIUM (Greek, *living in sand*). *Compósitæ.* Hardy herb, cult as an everlasting or immortelle.

Florets perfect, yellow, surrounded by a dry, silvery white involucre, and subtended by chaffy scales; pappus of 2 bristles and 2 teeth —Two or 3 Australian species Commonly grown as an annual, but seeds are sometimes sown in Sept, and the plant treated as a biennial Of easiest culture, the seeds being sown where the plants are to grow In the N, sow seeds in spring Cut the fls before they are fully expanded, and hang in a dry, shady place They will then remain white

alàtum, R Br Three ft or less high, erect and branchy, white-cottony, the branches broadly winged. early root-lvs ovate at the ends and long-tapering below (javelin-shaped), st -lvs small and distant, entire or nearly so. heads 1–2 in across, the involucre becoming pearly white, petal-like, fls all tubular V 2 62. Austral. A large-headed form is var. **grandiflòrum,** Hort L. H. B.

AMMÓCHARIS (*ammos*, sand, *charis*, beauty). *Amaryllidàceæ* Greenhouse bulb. cultivated for late winter and spring bloom

Allied to Brunsvigia, but the perianth regular, the tube cylindrical and straight, ovary flask-shaped and narrowed to a neck —Two species in Cape of Good Hope region (by some regarded as forms of one species) *A. falcata,* Herb, with limb 4 times length of tube, and *A. coranica,* Burchell, B.R 139:1219 (as Amaryllis), with limb only twice as long

falcàta, Herb Bulb ovoid, sometimes 6–9 in diam, with brown tunics lvs 1–2 ft long, 1 in wide, strap-shaped, spreading, produced in spring before the bloom fls 20–40, in an umbel, bright red, fragrant — *A. falcata* requires rich, loamy soil It starts to grow in the spring Give plenty of water during growing season in summer It can be cult out-of-doors When perfected and finished in autumn, the bulb may be put under the greenhouse bench, keep moderately dry in sand or earth, may be potted in January, after which it will soon throw out its fine, fragrant blooms

L. H. B.†

AMMONIACAL CARBONATE OF COPPER: *Fungicide*

AMMÓPHILA (Greek, *ammos*, sand, and *philein*, to love) *Graminæ* Perennial grasses, with long, creeping rootstalks and spike-like panicles spikelets 1-fld, awnless, the rachilla prolonged behind the palea as a hairy bristle, lemma firm, about as long as the glumes, hairy at the base, palea as long as lemma — Species 1 or 2, on the sandy seacoast of Eu, the Atlantic Coast of N. Amer and the shores of the Great Lakes.

arenària, Link (*A. arundinàcea,* Host) BEACH-GRASS MARRAM-GRASS SEA SAND-REED PSAMMA One to 3 ft blades long, somewhat involute panicle pale, several in or as much as a ft long Dept Agric, Div Agrost 7:167, 14 11 Sand-dunes along the seacoast —On account of the long, hard, branching rootstocks, it has been much used as a sand-binder in Eu and certain parts of Amer, especially Cape Cod and Golden Gate Park in San Francisco

A. S. HITCHCOCK

AMÒMUM (Greek-made name, referring to the qualities as antidote for poisons) *Zingiberàceæ* Hothouse ginger-like herbs with narrow entire leaves, grown for the habit and foliage and for the flowers in dense cone-like spikes

Amomums are aromatic tropical and subtropical plants, spreading by means of hard rhizomes and forming dense masses of handsome erect or spreading annual sts. and linear, lanceolate or elliptic lvs fls in dense cone-like spikes or racemes, half hidden in the floral-bracts, calyx funnel-shaped, split down one side, only slightly toothed; corolla-tube cylindrical, little longer than the calyx, the upper lobe curved, the 2 lower spreading and narrow, lip (staminode) large and petal-like, mostly obovate-cuneate, fertile stamen with a narrow or a very slender filament. fr ovoid, with a thick and fleshy exterior —About 50 species in tropics of Asia, Afr and Pacific Isls, allied to Alpinia and Elettaria The "grains of paradise" are amomum seeds, of several species, probably mostly of *A. Granum-Paradisi* and *A. Melegueta,* they are used, or have been used, for flavoring beverages Cardamons (aromatic tonic seeds) are secured from species of Amomum and from Elettaria.

Some of the amomums are extremely handsome as foliage plants, apart from their flowers. Many of the species have been confused with and included with the genus Alpinia, but may be readily distinguished from the flower-clusters, being borne on erect-solitary peduncles arising from the base of the leafy stem or direct

from the rhizome, the inflorescence in Alpinia being always terminal on the leafy shoots They thrive in an open soil, rich in humus and with abundance of water during the growing period They require a rest of several months and to be kept on the dry side, but not so dry in the case of the evergreen species as to cause the leaves to shrivel

Cárdamon, Linn CARDAMON Plant, 4–8 ft lvs thick, spicy, lanceolate fls brownish, in a recumbent compound spike E Indies —Produces many of the cardamon seeds of commerce Not to be confounded with *Elettaria Cardamomum* (which see) Sometimes seen in growing collections of economic plants Forms very large clumps

Meleguèta, Roscoe Plant 4–5 ft., the rhizome slender lvs lanceolate, acuminate, glabrous, 6–9 in long and 1 in or less broad, narrowed at base and nearly sessile on sheath fls. solitary, 3–4 in long, short-peduncled, upper corolla-lobe 2–3 in long, lip 2 in or less broad, pure white or tinged pink caps flask-shaped, 3 in. long, red or orange when ripe Trop. Afr

Grânum-Paradîsu, Linn (*A grandiflòrum,* Smith. *A Afzèlii,* Roscoe) Plant 4–5 ft sts red at base, rhizome slender lvs lanceolate, acuminate, glabrous, 4–8 in long and 1¾ in or less broad at middle, wedge-shaped at base and short-stalked on sheath fls 3–4 in the spike, the peduncles 2–6 in long, white; corolla-lobes 2 in long, lip 2 in or less long, yellow at the throat caps ovoid, pubescent, 2–3 in long, much grooved. Guinea. B M 4603

angustifòlium, Sonn (*A madagascaríense,* Lam *A Danielli,* Hook f *A Chisii,* Hanb *A erythrocárpum,* Rdl) Plant, 10–15 ft, the rhizome stout lvs oblong-lanceolate, acute, thin and glabrous, the lower ones 1 ft or more long and 3 in broad, nearly sessile fls several in spike, yellow, tinged red, upper corolla-lobe oblong, 1½ in long, lip about as large as the lobe, deflexed W and E Afr B M 1764, 5250



189 Amorpha fruticosa (×¼)

hemisphæ̀ricum, Baker Sts densely tufted, 10–12 ft lvs distichous, short-petioled above the sheathing base, 1½ ft long and 3 in broad, cuspidate, green above and claret-brown beneath fls very numerous, in a globose head, the outer bracts large and empty, obtuse, tinged brown, the inner bracts nearly as long as the fl, lobes of calyx and corolla green, lip strap-shaped, emarginate, red-brown in middle and yellow at edge Straits Settlements B M 7592

magnìficum, Benth & Hook f A species of large dimensions, reaching, when planted out in a rich soil, up to a height of 20 ft rhizomes branching freely, stout, dark brown, green when young lf -st erect, arching at top, terete lvs distichous shortly petiolate, lanceolate or elliptic, 1–2 ft long, acute, glabrous, upper side green, (red when young) lower side suffused with reddish brown peduncle stout, solitary, 2–5 ft high, infl a globose head with large bright scarlet and green bracts, outer bracts 3 in long, ovate, or ovate-lanceolate, fls numerous, densely crowded near the center of the head, sepals lanceolate, an inch long, primrose, tinted with red, petals lanceolate, slightly longer than the sepals, yellow, tinted with red, lip longer than the corolla-lobes, red, with a margin of yellow Mauritius B.M. 3192 (as Alpinia)

vitellìnum, Lindl Stemless, glabrous, 2 ft lvs. oval fls in oblong loose sessile spike, yellow, lip oblong E Indies(?)

vittàtum, Bull, not Hance A handsome dwarf evergreen species with each leading shoot bearing 2–4 erect or spreading elliptic lvs 4–5 in in length, alternately striped with silvery white and dark green on the upper side, and dull green on the lower Habitat unknown —Habit neat and compact, and similar in general appearance to some of the calatheas Easily prop by division of the rhizomes

L H B
C. P RAFFILL.

AMÓRPHA (Greek *amorphos,* deformed, the fls are destitute of wings and keel) *Leguminòsæ* FALSE INDIGO. Ornamental plants grown for their foliage and flowers

Shrubs, sometimes suffruticose. lvs alternate, odd pinnate, deciduous, with entire small lfts fls in dense terminal spikes, small, papilionaceous, but without wings and keel, calyx campanulate with 5 nearly equal teeth or the lower ones longer, standard folded around the stamens; stamens connate at the base, exserted pod short, indehiscent, slightly curved, with 1–2 seeds —Ten to 15 closely related species in N Amer., south to Mex Conspectus of all the known species by Schneider in Bot Gaz 43 297 (1907)

Amorphas are low or medium-sized shrubs with graceful pinnate foliage and small blue or purple flowers, in dense upright spikes

Most of the species are hardy as far north as Massachusetts, farther north they must be considered as only half-hardy They grow well in sunny and somewhat dry situations but *A. fruticosa* prefers moist soil, they are well adapted for the borders of shrubberies

Propagation is usually by seeds, also by greenwood cuttings under glass in early summer, or by hardwood cuttings, placed in sheltered situations early in fall and left undisturbed till the following autumn They may be grown, also, from layers and suckers

A. *Lowest pair of lfts close to the st plant grayish or whitish pubescent, suffruticose*

canéscens, Nutt LEAD-PLANT Low shrub, 1–3 ft, densely white-canescent lvs 2–4 in long, lfts 21–49, nearly sessile, oval or ovate-lanceolate, acutish, 4–7 lines long fls blue, the spikes crowded into terminal panicles pod tomentose June Southern states Mn 5 707 B M 6618 R H 1896 280 —Handsome free-flowering shrub of dense habit, well adapted for rockeries and borders of shrubberies in sunny and well-drained situations

herbàcea, Walt (*A pubéscens,* Willd *A pùmila,* Michx) Low shrub, 2–4 ft, grayish pubescent lvs. 2–6 in long, lfts 11–37, elliptic to oblong, rounded at both ends, 4–6 lines long, pubescent or glabrous above, beneath dotted with dark glands, short-petioluled. fls varying from violet-purple to white, spikes in terminal clusters pod glandular N C to Fla L B C 7:689.

AA *Lowest pair of lfts remote from the st plant glabrous or nearly so, rarely yellowish pubescent*

B *Calyx with the lower lobes elongated and pointed pod curved on the back young growth finely tomentose*

fruticòsa, Linn BASTARD INDIGO Fig 189 Shrub, 5–20 ft lvs 6–10 in long, lfts 11–21, oval or elliptic, ½–1½ in long, mostly obtuse and mucronulate spikes dense, 3–6 in long, usually in panicles, fls dark purple pods stout, glandular From Wis and Pa south B R 5 427 —Interesting ornamental shrub of spreading habit, with fine feathery foliage, remarkable for the unusual color of its dark violet-purplish fls. A very

variable species; of the many varieties, the following are probably the most important Var **crôceo-lanàta,** Moullef (*A cròceo-lanàta*, Wats). Covered with yellowish brown pubescence W D B 2 139 Var. **albiflòra,** Sheldon With white fls. Var **cærùlea,** Moullef With pale blue fls Var **péndula,** Dipp (*A péndula*, Carr) With recurved or pendulous branches Var **hùmilis,** Schneid (*A hùmilis*, Tausch) Low form with smaller and narrower lvs B.M. 2112 (as *A nana*) Var **crispa,** Kirchn Lvs with crisp margin

tennessénsis, Shuttlw Shrub, 5–20 ft · lvs 6–8 in. long, lfts 13–55, elliptic-oblong to oblong-ovate, ¼–¾in long, obtuse spikes clustered, to 6 in long; fls. violet-purple pods slender, glandular Tenn

BB. *Calyx with all the lobes very shallow and rounded· pod straight on the back young growth glabrous, bloomy and purplish*

glàbra, Porr (*A montàna*, Boynt) Glabrous shrub, to 6 ft high branches purplish lvs 3–6 in long, lfts 9–19, ovate or oval to oblong-ovate, 1-2 in long, obtuse, rounded at the base spikes clustered, 2½–6 in long, fls blue, calyx-lobes very short and obtuse pods nearly straight on the back with few glands Spring. N. C to Ga and Ala

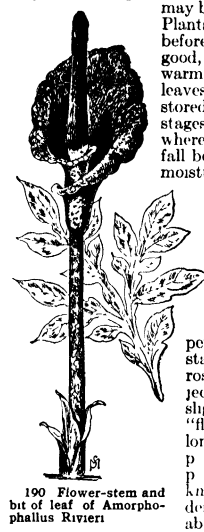
A californica, Nutt Allied to A fruticosa Only very young branches pubescent lfts 11 17, oval to elliptic-oblong, obtuse, broadly cuneate at the base spikes 2 4, to 12 in long *Calif —A californica*, Hook. & Arn =A hispidula - 4 *carolinàna*, Croom (A glabra, Boynt , not Porr) Allied to A fruticosa Lfts numerous, elliptic-oblong, about ½in long, glabrous racemes several, 4–8 in long pods nearly straight on the back Summer N C to Fla —*A glabra*, Boynt, not Porr =A carolinana —4 *hispidula*, Greene (A californica, Hook & Arn , not Nutt) Allied to A fruticosa Branchlets and petioles with prickly glands and pubescent lfts 17–25, ovate to oblong, villous spikes solitary, to 7 in long pods very glandular Calif —*A lasiocarpa*, Nutt Allied to A fruticosa Glabrous lfts 9 21, remote, elliptic to elliptic-oblong, obtuse or emarginate, cuneate at the base, 1 1¼ in long racemes solitary or several, to 12 in long pod straight on the back, very glandular Spring Ark , Texas Var *pubéscens*, Gray (A texana, Buckl) More or less pubescent Texas —*A microphylla*, Pursh (A nana, Nutt) One ft high lfts small, ½in long, crowded, glandular beneath spikes usually single From Minn and Iowa west to Rocky Mts —*A montàna*, Boynt =A glabra — 4 *nana*, Nutt =A microphylla, see also A fruticosa, var humilis —*A paniculàta*, Torr & Gray Shrub, to 12 ft high, grayish tomentose lfts 11–17, ovate-oblong or elliptic-oblong, 1–2 in long racemes long and slender, panicled Texas —4 *pubescens*, Willd =A herbacea —*A pùmila*, Michx =A herbacea — 4 *texana*, Buckl =A lævigata var pubescens —*A virgàta*, Small Allied to A fruticosa Perennial, 2–6 ft , sparingly branched lfts broad, coriaceous spikes single or few Southern states

ALFRED REHDER

AMORPHOPHÁLLUS (Greek-made name) *Aràceæ* Giant aroids from the eastern tropics, grown as curiosities in hothouses

Leaves ample, petioles smooth or warty and variously spotted, blade ample, 3-parted, the divisions pinnatifid· spadix long, spathe (or "flower") funnel- or bell-shaped at the base, springing from the great bulb-like tuber in advance of the lvs , the latter usually pedately compound differs from Arum and related genera by technical characters Monogr by Engler in De Candolle's Monographiæ Phanerogamarum, Vol 2, 1879

Amorphophalluses are propagated by offsets of the tubers These offsets are miniature tubers which grow out of the parent tuber They are taken off at the time of potting, placed in pots just large enough to accommodate them, in a soil composed of loam, leaf-mold and sand in about equal proportions and kept in a temperature of 65° to 70° They are rarely, if ever, propagated by seeds in northern gardens, and for this reason, together with their disagreeable odor when in flower, they are not commonly grown The flowers are like a huge calla except that the spathe and spadix are of a dark chocolate color The odor is supposed to attract carrion-loving insects, which pollinate the flowers in their native home and bring about the production of seeds Towards the end of March the plants should be taken from their winter quarters and placed on the stages of a moderately warm greenhouse and kept moist, where, if the tubers are strong enough, they will soon flower The leaves begin to grow immediately after the flowering season Toward the end of May, they should be planted out in the open ground, or they may be used in subtropical bedding. Plants should be lifted in the fall, before frost, and potted in any good, rich soil, and placed in a warm greenhouse to ripen off the leaves, after which they may be stored away under the greenhouse stages, or in any convenient place where the temperature does not fall below 50°, giving just sufficient moisture to keep the tubers from shriveling (E J Canning)



190 Flower-stem and bit of leaf of Amorphophallus Rivieri

Rivièri, Dur DEVIL'S TONGUE SNAKE PALM Fig 190 Scape (sent up in early spring) preceding the lvs , 3–4 ft , dark-colored and speckled with light red lf often 4 ft across, pedately decompound, the petiole mottled, standing on a stalk like an umbrella spathe rosy, calla-like, with a long-projecting and slender, dark red, slightly curved spadix, the whole "flower" often measuring 3 ft long Cochin China R H 1871, p 573 Gn M 5 232 G W 14, p 173 V 7 116 —The best-known species in American gardens Has a strong and disagreeable odor

campanulàtus, Blume STANLEY'S WASH-TUB Scape lower (2 ft or less), spathe nearly or quite 2 ft broad and 15 in high, with a horizontal, spreading fluted border (not calla-like), red-purple on the margin and grayish, spotted white lower down, and becoming purple in the center, spadix 10–12 in high, the purple top enlarged and convoluted lf much as in *A Rivieri*· tuber weighing 8–10 lbs , shape of a flat cheese An old garden plant from E Indies B M 2812 (as *Arum campanulatum*) F S. 15 1602–3 G C 1872 1720, 1721; III 5 755 G.W. 13, p 9

gigantèus, Blanc "Fl. larger than *A campanulatus* (often 2 ft across) and much more pleasing in color, shading from deep red to cream-color toward the center The club-shaped spadix is dark maroon, with yellow and red base After flowering, the foliage-st appears,—a stout st of deep green color, mottled with gray After growing at the rate of several inches a day, it expands into a large palm-like lf , of a rich, dark green color, often measuring 5 ft across" Blanc, 1892, received "under this name from India" *A campanulatus*(?). Probably not the *A. giganteus* of Blume

similénse, Blanc "Fl 15 in long, the inside of peculiar golden color, spotted purple; the back is metallic brown Fine palm-like foliage" The cut in Blanc's catalogue shows a spathe produced into a long foliaceous summit, and a long, slender, recurved spadix Probably of some other genus perhaps Sauromatum.

1 *Afzèlii*, Hort (Corynophallus Afzelii, Schott)=Hydrosme leonensis —*A Eichleri*, Hook f Spathe 2 in across, purple and white spadix 5 or 6 in high, thick, brown lf single, much divided. W Afr B M 7091 —*A Ellisiàna*, Hook Spathe short and broad, dull pink with pale green spots lvs tripinnatifid, 18 in broad B M 7349 —4 *Lacourii*, Linden (Pseudodracontium Lacourii, N E Br) Petioles barred with yellow, blades much cut, green, spotted white Cochin China I H 25 316 —4 *leonénsis*, Lem Spathe 6 in long, pear-shaped, the tube bell-shaped, white, dilated into the dark purple limb which is striped and spotted with white, lvs about 1 ft wide, tripinnatifid B M 7768 — 4 *Leopoldiànus*, Nichols (Hydrosme Leopoldiana, Mast) Spathe reddish, long acuminate on one side, with undulate margins, spadix 2–3 ft , terete,

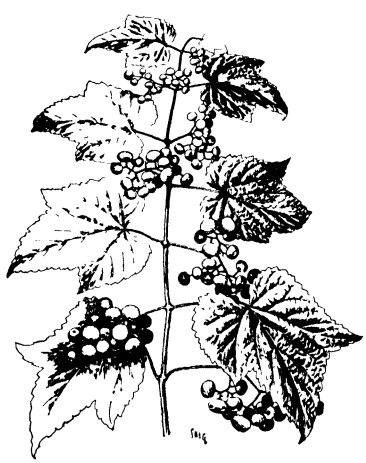
recurved. lf 2–3 ft across Congo I H 34 23, 42, p 380 —*A. nitidus*, Lem , I H 12 424 = Dracontium asperum —*A. oncophyllus*, Prain Spathe 6–7 in long, the tuber broadly ovoid, white, striped and spotted, the limb brown-purple with yellow spots lvs tripinnatifid Andaman Arch B M 7327 —*A. Prainii*, Hook f Tuber 6–10 in diam , not bulbiferous lvs 3–5 ft tall, the petiole green, mottled gray-white on red, spathe-tube 2 in long, pale green spotted white, the limb 6–8 in across, yellow, purple-brown inside at base Perak —*A. Rex*, Prain A larger plant than A campanulatus, the tuber 1 ft across lvs 5–6 ft tall, the petiole purplish, marked gray and green spathe *campanulate*, 12–18 in across, pale red-purple, spadix with an appendage 10–14 in long Java —*A. sativus*, Blume Petiole 2–3 ft tall, rugose, rough, white marked, each division of the blade pinnate-parted, the costa thick, white Molucca Isls —*A. Schweinfurthii* N E Br Spathe broad, reddish brown E Afr —*A. Titanum*, Becc Un One of the most remarkable plants known Tuber 5 ft in circ lf-stalk 10 ft lf-blade 4.5 ft in circ spathe 3 ft in diam , spadix 6 ft high Bloomed at Kew in 1890, the tuber dying thereafter Sumatra B M 7153–5 G C III 5 748 (as conophallus) —*A. variabilis*, Blume Lvs pinnatisect spathe erect, 5 in long, white inside, spotted outside, the margin rosy Java and Philippines G C II 6 pp 680, 681 (as Brachy-spatha) I H III 33 493, 63 283 —*A. virosus*, N E Br Spathe green externally, suffused with purple and spotted, internally lurid purple Siam B.M. 6978.

L H B.

GEORGE V NASH

AMPELÓPSIS (Greek *ampelos*, vine, and *opsis*, likeness) *Vitàceæ* Ornamental woody vines with handsome deciduous foliage and some species with ornamental fruits, used for covering trellis-work, pergolas, arbors, low walls and the like.

Shrubs, climbing by tendrils branches with close lenticillate bark and white pith and with tendrils opposite the lvs lvs alternate, petioled, simple, lobed, digitate, pinnate or bipinnate fls small, greenish, perfect, in dichotomous long-peduncled cymes opposite the lvs or terminal, calyx indistinct, petals 5, or rarely 4, expanding, stamens as many as petals, short, ovary 2-celled with a slender style, adnate to a distinct cup-shaped disk, entire or crenulate at the margin fr a 1–4-seeded berry —About 20 species in N Amer , Cent and E Asia By some botanists united with Vitis, which is easily distinguished, even in the winter state, by its shredding bark and brown pith, also by the paniculate infl and the petals cohering into a cap and falling off as a whole, more closely related to Parthenocissus, which differs chiefly in its disk-bearing tendrils and the absence of a distinct disk in the fl , still more closely to Cissus, which differs in the fleshy sts , usually 4-merous fls and 4-lobed disk Monogr by Planchon in De Candolle, Monographiæ Phanerogamarum, 5.447–463.



191. Ampelopsis heterophylla var. amurensis. (×¼)

The members of this genus are shrubs, climbing, with twining tendrils, not clinging by disks to its support, of medium height, with variously divided, rarely simple foliage, small greenish flowers, in peduncled cymes, followed by blue or yellow pea-sized berries Most of the species are hardy North, but *A. japonica*, *A. megalophylla* and *A. arborea* are only half-hardy, while *A. cantoniensis* and *A. leeoides* can be grown only in warmer temperate regions Page 3565.

They are not particular as to the soil and situation but grow best in fresh and loamy land Where only a light covering is desired, species like *A. japonica*, *A. aconitifolia* and *A. arborea* should be planted; *A. heterophylla* var *amurensis* makes a rather dense covering and is well suited for the covering of parapets, low walls and rocks, *A. megalophylla* is a very strong grower, with bold foliage Some species, as *A. heterophylla* and particularly its var *amurensis* are very ornamental in autumn with their bright blue profusely produced berries

Propagation is by seeds and by hardwood or greenwood cuttings All species may be propagated by cuttings with a good eye, placed in sandy soil under bell-glasses in September

INDEX.

aconitifolia, 5
affinis, 5
amurensis, 4.
arborea, 8
bipinnata, 8
brevipedunculata, 4
cantoniensis, 10
emersa, 2
citrulloides, 4
cordata, 3
Delavayana, 6.
dissecta, 5
elegans, 4
heterophylla, 2, 4, 6
humulifolia, 1
japonica, 7
megalophylla, 9
micans, 2
napiformis, 7
palmiloba, 5
rubricaulis, 5
serjaniæfolia, 7.
Sieboldii, 4
tricolor, 4
trispartita, 5
tuberosa, 7

A *Lvs simple or lobed*

B *Under side of lvs whitish lvs of firm texture*

1 **humulifòlia,** Bunge Lvs broadly ovate, 3–5-lobed, sometimes only slightly so, 3–5 in long, truncate or subcordate at the base, acute or acuminate, bright green and lustrous above, glaucescent and glabrous or hairy beneath cymes slender peduncled fr few and small, usually pale yellow with bluish cheek, or pale yellow or entirely pale blue N China —This species has been always confused with *A. heterophylla*, from which it is easily distinguished by the firmer texture of lvs , their pale whitish under side and the color of the frs It is very hardy and the foliage has the appearance of that of a true Vitis

2 **micans,** Rehd (*Vitis rèpens*, Veitch, not Wight & Arn) Shrub, climbing to 20 ft young growth purplish· branchlets glabrous lvs triangular-ovate and not lobed or broadly ovate and slightly 3-lobed, subcordate or sometimes truncate at the base, short-acuminate, the lobes acute, coarsely crenate-serrate, dark green and with a velvety sheen above, glaucescent below, 2–4 in long cymes long-stalked and rather dense fr dark blue Cent China —Has proved hardy at the Arnold Arboretum Var **cinèrea,** Rehd (*A heterophylla* var *cinèrea*, Gagnep) Lvs grayish pubescent on both sides or only below, often deeply 3–5-lobed

BB *Under side of lvs green lvs. membranous.*

3 **cordàta,** Michx (*Vitis indivisa*, Willd *Cissus Ampelópsis*, Pers) Nearly glabrous lvs cordate, roundish-ovate, not or slightly 3-lobed, acuminate, acutely serrate, pale green beneath, usually pubescent on the veins cymes loose, slender-stalked berries bluish or greenish From Ill and Ohio south Mn N. 2.6.

4 **heterophýlla,** Sieb & Zucc (*Vitis heterophýlla*, Thunb) Branchlets glabrous or hairy lvs cordate, 3–5-lobed, with rounded sinuses, sometimes slightly 3-lobed, lobes serrate or incised, shining green beneath and usually glabrous or sometimes hairy, 1½–3 in. long cymes on stalks ½–2½ in. long fr. changing from pale lilac to verdigris color and finally bright blue or

sometimes finally whitish July, Aug., fr Sept., Oct. E Asia. B M 5682 (**as var.** *humulifolia*). Gt 1813. 765 Gn 10, p 451. Var. **élegans,** Koch (*A. tricolor,* Hort *A. Sieboldii,* Hort *Vitis heterophýlla* var. *variegàta,* Nichols.). Lvs smaller, blotched and striped with white; flushed pink when young, slow-growing and tenderer. Gn. 54, p. 5.—A handsomely colored form, adapted for planting in vases and baskets. Var **citrulloides,** Schneid (*A citrulloides,* Lebas) Lvs. deeply lobed with rather narrow sinuately lobed segms Var **amurénsis,** Planch (*A brevipedunculàta,* Koehne *Vitis brevipedunculàta,* Dipp.) Fig 191 Branchlets and petioles usually hairy lvs slightly 3-lobed, 2–4 in. long, lobes crenately serrate, hairy beneath, at least on the veins cymes rather dense fr. darker blue —The variety is a stronger grower than the type and strikingly beautiful in autumn with its variously colored berries, it is well adapted for covering low walls, rocks and trellises

AA *Lvs 3–5-parted or digitate, at least partly, with usually lobed segms.*

B. *Segms of the lvs pinnately lobed or only serrate; the lower lvs sometimes only lobed.*

5 **aconitifòlia,** Bunge (*A. dissécta,* Carr. *A. aconitifòlia* var *dissécta,* Koehne *A affinis* var. *dissécta,* Hort) Branchlets glabrous· lvs 5-parted, the segms. pinnately lobed with rather narrow-toothed or entire lobes, 2–3 in long, green beneath, glabrous or hairy on the veins. berries small, orange when fully ripe, sometimes bluish before ripening Summer, fr. in autumn. N China R H 1868, p 10, 1883, p 318 Gn 5, p. 523 G 1 396—Very handsome vine with finely divided foliage Var **palmiloba,** Rehd (*A palmìloba,* Carr *A tripartìta,* Carr *A rubricaùlis,* Schneid) Lvs usually 3-parted, the lower ones often only 3-lobed, segms often rather broad, coarsely toothed, rarely pinnatifid R H 1867, p 10 J H S 28:87 (form with rather narrow segms)

6 **Delavayàna,** Planch (*A heterophylla* var *Delavayàna,* Gagnep *Vitis Delavayàna,* Franch) Young growth hairy and usually purplish lvs cordate at the base, partly 3-lobed and partly 3-parted, 2–5 in long, segms. coarsely crenately toothed, dark green and nearly glabrous above, light green and pubescent beneath or sometimes glabrous, the middle segm elliptic-oblong, cuneate, the lateral ones very unequal cymes on peduncles 1 in. or less long fr dark blue or bluish black. Cent China J H S 28.102—A strong-growing vine, hardy.

BB. *Segms of the lvs pinnate, the pinnæ separate from the winged rachis*

7 **japónica,** Makino (*A serjaniæfòlia,* Bunge. *Vitis serjaniæfòlia,* Maxim *A napiformis,* Carr *A. tuberòsa,* Carr) Roots tuberous. plant glabrous lvs. 3–5-parted or digitate, chartaceous, shining and dark green above, the divisions pinnate, with winged rachis, the pinnæ separate from the wings. berry small, blue, punctate Japan, N China Gt 16 531 R H. 1870, p 17. Gn 6, p 365 I.T 5 176—Very handsome vine with its lustrous and dark green, finely cut foliage, but somewhat tender

AAA *Lvs bipinnate or pinnate, lfts distinctly stalked.*

B. *Lfts. usually ½–1 in. long, very coarsely toothed*

8 **arbòrea,** Koehne (*A bipinnàta,* Michx *Vitis bipinnàta,* Torr & Gray *Cissus stans,* Pers) Pepper Vine. St erect or somewhat climbing: lvs. bipinnate, 4–8 in long, pinnæ and lfts. on each segm usually 5; lfts broadly ovate or cuneate-obovate, coarsely toothed, ½–1½ in long, veins beneath and rachis usually hairy: berries dark purple Summer, fr in autumn Southern states, Mex. B B 2, p 2409—Handsome vine with bright green finely cut foliage, not hardy N.

BB. *Lfts. usually 2–4 in. long, crenate-serrate*

9 **megalophýlla,** Diels & Gilg. (*Vitis megalophýlla,* Veitch). Climbing to 30 ft, glabrous. lvs long-petioled, 6–15 in or sometimes longer, the larger ones bipinnate; the lower pinnæ with 3-9 lfts, the lowest pair often 3-lvd.; lfts petioled, ovate or ovate-oblong, 2–5 in long, rounded or subcordate at the base, membranous, remotely serrate, pale or glaucescent beneath, veins nearly straight, ending in the teeth fr bluish black, in loose cymes W China J H S 28·16, 86, 97. Gn 65, p 45—Strong-growing vine, hardier and larger in every part than the following

10 **cantoniénsis,** Planch (*Vitis cantoniénsis,* Seem). Lvs long-petioled, similar to the preceding species but smaller, lfts 1–3 in long, cuneate or rounded at the base, sometimes nearly sessile, chartaceous, remotely and often indistinctly crenate-serrate, veins arching: fr violet or pale violet S China to Malay Penins

A Davidiana, Mott =Vitis Piasezkii—*A dumetòrum,* Hort = Parthenocissus vitacea—*A Engelmánnii,* Hort =Parthenocissus quinquefolia var Engelmannii—*A Graebneri,* Bolle=Parthenocissus quinquefolia var hirsuta—*A hederàcea,* DC =Parthenocissus quinquefolia—*A Henryana,* Hort =Parthenocissus Henryana—*A heptaphylla,* Buckl =Parthenocissus heptaphylla—*A himalayana,* Royle=Parthenocissus humalayana—*A hirsùta,* Don =Parthenocissus quinquefolia var hirsuta—*A Höggii,* Hort =Parthenocissus tricuspidata—*A inconstans,* Hort =Parthenocissus tricuspidata—*A japonica,* Hort =Parthenocissus tricuspidata—*A. lecoides,* Planch (Vitis lecoides, Maxim) Allied to A megalophylla Lvs usually pinnate, sometimes the lower lfts 4-leaved, lfts 5–7, ovate-oblong, 2–4½ in long, rounded or broadly cuneate at the base, remotely serrate S Japan Tender J H S 28 95, 96—*A Lòwii,* Hort =Parthenocissus tricuspidata var Lowii—*A macrophylla,* Hort =Parthenocissus vitacea var macrophylla—*A muralis,* Hort =Parthenocissus quinquefolia var murorum—*A orientalis* Planch (Vitis orientalis, Boiss) Allied and very similar to A arborea petioles longer, lvs ovate-elliptic, quite glabrous petals and stamens 4 Orient G C 1871 1015—4 *pubéscens,* Schlecht =Parthenocissus quinquefolia var hirsuta—4 *quinquefòlia,* Michx = Parthenocissus quinquefolia—4 *radicantissima,* Schelle =Parthenocissus quinquefolia var murorum—*A radicantissima,* Hort =Parthenocissus quinquefolia var hirsuta—4 *Röyleı,* Hort =Parthenocissus quinquefolia var murorum and P tricuspidata—*A St Paùli,* Hort =Parthenocissus quinquefolia var. St Paulii—4 *sempertirens,* Hort =Cissus striata—*A Thòmsonii,* Hort =Parthenocissus Thomsonii—4 *tricuspidata* and 4 *Veitchii,* Hort =Parthenocissus tricuspidata—4 *virginiana,* Hort =Parthenocissus quinquefolia

ALFRED REHDER

AMPELOPOVÎTIS: *Vitis*

AMPHICARPÆA (Greek, alluding to the two kinds of pods) Spelled also *Amphicarpa Leguminòsæ* Hog Peanut A genus of 6–8 species of herbaceous perennial vines of E N Amer and India, considered by some to contain also the species now credited to Falcata. Fls of 2 kinds, the upper axillary, racemose and showy, the lower apetalous, fertile, and borne in the lower axils —Not in the American trade and cult only in botanic gardens The only common species are *A. monòica,* Ell (*Falcàta comòsa,* Auct), and *A Pitcheri,* Torr & Gray Both are pubescent or glabrate vines, with trifoliolate lvs, white or purplish fls, and rather conspicuous pods.—Of little value horticulturally

N TAYLOR

AMPHÍCOME (*amphi,* both, and *kome,* hair, the seeds having a tuft of hair at both ends) *Bignoniàceæ.* Greenhouse herbaceous rockery plants from the Himalayas, with large, rosy, funnel-shaped, 5-lobed fls. which are axillary or terminal lvs alternate, unequally pinnate —Species 2

argùta, Royle Height 3 ft lvs. radical, the lfts in 3–4 pairs, sessile, lanceolate, acuminate, deeply serrate: fls in terminal racemes, fewer than in the next; corolla-tube rose-colored, trumpet-shaped; calyx-lobes long, awl-shaped P M 6.79.—Intro by Montarioso Nurseries

A Emòdi, Royle Height 1½–3 ft lfts in 5–7 pairs, cordate-ovate, obtuse, shortly petiolulate, margin crenate-lobate fls at first corymbose, corolla-tube and throat orange, calyx-lobes short, thick, fleshy B M 4890 Gn 8, p 25, 38, p 458 F S 11; 1109

N. TAYLOR †

AMPHIRÀPHIS: *Microglossa*

AMSÒNIA, (named for Charles Amson, colonial physician in eighteenth century) Called also *Ansonia. Apocynàceæ* Plants sold for border planting, mostly among shrubbery, but little known in cultivation

Tough-barked perennial herbs with alternate narrow lvs and terminal panicles of blue or bluish narrow-limbed small fls in May and June, the inside of the corolla-tube bearing reflexed hairs and also the 5 stamens fr two long and slender many-seeded follicles — About a dozen species in E U S and E Asia Prop. mostly by dividing the clumps, also by seeds, and by cuttings in summer

Tabernæmontàna, Walt. (*A salicifòlia,* Pursh *A Amsònia,* Brit *Tabernæmontàna Amsònia,* Linn) Glabrous or nearly so, 2–3 ft . lvs. willow-like, ovate to lanceolate, acuminate, alternate, short-petioled fls. many, with lanceolate spreading lobes, succeeded by slender, milkweed-like follicles or pods 2–3 in long. Holds its foliage late Pa to Fla and Texas B M 1873. L B C 6 592 B R. 151 (as *A latifolia*)

angustifòlia, Michx Villous when young, the st 1–3 ft lvs linear to lance-linear, an inch or two long, much crowded, margins becoming revolute: corolla-lobes ovate-oblong to linear-oblong Dryland, N C, to Texas. L. H B.

AMYGDALÓPSIS: *Prunus*

AMÝGDALUS (Greek-made name, referring to the furrowed pit) *Rosàceæ* A name given to the peaches, apricots and their kin, but here treated as a section of the genus *Prunus,* which see

ÁMYRIS (etymologically allied to *myrrh,* in allusion to the odor) *Rutàceæ* Torch-wood Some 10 species of shrubs and trees ranging from the S U S to Cent Amer and W Indies, a few of which have been mentioned as evergreen cult plants in hothouses Lvs alternate, compound but lfts sometimes reduced to 1 as in some other rutaceous plants fls white, in axillary or terminal spikes, sepals and petals 4, stamens 8 fr an ovoid or globose drupe, with a single stone — Apparently none of the species is in cult in this country, although *A balsamífera,* Linn , of S Fla and the W Indies, *A Plumièri,* DC , of the W Indies, and *A brazilénsis* (properly *Pròtium brazilénse,* of the Burseraceæ) may occur

ANACÁMPSEROS (Greek-made name, of no significance here) *Portulacàceæ* Love-Plant Succulent herbs, of a dozen species, from the Cape of Good Hope, but not grown in this country except in botanic gardens They are greenhouse plants, with ovate fleshy lvs . fls racemose, expanding in the sun, petals 5, fugacious, sepals 5, oblong Prop by seeds or by cuttings of sts or lvs The commonest species is *A arachnoides,* Sims, a peculiar, cobwebbed, green-lvd succulent, with simple racemes of white fls. B M 1368.

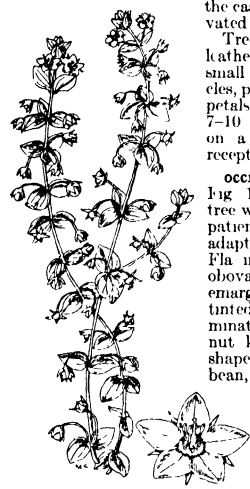


192 Anacardium occidentale (×⅓)

A Bórderi, Hort , "is a Pyrenean alpine plant of easy culture in border or rockery, purple fls , late-blooming " The name is apparently unknown in botanical literature

N Taylor.†

ANACÁRDIUM (name refers to the heart-shaped character of the nut) *Anacardiàceæ* Eight species native to the American tropics, of which one (yielding the cashew nut) is widely cultivated in tropical countries



193 Anagallis arvensis (×¼)

Trees and shrubs with leathery alternate lvs fls. small and numerous in panicles, polygamous, calyx 5-cleft; petals 5, very narrow, stamens 7–10 fr kidney-shaped, borne on a greatly enlarged hard receptacle.

occidentàle, Linn Cashew Fig 192 A large, spreading tree with milky juice, very impatient of frost, and therefore adaptable only to extreme S Fla in the U S : lvs oval or obovate, rounded, or even emarginate at the top· fls rosy-tinted, fragrant, in clusters terminating the young branches nut kidney-shaped or heart-shaped, the size of a large bean, the kernel edible This nut (about 1 in long) is borne on a fleshy receptacle (the cashew apple, Fig 33) which is about 3 in high when mature, white to yellow and red, and is sweetish-sour and edible Gn 11, p 211 — A vinous liquor is made from the apple The kernel of the nut yields oil, and is edible when roasted, the shell of the nut is exceedingly acrid, even the fumes from the roasting being highly irritant The tree yields a gum which is the basis of a varnish, being used to protect books and woodwork from the ravages of white ants and other insects The tree grows 20–40 ft high Sometimes grown under glass in collections of economic plants, prop then by cuttings of mature wood with lvs retained L H B

ANAGÁLLIS (Greek, *delighting*) *Primulàceæ* Pimpernel Low annual, biennial or perennial herbs cultivated in the open for their numerous bright-colored blossoms

Stems mostly angular, bearing opposite alternate or 3-whorled entire lvs fls axillary, mostly solitary, usually not longer than the lvs , in shades of red, blue or white, the corolla rotate or rotate-bell-shaped and with lobes obovate or linear which are either entire or toothed, stamens 5, attached in the base of the corolla, the filaments usually bearded fr a globose caps , circumscissile —Two dozen species of interesting little plants mostly with trailing or procumbent sts , in many parts of the world Pax and Knuth, Engler's Pflanzenreich, hft 22 321–334.

The pimpernels are of simple culture They thrive in a warm soil, the seeds of the annual species being planted where the plants are to grow The perennial kinds are increased by division, or by cuttings of young growths started under glass All of them are free-flowering and attractive minor plants The many forms in gardens are probably all referable to two species

A *Lvs ovate*

arvénsis, Linn. (*A pulchélla,* Salisb. *A orientàlis,* Hort *A Monélli,* Bieb , not Linn) Common Pimpernel, or Poor Man's Weatherglass (fls close at approach of bad weather) Fig 193 Annual sts procumbent or ascending, the branches becoming long, slightly winged. lvs opposite or in 3's, sessile fls scarlet varying to white, the lobes broadly obovate and

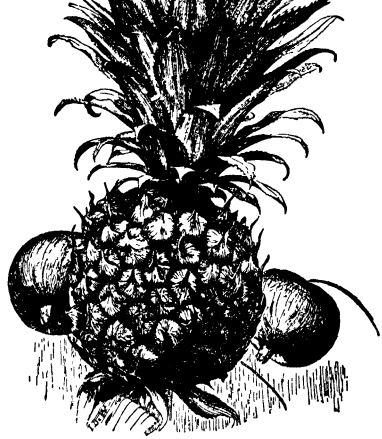
obtuse and the edges finely toothed Eu, Asia, and sparingly run wild in N Amer Var **phœnícea,** Gren & Godr. Fls red, corolla-lobes mostly glandular-ciliate at top. Var **cærùlea,** Gren. & Godr (*A. cærùlea,* Schreb. *A. verticillàta,* All.). Fls blue, lobes not glandular and slightly ciliate. Var. **latifòlia,** Lange (*A. latifòlia,* Lnn.). Fls blue. lvs very broad plant stout. B.M. 2389

AA. *Lvs linear or linear-lanceolate (except perhaps in var Monellii)*

linifòlia, Linn. (*A. angustifòlia,* Salisb. *A. fruticòsa,* Vent *A grandiflòra,* Andr *A Philipsii,* Hort.). Perennial or biennial sts woody at base, 1–1½ ft lvs. opposite or verticillate, sessile, acute, margin often revolute· fls blue, reddish underneath, the lobes obovate, obtuse and entire W Medit region B M 831. Var **Monéllii,** Knuth (*A Monéllii,* Linn, not Bieb. *A Willmoreàna,* Don) Lvs often in 3's, somewhat broader (even to ovate or oblong) corolla longer Var **collìna,** Ball (*A collìna,* Schousb.) Large, sts thick fls rose-colored or purplish (not blue) Var **microphýlla,** Ball. Many-std, branches ascending lvs. small, lanceolate. fls blue, reddish beneath

L H B

ANÀNAS (modified from aboriginal S Amer name) Written also *Ananassa Bromeliàceæ* Stove herbs, allied to the billbergias, and demanding the same general treatment As ornamental subjects, grown mostly for the rosette of rigid lvs and the strange, often colored head of fleshy fls, which are 6-cleft, with 6 stamens and 1 style The ripe head is composed of the thickened rachis, in which the fleshy berry is imbedded, and the fleshy persistent bracts, in the pineapple, the fls are abortive Prop. by the leafy crown or topknot, by



194 Ananas sativus (pineapple).

strong suckers, or by small offsets from the base· these are treated as cuttings, being rooted in sand with bottom heat, or in the S set directly in the field Monogr. by Mez, DC., Monogr Phaner 9.

sativus, Schult. f PINEAPPLE, which see for field culture Fig. 194. Plant producing a single shaft 2–4 ft. high, and when 12–20 mos old bearing a head, or pineapple, on the top of which is a rosette of stiff lvs lvs. long and sword-shaped, stiff, more or less rough-edged The same stalk does not bear a second time, but a new shoot may arise from the same root and bear fruit. Better results are usually secured by severing the sucker or crown, and growing a new plant. American



195. Ananas sativus var variegatus (×⅛)

tropics B M 1551 (as *Bromelia Ananas*) B R 1081 (as *A bracteata*) —There is a common cult form (var *variegàtus* or *stratifòlius*), Fig 195, with striped lvs Gn. 51, p 57 *A Porteànus,* Koch, is a form of *A sativus,* with olive-green, sharp-spined lvs with a yellow central band G W 5, p 51 *A cochin-chinénsis,* Hort., is another form (intro by Pitcher & Manda, 1891)

A bracteatus, Schult f., is a showy species with red heads, all the bracts being elongated, spiny and prominent Brazil B M 5025 Regarded by Mez as a form of *A sativus* —1 *macrodontes,* Morr., like a bromelia, has large toothed bracts Brazil —1 *Moritzìanus,* Hort., a form of *A sativus* probably, has variegated spineless lvs.

L H B

ANÁPHALIS (Greek name of a similar plant) *Compósitæ* EVERLASTING Hardy border plant, useful for immortelles A genus of 30 species, much like Antennaria, but differs in the pappus-bristles of the staminate fls not being thickened (these are thickened upwards in that genus) and the st leafy

margarìtàcea, Benth & Hook A foot or two high, with many corymbose heads, white lvs sessile, linear-lanceolate, long-pointed involucre pearly white, hence the value of the plant as an everlasting N Amer. and Asia —The plant from Asia, with yellow fls, is perhaps better referred to *A cinnamòmea,* Clarke, but is hardly separable from the type. It is offered as a yellow everlasting

N. TAYLOR.†

ANARRHÌNUM (*snoutless*). *Scrophulariàceæ.* A dozen biennials and perennials of S Eu and N Afr. Allied to Antirrhinum, but not cult in this country, except in botanic gardens Fls small, in interrupted spike-like racemes, white or blue Easily grown in ordinary garden soil, but not certainly hardy north of New York Known also as *Simbulata*

ANASTÁTICA: *Resurrection Plant*

ANCHÙSA (*anchousa,* a paint for the skin) *Boragìnàceæ* ALKANET Hardy annual, biennial or perennial plants, with blue or purple fls in paniculed scorpioid racemes or sometimes in headlike clusters, the corolla trumpet-shaped and the throat closed by scales lvs. alternate, usually hairy —Of easy cult in sunny position except *A italica* var "Dropmore," which is best suited in partial shade. Prop by seed generally, but old perennials may be root-divided in spring

A. *Fls. small, like forget-me-nots.*

Barrelièri, Vilm. Perennial: height 2 ft : lvs ovate-lanceolate, smaller and shorter than in *A italica:* **fls.**

blue, with a white tube and pink or yellow throat. May. Eu and Asia Minor. B M. 2349 —Valued for its earliness and for cut-fls. The least common of the 3 species

officinàlis, Linn. Biennial or perennial, 1–2 ft.: lvs. lanceolate, hairy, radical ones clustered· fls opening in pairs, bright blue or purple, in loose, one-sided spikes June–Oct Eu —Effective in masses and of easy cult. The common alkanet

capénsis, Thunb. Biennial. height 1½ ft . lvs. narrowly lanceolate and less hispid than in *A italica.* fls red-margined, with a white throat; buds red, calyx inflated after the fl. has withered, divisions short-obtuse June–Sept Cape of Good Hope. B.M 1822 — Fine for cut-fls Often winterkilled, but seeds itself freely, north of Boston best treated as a coolhouse plant. Var. **álba,** Hort., has white fls.

AA *Fls large*

itálica, Retz Perennial height 3–5 ft.· lvs. largest of the 3 species here contrasted, ovate-lanceolate, rough, shining; radical ones sometimes 2 ft long fls bright blue Medit B M 2197 L B C 14·1383 — If not allowed to go to seed, will bloom continuously from June to Sept Commonest and perhaps best species Var **Dróp more.** Fig 196 Three ft fls purple, in loose heads Best suited to partial shade Var **supérba,** Hort , has very dark blue fls

A Agárdhii, Lehm Lvs linear Siberia Rare —*A myosotidiflòra,* Lehm Lvs large , radical ones long-petiolate, cordate-reniform, cauline ones sessile, oval Siberia, Caucasus —4 *ochroleuca,* Bieb Perennial 2 ft fls yellowish white lvs minutely strigose, lanceolate, ciliate July, Aug —4 *sempervirens,* Linn Lvs broadly ovate, lower ones petiolate racemes short, generally bracted at the base Eu Esteemed in France N TAYLOR †

ÁNDA. *Joannesia*

ÁNDIRA (Brazilian name) *Leguminòsæ* ANGELEEN TREE Hothouse trees

Trees, with conspicuous fls in racemes· calyx 5-toothed or entire, keel petals distinct, ovary stalked fr a roundish 1-seeded pod —Nearly 30 species of Tropical American and African

Two or three species are sometimes cultivated in hothouses in the Old World and in American botanic gardens They must be grown in rich loam and peat in the warmhouse Propagation is by cuttings of ripened wood in sand under bell-jar, with bottom heat

inérmis, HBK CABBAGE TREE A tree 20–35 ft · lvs impari-pinnate, with 13–15 ovate-lanceolate and acute lfts fls in terminal panicles, purple, on short pedicels W. Indies and Brazil. N. TAYLOR.

ANDRÁCHNE (ancient Greek name). *Euphorbiàceæ* Low shrubs with bright green foliage, of little ornamental value; sometimes grown in botanical collections.

Shrubs or perennials lvs alternate, usually entire· fls small, monœcious or incompletely dioecious, axillary, 5–6-merous; staminate in clusters, with petals smaller than the sepals, stamens with free filaments, not exceeding the sepals, pistillate usually solitary, with very small petals, sometimes wanting, ovary 3-celled with 3 distinct, 2-cleft or 2-parted styles· fr a subglobose or depressed caps , separating into 3 2-valved carpels, 6-seeded —Ten or 12 species in N. Amer , Peru, Asia, N. and S. Afr , Malay Archipelago

These are low deciduous shrubs similar to Securinega, but smaller, with small bright green leaves, slender-stalked whitish inconspicuous flowers in axillary clusters or solitary, appearing during the summer followed by small greenish brown capsular fruits. There are three species in cultivation, of which two, *A. phyllanthoides* and *A colchica,* have proved hardy at the Arnold Arboretum; they may be used in borders of shrubberies They seem to grow in any soil, if it is well-drained, and prefer sunny positions

Propagation is by seeds, which are usually freely produced, and also by greenwood cuttings under glass. None of the species is in the trade

A cólchica, Fisch & Mey Shrub, to 2 ft , usually lower, glaucescent, glabrous lvs ovate, obtuse, ½–½in long petals 5, filiform, as long as the glands of the disk, much shorter than the calyx caps. depressed-globose, ⅓in thick Asia Minor —*A cordifòlia,* Muell. Arg Shrub, to 3 ft lvs ovate to oblong, rarely cordate at base, obtuse, 1–2 in long, soft pubescent beneath petals spathulate, disk-glands membranous caps depressed-globose, ¼in thick E India —*A fruticòsa,* Linn A greenhouse shrub from S China with ovate or broadly ovate, short-stalked lvs , 1–1¾ in long, and small greenish white, short-stalked fls , staminate as well as pistillate in axillary clusters of 3–6, is now referred to Breynia as B fruticosa, Benth It is probably no longer in cult B M 1862 and L B C 8 731 (as Phyllanthus turbinata) —4 *phyllanthoides,* Muell Arg (A Roemeriana, Muell Arg) Shrub, to 3 ft with slender glabrous branches lvs oval to obovate, obtuse, ½–1 in long, glabrous or slightly pubescent beneath, petals little shorter than the sepals, obovate, dentate near the apex, disk-glands thick· caps depressed-globose, about ½in thick Mo to Ark and Texas

ALFRED REHDER

ANDROCÝMBIUM (name referring to arrangement of stamens around a cavity) *Liliàceæ* A dozen or more species of bulbous plants growing from the



196 **Anchusa itálica, Dropmore variety** (×⅛)

Medit region to S Afr , one or two of which may be expected in choice greenhouse collections Bulbs tunicated sts subterranean, from which arise a few narrow lvs fls few, in short spikes and subtended by showy bracts in spring or summer **A. melanthoides,** Willd , of S and Cent Afr , recently intro., has bulb like minute tulip lvs 2–4, from 3–9 in. long fls small, borne in clusters in axils of large bracts which reach 3 in long and some of which are white, green-veined. G C III 45 315, desc **A. leucánthum,** Willd. (*A punctàtum,* Baker, in part), of S Afr , has few whitish fls, in dense umbel and 4 spreading lvs.

ANDRÓMEDA (Greek mythological name). *Ericàceæ.* Ornamental low plants grown for their evergreen foliage and for their flowers

Evergreen shrubs lvs short-petioled, narrow, entire fls in terminal umbels, pedicelled, calyx small, 5-toothed; corolla urceolate with 5 short recurved lobes, stamens 10 with aristate anthers opening with pores caps. dehiscent into 5 valves; seeds numerous, small —Two species through the northern hemisphere

The andromedas are low evergreen shrubs with small and narrow foliage and small pinkish flowers in terminal umbels They are perfectly hardy North and suited for borders of evergreen shrubberies and for rockeries and grow best in peaty or sandy and moist soil and in half-shady positions

Propagation is by seeds, sown thinly soon after maturity, in pots or pans of sandy peat soil, placed in a cool frame They germinate easily if sown in cut sphagnum, but must be pricked into boxes as soon as they can be handled. Cuttings from mature wood, placed in sand under glass in fall, and kept in a cool greenhouse during the winter, will root easily, also increased by layers. See, also, *Leucothoe*, *Chamædaphne*, *Pieris* and *Zenobia*.

polifòlia, Linn. (*A. rosmarinifòlia*, Pursh). Fig. 197. One-half to 2 ft.: branchlets usually not glaucous. lvs. narrow-oblong to linear, ¾–1½ in long, whitish-glaucous beneath, but not tomentose, later sometimes green, revolute at the margin fls nodding on slender pedicels, 2–4 times as long as the globose-urceolate corolla: caps brownish, ob-ovoid or subglobose, as high as broad. June. N. Eu., N. Asia, rare in the colder regions of N Amer L B C 18. 1714 G W 12. p 50 (habit) —Varies with narrower and broader lvs On account of its slender-stalked fls, more graceful than the following species



197 Andromeda polifolia. (×¾)

glaucophýlla, Link. Similar to the preceding, but young branchlets glaucous· lvs white beneath, with a fine tomentum fls. on curved thick pedicels, rarely twice as long as the urceolate corolla caps depressed, glaucous June. N E Amer., south to Minn and Pa. L B C 6 546; 16·1591; 18:1725 —Varies like the preceding species with broader and narrower lvs

A acuminata, Ait =Leucothoë populifolia —*A arbòrea*, Linn =Oxydendrum arboreum —*A axillàris*, Michx =Leucothoë Catesbæi —*A axillaris*, Lam =L axillaris —*A calyculàta*, Linn =Chamædaphne calyculata —*A campanulàta*, Miq =Enkianthus campanulatus —*A cándida*, Hort =Zenobia pulverulenta —*A cassinæfòlia*, Vent =Z pulverulenta —*A Catesbæi*, Walt =Leucothoë Catesbæi —*A cérnua*, Miq =Enkianthus cernuus —*A dealbàta*, Lindl =Zenobia pulverulenta —*A fastigiàta*, Wall =Cassiope fastigiata —*A ferruginea*, Walt =Lyonia ferruginea —*A floribunda*, Pursh=Pieris floribunda —*A formòsa*, Walt =Pieris formosa —*A glaùca*, Hort =Zenobia pulverulenta —*A japónica*, Thunb = Pieris japonica —*A ligustrina*, Muhl =Lyonia ligustrina —*A mariàna*, Linn =Pieris mariana —*A nítida*, Bartr =Pieris nitida —*A ovalifòlia*, Wall =Pieris ovalifolia —*A paniculàta*, Ait = Lyonia ligustrina —*A parabólica*, Duham =L ligustrina —*A populifòlia*, Lam =Leucothoë populifolia —*A pulverulénta*, Bartr = Zenobia pulverulenta —*A racemòsa*, Linn =Leucothoë racemosa. —*A speciòsa*, Michx =Zenobia pulverulenta.—*A tetrágona*, Linn. =Cassiope tetragona —*A tomentòsa*, Hort., not Dum -Cours = Lyonia ligustrina pubescens

ALFRED REHDER.

ANDROPÒGON (Greek, *aner*, man, and *pogon*, beard, referring to the silky hairs on the spikelets of some species) *Graminex* BEARD-GRASS. Annual or mostly perennial grasses of various habit but usually with coarse foliage, scarcely horticultural.

Spikelets in pairs at each joint of an articulate rachis, one sessile, perfect, 1-fld ; the other pedicelled, staminate, neutral or reduced to a pedicel; glumes of fertile spikelet equal, indurated, the first dorsally compressed, the second keeled; sterile and fertile lemmas hyaline, the latter usually awned; palea minute or wanting rachis usually hairy, often conspicuously so —A large genus of probably 200 species, widely distributed in both hemispheres except in the colder regions. Includes several important native forage grasses such as blue-stem or blue-joint (*A furcatus*, Muhl) with about 3 digitate spikes at the summit of the tall culm; and little blue-stem (*A scoparius*, Michx), with single spikes scattered along the branches, both species of the prairie region. Broom sedge (*A virginicus*, Linn), a common grass of the Atlantic states, is considered troublesome, though it has some forage value before it flowers Some of the species, such as silver beard-grass (*A argenteus*, DC), are ornamental on account of the silvery panicles. This is a stout grass, 2–4 ft , with bearded nodes and long-stalked oval panicles consisting of numerous woolly ascending or appressed spikes

Several species of oil-producing grasses formerly included in Andropogon are now referred to other genera. *A. Nárdus*, Linn =Cymbopogon Nardus, Rendle *A citràtus*, DC =Cymbopogon citratus, DC. *A. Schoenánthus*, Linn =Cymbopogon Schoenanthus, Spreng *A squarròsus*, Linn =Vetiveria zizanioides, Nash.

For a discussion of the sorghums and Johnson-grass referred by some authors to Andropogon, see *Holcus*, also Vol II, Cyclo Amer Agric A S HITCHCOCK.

ANDRÓSACE (old Greek name of no significance here) *Primulàcex* ROCK JASMINE Small tufted plants grown in the alpine garden

Root-lvs. clustered scapes mostly not exceeding 8 in high, often very short fls mostly pink, red and purplish, sometimes white, primula-like but constricted at the throat, umbellate or solitary, in early spring —Over 80 species in Eu., Asia, N Amer and Pacific Isls. Pax and Knuth, Engler's Pflanzenreich, hft 22.172–220

Many species of rock jasmine are known in European gardens, and they are much prized by fanciers in alpine-gardening. The tufted leaves sit close to the rocks. Some of them are woolly-leaved Only currently catalogued species are included in the present account. A well-drained soil, partial shade, free circulation of air, frequent waterings in dry summer months, and protection from heavy fall and spring rains, will lead to success with these charming alpines A heavy shading of evergreen boughs in winter will be found of great benefit Close covering is not to be recommended, because it smothers the plants Very many species have been tried in this country, with variable and not very encouraging results, but in a few instances, with extra care, plants have done well The northern aspect of a steep rockery seems to be the most favorable position for them Propagation is by division, seeds or cuttings Plants should be kept in pots until thoroughly established. The species are biennial or perennial except in group AAA below. Many of them are densely cespitose.

INDEX.

Aizoon, 6
angustifolia, 12.
arachnoidea, 7.
brigantiaca, 9.
Bulleyana, 6.
carnea, 9
Chumbyi, 3
chumbyiense, 3
coccinea, 6
coronopifolia, 12
eximea, 10
foliosa, 4
Halleri, 9
hedræantha, 8
Henryi, 1
imbricata, 11
Jacquemontii, 7.
lactea, 10
lactiflora, 12
Laggeri, 9
lanuginosa, 2.
odoratissima, 7.
pauciflora, 10.
Reverchonii, 9.
robusta, 7.
rosea, 9
sarmentosa, 3, 4.
spinulifera, 5.
villosa, 7.

A. *Lvs. long-petioled, large, orbicular-reniform or cordate, lobed or crenate.*

1 **Hénryi,** Oliver Scape 3–9 in., woolly, 12–25-fld.: lvs to 2½ in across, orbicular-reniform, lobed and toothed fls white China

AA. *Lvs sessile or nearly so, spatulate or linear, nearly or completely entire.*

B *Fls in umbels or umbellate heads.*

C *Plant stout scape 4 in or more high.*

D *Foliage woolly or villous.*

2 **lanuginòsa,** Wall Whole plant densely white-villous sts leafy lvs small, ¾in or less long, lance-ovate, acute scapes axillary, about 4 in , fls rose-colored, in a dense umbel Himalaya B M 4005.

3 **sarmentòsa,** Wall Creeping by brownish stolons: lvs clustered, all basal, more or less woolly, lanceolate or ovate-lanceolate, acute, 1½ in or less long, scapes often 4 in long, fls many, rose-colored Himalaya Var **Chúmbyi,** Hort (*A chumyénse,* Hort.) Rosettes dense, and the plant very cespitose lvs densely woolly

DD *Foliage bristly*

E *The lvs not in rosettes, crowded at base of st , narrowed into petiole*

4 **foliòsa,** Duby (*A sarmentòsa* var *foliòsa,* Hook. f) Stolons thick, brownish, naked lvs. all basal, obovate or ovate, sessile but base attenuated, mucronate or acute, ciliate, 1½ in or less long scape pilose, much exceeding lvs , fls flesh-colored becoming whitish. Himalaya B M. 6661

EE *The lvs in rosettes, long-petioled, usually cordate*

5 **spinulífera,** Knuth Not stoloniferous, densely hairy lvs linear-obovate, 3 in. or less long with petiole, spinulose at apex scape 10 in or less, fls numerous, densely capitate, purple China.

6 **Aizòon,** Franch Lvs 1 in or less, rosulate and imbricated, leathery and glaucous, spatulate, not spinulose scape 1 ft or less, many times exceeding the lvs , the bracts glandular, fls 6-10, flesh-colored or red. Himalaya Var **coccínea,** Franch (*A Bulleyàna,* Hort) Not glandular fls red or intense scarlet.

CC *Plant slender scape seldom 4 in high· lvs. all rosulate (in rosettes)*

D *The lvs with hairy margins.*

7. **villòsa,** Linn (*A odoratíssima,* Schreb) Entire plant densely white-hairy, loosely cespitose lvs linear-lanceolate or lance-ovate, sessile, entire scape 2 in or less, fls white or rose with yellow-red throat, corolla equaling the calyx-lobes, the corolla-lobes obovate, entire or slightly emarginate Eurasia Very variable Var **arachnoídea,** Knuth (*A arachnoídea,* Schott). More cespitose lvs oblong-ovate, densely webby-white scape very short Var **robústa,** Knuth Plant robust lvs lance-ovate, often densely congested, white-silky. Var **Jacquemóntii,** Knuth (*A Jacquemóntii,* Duby) Lvs crowded, imbricated, ovate, obtuse, the hairs white to brown scape long, fls flesh-colored, the corolla-lobes obtuse and entire

DD *The lvs glabrous, or only obscurely ciliate.*

8 **hedræántha,** Griseb Cespitose lvs ½in or less long, lance-oblong, obtuse, leathery, not crowded at base of st scape very short (about 1 in); fls 5–10 in each umbel or head, violet-red or pale purple, the corolla-lobes obovate Balkans

9 **cárnea,** Linn (*A Reverchònii,* Jord *A. rósea,* Jord & Fourr) More or less densely cespitose· lvs. linear or subulate, ¾in or less long scape 3 in or less, fls. 3–7, rose-colored or whitish, the throat yellow. Eurasia. L.B C. I 40 Var **Hálleri,** Linn Lvs twice longer than in type, recurved at apex, shining green, sparsely hairy. Var **Lággeri,** Knuth (*A Lággeri,* Huet) Lvs. acuminate, spreading, deep green· scape very short: densely cespitose. Gn 63, p. 333 Var. **brigantíaca,** Knuth (*A. brigantíaca,* Jord. & Fourr). Lvs. narrowly linear, short, slightly denticulate at apex· scape to 5 in · little cespitose

10 **láctea,** Linn (*A. pauciflóra,* Vill.). Cespitose, glabrous or nearly so: lvs rosulate, membranous, linear or linear-lanceolate, obtusish, sparsely ciliate, 1 in or less long, scape 5 in or less, fls snow-white Eurasia. B M 868, 981 Var **exímia,** Hook. Lvs less rigid, strongly recurved. fls larger (½in across). Switz. B M. 5906 (as *A carnea* var *exímia*).

BB *Fls solitary.*

11. **imbricàta,** Lam Cespitose, stellate-pubescent: lvs ½in long, linear-spatulate and obtuse, in densely superimposed imbricated rosettes Alps

AAA *Lvs. scarcely petioled, oblong or linear, entire or dentate fls umbellate annual.*

12 **lactiflóra,** Pall (*A. angustifólia,* Andr. *A. coronopifólia,* Andr) Glabrous, 1 ft or less high lvs. 2 in or less long, rosulate, linear-lanceolate or linear-spatulate, acute, toothed. fls milk-white, large Asia.—A handsome little annual, often self-seeding.

A Vitaliana, Lapeyr , listed as the only yellow-fld Androsace, is Douglasia Vitaliana. It is often catalogued as Aretia Vitaliana.

L H. B.

ANDRÓSÆMUM: *Hypericum*

ANDROSTÈPHIUM (Greek-made name, referring to the corona) *Liliàceæ* BABIES' BREATH. Outdoor bulbous plants, allied to the brodiæas

Small genus of S W and Cent U S , with funnel-shaped, spreading-limbed, 6-lobed perianth, 6 stamens, and 3-angled ovary, and a corona or crown at the mouth lvs linear, radical scape simple, leafless —Plant in a sunny place in sandy soil, placing the bulbs 4-6 in deep; protect in winter Prop by division of the bulbs and by seeds The name "babies' breath" or "baby's breath" is commonly applied to Gypsophila

violàceum, Torr (*A cæruleum,* Greene) Slender, 6–10 in.: umbel 2–7-fld , the fls. blue, 1 in long, supported on a stout (¾in) pedicel, crown exceeding the anthers.—Blooms in spring, pretty. N. TAYLOR †

ANEILÈMA (Greek, *no involucre*). Syn , *Aphylax. Commelinàceæ* Sixty tropical perennials, allied to Commelina, from which it may be distinguished by its sub-paniculate infl *A biflórum,* R Br , and *A sinicum,* Lindl , are sometimes cult in Old World hothouses and in American botanic gardens These species are blue-fld , diffuse or trailing plants with their fls having no involucral bracts. Culture as in Dichorisandra.

N. TAYLOR †

ANÈMIA (Greek, *naked,* without indusia). *Schizæàceæ* Tropical ferns, with 1–3 pinnate lvs with the lower pair of pinnæ erect, elongate and bearing the sporangia in panicles at their extremities —Of the 40 species, 2 are found in the southern states, and a few are occasionally in cult

Anemias are dwarf, compact ferns, suited for shelves, or for growing near the glass in warm pits or low houses They prefer being grown in small pots to being planted out in the fernery Their growth is too slow to make them popular decorative ferns for general purposes Propagation is by spores, which germinate freely, tufted kinds by division between March 15 and April 30 —Schneider, Book of Choice Ferns.

A *Lf 2–3-pinnate, with narrow divisions*

adiantifòlia, Swartz Lf.-blade 6–9 in long on a stalk often twice as long, the ultimate divisions oblong or linear-cuneate, with the outer margin toothed. S. Fla and tropics

AA *Lf only once pinnate with broad pinnæ.*

B *Veins free.*

mexicàna, Klotzsch Lf.-blade 6–9 in long, with 4–6 pinnæ on either side, which are distinctly stalked, ovate-lanceolate and rounded on both sides at the base fertile pinnæ 3–4 in long, dense. Texas and Mex.

collina, Raddi. Lvs. 1 ft. high, stalks hairy, blades with about 10 lfts. on each side, which are rounded at the outer ends and truncate at the upper side at the base fertile pinnæ about 1½ in long, dense Brazil. S. 1.384.



198. Anemone patens var. Nuttaliana (×⅓)

BB. *Veins anastomosing (netted)*

Phyllítidis, Swartz (*A. lanceolàta,* Lodd *A longifòlia,* Link *Anemidictyon Phyllitidis,* Willd.) Lf-blade 4–12 in long, with 4–12 pairs of sessile pinnæ, with a crenulate margin and a rounded or unequal base; veins forming long, narrow areolæ fertile pinnæ 3–9 in long, dense Cuba and Mex. to Brazil S 1 390

L M Underwood.
R. C. Benedict †

ANEMIDÍCTYON: *Anemia.*

ANEMÒNE (Greek, *wind*) *Ranunculàceæ.* Anemone, or Anemony. Windflower Hardy and attractive flower-garden and border plants

Stems usually erect, with great variation in height: basal lvs lobed, divided or dissected, those of the st. forming an involucre near to, or remote from, the fl: sepals few or many, petal-like, no true petals, stamens many, shorter than sepals carpels numerous fr a 1-seeded achene —A genus of about 85 species, with many handsome garden forms, all hardy perennials, cult for their beautiful show of fls and in a few cases for their striking foliage Chiefly native of the north temperate and mountainous regions As a technical generic name, pronounced anemòne, as a vernacular, anémone Pritzel, Revision of Anemone, in Linnæa 15.498 (1841) Britton, N Amer Anemone, in Ann. N Y. Acad Sci 6 217 (1891–92)

The plants thrive best in a fresh, rather rich, sandy loam, well drained, but most of the species will do well in any good garden soil The tuberous-rooted species are suitable for hardy borders, while most of the others prefer a place in a rockery, and some are partial to shady places *A hortensis, A coronaria, A fulgens* and others will well repay the little indoor or greenhouse care they require for producing winter blossoms They require essentially the same handling as tulips and hyacinths, and are usually classed with bulbous plants Tubers placed in pots in September or October bring forth a beautiful show of bloom by January or March For this purpose they should be well drained, and not kept very wet or too warm before the growth is well started; they prefer more moisture at flowering time There are many garden varieties of anemone, among which are Whirlwind and Geante Blanche (white), Queen Charlotte, Lorely, and Kriemhilde (pink), Rosa Zwey (lavender-pink), Brilliant Diademe, Purpurine and Prinz Heinrich (carmine and magenta)

Nearly all the species can be readily propagated by both root-division and seed. The seeds are sown very shallow in a clean bed, in either warm fall or early spring The division of roots is best made in early spring before growth starts The season for both outdoor and indoor planting will directly influence the flowering season Good months for outdoor planting are September, October, November, December, February and March As a rule, the tuberous anemones will blossom at any time desired, being influenced by the time they are kept out of the ground The bulbs may be ripened after flowering time by being taken from the ground to dry, or by covering the bed to keep out rains *A japonica* is one of the finest of all fall-blooming herbs.

INDEX.

acutipetala, 4, 6.
alba, 10, 15, 21.
albida, 10
Allenii, 13, 15
alpina, 5, 6
annuata-grandiflora, 8
apennina, 13
baicalensis, 12
blanda, 14
caerulea, 15
canadensis, 23
caroliniana, 11
chrysanthemiflora, 7.
coronaria, 7
crispa, 21
decapetala, 11
deltoidea, 17
dichotoma, 23.
elegans, 21
flore-pleno, 7, 10, 12, 15
fulgens, 8
Grayi, 19
Halleri, 2
hortensis, 8, 9
hybrida, 21
intermedia, 15
japonica, 21
lutea, 10
major, 15
multifida 22
multipetala, 8
narcissiflora, 24
nemorosa, 15, 16
Nuttalliana, 3
occidentalis, 5
ochroleuca, 3
oregana, 19
palmata, 10
patens, 3
Pavoniana, 8
pennsylvanica, 23.
pleno, 13
Pulsatilla, 4
purpurea, 13, 15
quinquefolia, 16
ranunculoides, 18
Robinsoniana, 15
rosea, 15, 21
rubra, 4, 15, 21
stellata, 9
sulphurea, 1, 6
sylvestris, 12
umbellata, 24
variegata, 4
vernalis, 1
virginiana, 20

A. *Achenes with long styles, which may become feather-like on ripening, fls solitary —Pulsatilla section*

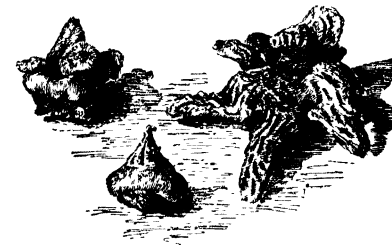
B. *Involucre bell-shaped, dissected into numerous linear equal lobes.*

1 **vernàlis,** Linn. (*Pulsatilla vernàlis,* Mill *A. sulphùrea,* All.) Very shaggy, 6 in high or less lvs pinnately parted, segms trifid fls purple without, whitish within, and smoothish, erect, on very short peduncles; sepals 6, rarely spreading Apr Cool, moist places Eu J H III 32 223 Gn 25 320 Gn W. 20 891; 26 134 F E 18 320 G 20 158

2 **Hálleri,** All Villous, 6 in or less in height, simple lvs pinnately divided with segms 3–4-parted, the lesser divisions lanceolate-linear, involucre of long narrow segms, sessile fls large, erect, whitish purple, sepals 6, anthers yellow Apr. Sunny places Switzerland L B C 10 940

3 **pàtens,** Linn Much like the first variety below, which is more common in Amer, but differs in its broader and shorter lf-segms and smaller fls Eu Gn. 60, p. 364, 65, p 167

Var **Nuttalliàna,** Gray (*Pulsatilla hirsutissima,* Brit.) Wild Patens American Pasque Flower. Fig 198 Villous, with long, silky hairs, 4–9 in high radical lvs petioled, others sessile, all much divided into narrow, linear, acute lobes fls appearing before



199. Tubers of Anemone coronaria.

the root-lvs, bluish purple or whitish, erect, seldom nodding achenes silky styles plumose, becoming 2 in. long, peduncle elongates several in after flowering Apr Low ground North central states and Siberia. C L A. 3 177 Gn M 13·15

Var **ochroleùca,** Sims. Fls creamy white, appearing at same time as basal lvs. March, Apr J H III 30.343 B M 1994

4 **Pulsatílla,** Linn (*Pulsatílla vulgáris,* Mill *A acutipétala,* Schleich) PASQUE FLOWER of Europe Villous, hairy, rising ¾-1 ft basal lvs finely thrice-pinnately divided, on slender petioles, involucre sessile, deeply cut into long narrow lobes fls blue to reddish purple, 1½–2½ in across Apr Well-drained soil or stony places Eu. Gn 32 466, 71, p 215, 530 L B C 18 1704 G C III 39 307 Gn M 13 17. G M. 52 636 Gn W 20 225. Var **rúbra,** Hort (*A rúbra,* Lam) Dwarfer fls always erect Var. **variegáta,** Hort Fls pale, appearing in May

BB *Involucre lvs 3, on short petioles, sheathing the st.*

5 **occidentális,** Wats (*A alpina,* Hook , not Linn) Silky-hairy, 1½–1½ ft high, simple lvs 2-parted, the divisions deeply pinnatifid into usually incised linear, acute lobes, involucre short-petioled, basal lvs long-petioled fls solitary, white or purple, varying, 1–2 in across, receptacle conic, sometimes much elongated achenes pubescent plumose styles reflexed, peduncle becoming much elongated after sepals fall May. Calif. to Brit Col Intro. 1892



200 Anemone coronaria, single-flowered form (×⅓)

6 **alpina,** Linn (*A acutipétala,* Hort) Closely allied to the above St ¾-1½ ft high, from thick, strong roots lvs large, finely divided, cut and serrated, smooth or hairy, lvs of involucre similar fls few, in an umbel or solitary, 2–3 in diam , creamy white inside, purple outside, but varying much, anthers yellow Mountain-sides Eu May, June L B C 17 1617 B M. 2007 (var *major*) Var **sulphúrea,** Hort Fls a delicate sulfur-yellow, larger, downy beneath lvs larger Moist, rich soil Gn 35 10, 66, p. 195. G M 49 797

AA. *Achenes woolly or smoothish, with short styles. (Anemone proper)*

B. *Peduncle 1 (rarely 2)· involucre mostly 3-lvd.*

C. *Head of fr cylindric: achenes woolly.*

D. *Roots tuberous involucre usually sessile*

7 **coronária,** Linn POPPY-FLOWERED ANEMONE. Figs 199, 200, 201, 202 One-half to 1 ft high, from tuberous roots: lvs cut into many fine lobes and lobules, involucral lvs. sessile, 3-4-parted, deeply cut fls. 1½–2½ in across, poppy-like, of many colors and mixtures of red, blue, white, etc , stamens blue. Early in spring to June. Meadows, Medit region V 11.257 B M. 841 Gn. 50 6, 61, p 275; 16, p. 111. A F. 25·93 C L A. 4: 344 G 24.5. G L. 20·355. Gn M 13 296 J H III 48 383 R H 1893 232 — Caen, Scarlet, The Bride, St Brigid, Victoria Giant, etc , are some of the trade names given to the single forms Var **flóre-plèno,** Hort Fls. double, as shown in Fig 202; many colors, scarlet being the most common at present F S 16.1678 Gn 63, p 353 Var **chrysanthemiflóra,** Hort A seedling variety produced in 1848, and into many years later Fls more completely doubled than the above variety by the stamens all becoming petal-like —A dozen forms, beautiful, self-colored, as deep red, sky-blue and even pure white, have been fixed and named Useful as cut-fl Gn 30·316 R.H 1887: 36; 1897, pp 418-9. R.B 21:260-1.



201. Anemone coronaria, semi-double-flowered form (×⅓)

8 **fúlgens,** Gay (*A Pavoniána* var *fúlgens,* DC *A horténsis,* Thore) Fig 203 One ft high, simple basal lvs 3-5-lobed, with rounded outline, followed later by deeply cut lvs , involucre sessile, several in below the solitary fl fls vivid scarlet, 2 in across, stamens black May, June France — Sometimes called a variety of *A hortensis,* Linn , from which it may have descended. Several garden forms, as *A annuàta-grandiflòra, A multipétala,* and Southern Star Gn 11 214 Gt. 37 66. R B 21 262-3 R.H. 1877 270 G 4 91.

9 **horténsis,** Linn. (*A stellàta,* Lam) BROAD-LEAVED GARDEN ANEMONE Fig 204 St simple, erect, 10 in high basal lvs lobed and cut irregularly, involucre small, 3-5-lobed, usually 3 or more in below the fl fls red, rosy purple, or whitish, single, 1½ in across, stamens brownish violet Rich, light soil S Eu May —This differs from *A coronaria* in its coarse, broad lvs and its elongated, rather narrow-pointed sepals Garden names are given to the forms with different coloration B M 123 Gn 61, p 352 F W 1877 257

10 **palmáta,** Linn St 6-9 in high from tuberous root basal lvs leathery, 3-5-lobed, cordate, toothed, involucral lvs 3-parted fls golden yellow, solitary or in 2's, sepals 10 or more May, June Deep, light soil Medit region B R 200 —Three good varieties in the trade Var **flóre-plèno,** Hort , with double yellow or white fls Var **álbida,** Sims (var *álba,* Hort) Fls white basal lvs lobed B M 2079 L B C 2 175 Gn 22 466 Var **lútea,** Lodd Like the last, but with yellow fls L B C 17 1660

11 **caroliniána,** Walt (*A decapétala,* Amer authors, not Ard) St simple, slender, ½–1 ft high, arising from a large tuber lvs of involucre sessile, with 3 wedge-shaped clefts, basal lvs thrice divided, and much lobed and parted, slender-petioled solitary fl erect, 1–1½ in broad, creamy white or purple, sepals often numerous achenes densely woolly April, May Open places, U S G 6 521

DD *Rootstock creeping lvs of involucre petioled*

12 **sylvéstris,** Linn. St 1–1½ ft , simple, or branched once at involucre, from a creeping rootstock lvs 3-4-parted, deeply cut at top, hairy beneath, involucre petioled: fls solitary or in 2's, pure white, 1½ in across, nodding, sweet-scented, sepals 6 May–July. Wooded places, Eu and Liberia. B M 54 Gn. 18, p 561; 30, p 173, 65, p. 73; 75, p 189 G 2.223, 33·31



202. Anemone coronaria var flore-pleno. (full double) (×⅓)

Gn.M. 13:295. J.H. III 57 80. L B C 18:1739. Var. **flòre-plèno,** Hort DOUBLE SNOWDROP ANEMONE Has large, white, double fls G C III 19:739. *A. baicalénsis,* Turcz, is much like this species.



203. Anemone fulgens. (× ¼)



204 Anemone hortensis. Reduced from an old cut, to show a little improved form

CC. *Head of fr. hemispherical. achenes silky-pubescent.*

D *Roots tuberous*

13. **apennìna,** Linn St simple, slender, 4–9 in.· lvs twice-divided and lobed, much toothed· fls sky-blue, 1½ in across, sepals 10–12, elongated, obtuse; anthers white March, Apr Woods, Italy. Gn 72, p. 482 —This and a form with whitish fls are both well suited for shady nooks in clumps of shrubbery, etc Var **Allenii,** Hort Fls large, pale blue Var **plèna,** Hort Fls double Var **purpúrea,** Hort Fls bright mauve Gn 72, p 254

14 **blánda,** Schott & Kotschy St 4–6 in high, from a cylindrical rootstock lvs like *A apennina,* but harder and smoother, and principal divisions sessile fls intense sky-blue, differing from above species in being larger, more finely rayed, styles black-pointed, and sepals smooth on the outside, opens in earliest spring or mild winter weather From Taurus Mts and Greece, rocky places Intro 1898 Gn 14 200, 75 p 152 G L 19 71 Gn W 22 Supp Apr 15 (var *atrocærulea*) G C III 41 297 (var *Scythissica*)

DD *Rootstock slender, creeping, cylindrical*

15 **nemorósa,** Linn (*A intermèdia,* Winkl) WOOD ANEMONE Fig 205 St simple, 3–8 in. nearly smooth rootstock horizontal, 3–4 times the st in diam lvs of involucre petioled, 3–5-parted, basal lvs appearing after the fl-st, 5-parted, divisions wedge-shaped, toothed· fls white or purplish, solitary, 1 in across· achenes pubescent, styles hooked Apr, May Eu and Siberia Gn 63, p 244 (as *A intermedia*) —Three or more horticultural varieties Var **álba,** Hort. (var. *flòre-plèno,* Hort). Fls larger, pure white, and abundant Intro 1883 Gn 32 344, 69, p 233 (var *grandiflora*). 75, p 128 (var *purpurea*) G 24 255 (var *major*) Var **Allenii,** Hort Fls large, lavender-mauve Var. **màjor,** Hort A robust variety with large white fls. Var **Robinsoniàna,** Hort (var *cærùlea,* Hort). A robust form, 6–12 in, with broader and thicker lvs., and large fls, becoming blue Sometimes given as a separate species March, Apr Gn 46, p 153, 32, p 345; 73, p 266 G 2 515 R H 1901·188 Var **rósea,** Hort (var *rùbra flòre-plèno,* Hort) Fls a reddish purple. now much used; suited to partially shaded places of the perennial border

16. **quinquefòlia,** Linn. (*A. nemorósa* var *quinquefòlia,* Gray) This American species differs from *A. nemorosa* in having smaller fls., involucral lvs less lobed, foliage paler, and much more slender st and petioles —The common windflower or spring anemone, formerly called *A nemorosa* Gn M. 13·15

17 **deltoídea,** Douglas St simple, slender, 6–12 in high, from a slender rootstock lvs trifoliate, basal ones petioled, others nearly sessile, coarsely crenated, often incised fls. solitary, white, rather large achenes several, densely pubescent; style very short Spring. Pacific slope

DDD. *Rootstock horizontal, fleshy or somewhat tuberous*

18 **ranunculoìdes,** Linn YELLOW WOOD ANEMONE. St 3–8 in, from elongated, somewhat tuberous rootstock. lvs 3–5-parted, divisions deeply cut and serrated fls golden yellow, usually solitary, single or semi-double March and Apr Rich, light soil in open places and woods Eu and Siberia Gn. 35 408, L B C. 6 556

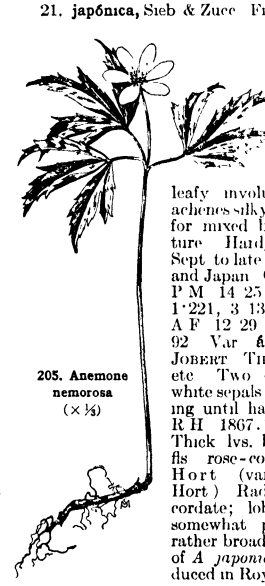
19 **Grèyi,** Behr (*A oreàna,* Gray) St slender, 3–12 in. high, from a fleshy, brittle rootstock basal lvs slender-petioled, 3-parted, coarsely serrate, involucral lvs petioled, trifoliate, the parts 2–3-lobed, much toothed, sepals blue or purplish achenes pubescent, in a globose head Moist, shady slopes. Ore and Wash. In gardens west of the Rockies Intro 1892

BB *Peduncles 2–5 (mostly 3)*

C. *Frs. (achenes) woolly or very silky secondary involucre present*

20 **virginiàna,** Linn Plant hairy, 2–3 ft high, stout, branching at the involucre the petioled involucral lvs. 3-parted, the lits cleft and lobed, basal lvs similar, broader than long, on long petioles fl peduncles naked (or the lateral ones 2-lvd), fls greenish or white, 1–1½ in across achenes woolly, in an oblong head, styles short, awl-shaped June–Aug Woods and meadows, U S and Canada G M 33 763

21. **japónica,** Sieb & Zucc Fig 206 Stately, branching st, 2–3 ft high· plant soft and downy, with short hairs lvs ternate, much lobed and toothed fls rosy purple or carmine, 1–3 whorls of sepals, 2–3 in diam, on long peduncles from leafy involucre, stamens yellow· achenes silky —A very useful species for mixed borders or for pot culture Hardy in northern states. Sept to late frosts Rich soil, China and Japan Gn 30 172 B M 4341. P M 14 25 A G 19 305 Gng. 1·221, 3 131 G C III 16 661. A F 12 29 F S 2 74 Gt 61, p. 92 Var **álba,** Hort HONORINE JOBERT THE BRIDE WHIRLWIND, etc Two or 3 whorls of large, white sepals fls 2–3 in across, lasting until hard frosts Gng 5.117. R H 1867.11 Var. **crìspa,** Hort Thick lvs. bronzed on the edges: fls rose-colored Var **hýbrida,** Hort (vars *rósea* and *élegans,* Hort) Radical lvs 5-lobed, often cordate; lobes twice serrate: fls. somewhat paler, earlier, sepals rather broader Said to be a hybrid of *A japonica* and *A. vitifolia,* produced in Royal Gardens, 1848 Var.



205. Anemone nemorosa (× ¼)

rùbra, Hort LADY ARDILAUN. Probably the same as the type, but having lvs. and fls with a waxy gloss plant 4–5 ft. high

22. **multífida,** POIR. Plant silky-hairy, somewhat branched, ½–1½ ft high, from a branched, upright rootstock. main involucre 2–3-lvd, others 2-lvd or naked, short petioles, similar to the root-lvs, 2–3 times 3-parted and cleft, divisions linear fls ½–1 in. across, red, varying to white or yellow achenes very woolly. Early summer. Rocks and uplands Middle states to Hudson Bay.

cc. *Frs. (achenes) glabrous at first: fls. white, somewhat umbellate.*

23 **canadénsis,** LINN (*A pennsylvánica,* Linn. *A. dichótoma,* Michx, not Linn.) Hairy, stout, 1–2 ft high, branching at or above the involucre: the 3 lvs of main involucre sessile, 3-cleft, upper involucres each 2-lvd; basal lvs broader than long, much divided, cleft and toothed, petioles long. fls. white, 1–2 in across. achenes wing-margined, naked, becoming pubescent, grouped into a spherical head. Summer. In shaded woods and open meadows N Amer Gng 2. 21 Gn M 13 355.

24 **narcissiflòra,** LINN (*A umbellàta,* LAM.) St. erect, rather stout, ½–1½ ft high lvs. of involucre sessile, basal lvs petioled, 3–5-parted, divisions deeply cut fls white, ½–1 in across, several in an umbel, anthers yellow achenes smooth, with short style May–July Mountainous regions Northern hemisphere Gn 30, p 173 B M 1120. G 6·309

A acutilòba=Hepatica acutiloba —*A álba,* JUSS Allied to A sylvestris if not the same L B C 4 322 B M 2167 —*A Bungeàna,* PRITZ Similar in habit to A Pulsatilla Fls golden yellow Siberia —*A cèrnua,* THUNB Lvs deeply cut, divided fls nodding, color of dragon's-blood Japan —*A cylíndrica,* GRAY A tall native species, used for beauty of foliage and fr —*A decapétala,* ARD (A trilobata, JUSS A heterophylla, NUTT) Native and reported as having been cultivated in southern states 1891 — *A elongàta,* D DON Similar in habit and foliage to A sylvestris but not so beautiful fls dull greenish white Himalaya —*A Fáxoni,* HAW Fls pure white, 2–3 in across 5 feet high lvs 1 ft across B M 6958 Gn 41 262 —*A hupehénsis,* HORT Allied to A japonica Fls produced very early Cent China —*A magellánica,* HORT Fls yellow pretty but not showy Straits of Magellan —*A parviflòra,* MICHX Pretty white fls Native of northern states and Canada —*A polyánthus,* DON Allied to A narcissiflora B M 6840 J H III 32 259 —*A pratensis,* LINN Allied to A Pulsatilla L B C 9 900 —*A pratensis* var *obsoléta,* SIMS Fls pale lfts terminated with a sort of bristle B M 1863 —*A rivulàris,* Bush-Ham Is a distinct species similar to A narcissiflora G 18 138 —*A sphenophýlla,* PORPH Fls blue S W U S — *A thalictroides* See Syndesmon —*A trifòlia,* LINN Lvs beautifully regular fls white, 1 in across Two blue varieties B M 6840 —*A triloba*=Hepatica triloba —*A vitifòlia,* HAM Allied to A japonica Has cordate 3–7-parted lvs B M 3376

K. C. DAVIS.

ANEMONÉLLA: *Syndesmon*

ANEMONÓPSIS (*Anemone-like*). *Ranunculàceæ.* A beautiful hardy plant for border purposes because of its effective foliage and showy flowers

This is a perennial herb, with erect sts: radical and st-lvs. rather large, ternately compound and much incised, similar to Actæa sepals many (often only 9), regular, petal-like, deciduous, petals many (often 12), short, sessile, with nectariferous impression at the base, carpels few (3–4), forming many-seeded follicles In general appearance similar to the Japanese anemones, but smaller in all its parts, and with numerous drooping fls, about 1½ in across, of pale purple color. A monotypic genus from Japan, now planted in American gardens

Anemonopsis thrives well in rich, deep loam, in well-drained situations in partial shade Propagation is by division of the roots in late fall or early spring Fresh seed may be sown in the fall or early the next spring and the plants will show some flowers the first season. Sow the seed in clean beds of black sandy loam, and cover very slightly.

macrophýlla, SIEB. & ZUCC The petals, instead of spreading, form a half-closed bud-like cone within the sepals Gn 25, p 383

K C. DAVIS

ANEMOPÆGMA: *Bignonia*

ANEMÓPSIS (Greek, from the resemblance of its fl-cluster to the flower of an anemone) *Saururàceæ* YERBA MANSA. Aquatic herb, yielding medicinal products.

A monotypic genus closely allied to Houttuynia of E Asia Stoloniferous aquatic plant with pungent aromatic rootstocks· lvs mostly radical, minutely punctate infl. a conical spike or spadix subtended by an involucre of petal-like bracts, resembling the fl of an anemone, fls small without calyx or corolla, each subtended by a bractlet, stamens 6–8, with short filaments adnate to the ovary at the base, ovary sunk in the rachis of the spike, 1-celled, composed of 3 or 4 carpels, with as many spreading stigmas and parietal 4–10-ovuled placentæ, caps dehiscent at the top; seeds rounded, punctulate Calif and Mex.

califórnica, HOOK. (*Anèmia califórnica,* NUTT. *Houttuýnia califórnica,* BENTH. & HOOK *Anemópsis califórnica,* ENDL) YERBA MANSA. APACHE BEADS. VAVISA An erect aquatic herb radical lvs long-petioled, oblong-obovate, cordate at the base, cauline lf. broad, clasping, from the axil of which grows a branchlet reduced to 1 or 2 lvs fls minute, crowded, forming a conical spadix with a whorl of whitish petaloid bracts below it, giving it the appearance of the fl. of an anemone. Calif and Mex HOOK & ARN BOT. BEECH VOY pl 92 —The pungent aromatic astringent rootstocks are strung into necklaces in the form of cylindrical beads by the Indians of the S W U S, and are used medicinally in the form of an infusion for malaria, dysentery, and syphilis They are also pulverized and applied locally to ulcers and malignant sores The plant grows in swampy places and on the margins of springs and ponds more or less alkaline The roots are gathered in the dry season in Mex. and sold in the local drug markets.



206. Anemone japonica

W. E. SAFFORD.

ANÈTHUM: *Dill* and *Peucedanum*; also *Fennel*

ANGADÈNIA: *Ontadenia*

ANGÉLICA (supposed to have angelic healing virtues) *Umbellíferæ* ANGELICA. Herbs, sometimes planted for ornament.

Stout, fls small, white or greenish, in many-lvd involucels fr. fattened dorsally, with very prominent ribs —A genus of 60 species in north temperate regions, and from New Zeal. Several of them are native to N Amer They are perennial herbs with compound lvs. and large umbels of white fls not unlike the cow-parsnip (Heracleum). The word "angelica" is loosely applied to various plants. In the American tropics, it is used for some of the aralias The angelica of vegetable gardens is *Archangelica officinalis*

Cúrtisii, Buckl Stout perennial, 2–5 ft, glabrous: lvs 2–ternate, with quinate divisions, the lfts. thin, ovate-lanceolate, irregularly sharp-toothed Pa. to N. C —Grown for the subtropical effect of its finely cut, ample foliage Intro. 1891 by H P Kelsey.

hirsùta, Muhl (*A villòsa,* B S P. *Archangélica hirsùta,* Torr & Gray) Pubescent above lvs twice pinnately or ternately divided, the lfts thickish and serrate, the upper lvs mostly reduced to sheathing petioles Eastern states Intro 1892 by H. P. Kelsey.
N. Taylor †

ANGELÒNIA (South American name, *angelon,* of one of the species) *Scrophulariàceæ* Perennial herbs or sub-shrubs, grown in hothouses and conservatories, and in the open far South.

Plants with the look of alonsoas lvs simple, opposite (or alternate above) fls showy, blue, irregularly 2-lipped, the upper lip 2-lobed and the lower larger and 3-lobed, calyx 5-parted or 5-toothed, stamens 4, in pairs, ovary 2-celled The axillary fls are in a long, leafy terminal raceme branches 4-sided —About two dozen species from Mex to Brazil Grown as pot-plants in warm glasshouses and prop by seeds or soft-wood cuttings

salicariæfòlia, Humb & Bonpl Perennial, 3 ft or less lvs lanceolate to ovate-lanceolate, sessile, toothed, closely pubescent fls deep blue. S Amer. B.M. 2478. P M 5 75 B R 415

Gárdneri, Hook Woody, 3 ft lvs linear-lanceolate, more strongly toothed throughout their length: fls purple, white-centered, handsome, in a long terminal leafy raceme or spike plant pubescent-glandular and aromatic Brazil. B.M 3754

grandiflòra, Hort (C Morr ?) Perennial; graceful, 2 ft lvs entire, or slightly toothed, lance-pointed fls. lilac, fragrant, solitary, not exceeding the lvs., the lobes prominent and spreading S Amer —An excellent plant for winter bloom, particularly the white-fld var.

álba, Hort, and grown in the open satisfactorily in Fla It is a good pot-plant for conservatory or for table decoration Blooming plants are secured the same year the seeds are sown Intro 1897 in Eu Gt 46, p 612, G C III 22 307, Gn 52, p 461, R B 23:272; all the same picture of a pot-plant of var *alba*

angustifòlia, Benth Lower lvs smooth, narrow-lanceolate fls deep violet in erect terminal racemes. Mex.

cornígera, Hook Annual, 1 ft or more, slightly hirsute lvs lanceolate, practically sessile, broad at the base, slightly ciliate fls solitary in the axils, shorter than the lvs, rich purple and deeper colored in the throat, the upper segms velvety-dotted, the middle segm of the lower lip bearing a horn-like process (whence the name *cornigera,* "horned"). Brazil. B M. 3848

integérrima, Spreng Perennial, with fleshy root, branching above lvs lanceolate, entire, narrowed at base fls stalked in the axils of short bracts and forming a terminal spike or raceme 6 in long, light blue- and purple-spotted, the throat wide open and lobes very short and rounded except the lower which is broad-ovate and toothed. S. Brazil, Paraguay. Gt. 54:1538.
L. H B.

ANGIÓPTERIS (Greek, *vessel-fern*) *Marattiàceæ.* An Old World genus of coarse greenhouse ferns, with twice- or thrice-pinnate lvs, and the large fleshy sporangia arranged in boat-shaped marginal sori In cult, requires plenty of room and abundant drainage.

Angiopteris grows wild in swampy places, and is of robust habit If grown in pots, the pots may stand in 2 or 3 inches of water Although spores are freely produced, no seedlings are on record Easily propagated by the fleshy scales at the base of each frond. Each scale contains at least two dormant buds, and should not be divided They may be laid in sand, covered with sphagnum, and kept in a close case for three to five months. They start more quickly in early spring. (Schneider, Book of Choice Ferns)

evécta, Hoffm. Growing from a stout, fleshy, erect caudix, 2–6 ft high lvs. 6–15 ft long, mostly bipinnate, with swollen rachises, lfts. 4–12 in long, ½–1½ in. wide, the margin entire or slightly toothed India and Japan to Madagascar and Queensland. S 1.399 —Known under various names in cult, as *A. longifolia,* etc The trade names, which appear to indicate species, may be regarded as varieties R. C. Benedict †

ANGÓPHORA (*vessel-bearing,* Greek, in allusion to shape of fruit) *Myrtàceæ* Gum Myrtle. A genus of 4 species of Australian trees or shrubs, sometimes cult. in glasshouses in the Old World, but not known to the trade in this country, where their cult seems to be confined to botanic gardens They have large opposite lvs, corymbose fls, with a 5–6-cleft calyx The commonest species in cult are *A cordifòlia,* Cav, with yellowish fls and sessile lvs, and *A lanceolàta,* Cav, with white fls and petiolate lvs See page 3565

ANGRÆCUM (Latinized from *Angrek,* the Malay name for all orchids of this habit) *Orchidàceæ* Epiphytic hothouse orchids with the habit of Vanda

Leaves flat or terete fls few to many in a raceme, or rarely solitary, sepals and petals nearly alike, spreading, lip adnate to the base of the column, lateral lobes small or obsolete, middle lobe entire, spur long and slender, pollinia 2, upon a single undivided stipe —About 20 species, natives of Trop Afr, Madagascar, and the Mascarene Isls

These are valued for their winter-flowering habit and lasting qualities All have peculiar or grotesque forms and some are fragrant All need a warmhouse in winter, preferably the warmest corner, where it is moist. As the plants have no pseudobulbs they must never become dry No soil is necessary at the roots, but a surfacing of live sphagnum may be placed over the crocks, this should be renewed as often as it becomes decayed The angræcums may be classed with the aerides, vandas and saccolabiums as being true air-plants and the roots are impatient of confinement in pots or other receptacles Care must be taken to secure the plants firm and upright when repotting, by means of stakes or wire Frequent spraying overhead in bright weather is of great assistance, especially in the growing time They must never be removed from the greenhouse for decoration elsewhere, for if the plants become chilled, there is total loss. (Orpet)

A. *Lvs. semi-terete, narrow*

Scottiànum, Reichb f Sts up to 2 ft long, with brown sheaths below lvs. terete, grooved on the upper side, 3–4 in long, spreading or recurved peduncles with 1–3 fls which are inverted and 1½–2 in. across, the sepals and petals pale yellow, changing to white, linear, similar, acute, the sepals a little broader than the petals, the lip white, concave, transversely oblong, nucronate, spur 4–5 in long, reddish brown Comoro Isls. G C. II 14, p. 137. F M. 1880 421. B.M 6723.

AA. *Lvs flat.*

B. *Plant dwarf: fls. few, 3–5, the clusters shorter than the lvs.*

falcàtum, Lindl St 1–2 in tall: lvs few, linear, falcate, 2–3 in long, channeled above, keeled beneath: peduncles with 3–5 fls, fragrant, white, about ¾ in. across, the sepals and petals acute, similar, linear-oblong; lip 3-lobed, the lateral lobes minute, the middle lobe narrow-oblong, retuse; spur curved, filiform Japan B R 4·283 B M 2097 (both as *Lamodorum falcatum*)

BB. *Plant larger than above fls numerous, in racemes usually longer than the lvs*

C *Fls white or tinged with yellow.*

D. *Lip acute*

E *Spur less than 5 in long, white.*

F *Sepals lanceolate fls about 1 in. across, spur 2–3 in. long.*

modéstum, Hook. f (*A. Sanderiànum,* Reichb f.). Lvs oblong to obovate-oblong, acutish to emarginate, 3–6 in long racemes of numerous pure white fls on orange pedicels, sepals lanceolate, petals ovate-lanceolate, lip broadly ovate Madagascar and Comoro Isls B M 6693 Lnd 2 92 R H 1888, p 516 R B 15 217 A F 22 951, 35 381. O R 8 152, 12 337. O 4 f 24

FF *Sepals elliptic fls about 1¼ in across, spur 3–4 in long*

articulàtum, Reichb (*A. descéndens,* Reichb) Lvs oval to obovate-oblong, 3–5 in long, emarginate or 2-lobed racemes pendulous, of numerous pure white fls on pale orange pedicels, sepals and petals elliptic-oblong, acute, the lateral sepals narrower, lip broadly oblong-oval, acute, spur 3–4 in long Madagascar

EE *Spur 6–7 in long, tinged with orange-red*

Éllisu, Reichb Sts up to 1 ft high lvs narrow, oblong, 5–8 in long, emarginate or bilobed at apex racemes pendulous, of 12 or more pure white fls, sepals and petals elliptic-oblong, acute, the dorsal sepal inflexed at the summit, the lateral reflexed, lip oblong-elliptic, acute, spur slender, tinged with orange-red Madagascar G C II 3 277 F M 1875 191. O R 7 81

DD *Lip emarginate or 2-lobed at apex*

citràtum, Thouars Sts 3–4 in high lvs oblong-ovate, 3–5 in long, acute or lobed at the apex racemes pendulous, of 12 or more white or pale straw-color fls, sepals obovate, obtuse, petals oblong-elliptic, lip flat, nearly orbicular, emarginate, spur slender Madagascar. B M 5624 I H 33 592 Lnd 5 238

CC *Fls with green sepals and petals, lip white*

supérbum, Thouars (*A. ebúrneum,* Lndl) Fig 207 Sts up to 4 ft or more long lvs up to 2 ft long, 2 in wide, coriaceous racemes ascending, with 8 or more fls; sepals and petals spreading, green, lanceolate, lip white, orbicular, fleshy, abruptly acuminate, spur green Madagascar B M 4761. B R 1522 Var **virens,** Veitch (*A. virens,* Lndl) Differs from the type in its smaller fls with the labellum tinged green B M 5170

A. augustum, Rolfe (A Augustu) Allied to A Kotschyi Lvs thick and fleshy, glaucous green fls in arched raceme, pure white, spur pale green G C III 45 Feb 6, Suppl O R 1908 246 Rhodesia —*A. bilobum,* Lndl Racemes of 6–10 fls, about 1 in across, the sepals, petals and lips nearly alike, lanceolate-acuminate, the spur pale orange-red W Afr J H III 43 483 — *A. Buysséni,* God Resembles A. articulatum. fls pure white, brown spurs.



207 Angræcum superbum (×⅙)

Madagascar —*A. caudàtum,* Lndl =Listrostachys caudata — *A. Chailluàrum,* Hook =Listrostachys Chailluanum —*A. distérrimum,* Lndl =Mystacidium distichum —*A. Eckleràrum,* Kränzl (*A. Arnoldianum,* DeWild) St elongated lvs distant fls large, solitary, sepals and petals oval-lanceolate, acuminate, lip large, extinguisher-shaped, emarginate and apiculate at the summit, spur about as long as lateral sepals Afr B M 7813 A F 25 79 Gng 13 377 —*A. ezpánsum,* Thouars Fls white, of peculiar form, spur longer than perianth segms Mascarene Isls —*A. fastuòsum,* Reichb St 1–2 in high racemes of 2–4 fls about 1½ in diam, pure white, the slender spur about 3 in long Madagascar J H III 42 297 —*A. fuscatum,* Reichb Sts short racemes of numerous fls, 1 1½ in across, cream-white, the lip oblong, acuminate abruptly the slender spur about 3 in long Madagascar Gn 37, p 61 —*A. Humblòti,* Reichb =Macroplectrum Leonis —*A. ichneumòneum,* Lndl =Listrostachys ichneumonicum —*A. infundibulare,* Lndl Sts long, fls large, solitary, sepals and petals pale yellow, lip funnel-shaped, 2½–3 in long, white with a green throat, the curved spur 3–5 in long W Afr B M 8153 G C III 36 130 G M 47 629 Gn 66, p 109 J H III 49 219, 59 387 —*A. Kotschyi,* Reichb Lvs obovate-oblong, 3–7 in long racemes of 6–10 white fls, 1½ in across, the ovate-oblong dorsal sepals and petals reflexed, the spreading lateral sepals lanceolate lip nearly rhombod, with a broad claw, spur pale brown, up to 9 in long E Afr G C II 14 693, III 39 379, III 46 221 Gn 31, p 323, 37, p 101, 75, p 583 —*A. Leònis,* Veitch—Macroplectrum Leonis —*A. pellùcidum,* Lndl =Listrostachys pellucida —*A. pertùsum,* Lndl =Listrostachys pertusa —*A. Rothschildianum,* J O'Brien Sts 3–6 in lvs ovate, 4–8 in long racemes of 10–12 fragrant white fls with a pale green band along the sepals and petals, the lip white with an emerald center and black-purple throat, the spur green with a brown tip Cent Afr G C III 34 131 —*A. Schefflera,* Hort Scarcely 8 in high fls long, reddish brown German E Afr Var *virens* differs from the type in having all the vegetative parts green — *A. sesquipedale* = Macroplectrum sesquipedale

GEORGE V NASH.

ANGULÒA (dedicated to Don Francisco de Angulo) *Orchidàceæ* Stout coolhouse orchids, with large pseudobulbs, the scales at the base passing into lvs

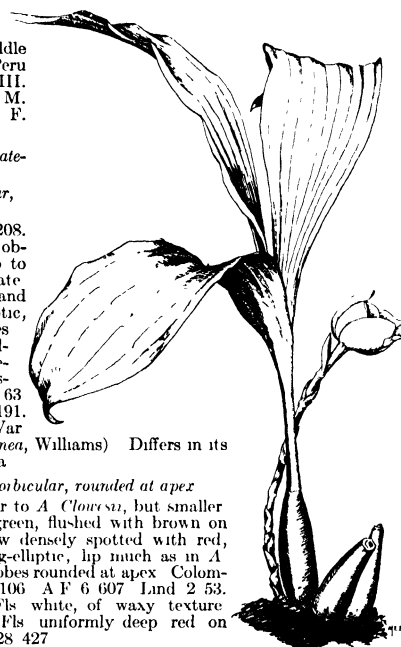
Leaves large, plicately nerved scapes from the base of the pseudobulbs, clothed with large lax sheaths, fls subglobular, sepals and petals connivent, fleshy, lip shorter than sepals and petals, 3-lobed, the middle lobe much smaller than the lateral lobes, linear and recurved, or broader and 2-lipped —Species 3, all in cult, natives of S American Andes, at elevations of 5,000–7,000 ft

This interesting genus comprises but few species, but these are singular, since all are well worthy of culture Coming from the Andes of Colombia, a moderate temperature of 50° in winter will be ample for their needs, and a cool, shaded structure in summer, as the foliage is easily scorched by direct sunlight in hot weather The peculiar structure of the flowers has given the popular name of "boat orchid," which suggests the general shape This, together with the fragrance, and the hinged lip, which oscillates with the least movement, makes the plants very interesting when in bloom The anguloas are rather terrestrial than epiphytal The culture is very simple if, as a potting compost, a mixture is used containing some soil with the fiber and some sphagnum moss as a surfacing, the potting being very firm Propagation is simple by division of the bulbs The old back ones may be severed at the creeping rhizome after the new growth

has been completed, and these will start new shoots usually in spring. Division must be made after the shoots are visible from the back bulbs The black-spot disease of the bulbs is often fatal to anguloas It appears suddenly and is generally due to too much moisture in the atmosphere or at the roots Directly it is seen, the affected parts must be cut out clean, and dry sulfur applied, this, if done in time, will stop the progress of the disease If brown scale attacks the plants, sponge with soap and water, taking care not to injure the tender leaves (Orpet)

A *Middle lobe of lip linear, recurved*

unifl̀ora, Ruiz & Pav (*A virgiǹalis,* Hort.). Pseudobulbs angled, ovate-oblong, 3–6 in long lvs up to 2 ft long, broadly lanceolate fls creamy white, often flushed or spotted internally with pink, sepals ovate, acute, petals oblong-elliptic, acute; lateral lobes of lip semi-orbicular, rounded at apex, the middle lobe linear, recurved Peru and Colombia G C III. 19 423 B R 30 60 B M. 4807 Gt 32 1137 A F. 6·607.



208 Anguloa Clowesii. (×1/4)

AA *Middle lobe of lip ovate-triangular, 2-lipped*

B *Lateral lobes triangular, acute*

Cl̀owesii, Lindl Fig 208. Pseudobulbs cylindric-oblong, 4–6 in long lvs up to 2 ft long, obovate-lanceolate fls lemon-yellow, sepals and petals acute, oblong-elliptic, lip with the lateral lobes triangular, acute, the middle lobe broadly ovate-triangular, fleshy, pubescent Colombia B R 30 63 B M 4313 Lind 4 191. Veitch, Man pl p 100 Var **ebúrnea,** Veitch (*A ebúrnea,* Williams) Differs in its ivory-white fls Colombia

BB *Lateral lobes semi-orbicular, rounded at apex*

Rúckeri, Lindl Similar to *A Clowesii,* but smaller Fls green or yellowish green, flushed with brown on the outside, inside yellow densely spotted with red, sepals and petals oblong-elliptic, lip much as in *A Clowesii,* but the lateral lobes rounded at apex Colombia B R 32 41 Gt 3 106 A F 6 607 Lind 2 53. Var **albiflòra,** Veitch Fls white, of waxy texture Var **sanguínea,** Lindl Fls uniformly deep red on inside B H 3 31 I H 28 427

A Cliftonii, Hort O 4 pl 3 —*A intermèdia,* Rolfe, a hybrid between A Ruckeri and A Clowesii, was produced by Seden This had fls of nearly the size and shape of A Ruckeri

GEORGE V NASH.

ANHALÒNIUM. *Cactàceæ* A name used in the first edition of this Cyclopedia, but now given place to the slightly older name *Ariocarpus,* which see. *A. Williamsii* and *A Lewinii,* sometimes referred to Echinocactus or to Mamillaria, are here treated under *Lophophora,* which see

ANIGOZÁNTHOS (Greek, *expanded flower*). *Amaryllidàceæ.* AUSTRALIAN SWORD LILY. About 8 Australian greenhouse or half-hardy perennials with sword-like lvs and woolly-yellow, -green, or -red fls in short 1-sided racemes or spikes and a much elongated perianth-tube. The two species likely to be met with are **A. flávida,** Red (*A coccínea,* Paxt.), with mostly red-woolly fls. 1¼ in long and appendaged anthers; and **A. Mánglesii,** Don, with fls about 3 in. long, red-woolly at base and green beyond, the anthers not appendaged. These plants are little known in N. Amer.

ANISACÁNTHUS (Greek, *unequal acanthus*) *Acanthàceæ* A genus of 6 species of Mexican and American shrubs, with mostly lanceolate, entire, petioled opposite or clustered lvs, and loosely spicate or scattered red fls 1 in or more long, corolla-lobes 4, the tube 2-lipped, the upper lip 3-parted, the lower entire; stamens 2, equaling or exceeding the corolla-lobes

Wrightii, Gray Height, 2–4 ft: lvs 1–2 in long, oblong- or ovate-lanceolate, acute or acuminate fls. racemose, or paniculate-racemose, the corolla vermilion or purplish red, 1½–2 in long, the lip shorter than the tube, calyx deeply 5-cleft S and W Texas Offered by Franceschi of Santa Barbara, Calif

Gonzalèzii, Greenm (*A Conzàttii,* Hort) Sub-shrub, the st. much branched lvs 1–2 in long ½–¾ in wide, acuminate, and obtuse at the apex fls cymose-racemose, brick-red, or scarlet and larger than in the preceding Oaxaca, Mex —Suitable for dry places. Intro by Franceschi in 1911 N TAYLOR †

ANISE. *Umbellìferæ* An aromatic condimental and medicinal herb

Anise (*Pimpinélla Anìsum,* Linn) is an annual, easily grown from seeds in any warm and mellow soil The seeds are commonly sown where the plants are to stand, and the plant matures rapidly The seeds are used in medicine and in cookery, and for flavoring liquors, they yield a highly perfumed essential oil, they are mostly grown in Mediterranean countries The lvs are also used as seasoning and garnishing The plant reaches a height of 2 ft or less, bears twice-pinnate lvs and small yellowish white fls. in large, loose umbels The seeds are oblong and curved, ribbed on the convex side, grayish, the size of caraway seed In common with all umbelliferous seed, anise seed does not retain its vitality long, the normal longevity being 1–3 years Native from Greece to Egypt. L. H B

ANISÒTES (Greek, *unlikeness*). *Acanthàceæ* Broad-leaved shrubs of about 4 Arabian and African species, one of which has been intro to cult recently Fls in short axillary clusters, sepals 5, nearly free, corolla 2-lipped, in shades of red, stamens 2, the filaments long and glabrous fr a caps **A. diversifòlius,** Balf, from the Isl of Socotra, is an erect nearly glabrous shrub less than 2 ft high lvs elliptic-ovate or obovate, 2 in or less long, flame-colored or yellow, tubular and 2-lipped, the lips curved B M 8219 —Warm greenhouse, blooming spring and summer Requires the treatment given to Justicia and Jacobinia Prop. easily by cuttings L H B.

ANÌSUM. An old generic name now referred to Pimpinella *A officinale,* D C. (P Anisum) is *Anise,* which see

ANNÒNA (Latin, *year's harvest*, suggested by the Haitian name *anon* applied to one of the species. Commonly spelled *Anona*, but Linnæus used the double *n*). *Annonàceæ* (Richard, 1808) CUSTARD-APPLE. ARATICÚ Tropical and subtropical woody plants cultivated for their fleshy fruits and for ornament

Leaves 2-ranked, alternate, devoid of stipules: fls. perfect, solitary or in clusters, extra-axillary, often opposite the lvs and sometimes subterminal; calyx usually gamosepalous, 3-parted, petals typically 6, in 2 series, but the inner series in some species reduced to small scales or even wanting, stamens numerous, crowded on the receptacle, the fleshy filament bearing a pair of linear parallel pollen-sacs on its back, these opening extrorsely by a longitudinal slit and capped by the expanded hood-like connective, pistils many, the ovaries usually clothed on the outside with minute hairs and containing a single erect ovule at the base fr a syncarpium, formed by the growing together of the carpels and receptacle into a fleshy mass, seeds containing a large wrinkled endosperm with small basal embryo —Trees and shrubs, over 50 in number, chiefly from Trop Amer , but a few from Afr , and several now widely cult in the warmer regions of both hemispheres

Several species have been successfully introduced into southern California and Florida Some of those cited in catalogues and horticultural publications are merely forms of old species and others are generically distinct Amongst these names are *A mexicana*, which was a catalogue name used by Loddiges; *A excelsa* of Humboldt & Bonpland, a species never fully described, the flowers and fruit of which are entirely unknown; and *A africana*, an obscure species based by Linnæus upon an American specimen with lanceolate, pubescent leaves *A trilobata* and *A obovata* are *Asimina triloba* and *Asimina obovata*, *A asiatica* of Linnæus is not an annona at all but a rubiaceous plant, *Morinda citrifolia*, while *A asiatica* of Loureiro is *A reticulata*, and *A asiatica* of Vahl is *A squamosa* *A Forskahlii* of De Candolle (*A glabra*, Forsk , not Linn) was based upon a specimen of *A squamosa* growing in cultivation in Egypt, to *A squamosa* must also be referred *A. biflora* of Mociño & Sessé, while *A longifolia* of these authors is undoubtedly *A reticulata*, and their *A fruticosa* is *A globiflora* of Schlechtendahl *A aurantiaca* and *A macrocarpa* are Brazilian species, the names of which were erroneously applied to certain cultivated forms in southern California, while *A suavissima* is only a horticultural variety of *A Cherimola*, and *A. cinerea* of the Antilles a form of *A squamosa* *A palustris* of Linnæus is identical with his previously described *A glabra*, and the latter name must take precedence in accordance with accepted rules of priority A number of species described as annonas belong to other genera Among them are *A amplexicaulis* and *A grandiflora* of the islands of Mauritius and Madagascar, which belong to the genus Pseudannona *A Manni* of Oliver, an African species which has a branching inflorescence very different from that of the genus Annona, has been assigned to a new genus Anonidium by Engler & Diels, and *A Perrottetia* of A De Candolle has been placed in the genus Unonopsis by R E Fries *Annona obtusiflora* of Tussac, together with *A mucosa* of Jacquin, must be placed in the genus Rollinia under the name *R mucosa*, and to this genus should also be assigned the Brazilian biriba, which is probably *Rollinia orthopetala*, a species with large, fleshy fruit of delicious flavor, successfully introduced into Florida from Para The climbing *Annona uncinata* of Lamarck belongs to the genus Artabotrys. *A pyriformis*, also a climbing shrub, of Mauritius, the fruit of which is unknown, belongs undoubtedly to some other genus For *Annona longifolia* see *Duguetia* See also *Rollinia*, *Artabotrys* and *Cananga*

W E SAFFORD

Cultural notes

While the annonas succeed best on a heavy loam, most species can be grown on light soils and under adverse conditions The custard-apple (*A reticulata*) thrives on the Florida keys in a semi-naturalized state; the cherimoya (*A Cherimola*) grows and bears abundantly on steep calcareous cliffs in Central America, the sugar-apple (*A squamosa*) is successful on dry and sandy soils with practically no attention whatever The situation best adapted to them is a sloping piece of ground, for, with the exception of *A glabra*, they are intolerant of stagnant water about the roots

The cherimoya, probably the hardiest of the genus, withstands temperatures as low as 26° F without injury, and reaches perfection only in a comparatively cool climate. The soursop (*A muricata*) is one of the tenderest species; the sugar-apple and the custard-apple are somewhat hardier, all three are successfully grown in southern Florida, but not in California

Propagation is usually effected by means of seeds; the most highly valued species, however, such as the cherimoya, are budded or grafted

Seeds will retain their vitality for several years, and if planted in warm weather or under glass will germinate in a few weeks If in a greenhouse, they may be planted at any season of the year, otherwise, it is best to plant only during spring or early summer Sow thickly in flats or pans of light, porous soil containing an abundance of humus, covering to the depth of ½ or ¾ inch When the plants are 3 or 4 inches high, they should be potted into 3-inch pots, care should be taken to see that the soil is perfectly drained, and waterings should not be too frequent or copious When the plants have attained a height of 8 or 10 inches, they may either be shifted into larger pots or set out in the open ground, in the latter case, they must have careful attention until they have become established and made considerable growth

Both budding and grafting have proved to be readily applicable to the annonas, either in the open ground or in pots, under glass Several different species have been used for stocks, *A Cherimola* proving the most satisfactory thus far in California, as it is best adapted to that climate; *A glabra* has been found to be the most vigorous and satisfactory in Florida.

Shield budding, essentially the same as practised with the citrous fruits, is the method most commonly used The work is best done in spring, shortly after the sap has begun to flow, the time varying, of course, according to locality and season Stocks should be from ⅜ to ½ inch in diameter, seedlings of this size will be eighteen months to two years old Budwood from which the leaves have dropped, and of about a year's growth, is the most desirable It is important that the buds be cut large,—about 1½ inches in length, —as they are likely to have difficulty in starting and be choked out, on account of the thick bark and rapid callousing of the annonas, if they are too small The incision may be made either in the form of a T or an inverted T, raising the bark with care so that the delicate tissues lying under it will not be injured, and inserting the bud with as little pressure as possible Waxed tape should be used for tying. Three or four weeks after insertion, the buds should be unwrapped, and, if they have united with the stock, re-wrapped loosely, lopping the stock at a point 5 or 6 inches above the bud The wrap should not be removed until the bud has made a growth of several inches.

For grafting, two-year-old seedlings are used, the operation being a simple cleft-graft, using a scion of well-matured wood from which the leaves have dropped

Cuttings of well-ripened wood can be rooted under glass, with bottom heat This method of propagation is not widely practised, however.

The annonas, when grown from seed, vary greatly

in regard to productiveness as well as size, color, form, texture and quality of fruit In southern California, many large seedling cherimoyas have been grubbed out because they were unproductive, while others produce fruit of such poor quality as to be of no value. Careful attention to culture will assist in improving the quality and size of the fruit, but the only sure way to perpetuate choice forms and eliminate all possibility of the tree turning out to be inferior is to propagate by some asexual means.



209. Annona muricata. (×⅛)

Most species come into bearing when three or four years old Few named varieties have been established, and these are probably confined to the cherimoya.

In some countries, the annonas are subject to certain fungous diseases and insect pests, notably the mealy-bug As a class, however, they seem to suffer less from these pests than most other fruit trees They require very little pruning

Fruits must be picked when mature,—to avoid their falling to the ground and becoming bruised,—and laid away for a few days before they are ready for eating If they are to be shipped any distance, they must be packed in some material, such as excelsior or straw, that will allow good ventilation, each fruit being wrapped in a piece of strong paper. The selection of the toughest-skinned varieties adds greatly to the facility with which they can be shipped F W. Popenoe

INDEX.

biflora, 9.
Cherimola, 6
cinerea, 9
diversifolia, 5
Forskahlii, 9
glabra, 4
laurifolia, 4
longiflora, 7.
longifolia, 8
montana, 2
muricata, 1, 2
palustris, 4
purpurea, 3
reticulata, 8
squamosa, 9.
tripetala, 6

A. *Petals broadly cordate-ovate or suborbicular, the inner ones somewhat smaller than the outer.*

B. *Exterior petals valvate or edge-to-edge, usually acute, inner ones imbricate or overlapping, obtuse or rounded*

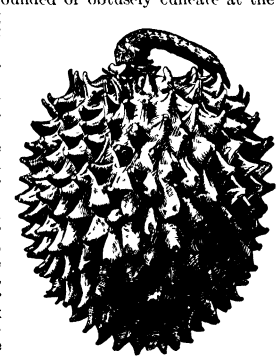
C. *Fr. glabrous, bearing fleshy spines· lvs glossy leathery, with minute pockets in the axils of the lateral nerves*

1. **muricàta,** Linn Soursop Guanábana Corossol Coração de Rainha Graviola Suirsaak Zuursaak Fig 209 Small evergreen tree, the size of a peach tree, in general cult throughout the tropics of both hemispheres· lvs leathery, ill-smelling, obovate-oblong or oblanceolate, to ovate or elliptic, acute or abruptly acuminate, glossy above and rusty beneath but at length glabrous, with the minute pockets in the axils of the lateral veins scarcely perceptible without a lens· fls large, the exterior petals thick and fleshy, ovate-acute, valvate or edge-to-edge, the interior petals somewhat smaller and thinner, concave, rounded, imbricate or overlapping· fr very large, fleshy, often as large as a child's head and weighing as much as 5 lbs , ovoid or heart-shaped, dark green, the glabrous ill-smelling skin bearing numerous recurved fleshy spines; pulp white and juicy, pleasantly subacid, with a slight mango-like flavor. Of Trop Amer origin, but now common in the tropics of the Old World —As in all cult frs , there is more or less variation in its flavor. It is easily prop from the seed or from buds, and is undoubtedly capable of improvement by selection It begins to bear at a very early age and is consequently one of the most valuable fr. trees of the tropics. It is grown with especial excellence in Porto Rico, and is common in the markets of Key West, whither it is shipped from the islands to the southward A favorite drink is made from the juice, and the pulp yields excellent jelly, tarts and preserves Care must be taken, however, to remove the skin in preparing the fr for the table

2 **montàna,** Macfadyan (*A muricàta*, Velloso, not Linn) Mountain Soursop Guanábana Cimarrona Corossolier Bâtard Araticú Ponhé A forest tree, sometimes reaching the height of 45 ft , but usually of smaller dimensions lvs resembling those of the soursop, varnished above and dull beneath, with the pits in the axils of the lateral nerves often conspicuous fls similar to those of the soursop, solitary or in pairs. fr spheroid or broadly ovoid, varying from the size of an orange to 6 in diam , green at first, at length turning yellowish, skin glabrous, bearing numerous short erect fleshy spines, pulp not edible This species, which is larger and more robust than the closely allied *A muricata*, has been intro into Fla for use as stock upon which to bud other species of the genus W Indies and N. S Amer ; thus far unknown from Mex and Cent Amer —The peculiar pits, or pockets in the axils of the lateral nerves of the lvs set apart this species, together with *A muricata*, from all other species of the genus

CC. *Fr. covered with felt-like tomentum, bearing rigid stout pyramidal spines often hooked at the tip lvs very large, subcoriaceous or membranaceous, undulate without axillary pockets*

3. **purpùrea,** Mociño & Sessé Negro-head Cabeza de Negro Soncoya Sencuya Toreta Fig 210 A small or medium-sized tree, sometimes reaching the height of 25 ft , the younger branches clothed with reddish tomentum but becoming glabrate at length lvs large, membranaceous or subcoriaceous, undulate, oblong-elliptical to oblong-obovate, acuminate at the apex, rounded or obtusely cuneate at the base, 8–12 in long and 4–5½ in broad; petioles short and thick. fls resembling those of *A. muricata* but sessile or nearly so, solitary, extra-axillary, sometimes opposite a lf , inclosed when very young in an involucre of 2 bracts, the apex of which becomes more or less shriveled at length, and the base persists somewhat like an outer or second calyx, calyx 3-lobed, ferrugineous-velvety on the outside, 3 outer petals very thick, valvate, usually acute or acuminate, sometimes obtuse at the apex, ferrugineous-velvety on the outside, stained with purple within, inner petals overlapping, thinner and rounded, forming a dome-like covering over the essential parts, whitish on the outside, purple within; terminal connectives of the stamens velvety carpels distinct at first, the hirtellous ovaries crown. by a

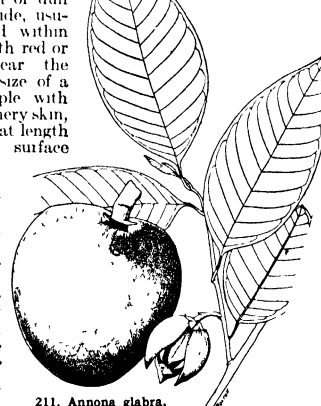


210. Annona purpurea. (×⅓)

prismatic style about ⅛in long fr large, spheroid or broadly ovoid, sometimes 6–8 in diam, covered with a brownish felt-like indumentum and bearing numerous pyramidal protuberances, grooved longitudinally on the ventral side and usually terminating in a hook directed toward the peduncle, seeds large, obovate, more or less flattened and marginate, sometimes exceeding an inch in length by ½–¾in broad, pulp fleshy, fibrous, very fragrant, edible, with a flavor somewhat like that of a mango Mex to Panama and perhaps N S Amer It is abundant on the Isthmus of Tehuantepec and is sold in the markets of Veracruz —The frs differ considerably in flavor Some of those on the Isthmus of Panama are reputed to be excellent, though here, as elsewhere, they are supposed to induce chills and fever. Intro into S Calif, but imperfectly known in cult Like its congeners, it is undoubtedly capable of improvement by careful selection

BB. *Exterior and interior petals both valvate or edge-to-edge and usually acute*

4 **glàbra,** Linn (*A palústris*, Linn *A laurifòlia*, Dunal) Pond-Apple Alligator-Apple Monkey-Apple Mangrove-Annona Mamin Mamain Cachiman-Cochon Cayul Cayures Cork-wood. Palo Bobo Bois-flot Corcho Cortisso Araticú do Brejo Fig 211 Small to medium-sized tree, sometimes reaching a height of 45 ft, growing in swampy places and along the banks of streams, young growth smooth lvs smooth and laurel-like, glossy green above, paler beneath, evergreen, ovate to oblong or elliptic, usually acute or acuminate but sometimes blunt-ish at the apex and rounded or tapering at the base fls fragrant, varying considerably in size, those of trees growing in favorable situations larger than those growing in crowded mangrove swamps, outer petals cream-colored or pale greenish yellow when fresh, usually marked within by a deep red spot near the base, inner ones somewhat shorter and narrower, whitish or dull greenish outside, usually blood-red within or spotted with red or wine-color near the base fr the size of a bellflower apple with a smooth leathery skin, green at first, at length yellowish, its surface covered with indistinctly outlined areoles, but these never elevated or squamose, pulp cream-colored when ripe, not edible except by iguanas and other animals Everglades of Fla. and banks of the Indian and Caloosahatchee Rivers; also the tropical shores of Amer, W. Indies, west coast of Afr., and the Galapagos Isls —Statements that the fr. is sold in the markets of Mex and that the tree is cult for its fr are based upon the confusion of other species of annona having smooth frs with this This species is essentially tropical and swamp-loving. Its light spongy roots are used as a substitute for cork and for floats of fishing-nets, hence its name cork-wood.

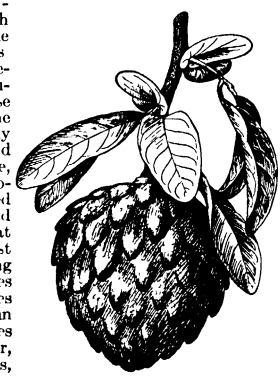


211. Annona glabra. (×⅓)

AA *Petals (exterior) linear or oblong, the inner ones minute and scale-like*

B. *Peduncles with broad persistent lf-like bracts at the base*

5. **diversifòlia,** Safford Ilama. Ilamatzapotl. Fig 212 Small tree with brownish-gray, aromatic, longitudinally furrowed bark; young growth glabrous, with prominent lf-scars bordered with a margin of pale rufous hairs lvs thin, membranaceous, glabrous, variable in form, those near the base of the branchlets broadly elliptical and rounded at the base, those higher up oblanceolate, rounded at the apex and acute or cuneate at the base, the largest 4–5½ inches long and 1½–2 inches broad with petioles exceeding ½inch in length peduncles long and slender, recurved, glabrous, issuing from 2 suborbicular, lf-like, amplexicaul bracts at the base of the branchlets; fl-buds obpyriform, calyx-divisions broadly ovate or triangular, terminating at the points in a tuft of ferruginous hairs, outer petals linear-oblong, swollen at the base and concave within, sparsely rusty-pubescent on the outside, inner petals minute, pubescent on the back and bearing 2 rudimentary pollen-sacs, carpels distinct, glabrous near the base, rufous hirtellous above, at length growing together into a compound fr or syncarpium fr large, conoid or broadly ovoid with an axis of about 6 in and a diam of 5 in, clothed with dense gravish felt-like tomentum and when mature usually bearing stout thick protuberances directed toward the apex, but these sometimes suppressed, pulp edible, cream-colored or rose-tinted, seeds hard, smooth and nutlike, golden brown or tan-colored Mts and foot-hills west coast of Mex to Salvador —The fr is offered for sale in the markets of Colima and Acapulco It is described by American Consul Marion Letcher, stationed at Acapulco, as shaped like a pineapple cheese, with delicious pink-tinted pulp, and Samuel E Magill, American Consul at Guadalajara, states that the frs grown on the side of the volcanos of Colima and Cerro Grande are of unusually fine quality This species has been intro. into S. Fla.



212. Annona diversifolia (×¼)

BB *Peduncles devoid of lf-like bracts at the base*

C. *Lvs velvety beneath*

6 **Cherimòla,** Mill (*A tripétala*, Ait.). Chirimoya. Cherimoya Cherimoyer Cherimolla. Tree, 15–25 ft high, with young growth fulvous tomentose: lvs persistently velvety-tomentose beneath, sparsely pubescent above, ovate to ovate-lanceolate or obovate, sometimes elliptical, obtuse at the apex or obtusely acuminate, usually rounded at the base fls fragrant, extra-axillary, often opposite a lf at the base of a branchlet, usually solitary but sometimes 2 or 3 on short nodding tomentose peduncles, the exterior petals oblong-linear, not exceeding 1¼ in length, keeled on the inside and excavated at the base, greenish yellow or rufous on the outside and clothed with velvety tomentum, pale yellow or whitish within and marked with a purple spot at the base, inner petals very small, squa-

mose, ovate or triangular, usually flesh-colored or purple and keeled on the outside. fr variable in shape and appearance, sometimes conoid or heart-shaped, with surface bearing protuberances, sometimes spheroid or ovoid with the surface covered with concave or squamose U-shaped areoles, each bearing a small wart or tubercle, and sometimes quite smooth or with the surface having the appearance of putty marked by fingerprints; pulp white, edible, pleasantly acidulous, easily separable from the seeds, seeds usually obovate, obliquely truncate, somewhat compressed, with a thin membranous brown testa which is usually more or less wrinkled or pitted, owing to the wrinkled surface of the inclosed endosperm Andes of Peru and adjacent regions, but naturalized at a very early date in Mex. and Cent Amer. Successfully intro into S Calif, Canary Isls, Madeira, the mts of India, and Hawaii Essentially a subtropical plant which does not yield good results in low tropical countries —Frs of exquisite flavor are produced on the island of Madeira, where the trees are trained on trellises and are taking the place of grapes in the economy of the island Excellent results have also been secured in S Calif See *Cherimoya*



213. **Annona reticulata.** (×¼)

7. **longiflòra,** Wats WILD CHERIMOYA OF JALISCO A shrub or small tree, 3–10 ft high, young growth softly pubescent branches with prominent lf -scars, which are clothed with a marginal collar of plush-like hairs· lvs resembling those of *A Cherimola* but distinguished when mature by being glabrate or glabrescent between the lateral nerves, which together with the midrib are persistently velvety pubescent, the blades 2–5½ in long and 1½–3¼ in broad, elliptical to obovate-elliptical, usually rounded but sometimes acute at the base and rounded at the apex, which is often minutely apiculate fls short-peduncled, pubescent, the calyx-divisions deltoid-ovate, clothed on the outside with fine soft hairs, the outer petals leathery, often 2 in long, linear-oblong or oblong-lanceolate in shape, cream-colored or whitish, and marked within with a dark purple or blackish spot at the excavated base; inner petals minute (sometimes wanting), ovate, obtuse, finely pubescent; carpels distinct, the ovaries clothed with rufous hairs, and the styles minutely puberulent fr conoid or globose-ovate, its surface covered with protuberances or with reticulated areoles; pulp white, resembling that of *A. Cherimola* in flavor. State of Jalisco, Mex, especially in vicinity of Guadalajara and Tequila. Intro. into S. Calif, but as yet little known

CC *Lvs not velvety*

D. *Fr. smooth or nearly so, its surface divided into angular areoles by impressed lines, pulp tallow-like.*

8. **reticulàta,** Linn (*A longifòlia,* Mociño & Sessé). COMMON CUSTARD-APPLE. BULLOCK'S-HEART. CORAZON. COROSSOL CŒUR-DE-BŒUF CORAÇÃO DE BOI. MAMON ANONAS ANONA COLORADA. QUAUHTZAPOTL. Fig 213 A deciduous tree, 15–25 ft high with young growth fulvous-pubescent, at length glabrate lvs. approximate, oblong-lanceolate or lanceolate, acute at the apex, conduplicate, glabrate, or with the midrib and lateral nerves sparsely pubescent fls in extra-axillary clusters of several issuing from the new branchlets, peduncles nodding; outer petals fleshy, oblong-linear, keeled on the inside and excavated at the base, olive-green or yellowish, usually stained within with purple and with a dark purple blotch at the base, inner petals very small, scale-like, ovate, acute, carpels distinct, the ovaries covered with pale brown silky hairs, at length uniting to form a solid fr. fl. 3–5 in diam, smooth, with the surface divided into rhomboid or hexagonal areoles by impressed lines, usually reddish or reddish brown when ripe, or red-cheeked on the sunny side, pulp sweetish but insipid, tallow-like and usually granular, adhering closely to the seeds Trop. Amer, now widely spread throughout the tropics of both hemispheres —A robust tree which has spread spontaneously in the forests of the Philippines, the island of Guam and the E Indies, while its congeners, *A. muricata* and *A squamosa,* occur usually only where planted It is essentially tropical while the cherimoya, with the smooth-fruited forms of which it has often been confused, is subtropical Its fr is inferior in flavor to both the cherimoya and the sugar-apple (*A squamosa*), from the first of which it may be distinguished by its long, narrow, glabrate lvs, and from the second by its solid, compact fr, as well as its larger lvs From *A glabra,* with which it is also confused, it may be distinguished by its elongate narrow outer petals and its small, dark brown seeds It is common in the W Indies and thrives in S Fla

DD *Fr composed of rounded carpels loosely cohering when ripe, covered with a glaucous bloom, pulp creamy or custard-like*

9 **squamòsa,** Linn (*A. cinèrea,* Dunal *A Forskâhlii,* DC *A biflòra,* Mociño & Sessé) SUGAR-APPLE SWEET-SOP ANON ATTA ATTE ATIS POMME-CANNELLE KESCHTA FRUTA DA CONDESSA AHATE DE PANUCO STEENAPPEL TEXALTZAPOTL PINHA Fig 214 A small deciduous tree, 15–20 ft high, with irregularly spreading branches and zigzag branchlets bearing approximate 2-ranked lvs, young growth pubescent, at length glabrate or clothed with scattered hairs and dotted with lenticels lvs conduplicate, resembling those of *A reticulata,* but smaller, usually lanceolate or oblong-lanceolate, acute or shortly acuminate at the apex and acute or cuneate at the base, sometimes ovate or elliptical and rounded at the base with a tendency to be asymmetrical, membranaceous, minutely punctate with both surfaces pale green; sparsely hairy at first, at length glabrate or nearly so, except the petiole, which is pubescent. fls borne on the young branchlets, closely resembling those of *A. reticulata,* extra-axillary, usually in clusters of 2, 3, or 4, but sometimes solitary; peduncles slender, sparsely and delicately pilose, at length glabrate, bearing a minute bracteole below the middle, which terminates in a tuft of floccose hairs, outer petals oblong-linear, thick, tri-quetrous, rounded at the apex and



214. **Annona squamosa** (×⅓)

excavated at the base, greenish yellow, usually marked within by a wine-colored or purplish red spot at the base; inner petals minute, ovate or obovate, keeled on the outside; stamens with broad terminal connectives of a cinnamon-brown or orange-red color; carpels distinct, clothed with pale brown hairs, sulcate on the ventral side and terminating in oblong or taper-pointed styles: fr. about the size of an orange, spheroid or heart-shaped, composed of loosely cohering carpels rounded at the extremities and grooved on the inner side, forming a squamose or tuberculated surface, greenish yellow and covered with a glaucous bloom at first, but soon turning black in spots when handled, and the waxy bloom easily rubbed off; pulp yellowish white, creamy or custard-like, very sweet and pleasantly flavored; seeds dark brown, smooth, closely resembling those of *A reticulata*. Trop Amer, now widely cult. in all tropical countries —Less robust than *A reticulata*, with fr much more highly prized, and produced several times during the year instead of only once, as in that species Like *A reticulata*, it is essentially tropical and will not thrive in subtropical regions which are suitable for the cult of the cherimoya. It has been intro into S Fla Delicious sherbets are made from its custard-like pulp, often with the addition of a little lemon juice, but it is never cooked or made into preserves or jelly, like the soursop The fr, when green, as well as the seeds and lvs, is used for destroying vermin, and the crushed lvs, in the form of poultices, are applied to ulcers and malignant sores in the W. Indies. The root is a drastic purgative W. E. Safford.

ANNUALS. What are known to gardeners as "annuals" are plants that bloom in the open the same year the seeds are sown and that do not live over winter

These plants are not necessarily true annuals, for annuals in the botanical sense are plants that normally complete their entire life-cycle within one vegetation-year Perennial plants that bloom freely from seed the first year and do not usefully survive till another year may be classed as annuals by the gardener and treated as such these are properly plur-annuals, a group standing midway between annuals and perennials The garden *Nicotiana affinis* (properly *N. alata*) and pinks and snapdragons are such It may be said that plur-annuals are plants of somewhat indefinite duration that are terminated by cold weather rather than by their normal maturity within the season Many real perennials, as castor bean, are treated as annuals in northern gardens

Some of the biennial plants—those that normally bloom and perish in the second year—may flower the first year if the seeds are sown early and the plants are hurried along Of these, Canterbury bell, ipomopsis and some of the œnotheras are examples See *Biennials*.

The annuals of gardens are grown directly from seeds, in usual practice Some plants are reared annually from bulbs or tubers, as crocus, lilies, potato: these are really perennials that die each year to the ground and do not perish root and branch To these plants the name pseud-annuals (i e, false annuals) has been given

Among the true annuals there are many grades Some of them are winter annuals, growing in the cool part of the year and carrying over winter under the snow, as the common creeping chickweed and other crucifers In the arid regions of the West, many annual plants spring into growth with the rains and thrive in the cool months Many of the annuals are summer annuals and others are autumn annuals these two classes are practically the only ones that are cultivated in the open for ornament

Among the annuals are found some of the most showy garden flowers As a rule, they are easily grown, producing quick results and affording a great variety of colors, forms and foliage Some of the annuals last only a few weeks in bloom, others continue throughout the summer. There are trailers and climbers, dwarfs and tall growers By a judicious selection and arrangement of kinds, the handsomest effect may be produced Many of the showy kinds are adapted to mass effects, while the dwarf-growing sorts make good flowering edgings for beds or walks. With the latter, handsome ribbon-beds are possible, but this requires care in the selection of kinds, and as the use of the trimming shears is almost precluded, it is best to limit oneself to simple designs. Annuals are well suited to the covering of bare spots of ground in the border Like other flowers, they display best when seen against a background of foliage. The tall and leafy kinds make excellent covers for unsightly objects For climbing and twining kinds, see *Vines*. See, also, *Everlastings* and *Grasses*.

Classification as to hardiness.

It is customary to divide annuals into three classes: (1) Hardy annuals are those that are sown directly in the open ground where they are to grow. They are



215. Annuals filling the formal space between a drive and a tree-group

vitally strong, developing without artificial heat, and may be sown from February to May, according to the season and latitude Some of them, as sweet peas, may be sown even in the fall For this class, a well-prepared border on the south side of a fence or wall, or other sheltered place, is usually preferred for early sowings. From here the seedlings are transplanted later where they are to grow Some sorts, however, do not bear transplanting well, consequently must be sown in the places they are to occupy Among such are poppies, eschscholtzia, bartonia, Venus' looking-glass, lupine, malope, and the dwarf convolvulus. (2) Half-hardy annuals are usually sown in February or March in the window or a warm frame The season is usually not long enough to enable them to reach full development in the open In the early stages of growth they need protection and warmth Such kinds are sometimes sown in the fall and wintered over in a coldframe When once established, they are hardy with slight protection. Some of the kinds are grown to their greatest perfection only in this way (3) Tender annuals require still more warmth and are started from January to May in the greenhouse or other suitable place They commonly need a temperature of 60° to 70° The danger with early-grown seedlings, especially those started in the window, is over-crowding and want of light. As soon as crowding begins, the plants should be

thinned out or transplanted to other trays, or into pots, and reset from time to time, as they need; frequent transplanting is usually an advantage The last transplanting is preferably into small pots, as then the seedlings may be readily set in the open ground at the proper time, with little or no check.

Seed-sowing.

The greater number of common annuals will bloom freely if the seeds are sown in the open ground when the weather becomes thoroughly settled. But there are some kinds, as the late cosmos and moonflowers, for which the northern season is commonly too short to give good bloom unless they are started very early indoors.

In the case of others than the continuous bloomers, a succession of sowings or plantings is desirable to provide for a continuous display, then as a kind begins to fail, its place may be filled with young plants of the same



216. A semi-formal garden space of annual flowers.

or other species. The usual method of securing succession is to sow the seeds in flats, or beds, and transplant the seedlings first to pots The potted plants may be set out at any time, with but little check to growth.

When flowers of any annual are wanted extra early, the seeds should be started indoors It is not necessary to have a greenhouse for this purpose, although best results are to be expected with such a building. The seed may be sown in boxes, and these boxes then placed in a sheltered position on the warm side of a building At night they may be covered with boards or matting In very cold "spells" the boxes should be brought inside In this simple way seeds may often be started one to three weeks ahead of the time when they can be sown in the open garden Moreover, the plants are likely to receive better care in these boxes, and therefore to grow more rapidly Of course, if still earlier results are desired, the seed should be sown in the kitchen, hotbed, coldframe, or in a greenhouse In starting plants ahead of the season, be careful not to use too deep boxes The gardener's "flat" may be taken as a suggestion Three inches of earth is sufficient, and in some cases (as when the plants are started late) half this depth is enough

One trouble with early sown seedlings is "drawing up," and weakness from crowding and want of light. This is most likely to occur with window-grown plants. Vigorous June-sown plants are better than such weaklings It must be remembered, however, that very early bloom usually means the shortening of the season at the other end, this may be remedied to some extent by making sowings at different times

Only the best seeds should be purchased, and it is usually best to get the colors in separate packets. In the open ground, seeds may be covered to a depth of four or five times their own thickness, but when sown indoors in trays or pots, the rule is to cover them to about their own thickness After covering, the soil should be pressed firmly over the seed with a board or hoe, or the feet. In soils that are inclined to bake, a sprinkling of sand or fine litter over the surface after sowing will remedy this evil Evergreen boughs placed over the beds until the seedlings have appeared will afford useful shelter from beating rains It is desirable to sow the seeds thickly. For the reception of seeds, the surface should be mellow and smooth The seeds are sown in drills or concentric circles, according to the method of planting decided upon Taller-growing kinds are sown toward the center or back of the bed When up, the plants may be thinned to their proper distances Particular care should be given to this matter, and to keeping down weeds, or the plants may become weak, spindling and valueless Much trouble will be avoided if each seed-row is plainly labeled or marked so that the young plants may be distinguished from the weeds, with which they must often compete

Soils and places.

Most annuals thrive best in an open, sunny situation, but pansies, forget-me-nots, and some others, thrive where they get the full sunshine for only half the day Some of the kinds are at their best in full sunlight, as portulaca, sunflower, and zinnia. In all cases the best results are secured only when the soil is well enriched and thoroughly prepared previous to sowing or planting, and it is far better to make this preparation a fortnight or more in advance A considerable proportion of humus in the soil is desirable, rendering it less subject to baking and drying out. Cow-manure, stable-manure or leaf-mold, worked in liberally, will supply this Beds should be spaded thoroughly and at least a foot deep If the surface is then again worked over to half this depth, better results will be obtainable. The soil should not be disturbed, however, unless it pulverizes readily.

When the flowers are to be grown about the edges of the lawn, make sure that the grass roots do not run underneath them and rob them of food and moisture It is well to run a sharp spade deep into the ground about the edges of the bed every two or three weeks for the purpose of cutting off any grass roots that may have

run into the bed. If beds are made in the turf, see that they are 3 feet or more wide, so that the grass roots will not undermine them Against the shrub borders, this precaution may not be necessary it is desirable that the flowers fill all the space between the overhanging branches and the sod

The plants should not be allowed to bear seed, else they will be exhausted and the season of bloom will be short Sweet peas, for example, soon spend themselves and dry up if the pods are allowed to ripen The frequent cutting of blooms prolongs the season.

The kinds

Most of the staple or general-purpose types of annuals in the North are the following petunias, phloxes, pinks or dianthuses, larkspurs or delphiniums, calliopsis or coreopsis, pot marigolds or calendulas, bachelor's buttons or *Centaurea Cyanus*, clarkias, zinnias, marigolds or tagetes, collinsias, gilias, California poppies or eschscholtzias, verbenas, poppies, China asters, sweet peas, nemophilas, portulacas, silenes, candytufts or iberis, alyssum, stocks or matthiolas, morning-glories, nasturtiums or tropæolums, wallflowers, gaillardias, snapdragons, coxcombs, lobelias, four-o'clocks, amaranths, balsams, sweet sultans, salpiglossis, scabiosas, nicotianas, and pansies Other species are mostly of special or particular use, not general-use types In the South, and occasionally at the North, some of the annuals come up voluntarily year after year from self-sown seeds, e g, petunias, phloxes and morning-glories

Late sowings, even as late as June in the latitude of New York City, may be made of such things as China aster, sweet alyssum, California poppy (Eschscholtzia), calliopsis or coreopsis, portulaca, calendula, phlox, zinnia, marigold, candytuft, mignonette, petunia Late-blooming beds of these and other annuals may be secured by this delayed sowing The tendency to sow everything for early bloom deprives the garden of much freshness and interest in autumn

The numbers of varieties in some of these long-cultivated species-groups are surprising large, and they often appeal to collectors If a collector desires annuals for autumn display, for example, he will find that zinnias have about forty current varieties, annual pinks about fifty, petunias about sixty, pansies sixty to seventy, balsams over sixty, and stocks perhaps 300, all of which may be prolonged more or less into autumn But the most appropriate and varied of these annuals are the China asters, which have about 450 varieties Owing to the greater variety of everything abroad, collectors naturally send to Europe for large collections, and the very low duty on flower seeds has stimulated the collecting of annuals Perennial flowers are more difficult to import, but many persons have recently imported fifty or more varieties of the following gaillardia about 100 varieties, hardy chrysanthemums 100 and more, florists' pentstemons more than 150 (not sufficiently hardy), delphiniums over 200, and phlox 350 Unfortunately, collections of a single flower rarely give an artistic effect, even when at their best, owing to the difficulty of isolating troublesome colors in a garden that must be sunny, failures among highly bred varieties, the fact that the early, midseason and late sections mix poorly, and so on The obvious limitation of gardens devoted to one kind of flower is that they are unattractive out of season, and therefore it is best to isolate them. There are practically no annuals that bloom satisfactorily throughout summer and autumn

Background plants, for bold mass-displays of color in the rear parts of the grounds or along the borders may be secured from some of the coarser species. Good plants for such use are. sunflower and castor-bean for the back rows; zinnias for bright effects in the scarlets and lilacs; African marigolds for brilliant yellows; nicotianas for whites. Unfortunately, we have no robust-growing annuals with good blues. Some of the larkspurs and the browallias are perhaps the nearest approach to them

For lower-growing and less prominent mass-displays, the following are good California poppies for oranges and yellows, sweet sultans for purples, whites, and pale yellows, petunias for purples, violets, and whites, larkspurs for blues and violets, bachelor's buttons (or cornflowers) for blues; calliopsis and corcopsis and calendulas for yellows; gaillardias for red-yellows and orange-reds; China asters for many colors except yellows

For still less robustness, good mass-displays can be made with the following. alyssums and candytufts for whites, phloxes for whites and various pinks and reds, lobelias and browallias for blues, pinks for whites and various shades of pink, stocks for whites and reds, wallflowers for brown-yellows, verbenas for many colors.

Vines are abundant among the annuals, the most prominent being morning-glory, sweet pea, cobea, climbing nasturtium, Japanese hop, cypress-vine and other ipomœas, balloon-vine, scarlet-runner, moon-flowers in the South

Some of the "everlastings" or immortelles are useful as flower-garden subjects as well as for "dry-bouquets" These "paper flowers" are always interesting to children The colors are bright, the blooms hold long on the plant, and most of the kinds are very easy to grow. Favorite groups are the different kinds of xeranthemums and helichrysums The globe amaranths, with clover-like heads (sometimes known as bachelor's buttons), are good old favorites Rhodanthes and acroclinums are also good and reliable

Ornamental grasses should not be overlooked They add a note to the flower-garden and to bouquets that is distinct and can be secured by no other plants They are easily grown Some of the good annual grasses are *Agrostis nebulosa*, the brizas, *Bromus brizæformis*, the species of eragrostis, and pennisetums and *Coix Lachryma* as a curiosity Such good lawn grasses as arundo, pampas-grass, eulalias, and erianthus are perennials and therefore are not discussed here.

The amateur would do well to make up lists from the most detailed seed catalogues The following short lists (under trade names) suggest a few things in several categories

White-flowered annuals

Ageratum mexicanum album
Alyssum, common sweet
Centranthus macrosiphon albus
China asters
Convolvulus major
Dianthus, Double White Margaret
Iberis amara, coronaria
Ipomœa hederacea
Lavatera alba
Malope grandiflora alba
Matthiola (Stocks), Cut-and-Come-Again, Dresden Perpetual, Giant Perfection, White Pearl
Mirabilis longiflora alba
Nigella
Phlox, Dwarf Snowball, Leopoldii
Poppies, Flag of Truce, Shirley, The Mikado
Zinnia

Yellow- and orange-flowered annuals

Cacalia lutea
Calendula officinalis, common, Meteor, sulphurea, suffruticosa.
Calliopsis bicolor marmorata; cardaminifolia, elegans
Cosmidium Burridgeanum
Dimorphotheca aurantiaca
Erysimum Perofskianum
Eschscholtzia californica
Hibiscus africanus, Golden Bowl
Ipomœa coccinea lutea.
Loasa tricolor
Tagetes, various kinds
Thunbergia alata Fryeri, aurantiaca
Tropæolum, Dwarf, Lady Bird, Tall, Schulzii
Zinnia

Blue- and purple-flowered annuals

Ageratum mexicanum, mexicanum Dwarf
Browallia Czerniakowski, elata
Centaurea Cyanus, Victoria Dwarf Compact, Cyanus minor
China asters of several varieties
Convolvulus minor, minor unicaulis
Gilia achilleæfolia, capitata
Iberis umbellata, umbellata lilacina
Kaulfussia amelloides, atroviolacea
Lobelia Erinus
Nigella
Phlox variabilis atropurpurea
Salvia farinacea
Specularia
Verbena, Black-Blue, cærulea; Golden-leaved
Whitlavia gloxinioides

Rose- and rose-red-flowered annuals.

Cacalia, Scarlet.
Clarkia elegans rosea
Convolvulus tricolor roseus
Dianthus, Half-Dwarf Early Margaret, Dwarf Perpetual chinensis
Gaillardia picta
Ipomœa coccinea, volubilis
Matthiola annuus, Blood-Red Ten Weeks, grandiflora, Dwarf
Papaver (Poppy) cardinale; Mephisto
Phaseolus multiflorus.
Phlox, Large-flowering Dwarf, Dwarf Fire-ball, Black Warrior
Salvia coccinea.
Saponaria [Thumb.
Tropæolum, Dwarf, Tom
Verbena hybrida, Scarlet Defiance.
Zinnia.

Annuals useful for edgings of beds and walks, and for ribbon-beds.

Ageratum, blue and white
Alyssum, sweet.
Brachycome
Calandrinia
Clarkia
Collinsias
Dianthuses or pinks.
Gilia
Gypsophila muralis.
Iberis or candytufts.
Leptosiphons.
Lobelia Erinus
Nemophilas
Nigellas
Portulacas or rose moss.
Saponaria calabrica.
Specularia
Torenia
Whitlavia.

Late-blooming annuals.

Probably the best annuals to bloom in late fall, even after the first frosts, are petunia, phlox, and verbena Other excellent kinds are ageratum, alyssum, antirrhinum or snapdragon, *Calendula officinalis*, California poppy, gaillardia, marigold, and pansy. The list may be extended by

Abronia umbellata
Adonis æstivalis, autumnale.
Argemone grandiflora
Callirhoë
Carduus benedictus
Centaurea Cyanus (bachelor's button)
Centaridium
Centranthus macrosiphon.
Cerinthe retorta
Cheiranthus Cheiri
Chrysanthemums.
Convolvulus minor, tricolor.
Dianthus of various kinds
Elsholtzia cristata
Erysimum Perofskianum, arkansanum
Gilia achilleæfolia, capitata, laciniata, tricolor.
Iberis affinis
Lavatera alba
Matthiolas or stocks
Œnothera rosea, Lamarckiana; Drummondi
Podolepis affinis, chrysantha
Salvia coccinea, farinacea, Horminum
Vicia Gerardi
Virginian stocks
Viscaria elegans, oculata, Cœlirosa

If sown early or in the fall, bachelor's button, annual gypsophila and poppy will re-seed and furnish plants for late fall bloom L H. B †

ANŒCTOCHÍLUS (Greek, *open lip*) *Orchidàceæ*. A group cultivated for the beautifully reticulated leaves, which are oval or ovate, membranaceous and diversely colored, the flowers are small, not ornamental

Terrestrial, from a creeping rhizome lvs basal: fls. in a spike or raceme, sepals free, the dorsal erect, forming a hood with the petals, the lateral sepals spreading; lip adnate to the foot of the column, spreading; claw fimbriate, the blade 2-lobed —About 8 species

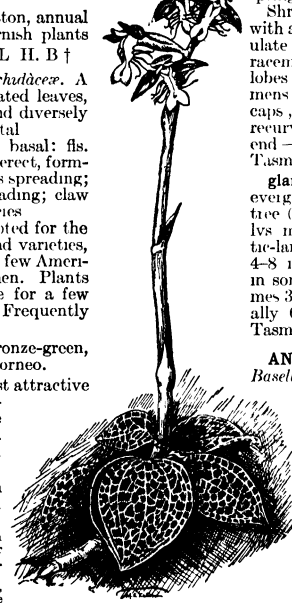
Although many methods have been adopted for the successful cultivation of the best species and varieties, failure has been the rule, so that at present few American collections contain even a single specimen. Plants introduced by collectors sometimes thrive for a few years and then fail, in spite of all efforts. Frequently they can be kept only a year or two.

Búllenii, Low Lvs about 2 in. long, bronze-green, with 3 longitudinal bands of copper-red Borneo.

regàlis, Blume Fig 217 One of the most attractive species of the group lvs oval, large, bronze-green netted, veined with gold, the surface of the lvs like velvet. Java B M. 4123. F S 2 79 (both as *A. setaceus*).—Several good varieties exist

Róxburghii, Lindl Lvs ovate, median line of pale green, reticulated and veined with gold Java and India

Several kinds are described and figured in foreign publications, but they are all fanciers' plants Other names which appear in the American trade are *A. Dayàna* = (?) — *A. Dawsonianus* = Hæmaria —*A. Fréderici-Augusti*, Reichb f (*A. xanthophyllus*, Planch.) Lvs dark velvety green, the broad orange stripe down the center covered with a network of gold



217 Anœctochilus regalis (× ½)

G 10 675, 27 54 —*A. Lowii*, Hort =Dossinia —*A. Petòla*, Hort.= Macodes —*A. Veitchianus*, Hort =Macodes

GEORGE V NASH †

ANOGRÁMMA (Greek, *without lines* referring probably to the absence of indusia) *Polypodiàceæ* A small group of tropical ferns, somewhat related to Pteris, and characterized by linear sori uncovered by indusia The lvs are borne in a cluster, are small, 1–2 pinnate with pinnatifid divisions and forking veinlets

schizophýlla, Diels (*Gymnogràmma schizophylla*, Baker) Lvs. 18–24 in long, quadri-pinnatifid, the stalks, rachises and divisions slender, the ultimate segms finely cut A comparatively recent intro., very graceful in cult Jamaica A G 18 421 G F. 2 533 A F 10 827 I H 31 522 Gn 48, p 417. Var **elegantíssima** (*Gymnogràmma elegantíssima*, Hort. W. Bull.), has reddish brown rachises

R C BENEDICT

ANOIGÁNTHUS (from Greek words, alluding to the expanded flower) *Amaryllidàceæ* A small probably monotypic genus of Natal and the Cape region, the plants sometimes cult as greenhouse winter- and spring-flowering bulbs **A. brevifòlius,** Baker (*Cyrtànthus brevifòlius*, Harv.), has an ovoid bulb 1 in diam., with a short neck lvs 3–4, appearing with the fls., 1 ft. or more first to 1 ft high, bearing a 2–10-fld umbel fls bright yellow, about 1 in long, with a short tube and oblong-lanceolate nearly equal segms, stamens 6, in 2 series fr a globose membranous caps., 3-valved, seeds flat B M 7072 Var **minor,** Baker (*A. lùteus*, Baker), is a dwarf mountain form with narrower perianth-segms These plants are half-hardy in the milder parts if given good protection over winter

ANOMATHÈCA: *Lapeyrousia*

ANÓPTERUS (referring to the seeds being winged at top) *Saxifragàceæ* Greenhouse shrub, blooming in spring

Shrubs or small trees, glabrous, with alternate thick evergreen exstipulate lvs., and white fls in terminal racemes calyx-tube very short, the lobes 6–9, persistent, petals and stamens as many as calyx-lobes fr a caps., oblong-conical, opening by 2 recurved valves, seeds winged at one end —Two species in Australia and Tasmania

glandulòsus, Labill Handsome evergreen shrub, becoming a small tree (to 40 ft.) in its native regions lvs mostly at ends of branches, elliptic-lanceolate to somewhat obovate, 4–8 in long, somewhat serrate fls in somewhat drooping bracted racemes 3–6 in long, parts of petals usually 6, about ½in long Subalpine Tasmania L H B

ANREDÈRA (personal name). *Basellàceæ* A monotypic genus, allied to Boussingaultia Vine, with fleshy sts and lvs, tuberous-rooted fls small, white, in long slender mostly axillary spikes, sepals 2, broadly winged, petals 5, not exceeding sepals, stamens 5, the filaments fattened; stigma entire **A. scándens,** Moq., is native Texas to S Amer., and planted in Old World tropics, a much-branched vine sometimes cult in greenhouses, with lvs ovate and more or less acute, entire.

ANSÉLLIA (in honor of John Ansell, African explorer) *Orchidàceæ* Epiphytic hothouse orchids with tall, thickened leafy stems.

Flowers in panicles, showy, sepals and petals similar, spreading, lip erect, sessile at the end of the column-foot, lateral lobes broad, parallel, erect, middle lobe round-ovate, spreading; pollinia 2.—A genus of 4 closely related species, perhaps all forms of 1 species.

africàna, Lindl Sts up to 2 ft tall, leafy above: lvs. 4–8 in long, about 5-nerved, elongated-lanceolate: panicle many-fld, fls 2 in across, with brown-purple spots on a light yellow-green background, sepals narrow-oblong, petals about twice as broad as sepals; lateral lobes of lip oblong, the middle lobe ovate. Fernando Po B.M. 4965.

gigantèa, Reichb (*Cymbídium Sándersonii,* Harv). Differs from the above in the smaller fls with narrower segms. which are spotted on the lower part only. Natal. B M 4965, f 3 GEORGE V NASH. †

ANSÒNIA: *Amsonia*

ANTENNÀRIA (pappus likened to antennæ) *Compósitæ* EVERLASTING CAT'S-EAR LADIES' TOBACCO. PUSSY'S TOES Field herbs, sometimes offered by dealers in native plants

Small, white-woolly perennial plants, with spatulate or obovate root-lvs, and mostly leafless scapes, bearing small gray or white heads which remain stiff and dry. fls dioecious, the staminate forms rare in cult, all tubular None is showy They are interesting for rock-work and the edges of borders, and for this purpose have been sparingly intro in the last few years They are perfectly hardy, and thrive in poor soil. The fls. are often cut before fully mature and dried (and often dyed) as everlastings About 20 species grow wild. Prop mostly by division of the mats, also by seeds. Allied to Anaphalis and Gnaphalium, both of which are leafy stemmed plants quite distinct from the prostrate, stemless antennarias, which send up only a bracted scape, except in *A racemosa* See *Everlastings.*

A *Pappus of sterile fls not thickened at the tip, minutely roughened.*

dimórpha, Torr & Gray Tufted, with spatulate lvs. and a sparsely lvd fl-st an inch or less high, from a stout, much-branched rootstalk Neb west to Calif.

AA *Pappus of sterile fls thickened at the top.*

B *Not spreading by stolons*

Geyèri, Grav Stout, thick-woolly, from a woody base fls-st 3 in or more high, very leafy to the top: pistillate heads narrow involucre with rose-purple or ivory-white tips to the inner scales Calif and Ore.

BB *Spreading by stolons*

C *Heads solitary or in a cymose cluster.*

dioìca, Linn. (*A cándida,* Hort) Basal lvs 1½ in. or less long, 1-nerved or only indistinctly 3-nerved st. 2–12 in involucral bracts all light green or light brown, with white or pinkish tips Northern states and Eu, and Asia.—The plant in the trade as *A tomentosum* is probably a form of this species Also in cult under the proper name, *A dioica A hyperborea,* Hort, a name common in the trade, is apparently a mere form of this with pinkish fls

alpìna, Gaertn Plant 1–4 in involucral bracts in fertile heads, dark brownish green, acute. Canada, Rocky Mts, Sierra Nevadas

plantaginifòlia, Rich Basal lvs 1½ in. or more long, distinctly 3-nerved st 6–18 in high.—Stoloniferous, making broad patches. Common in fields and old pastures. Perhaps not in cult.

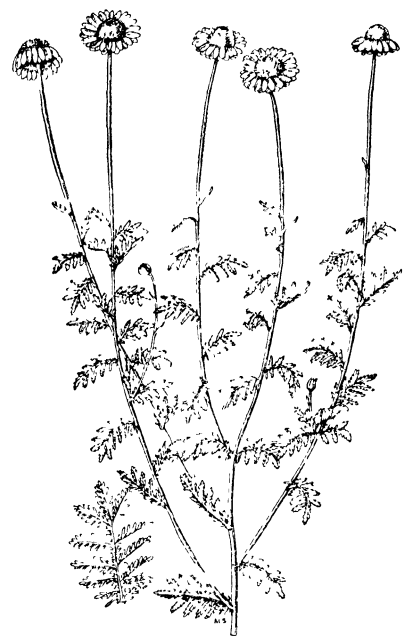
CC *Heads loosely panicled.*

racemòsa, Hook Light-woolly, the flowering sts. 6–20 in. high, sparsely leafy, the heads mostly on slender peduncles involucre brownish, white-tipped Ore. and Brit. Col. to the Rockies.

A margaritàcea=Anaphalis margaritacea.

N. TAYLOR †

ÁNTHEMIS (Greek name of the chamomile) *Compósitæ* CHAMOMILE Pyrethrum-like heavy-scented plants, annual, biennial or perennial, members of a



218 Anthemis tinctoria (×⅓)

large, Old World temperate-region genus, used in borders and alpine gardens

Heads many-fld, the disk yellow, the rays white and yellow and (in the common cult species) pistillate, the receptacle conical and chaffy, the achenes terete or ribbed, and either naked or bearing a minute crown lvs pinnately dissected

Two or three of the species are weeds Others are excellent border plants The true chamomile is a medicinal plant The hardy perennial species, which alone are grown in this country, are easily handled in the border, where they bloom from midsummer till frost They thrive in almost any soil, but need full exposure to sun

Propagation is by seeds or division of the clumps, usually the latter.

A *Rays normally yellow.*

tinctòria, Linn GOLDEN MARGUERITE Fig 218 Of bushy habit, 2–3 ft., with angular st and pinnately divided, and again pinnatifid or cut-toothed lvs, and large, daisy-like golden yellow fls (1–2 in across). Gn 12, p. 91; V. 18 33 *A Kélwayi,* Hort (or var *Kélwayi,* Hort.), has finer-cut foliage and deeper yellow fls There is also a pale-rayed variety and a white-fld form is sold under the name *A montàna* Gn 52 484 —An excellent hardy perennial border plant, and useful at the same time for cut-fls

AA. *Rays white.*

B *Perennial, cult.*

nóbilis, Linn. CHAMOMILE. Half-spreading and much-branched herb, downy, the lvs. very finely dissected. pappus wanting, chaff of the receptacle blunt. Var. **grandiflòra,** Hort., is larger-fld. than the type, and sometimes yellow-fld —A pleasant-scented herb, sometimes escaped from cult It yields the medicinal chamomile fls of commerce For medicinal purposes, the heads (the single preferred) are cut as soon as fully expanded, and dried Cult also as a hardy border plant; often double.



219 Anthemis Cotula. (×½)

BB. *Biennial or annual; weeds.*

arvénsis, Linn. Pubescent, not ill-scented lvs. rather coarsely 1–2 pinnately parted. pappus a minute border: heads 1 in or more across; the involucre with broad, blunt scarious marginal edges, rays pistillate, spreading, 2-toothed —Not common and rather coarse

Cótula, DC MAYWEED DOG FENNEL Fig 219 A common weed along roadsides, ill-scented, growing 1–2 ft high, with finely dissected lvs , neutral rays and many asterlike fls 1 in across

A Aizóon, Grisch =Achillea ageratifolia Gn 24 342 —*A arábica,* Linn =Cladanthus —*A coronaria,* Hort =Chrysanthemum coronarium —*A floribunda,* Hort. Dwarf lvs much dissected fl-heads pure white — *A Biebersteinidna,* Koch, is found in some catalogues It is an alpine plant with pinnate lvs , which are silvery, and yellow fls Can be cult only in the alpine garden

L. H. B.
N. TAYLOR.†

ANTHER: *Flower*

ANTHÉRICUM (Greek, *flower hedge*). Includes *Phalangium Liliàceæ* Non-bulbous liliaceous plants grown in borders and cool greenhouses

Herbs, with tuber-like rhizomes, and racemes of rather small, white, deep-cut fls : perianth rotate; anthers attached between their basal lobes, and the locules many-ovuled—in these characters differing from Paradisea —Some 50 species, mostly African, but a few in the western hemisphere

The anthericums are useful for lawn vases, for borders that are protected in winter at the North, for greenhouses and also for growing under benches Propagation naturally by stolons; increased also by division and seeds Of easiest culture. Give plenty of water when in bloom.

Liliàgo, Linn. ST BERNARD'S LILY. Figs. 220, 221. St. simple, 2–3 ft high, bearing an open raceme of open-spreading fls 1 in. or less across, the segms. linear-oblong· lvs long and narrow. S. Eu and N Afr. B.M. 914. Var. **màjor,** Sims, is larger in all its parts. B.M. 1635.

ramòsum, Linn. St. branched fls. somewhat smaller. Eu. B.M. 1055

A Bichétii, Hort Lvs flexible, variegated with white, elegant habit W Trop Afr —*A. califórnicum,* Hort =Chlorogalum pomeridianum —*A Hóffmannii,* Engler Free-flowering lvs 1 ft , 1¼ in broad, shining green fls -sts scarcely exceeding the lvs.: fls in dense panicles, star-shaped, white E Afr —*A Liliastrum,* Linn =Paradisea Liliastrum —*A picturatum, A variegàtum* and *A. vittàtum* are garden names for Chlorophytum elatum

L. H. B.

ANTHOLÝZA (name from the Greek, referring to fancied shape of flower). *Iridàceæ.* Cormous plants of the gladiolus kind, grown in the open for summer bloom, red and yellow

Perianth long-tubular, curved, dilated above, the uppermost segms. largest; stamens 3, style branched; ovary 3-loculed.—About 14 or more Cape and Trop. African plants, with linear or sword-shaped lvs and bright fls in 2-sided spikes Cult the same as gladiolus, being taken up in the fall The tubers are often started in a frame or in the house before planting in the open.

A. *Perianth red, segms very unequal.*

Cunónia, Linn Corm small, globose st simple, 1–1½ ft.. lvs. about 4, linear, 1 ft or less long· fls. 4–6, in a lax spike, bright red, tube an inch long, the stamens reaching to the tip of the upper segm seeds discoid, winged Cape L.B C 20 1971 (as Anisanthes).

cáffra, Ker Corm large, globose, long-necked st 2 ft or less. lvs narrow-linear, 1 ft fls 12–20, in a lax spike, bright red, tube 1–1¼ in long, stamens not quite reaching tip of upper segm . seeds 3-angled, narrowly winged Cape —Has been hybridized with gladiolus

AA *Perianth red and yellow, segms less unequal*

æthiópica, Linn. (*A ringens,* Andr) Corm large, globose st branched, 3–4 ft lvs several, sword-shaped, 1 in broad and 1–1½ ft long. spikes 6–9 in long, rather dense; fls 1½–2 in long, red-yellow; stamens reaching to the tip of the upper segm seeds turgid, not winged Cape B M 561 Var **minor,** Lindl. (*A bicolor,* Gasp) Dwarf lvs narrow fls red at top, pale yellow below B R 1159 Var **vittígera,** Baker, (var *ringens,* Nichols) Tall as the type fls bright yellow, striped red B M 1172 Var **immarginàta,** Baker. Fls red, with dull yellow

paniculàta, Klatt Corm large, globose st stout, much branched, 3–4 ft lvs lanceolate, oblique, 2 ft. or less long, to 3 in broad spikes dense, many-fld., with wavy rachis, fls bright red-yellow, tube curved, to 1¼ in long, upper segm. ligulate. Natal Var. **màjor,** Hort. A form with larger lvs. and fls.



220. Anthericum Liliago.

crocosmioìdes, Hort. Said to be a hybrid of *A. paniculata* and Crocosmia: 3 ft : spikes branching, fls. brilliant orange-red, shaded to gold

A abyssínica, Bronga Corm globose, 1 in diam st 2 ft. or less lvs 3–4, linear, 1 ft. long spike simple, few-fld , fls bright red, the curved tube 1 in long Abyssinia —*A quadrangulàris,* Burm (Gladiolus quadrangularis, Ker) Corm large, globose, plant stoloniferous st slender, 2–3 ft lvs 2–3, narrow spike very lax, 2–4 fld , fls bright red and yellow, tube 2 in long Cape —*A Schweinfurthii,* Baker St terete, 1 ft to spike lvs 5 to 6, grass-like, 6 in long spike simple and lax, many-fld , fls. bright red shading to yellow, about 1½ in long, the tube curved and dilated Abyssinia. B.M 7709

L. H. B.

ANTHOXÁNTHUM (Greek, *anthos*, flower, and *xanthos*, yellow). *Gramíneæ* Aromatic grasses with spike-like panicles Spikelets with 1 awnless perfect floret, and two 2-lobed, awned sterile lemmas. Species 4, Eu A perennial species, sweet vernal grass (*A. odorâtum*, Linn), is occasionally cult. as a meadow grass to give a pleasant odor to hay. Dept. of Agric , Div of Agrost , Bull 20:55. Another species, an annual (*A Puélii*, Lecq & Lam), is more rarely cult

A S. HITCHCOCK.

ANTHRÍSCUS: *Chervil.*

ANTHÙRIUM (Greek, *tail-flower*). *Aràceæ*. Choice hothouse foliage plants.

Perennial, the st creeping, climbing, assurgent or arborescent· lvs. variable, net-veined, with a prominent midnerve and lateral nerves, and a well-defined nerve at or near the margin fls in a spike (spadix), subtended or inclosed in the spathe. fr a berry. Tropical herbs and climbing plants of perhaps 608 species besides varieties, mostly from the central and warmer parts of S. Amer , though probably not one-tenth are in cult in this country Grown either for their showy spathes and spadices, or their handsome velvety lvs Spathe usually spreading or even reflexed, only rarely partially inclosing the spadix Differs from Alocasia and allied genera in technical characters Monogr by Engler in De Candolle's Monographiæ Phanerogamarum, Vol 2 (1879), and Pflanzenreich, hft 21 (1905)

The genus Anthurium appears to be a constantly increasing one as regards the number of species Index Kewensis, when first issued in 1893, gave the number of known species as 213 The supplements have now recognized 365 more species, making in all about 578 known species, though there are probably not more than fifty in cultivation in this country and perhaps not more than ten or fifteen known to the trade Of those that are in cultivation there are several varieties or hybrids, as the species seem to cross readily

Anthuriums are tropical aroids of great beauty, and at least a few species should be included in every collection of choice plants. They seem to fall naturally



221 Stolon of Anthericum Liliago.

into two sections or groups, viz , foliage and flowering. Although anthuriums all flower, those that have the large handsome velvety leaves, such as *A crystallinum*, *A Warocqueanum*, *A. splendidum*, and the like, have very inconspicuous or decidedly unattractive flowers, while *A Andræanum*, *A Brownii*, *A Regnellianum* and *A. Scherzerianum* and many others have remarkably showy, usually scarlet spathes and spadices but much less handsome foliage. All are striking plants — Anthuriums such as *A. Andræanum*, *A ornatum*, and their numerous hybrid progeny, require at all times a high and humid atmosphere Under these conditions and in a good rooting medium, they ought to be continually in flower A bloom is produced from the axil of each leaf, and immediately beneath this leaf a new root is produced, thick and succulent at first, becoming tough with age, and, if not allowed to bury itself among the compost in which the plant grows, it eventually hardens and is of no help in the sustenance of the plant. Therefore, the growing point of the specimens should not be allowed to get too high, or the flowers will be few and poor. When the plant forms stems above the pot, the compost should either be built up around the stem, to catch the roots, or the plant may be cut over, rooted afresh in sand, and given a new start in a pot The two ornamental-leaved species, *A Veitchii* and *A Warocqueanum*, should be treated in the same manner. When cut down, one may look for the old stocks to send out small growths, which in course of time may be taken off and put in small pots All of the above are such free-rooting kinds that they may, with the addition of some rotted manure, be grown in sphagnum moss A good mixture is as follows sphagnum, chopped not too fine, one part; fern or kalmia roots, chopped up and the fine substance removed, one part; another part to be made up equally of sand and rotted manure With well-drained pots, this forms an admirable rooting substance —Most of the other species and their forms, including *A Scherzerianum* and *A crystallinum*, will thrive better in material mainly composed of rough, fibrous loam and peat with the fine material sifted from it This rough, fibrous material should be mixed with a small quantity each of sphagnum, charcoal and sand Good drainage, and less water than is needed for the Andreanum and Warocqueanum groups will be necessary *A Scherzerianum*, although thriving well in the hottest house, will succeed in an intermediate house —Established plants of anthurium will need repotting only once in two or three years, but should have a fresh top-dressing every year, the best time to overhaul them is about the end of January, or before active growth begins They should be given a shaded position, free from draughts of cold air, and ordinary stove temperature Care must be taken not to mar the leaves by hard spraying The temperature during winter should not fall below 55° —Propagation is by suckers or cuttings of the rhizome inserted in small pots containing a mixture of peat fiber, chopped sphagnum moss and silver-sand in equal proportions, and plunged in a propagating-box in a temperature of 75° to 80°, with bottom heat About the end of January is the most suitable time to take the cuttings Anthuriums may also be propagated by seeds sown in a mixture of very fine fibrous peat and chopped sphagnum moss in 4-inch pots The seeds should be lightly covered with sphagnum, and the pots placed either in a propagating-case or under bell-glasses, where a temperature of 80° can be maintained A constant humid atmosphere is very necessary to induce the seeds to germinate To prevent damping, the seedlings should be pricked off round the edge of a 3-inch pot as soon as the first leaf is large enough to handle Seeds of such kinds as *A. crystallinum* and *A regale* will germinate well on the moss of nepenthes baskets.



222. Anthurium Scherzerianum (×⅛)

Seeds are secured by pollinating the flowers, the stigmas of which become mature long before the anthers Anthuriums of the Scherzerianum type may be increased by division of the crown (E J Canning and G W. Oliver.)

INDEX.

álbum, 1, 5	maximum, 1	sanguineum, 5.
andegavense, 1.	mutabile, 1	Scherzerianum, 1
Andræanum, 5	nebulosum, 1.	spathiphyllum, 2
Bennettii, 1	parisiense, 1	splendidum, 11
Brownii, 4	pygmæum, 1	Veitchii, 6
crystallinum, 9.	regale, 10	Vervæneum, 1.
Gameri, 5	Regnellianum, 3	Wardii, 1
giganteum, 1.	rhodochlorum, 5	Warocqueanum, 1, 7.
lacteum, 1	roseum, 1, 5	Williamsii, 1
Lawrenciæ, 5	Rothschildianum, 1	Woodbridgei, 1
magnificum, 8	salmoneum, 5	

A *Lvs plain green, grown mostly for the showy "flowers."*

B *Spadix coiled*

1 **Scherzerianum,** Schott Fig 222 A foot or two high, evergreen lvs long-lanceolate (the blade 1 ft or more long and petiole of nearly equal length), thick, usually somewhat revolute, with a strong vein parallel with each edge and close to it, and many cross-veins scape long and slender (1–2 ft), red, spathe ovate-oblong, 3–4 in long, spreading or deflexed, intense red (sometimes double, I.H. 37 107), spadix slender, curled, yellow Cent Amer B M 5319 R B 22 121 Gn 33, p. 89 G C. II 12 301. G. 3 55 A F 6 569 (in variety) — An old favorite Runs into many forms spathe white, vars **álbum, álbum magnífícum, lácteum, máximum álbum, Williamsii, Vervænèum**; spathe parti-colored, vars. **andegavénse** (scarlet on the back, white and scarlet spotted above), **mutábile** (white-bordered), **nebulósum** (double white spotted rose), **Rothschildiánum** (scarlet mottled white, Gn 30 454), **Warocqueánum,** not *A Warocqueanum* (white spotted red); spathe very large, vars **gigantèum, máximum, Wárdii, Woódbridgei.** Very dwarf is var **pýgmæum;** rose-salmon spathe and orange spadix is var **parisiénse;** sharp pointed lvs and spathes is var **Bénnettii;** rose-colored spathes, var **róseum;** deep blood-red spathes, var **sanguíneum.**

BB *Spadix not coiled*

C. *Spathe narrow, green*

D. *The lvs narrow, not cordate.*

2. spathiphýllum, N. E Br Two ft or less, stemless or nearly so lf -blade 2 ft or less, narrow-lanceolate, attenuate in a straight line from the middle to the base, acuminate, bright green above and grayish beneath,



223. Anthurium Andræanum. (×⅛)

with prominent midrib spathe 2 in. or less long and a half or more as wide, erect, boat-shaped, pale green or whitish, spadix 1 in long and very blunt, pale yellow. Trop. Amer

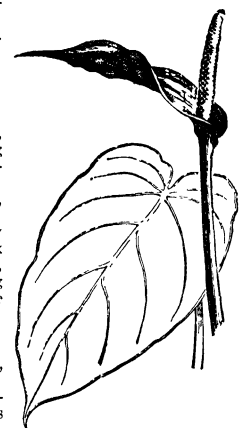
3 **Regnelliánum,** Engl Lvs 5–6 in long, about 2 in. broad, obtuse or slightly emarginate at the base, gradually narrowed to an acute apex, green. spathe about 1½ in long, ¼–⅓in broad, spadix dark green, 1½–2 in long, on a short stipe. Brazil.

DD. *The lvs broad, deeply cordate.*

4 **Brównii,** Mast Lvs 2–3 ft long, a deep sinus separating the rounded basal lobes, leathery, dark shining green above, paler beneath, with 12–15 pairs of prominent lateral nerves spathe 6–8 in long, lanceolate, greenish, rose-tinted, spadix 10–15 in long Colombia G C II. 6 744–5

CC *Spathe cordate-ovate, colored*

5 **Andræánum,** Lind Fig 223 Low species, with lf -blades drooping like an alocasia and cordate ovate-lanceolate spathe cordate-ovate, thick in texture, 6–10 in long, orange-red, widely open-spreading, spadix 3–4 in long, yellowish, with white band marking the zone in which the stigmas are receptive Colombia B M 6616 A F 6 569, 10 1065 Gt 38 1293 I H 24 271, 37 105 V 9 259, 11 138 G C II 13:497 —Beautiful and popular Runs into many varieties Spathes white, var **álbum;** spathe very bright red, shining, var **Gámeri** (R H 1907*:30, desc), spathes very large, pure white, var. **Láwrenciæ;** spathes of a soft rose-color in upper part passing into light green on lateral lobes, var **rhodochlórum** (R H 1901 452), spathes shining rose-pink, var **róseum;** spathes salmon-color, var **salmóneum;** spathes dark crimson, var **sanguíneum.**



224 Anthurium Veitchii (×⅛)
Young leaf, not yet showing the arched depressions

AA *Lvs prominently marked with white or colors, or with deep bands of green cult mostly for foliage*

B *The lvs not bullate*

C *Markings green or greenish*

6 **Vèitchii,** Mast Fig 224 Tall and robust species (st 2–3 ft) lf -blades pendent, like a fine alocasia, often 3–4 ft long, cordate or eared at base, metallic green, but marked by deep-sunk nerves, which arch off the midrib spathe 1 ft long, horizontal, green, spadix 6–8 in long, straw-color Colombia G C II 6 773 B M 6968 Mn 8 187 I H 27 106 Gn 29, p 453 G C. III 44 181 —Striking

CC *Markings white or essentially so*

7 **Warocqueánum,** Moore Fig 225 Very vigorous: lvs oblong-lanceolate, long-tapering, hanging, 2–4 ft long, deep velvety green, with rib and principal veins of a prominently lighter shade, making handsome contrasts Colombia I H 27 392 G C III 44 180 —A handsome and striking foliage plant

8 **magnífícum,** Lind. Lf.-blade deep cordate, oval, 2 ft long, upper surface olive-green with white nerves; petiole 4-angled· spathe small, oblong, green, spadix green, cylindrical Colombia

9 **crystallínum,** Lind & André Like *A magnificum;* differs in petiole terete or only very imperfectly angled, sinus of blade smaller, veins wide-banded and whiter and very regular lf -blade ovate-cordate, short, deep velvety green, with the midrib and two consecutive bands crystal white. spathe linear-oblong, acuminate,

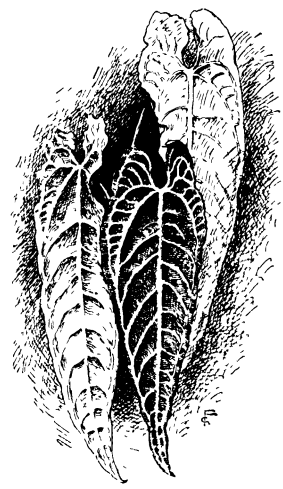
green. Peru. I.H. 20.128 G C. III. 24:417 (var. *illustre*). G. 21:98. G W. 15, p. 254.

10 **regâle,** Lind. Lf-blade cordate-oblong, long-cuspidate, 3 ft or less, at first tinged rose, but becoming dull green and marked with white veins, petiole nearly terete. spathe broad-lanceolate, greenish. Peru.

BB. *The lvs. bullate.*

11. **spléndidum,** Hort Lvs large, cordate-ovate, coriaceous, sea-green, glaucous above, bullate, the depressions and nerves brownish Colombia

Various horticultural forms and hybrids are in cult in this country *A amábile.* Lvs soft rose (crystallinum × magnificum) —*A. Archdúcis Jòsephi,* Lind Spathe shining carmine, broadly cordate (Andræanum × Lindenianum) —*A atropurpúreum,* Pynaert Spathes black-purple, spadix white —*A bicolor,* Crousse Spathe white beneath, above whitish and rose-colored R H 1904 40 —*A cárneum* is a hybrid of Andræanum and ornatum —*A. Chantinidnum,* Mart Spathe rose, with paler nerves —*A. Chantrièri.* Lvs triangular, with wide-spreading basal lobes spathe ivory-white, erect (nymphæfolium × subsignatum).—*A. chelseénse,* N E. Br (Andræanum × Veitchii). G Z 31, p 169 —*A Clarkiànum* Lvs large and broad. spathe resembling that of Andræanum but salmon-rose — *A ferrierénse* Lvs large, cordate spathe cordate, brilliant red (ornatum × Andræanum) —*A. floribundum,* Lind and André = Spathiphyllum floribundum. I H 21.159 —*A. Fræbelii.* Lvs. large and cordate: spathe deep carmine (Andræanum × ornatum) —*A. grándе* = A magnificum.—*A Hrúbyi,* Hort Spathe flesh-colored or almost white.—*A hýbridum* Lvs large, lobed at base, obtuse, green —*A musáicum* —*A ornátum* Lvs oval or oblong, cordate spathe linear-oblong, white, purple-tinted —*A Reynoldsiànum,* various forms (ferrierense × Andræanum?) —*A Siebrechtiànum* Lvs much as in *A magnificum,* rich, velvety green, with thick margins spathe light green shading to crear , spadix large, crimson —*A triúmphans* Lvs long-heart-shaped, bright green with lighter veins spathe narrow, green, spadix greenish white



225. Anthurium Warocqueanum.

A acaúle, Schott Fls fragrant lvs 1 2½ ft long, very broad W Indies —*A acutum,* N E Br Lvs 8-10 in long, triangular and long-acuminate, green spathe reflexed, green, spadix deep green. Brazil —*A Allendórfii* = Andræanum × Grusonii — *A Bàkeri,* Hook. Lvs elliptic-lanceolate or lineal, green spathe small, reflexed, green, spadix 3 in long, yellowish green, becoming longer and red and drooping in fr —the chief merit of the plant Costa Rica B M 8201 G C III 29 2 —*A bogotánse,* Schott Lvs with a very broad halbard-shaped base and a long-acuminate middle lobe, dark green Gt 46, p 525 — *A brevilobum,* N E Br Lvs oval-acuminate cordate, 8–10 in , paper-like, green spathe lanceolate, purplish. spadix purplish brown —*A cárneum,* Hort Chant Spathe a beautiful rose color —*A Chàmberlainii,* Mast Lvs 4 ft long, broadly cordate-ovate and narrowly long-pointed, green spathe erect, boat-shaped, 8–9 in long, purplish outside, crimson inside, partially inclosing the purplish spadix Venezuela G C III 3 465 I.H. 35 62. B M 7297 —*A Clémentinæ,* DeSmet. Spathe white with rosy nerves.—*A cordàcum,* Endl Lvs very thick, leathery, 2 ft long Brazil —*A Eduárdi,* Pynaert Spathe white (Andræanum × Lindenianum) —*A Forgétii,* N E Br Related to *A crystallinum,* but smaller and with peltate lvs of a deep rich green with a velvety sheen, the veins not quite so marked Colombia —*A Glaziovii,* Hook Lf-blade obovate-oblong, not hanging, tapering to petiole, green and strongly light-veined spathe linear-oblong, often twisted, purple (as is also the spadix) Brazil B M 6833 — *A grandifòlium* var *perfectum,* Hort Spathe very large, of a pronounced red color —*A Gustávi,* Regel Lvs broadly ovate-cordate, bright green spathe cylindric, about 1 ft long, and dark violet-purple like the spadix Colombia B M 7437 —*A Hardyànum,* Mart Spathe rose, spadix white —*A Hóokeri,* Kunth Lvs dotted with black, spathe lanceolate B M 2987 (as Pothos crassinervia) W Indies —*A insigne,* Mast G C II 6 365 = Philodendron tripartitum —*A Kalbréyeri,* Hort Climbing lvs 9-parted Colombia G C II 16 117 —*A Lauchednum,* Hort , Sand Resembles A Andræanum, but lvs reticulated sts climbing Colombia G C III 43 258 — *A Lindenianum,* Koch & August Lvs ovate-cordate, green, coriaceous spathe pure white, linear-oblong, 5-6 in long, spadix dark purple Colombia B M 5848 F M 1870 236 (both as *A ornatum*) —*A Moyadianum,* Koch St climbing lvs shining, elliptic-ob long, 1-2 ft long spathe lanceolate, green Brazil G 7 435 (as *A ornatum*) —*A Nicolaidnum,* Engl Spathe yellowish, flushed with rose —*A nymphæfòlium,* Koch Spathe white , spadix purple Venezuela —*A purpureum,* N E Br Lvs oblong-lanceolate, thick green spathe and spadix purple Brazil 4 *rotundispathum,* Lind & Rod Spathes nearly round, intensely sanguineous —*A Sanderi,* Hort R B 34, p 196 —*A signatum,* Koch. Lvs 3-lobed, deep green Venezuela *A trifidum,* Oliver (B M 6349) = *A signatum* —*A trinérve,* Miq Climbing lvs oblong-elliptic, 4–7 in long spadix up to 2 in long, ⅜in thick in fruit berries lilac S Amer B M 8251 —*A watermaliénse,* Hort Allied to A Andræanum Spathes of a metallic black Colombia Intro from Watermall, Belgium

L H B

GEORGE V NASH †

ANTHÝLLIS (Greek, meaning *downy flowers*) KIDNEY VETCH *Leguminosæ* Perennial herbs, or somewhat shrubby, prized for their spikes or heads of yellow, purple or white flowers and usually silky pinnate foliage, also for forage, in the Old World, prized mostly for rockwork.

Calyx-tube inflated near the base, dentate or lobed above, petals pea-like, the stamens all connected into a tube legume usually ovoid

The culture is the easiest, as the plants thrive even in poor soil Propagation is by seeds or division, or, rarely, by soft cuttings Not generally known in United States

A *Lfts 4 or more pairs*

Vulnerària, Linn SAND CLOVER WOUNDWORT A foot high lfts 5 or more fls normally yellow, but there are red and white varieties. Eu —A deep-rooted, clover-like, hardy plant, excellent for sandy and light lands Useful for forage, and, for that purpose, occasionally grown in this country Requires 20 lbs of seed to the acre. See Cyclo. Amer. Agric , Vol II, p. 308 and fig 416

montàna, Linn. A foot or less high, silky-hoary. lfts. numerous fls purple in dense heads subtended by a leafy involucre Herbaceous Var **rùbra,** Hort , is a reddish fld form suitable for rock-gardens. Eu L B C. 6 578

Bárba-Jòvis, Linn. JUPITER'S BEARD Glasshouse silky evergreen, 3–8, or even 12 ft high, with several to many pairs of narrow, pointed lfts . fls straw-colored or whitish, in clover-like heads S Eu. B M 1927 — In frostless countries, endures sea-winds and salt spray

AA. *Lvs. unifoliolate or trifoliolate.*

Hérmanniæ, Linn Two to 4 ft , dwarfer and more bushy than the preceding lvs almost sessile, simple or trifoliolate, the lfts oblong-cuneate fls yellow in axillary almost sessile, few-fld heads. S Eu B.M 2576 —Good for dry places. Intro. by Franceschi in 1910.

N. TAYLOR.†

ANTIÀRIS (name derived from Greek word for *arrow,* the sap being used for arrow poison) *Moràceæ.* Five or 6 trees or shrubs of the E Indies and Malaya famous because of the upas-tree, **A. toxicària,** Lesch , fabled for years to be so poisonous that men or animals were destroyed who came within some distance of it. These

legends are apparently Javan. The tree has been grown in botanic gardens, however, with no disastrous results. The dried milky juice is very poisonous, and the natives use it with other ingredients (the upoh poison) for poisoning arrows The tree grows 60–70 ft high, with alternate distichous short-std. oblong or oblong-ovate, entire lvs and monœcious fls, the sterile fls. in dense heads and the fertile fls solitary. fr. a 1-seeded fleshy drupe A fiber is yielded from the inner bark Another species, **A. innóxia,** Blume, yields fiber that is used for the making of sacks

ANTIDÉSMA (Greek, *for* and *band,* the bark of *A. Bunius,* being used for cordage) *Euphorbiàceæ* Tropical trees rarely cult Lvs large, alternate, simple fls. small, in spikes; calyx imbricate, petals none, ovary 1-celled, 2-ovuled. The 1 species cult for its currant-like berries used in preserves. The very tough fiber of the bark also used The tree is very ornamental and suited to the subtropical parts of this country. Prop



226. Antigonon leptopus var albus (×⅓)
From a plant grown under glass

by cuttings There are about 70 other species in the warmer parts of the Old World

Bùnius, Spreng NIGGER'S CORD SALAMANDER TREE CHINESE LAUREL BIGNAY of Malays A medium-sized evergreen tree with dark green laurel-like foliage, and small red berries in racemes Malay region

Two similar shrubs, *A. nítidum,* Tul, from Malaya, and *A. venòsum,* Mey, from S Afr, have been intro. by U S Dept of Agric J. B. S NORTON

ANTIGÒNON (name from Greek, probably referring to the kneed or angled character of stem) *Polygonàceæ.* Showy-flowered climbers, abundant in southernmost United States and southward, and sometimes grown in warmhouses

Tropical tendril-climbers sepals 5, colored petal-like and cordate, the 2 interior ones narrower, stamens 8; styles 3, and ovary 3-angled lvs alternate and entire. fls in racemes, which end in branching tendrils —Species 3 or 4, in Mex and Cent Amer

The usual species is *A. leptopus,* one of the most conspicuous and beautiful climbers grown in Florida, and always in flower from early spring to late autumn It grows 30 to 40 feet high in good soils Some plants are shy bloomers, while others are often covered from top to bottom with a mass of bright deep rosy red Too much fertilizer effects a very vigorous growth at the cost of the flowering. Verandas covered with antigonon look extremely beautiful, and cabbage palmettos decorated with masses of its pendent flower-trusses form charming objects The plants form large tubers and when killed down by frost, sprout readily again in spring Seeds, looking much like buckwheat, are abundantly produced and form a ready means for propagation. Small plants from self-sown seeds come up everywhere in Florida gardens. (H. Nehrling.)

léptopus, Hook & Arn. MOUNTAIN ROSE ROSA DE MONTANA SAN MIGUELITO CORALLITA. LOVE'S CHAIN Plant tuberous-rooted st slender and tall, glabrous, or nearly so. lvs cordate and acuminate, or hastate-ovate, 3–5 in long fls 6–15 in the raceme, handsome rose-pink Mex B M. 5816 G C III 17.797 Gn 68, p 320 G M 49 317. Var **álbus,** Hort (Fig 226), has fls nearly or quite white —One of the handsomest summer-blooming greenhouse climbers, requiring abundance of light and recommended to be planted near heating-pipes and to be trained on the rafters; usually grown from seeds, but also from cuttings Give plenty of water when in flower but keep dry when at rest In the S and the American tropics it is one of the commonest vines on fences, arbors and verandas

guatemalénse, Meisn (*A. insígne,* Mast). Pubescent lvs broader fls more numerous, the sepals nearly twice longer (1 in long) than in the last Guatemala G C II. 7 789.

L H B.

ANTIRRHÌNUM (Greek, *snout-flower*) *Scrophulariàceæ* SNAPDRAGON Flower-garden and greenhouse herbs

Erect or climbing herbs or even half-shrubs. lvs usually opposite below and commonly entire, never compound corolla saccate or gibbous at base, but not spurred, personate or closed at the throat, stamens 4· seeds not winged —Closely allied to Linaria, from which it differs in the spurless fls About 30 or 40 species in the northern hemisphere, particularly in N Amer

Snapdragons are flowered either in the open or under glass The common varieties are forms of *A. majus,* and are perennial, although the first crop of bloom is usually the only one that is desired Most of the varieties of this species are hardy in the North, if well covered during winter Seeds sown very early in the spring, especially under frames, and transplanted, produce blooming plants the same season It is usual, however, if early bloom is desired, to sow the seeds in August or September, and cover the plants with a mulch on the approach of cold weather These fall-sown plants may be transplanted into pots (or grown in them from the first) and flowered in the house For growing under glass in this way, snapdragons are very satisfactory The temperature and treatment required for geraniums and carnations suit them well. Dwarf varieties are used for edgings

A *Plant erect, herbaceous.*

B *Root annual small-fld*

Orórtium, Linn SMALL SNAPDRAGON Fig 227. A low, slender annual, with linear lvs. and small fls. purple or white (½in long) in the axils An occasional weed in cult grounds, 6–12 in high, not cult

Orcuttànum, Gray Slender, 2-4 ft, glabrous: corolla ½in long, white or violet, lower lip not much larger than the upper: lower lvs spatulate-lanceolate, the upper linear Lower and S Calif —Intro by Orcutt in 1891 Tendril-like branchlets are produced in the fl-clusters

BB *Root perennial large-fld.*

màjus, Linn COMMON OR LARGE SNAPDRAGON. Fig. 228 Perennial, or practically a biennial under cult.· 1–3 ft, not downy except in the fl-cluster: lvs oblong or lanceolate, entire, sometimes variegated. fls. large,

long-tubular, with spreading, very irregular lobes, in an elongated terminal spike or raceme In many colors and varieties (ranging from red and purple to white), in forms both tall and dwarf. Medit region, sometimes running wild about gardens A F 9 909, 13.949 I H 41:22. A.G. 17:379. F.E 7:711.—There are double forms Some of the varietal names used by horticulturists are *álbum, bicolor, coccíneum, prócerum, púmilum, variegátum* Peloric forms are reported, with regular corolla and the much-reflexed limb 5-7-lobed Gt 53 1524



227. Antirrhinum Orontium. (×¼)

AA *Plant erect, perennial and shrubby fls about 1 in long*

speciósum, Gray Three to 4 ft., somewhat pubescent, leafy lvs oval or oblong, short-petioled, thick fls scarlet or pink-red, the corolla-tube three times length of the lips (which are narrow) S and Lower Calif., on the islands

AAA *Plant trailing or procumbent, perennial, with small fls, used mostly in rock-gardens. June, July*

Asarìna, Linn Gravish-clammy, procumbent lvs 5-lobed, cordate, crenate, long-petioled fls axillary, solitary, white and sometimes tinged red, the palate yellow S. W Eu

sempérvirens, Lapeyr Procumbent, woolly, small fls. white with purple blotch Pyrenees.

glutinósum, Boiss & Reut Prostrate, glandular-pilose lvs alternate, elliptic to elliptic-ovate, short-petioled fls pale yellowish white, the lip striped red Spain. B M 7285

AAAA *Plant climbing, perennial.*

maurandioides, Gray (*Maurándia antirrhiniflóra,* Willd.) Fig 229 Climbing 2-6 ft by means of the coiling petioles and peduncles lvs 3-lobed, halberd-shape fls axillary, 1 in. or more long, violet or purple, handsome Texas to Calif B M. 1643.—Attractive plant for the window, cool greenhouse or conservatory. Suitable for baskets. L H B.

ANTRÒPHYUM (Greek, *growing in caverns*) *Polypodiàceæ* A genus of simple-lvd herbaceous ferns, rarely found in cult Native in tropics, in damp forests All the species are epiphytes, and not of commercial value except as rarities. Require high temp

ANTS, Their Habits, Activities, Injuries and Control. Various kinds of ants are troublesome to gardeners; and all the ants are most interesting animals

The ants belong to the same great group of insects (Hymenoptera) that contains the wasps, bees, sawflies, and others; and like the honey bee and common wasps are congregate in their habits of living The abdomen of all the common ants is attached to the thorax by a slender waist, or peduncle; and each segment (there may be one or two) of this peduncle is expanded on the top side and forms a lens, or button-shaped knot, a character that distinguishes ants from all other insects

Everyone is familiar with ants, they occur in all lands and all regions, from the dry deserts to the damp forests, from the timber line of mountains to the lowest valleys and among the dwellings and habitations of man They seem to thrive in all kinds of environment and multiply enormously, so that they outnumber all other terrestrial animals

The nature of an ant colony

Ants are social, that is, they live in colonies or communities where every individual ant works for the good of the whole and not for itself alone A colony of ants furnishes an illustration of a more perfect communistic society than any ever established by man, and perhaps a more amicable one than any he will ever be able to organize

In a typical colony of ants, there are at least three kinds of individuals, the queen, the males, and the workers The queen is not the ruler but the mother of the colony Her only business seems to be to lay eggs which hatch into workers and other forms to take the places of those that disappear or die, thus maintaining the full and continuous strength of the community When the queen comes forth from the pupal stage, she has wings which she retains until after the swarming period After the swarming flight is over and the queen alights, her wings fall off or are torn off by herself or workers and from that time she remains wingless In some species of ants there may be modified forms of the queen, for example, giant queens, dwarf queens, worker-like queens, and other forms

The males, which have wings, exist only to mate with the queens, and after the swarming period is over they eventually die The males are also often modified into giant males, dwarf males, worker-like males, and other forms

The workers, which are undeveloped females, are wingless and constitute the great majority of individuals that we see running about in the vicinity of an ant-nest The workers are just what their title implies They do the work of the community, build the nest, keep it clean, care for and procure food for the queen and larvæ, care for the eggs, fight the battles, and so forth The workers may exist under several different forms One especially interesting form has a very large head and strong jaws, thus fitting it for war-like functions Ants of this form are known as the soldiers



228 Young spike of a dwarf form of Antirrhinum majus (×½)

The nests and activities of ants

The nests of ants, in a general way, consist merely of a system of passage-ways or cavities communicating with each other and connected to the outside world with one or more openings There are some species of ants that live below the surface of the earth and have no openings from their nests into

the air, except at the swarming period The style of construction and the materials used by ants in making their nests vary with the different species and with the environment in which the animals live Moreover, the nests are very irregular, especially when compared with those of wasps and bees.

The passageways of the nests are enlarged here and there into comparatively large cavities, or chambers. It is in these different chambers that the activities of the colony are conducted The queen lies deep within the interior of the nest in a dry, dark chamber. Here she is carefully tended and fed by the workers who bear the eggs as they are laid, to other chambers and zealously care for them Many insects never see their young; others may see them but do not care for them, others, like the bees and wasps, put food into the gaping mouths of their young but have no further association with them The ants, however, stand alone among insects in their very intimate relations with their progeny from the egg to the adult Some of the chambers in the nest are reserved for the eggs, some for the larvæ, and some for the pupæ. If, as often happens, the eggs, larvæ and pupæ are all in one chamber, then they are each grouped by themselves in separate piles, reminding one, as Lubbock says, "of a school divided into five or six classes" In the simpler and more primitive ants, this grouping and separation may not be so distinct The ants are constantly transferring their young from one part of the nest to another in search of the right degree of moisture, temperature, and the like In the warm part of the day, the young will be transferred to near the surface but at night will be carried down again away from the cool air The ants are constantly cleaning the young, caring for the eggs to prevent mold from growing on them, helping the callow ants to emerge from their cocoons, bringing food, cleaning, enlarging and reconstructing the nest and doing thousands of things contributing to the comfort, growth and happiness of the community



229 Anturrhinum maurandioides, in bud (×½)

The relation of ants to plants and to insects.

It has been argued and many observations have been offered to show that there is a most intimate relation between ants and many kinds of plants Certain observers think that many plants not only offer special inducements to attract ants to them by affording favorable nesting-places, but also offer the ants delectable food in the way of a sweet liquid, the floral and extrafloral nectar In return for the domiciles and the food, the ants are supposed to protect their plant hosts from certain insect and other animal enemies In other words, the relationship is one of mutual benefit, or a symbiotic one. It is certainly true that many species of ants make their homes in the hollow stems of plants, in the thorns of acacias which the ants easily hollow out (see *Bull-horn Acacias*), in cavities in bulbs, leaves, and so on, and in the dried seed-pods of plants It is also true that ants assiduously collect and carry to their nests the sweet nectar excreted by many plants. It is not so clear, however, that these favorable nesting-places and the nectar are provided by the plants on purpose to attract the ants, nor is it clear that the ants afford the plants protection from their animal enemies. In other words, more definite proof is needed to show that the relation between ants and plants is a purposely mutual one

On the other hand, the relation of ants to plant-lice, tree-hoppers and certain scale insects is clearly, in many cases, a mutually helpful one Especially is this true of the relations between ants and plant-lice The aphids secrete a sweet liquid material known as honey-dew, of which the ants are very fond and which they are active in collecting and carrying to their nests It can hardly be supposed that the aphids excrete the honey-dew solely for the ants The liquid is an excretion from the alimentary canal and is exuded whether ants are in attendance or not On the other hand, ants are very solicitous in their care of aphids in return for the honey-dew The ants sometimes build "sheds" over the lice for their protection and sometimes take the lice into their own nests to care for them In the case of the corn-root louse, the ants collect the eggs of the aphid in the fall, carry them into their own nests, and care for them all winter In the spring, the newly-hatched aphids are carried out by the ants and placed in burrows dug beforehand among the roots of certain early food-plants Later, the ants excavate burrows along the roots of the corn and transfer the aphids to these plants

It is interesting to watch the ants collecting the honey-dew from the aphids An ant approaches a louse and gently strokes the latter with its antennæ, whereupon the aphid exudes a drop of the sweet material which is quickly gathered up by the ant This action may be repeated with three or four of the aphids until the ant has all it desires, when it hurries down the stem of the plant and away to its nest with its load of sweet provender.

The life-history of ants.

Enough observations have now been made to enable us to say that most, if not all, colonies of ants are started by a solitary queen or occasionally by two queens working together The queen, after the swarming period, alights, breaks off her wings, and digs a burrow in the soil or in decayed wood, forms a small chamber, and then closes the opening Here she remains until her eggs are laid and have hatched into small larvæ that finally mature into normal but diminutive workers. All this time the queen has taken no food but has lived and fed the first workers on the reserve material in her body The small workers now begin to enlarge the nest and soon other larger workers are reared and the community begins to multiply and increase

The eggs laid by the queen are small and white and rarely seen by the ordinary observer These are solicitously cared for by workers and finally hatch into white, footless, soft, grub-like larvæ The larvæ are also tenderly cared for by the workers and changed from chamber to chamber in conformity with variations in temperature and moisture The workers feed the larvæ either on food which has been predigested and which the workers now regurgitate, or on bits of dead insects, leaves, or seeds that have been chewed fine The larvæ finally, after attaining their growth, change to whitish pupæ which, in some species, are inclosed in cocoons, while in others they are not. These the workers treat with the same solicitude and care that they show toward the larvæ The pupæ are often mistaken for eggs. Often, on raising up a flat stone, one will see the workers running this way and that with the larvæ and pupæ in their jaws, evidently seeking a place of safety for them. The pupæ finally transform to the adult ants of the various forms, workers, queens, and males

Economic importance of ants.

Ants, as a whole, may probably be considered as agents in making the earth more habitable for man.

Some of the species are neutral, perhaps, in relation to the economic status of mankind A great many species are certainly beneficial through their action in stirring and aérating the soil They are constantly burrowing deep into the earth and bringing up the particles which they distribute over the surface Their action in this respect is similar to that of earthworms, the value of which was revealed to us by the classic investigations of Darwin Ants are also important agents in aiding in the decomposition of organic substances. Their work in this respect is little appreciated or realized because it is invisible It must be remembered, however, that this work of ants is gradual, incessant, and extends through tremendously long periods of time

Again, ants are great insect-destroyers Their food consists, in great part, of the juices and tissues of dead insects or insects that they kill The interesting driver ants of the Old World and the legionary ants of tropical Africa pass through a territory killing and devouring multitudes of living insects, rats, mice, and the like Hunter and Hinds tell us that there are twelve species of ants known to attack the immature stages of the Mexican cotton boll-weevil. "In some cases more than half of the immature stages in fields have been found to be destroyed by ants alone To find 25 per cent so destroyed is not a rare occurrence"

On the other hand, certain household species of ants are very annoying and troublesome Moreover, the leaf-cutting ants of tropical America are very injurious to plants They will strip a fruit tree of its foliage in a very short time One species of these leaf-cutting forms (*Atta texana*) found in Texas, attacks cotton, corn, fruit trees, sorghum and other plants, and has become of considerable economic importance In some places, land is not planted on account of fear of attack by these ants

The mound-building prairie ant (*Pogonomyrmex occidentalis*), distributed over a large part of the western plains of the United States, has become a distinct pest since man has begun to occupy the prairies. Its large mound-nests in fields of alfalfa or grain become serious obstacles to harvesting the crops Moreover, when the nests are disturbed, the ants emerge in large numbers and attack man and beast, inflicting painful wounds with their stings In dooryards and lawns and along paths, they are liable to attack the passerby, especially dawdling children

The agricultural ant (*Pogonomyrmex barbatus molefaciens*) of Texas may build its mound-nests in fields of alfalfa, corn, or cotton, and, since it allows no vegetation to grow over a considerable area around the nest, the injury may be serious Moreover, they are pugnacious and sting intruders severely

Perhaps the most injurious rôle assumed by ants is their protection and fostering of plant-lice, scale insects, and the like Aphids and scale insects are among the most injurious insect pests, and anything that protects them or aids them in increasing may be considered an enemy to man

As a pest, the Argentine ant (*Iridomyrmex humilis*), stands by itself Professor Newell says, "As a household pest I venture the opinion that this ant has no equal in the United States" Unfortunately, it has also become a serious menace to horticultural interests as well It destroys the buds, blossoms, and fruit of certain plants and protects and fosters certain scale insects that are very injurious to sugar-cane Moreover, it has in a few instances actually shown itself to be dangerous to human life by nearly suffocating young infants

The Argentine ant was probably first introduced into the United States through the port of New Orleans, and is now found in Louisiana, Mississippi, parts of California, and probably Texas It is an exceedingly tenacious ant, holding on where once established, increasing with great rapidity, and driving out all the native ants.

The termites, or white ants

The termites are not true ants In fact, they stand at the opposite end of the insect-world, widely separated from the ants just discussed They resemble the true ants, however, in many important respects For example, they live in great colonies, and many tropical species build large mound-like nests. Moreover, in each colony there are several kinds of individuals, for example, the queen, the males, the workers which are blind or have imperfect vision, and, finally, the soldiers The food of termites usually consists of dead or decaying wood, and the species in the United States live mostly underground or in old logs, in the timbers of buildings, or in the walls and floors of houses Occasionally they injure young pecan and orange trees by mining into the stems and sometimes attack sugar-cane The greatest injury performed by termites, however, is by burrowing into the sills and foundation-timbers of buildings, thus undermining the whole structure They also injure books and documents stored in damp basements and sometimes become serious pests to greenhouses

The control of ants in gardens, lawns and fields.

The only method of getting rid of ants permanently is by locating the nests and treating them in such a way that the queen will finally be destroyed The substance most used for treating the nests is carbon bisulfide One or more holes should be made in the nest with an iron bar and an ounce or two of the liquid poured into each hole The openings to the holes should be quickly and tightly closed with a clod of dirt A heavy wet blanket thrown over the nest will aid in retaining the gas and tend to make the fumigation more effective The liquid evaporates and the gas penetrates the whole nest, killing queen and workers, thus exterminating the colony

Within the past few years, several workers have used potassium cyanide with good success in destroying ants in the field J D Mitchell conducted experiments against the leaf-cutting ant in Texas He dissolved the cyanide at the rate of one ounce in one quart of water and poured a quart into each of the openings of the nests In every case the colony was destroyed by one or two applications This method may be followed to advantage in destroying ants in gardens and on lawns, but the solution may be made weaker—one ounce of the cyanide to two to four quarts of water Best results will be secured by using 98 per cent pure potassium cyanide It must be remembered that this is a deadly poison and great care should be exercised in handling and storing it G W HERRICK

AÒTUS (*without ear*, no calyx appendages) *Leguminòsæ*. Greenhouse plant, blooming April to June in N

Shrubs, with simple scattered or 3-whorled revolute-margined lvs, and yellow or reddish fls in axillary clusters or short terminal racemes; calyx 2-lipped; petals long-clawed, the standard nearly orbicular and longer than lower petals, the wings oblong and keel incurved; stamens free pod ovate, flat or turgid, 2-valved —Ten or 11 species in Austral

gracíllima, Meisn Tall shrub, with long slender branches, hoary or slightly tomentose fls yellow with crimson or dark-colored keel, in long leafy dense racemes, the petals twice as long as calyx. W. Austral. R.B. 26.193. L. H B.

APÈRA ARUNDINÀCEA: *Stipa arundinacea*

APHANÁNTHE (Greek, *aphanes*, inconspicuous, and *anthe*, flower) *Ulmàceæ* Ornamental deciduous tree cultivated for its foliage and sometimes planted as a shade tree.

Trees or shrubs lvs alternate, petiolate, serrate; stipules free fls monœcious, inconspicuous, staminate

in axillary corymbs, sepals and stamens 5; pistillate solitary, axillary; ovary 1-celled with 1 ovule, styles 2: fr a drupe —Three to 4 species in E Asia and Austral. The only species in cult. is a deciduous tree of the appearance of a hackberry, with slender branches forming a dense head, fls and fr. inconspicuous. Not hardy north of Ga. Prop. by seeds sown after maturity and by cuttings of mature wood in fall; it also may be grafted on Celtis.

áspera, Planchon (*Homoiocéltis áspera*, Blume. *Homocéltis japónica*, Hort.). Tree, to 60 ft.: lvs. ovate to ovate-oblong, broadly cuneate at the base, long-acuminate, 2–3½ in. long, serrate with straight veins ending in the teeth, with appressed hairs on both sides, rough to the touch, on short stalks ¼in long fls greenish, with the lvs drupe globular, black, ½in diam, short-stalked. Early spring: fr. in autumn Japan. S I F. 1·37.—This tree has been confused with *Celtis sinensis*, but is easily distinguished by the straight veins ending in the teeth, while in Celtis they are curved and form loops along the margin

ALFRED REHDER



230. Aphelandra squarrosa var. Leopoldii. (×¼)

APHELÁNDRA

(Greek-made name). *Acanthàceæ*. Tropical American evergreen shrubs or tall herbs, grown in hothouses for the fine foliage and very showy 4-sided terminal spikes of red or yellow gaudy-bracted flowers

Leaves mostly opposite, simple, entire or toothed, usually many and large· fls. labiate, the upper lip mostly 3-lobed and the middle lobe erect or arching, the lower lip more or less 2-lobed or notched; stamens 4, rising from the base of the corolla, the anthers connivent and 1-celled; style 2-lobed: fr. a 4-angled caps —About 60 species

Aphelandras are of easy culture, if given plenty of diffused light in the growing season, and plants are not allowed to become tall and leggy It is well to grow new plants frequently Propagation is by seeds when obtainable, or by cuttings of partially ripened wood at any season or the young growths taken off with a heel. They bloom in autumn, but can readily be brought into flower at other seasons. When done blooming, the plants should be rested in an intermediate temperature, kept rather dry, but not allowed to wilt or shrivel. They require treatment of justicias, and thrive along with allamandas and poinsettias

A. Fls in yellow series.

squarrósa, Nees (*A. Lèopoldii*, Hort *A. chrỳsops*, Bull). Lvs. large, ovate to ovate-elliptic, acuminate, dark green above (pale below), with white rib and main veins: infl. a simple, erect, or compound spike, up to 1 ft. long; fls pale yellow and exserted one-third their length beyond the yellow crenate-dentate bracts. Brazil. *A. squarrosa* itself is not in cult, the showy plant in the trade (and described herewith) being Var. **Lèopoldii,** Van Houtte Fig 230 F S 9 889 G.C III, 1, p. 737. Var. **Loûisæ,** Van Houtte. Dwarfer and smaller in all its parts than var. *Leopoldii:* St. slender, dark reddish green, terete, covered in parts with soft pilose hairs, upper part of the st. below the infl. quite glabrous: lvs. 3–5 in. long, elliptic, rich dark green with brighter colored silvery markings along the midrib and principal veins. infl 3–6 in. long, unbranched; bracts ovate, ¾in long, rich dark yellow, with green markings in the middle; fls exserted beyond the bracts over half their length, rich canary-yellow, ½in. diam., lower 3 petals forming a lip and reflexed, upper 2 hooded, reflexing with age, tube broad, broadening out upwards with a narrow base, 1¼ in long. Brazil G W. 3.157.

Chamissoniàna, Nees (*A punctàta*, Bull). An erect herb or sub-shrub· sts slender, erect, terete, green, lower part more or less woody lvs petiolate, elliptic or elliptic-lanceolate, tapering at apex and base, and up to 6 in. long, upper part light green, marked along the principal veins and midrib with dull silvery white or yellowish white, the silvery markings sometimes spreading over nearly the entire lf.; petiole short or up to an inch or more long, lower side dull light green infl an erect unbranched spike, as much as a foot long when strong and 2–3 in. wide, bracts ovate-lanceolate, bright yellow, tipped with green, coarsely serrate, slightly reflexed; calyx ½in long; sepals lanceolate, corolla bright yellow, an inch diam, tube 1½ in long, curved outward and tapering upward; lobes ovate, nearly equal, anthers yellow. S. Brazil. B.M. 6627 I H. 29:457

Blanchetiàna, Hook f (*A. amæna*, Bull). St terete, green, tinted with dull purple, with deeper shading around the base of petiole and at the nodes, thick and stout. lvs. ovate-acuminate, with many pairs of conspicuous nerves, green, the midrib, and often the main veins, white; petiole, 1–2 in long, terete, glabrous fls dark yellow, exceeding the long, entire, cusp-pointed red scales. spike sessile Brazil. B M 7179 —Known in the trade as *A. amæna*, having been described under that name before it had flowered in cult.

AA. Fls. in red-orange series,—i e, scarlet, or verging to orange

aurantiaca, Lindl. Lvs. ovate-elliptic, deep green above, light green below, strongly veined, but not particolored, slightly wavy edged. fls orange, with a tinge of scarlet, the spreading limb overhanging the greenish sharp-toothed scales.—A dwarf-growing species of easy cult. and readily raised from seed Mex B M 4224. B.R. 31:12. Var. **Rœzlii,** Nichols. (*A Rœzlei*, Carr). Fls. with more scarlet: lvs. twisted, with silvery hue between the veins. Mex. Gn. W. 20·576.—Showy and good. Not so tall as *A. aurantiaca*.

Macleàyi, Bedd. Lvs. ovate-elliptic, 3 in or less long, acute, entire, green both sides with white band along midrib above. spike cone-like, orange-scarlet nearly 2 in. long Country unknown.—Said to have been cult. as *A. punctata* and *A squarrosa*.

tetragòna, Nees (*A cristàta,* Lindl *Justicia cristàta,* Jacq. *J. tetragòna,* Vahl). An erect or spreading, shrub: sts. terete, woody below, green, tinted with red when young: lvs. opposite and decussate, petiolate, green, glabrous or nearly so, elliptic or elliptic-ovate, acuminate or acute, 6–12 in. long, and 2–7 in diam., entire or crenate, slightly undulate; petiole as much as 6 in. long, slender, hairy. infl. an erect-terminal cluster of spikes, the central one hairy, 6–8 in long, with shorter ones branching from its base, often, when well grown, bearing from 10–12 lateral spikes of various lengths; fls bright scarlet, crowded on the spike, and the bulk of them opening together, bracts erect, closely adpressed to the rachis, green, ovate, acute, ⅛in. long, ciliate, bracteoles lanceolate, hairy, corolla scarlet, 1¼ in diam, tube 2 in long, narrow at the base, broadening upwards, lip reflexed, 1¼ in. long, upper pair of petals hooded, lateral ones reduced to short obtuse lobes. Trop. S Amer. B M. 8272. Gt. 40: 1354.—The finest species in cult; a magnificent stove plant

nitens, Hook f. An erect herb or sub-shrub: st. terete, green, stout, usually dwarf and compact. lvs. shortly petiolate, ovate-acute, entire, thick, rich dark olive-green above, bright vinous purple below, highly glabrous on both sides, margins recurved, petiole very short or none, winged. infl. an erect terminal spike, 6 in or more long, bracts green and erect, 1–1½ in long, serrate; sepals ⅓in. long, linear-lanceolate; corolla bright vermilion-scarlet, 1–1½ in diam; lip ovate, larger than the rest of the petals and slightly reflexed, upper pair of petals hooded, tube 1–1¼ in. long, yellow. Colombia B M 5741 Gn 48.122.—A fine dwarf-growing stove plant readily prop by cuttings and often setting seed if kept in a cooler and drier house when in flower.

fascinàtor, Lind & André. Habit stiff and erect, with fls opening in succession over a period of some 4–6 weeks st. terete, green, glabrous. lvs. elliptic, lanceolate or ovate-lanceolate, acuminate, entire, shortly petiolate, 6–9 in. long, upper side dark green with narrow band of silvery white along midrib and principal veins, lower side dull wine-red with veins of a darker shade infl an erect unbranched terminal spike up to 6 in long, bracts ovate or elliptic, basal ones an inch long, tapering upwards to ½in long, covered with short pilose hairs, sepals ⅓in. long, lanceolate, glandular, green; corolla bright vermilion-scarlet, 1½ in. diam with large and prominent front lobe, tube slender 1½ in long B M 8398 I H 21·164.—A beautiful and striking species, well worth growing for its handsome foliage apart from its beautiful fls. It should be kept rather on the dry side as soon as the fls. appear, otherwise the plant is likely to lose all its roots.

A atròsirens, N E Br Dwarf lvs very dark green above and purplish beneath fls yellow, 1 in long Brazil I H 31 527.—*A. lìbomàna,* Lind Dwarf lvs ovate and long-acuminate, with a white rib, green below fls deep yellow, small, scarcely exserted beyond the red bracts Brazil B M 5463.—*A macedoniàna,* Lind & Rod Said to be a form of A atrosirens Lvs with white rib and main veins Brazil I H 33 583.—*A Márgaritæ,* E Morr Lvs elliptic-acuminate, barred with white, purple below fls yellow, the bracts strong-toothed Brazil G C III. 2.585.—*A. orientàlis,* offered in Amer, is possibly a form of some well-known species.—*A pùmila,* Hook f Less than 1 ft lvs large, acute fls orange, bracts purplish Brazil B M 6467.—*A variegàta,* Morel A near ally of A Blanchetiana with bright scarlet bracts, and bright yellow fls. Probably not now in cult. B M 4899. F S 10 981

L. H. B.
C. P. RAFFILL.

APHELÈXIS: *Helichrysum.*

APHYLLON (Greek, *leafless*). *Orobanchàceæ.* Two species of small N. American parasitic herbs, now often united with Orobanche, and by others kept distinct under Rafinesque's name, Thalesia. These plants are not cult., but are always interesting to the collector and surprising to one who runs across them in woods or fields. **A. unifiòrum,** Gray, Fig. 231, produces very few leafless 1-fid. pale scapes, 3–8 in. high, and 5-lobed, curved, white or violet fls., and known as cancer-root. **A. fasciculàtum,** Torr. & Gray, has the scaly st. rising higher out of the ground and bearing several crowded peduncles. fls purplish yellow.—These plants occur sparingly nearly or quite across the continent.



231. Aphyllon uniflorum. (×½)

APÌCRA (*not bitter,* from the Greek) *Liliàceæ,* tribe *Aloìneæ.* Aloe-like plants, grown with other succulents.

Shortly caulescent small succulents: lvs. spirally arranged or crowded along the st.: fls. greenish, often striped with white, straight, tubular or prismatic, with short, flat or spreading white limb surpassing the stamens Cape region.—Agave house or cactus house; suitable for rockeries during the summer Prop like Aloe. Monogr. by Baker. G C II, 11.717 (1879) Journ. Linn Soc. Bot. 18.216. Berger in Das Pflanzenreich 1908, hft. 33.

INDEX.

aspera, 1
bicarinata, 2.
bullulata, 3.
congesta, 6.
deltoidea, 7.
foliolosa, 8
imbricata, 4
intermedia, 7.
major, 1.
pentagona, 3, 5.
spiralis, 4, 5.
spirella, 5.
turgida, 7
Willdenowii, 5.

A. *Lvs. warty on the back. fls. smooth.*

1. **áspera,** Haw (*Alòe áspera,* Haw *Hawórthia áspera,* Haw.). St. mostly simple, erect, 4–6 in. high, 1½ in. diam, including lvs. lvs. half-globose, acuminate, slightly keeled, ⅝in long, green, smooth on the rather convex upper surface, green-warty on the back, the margin granular infl scarcely 1 ft. high, unbranched, fls. somewhat rosy, ⅜in long, twice as long as the pedicels Cape Salm, Aloe §2 f. 2.—A large form with white-warty lvs twice as long, is var **màjor,** Haw.

2 **bicarinàta,** Haw. (*Alòe bicarinàta,* Roem.) St erect, 6–12 in high. lvs. falcately short-ovate, acute, acutely keeled, ⅝ x ¾in, green, smooth on the somewhat concave upper surface, irregularly white-warty on the back, the margin and keel granular roughened. Cape Berger 40

3 **bullulàta,** Willd (*A pentagòna bullulàta,* Baker *Alòe bullulàta,* Jacq.) St. erect. lvs lanceolate, acute, obliquely keeled, ⅝ x 1¼ in, pale, the back unequally



232. Apicra pentagona.

white-warty, the margin and keel finely denticulate: fls. somewhat yellow. Cape.

AA. *Lvs. not warty.*

B *Fls. warty. lvs smooth.*

4. spiràlis, Baker (*A umbricàta*, Willd *Alòe spiràlis*, Linn. *A. umbricàta*, Haw. *A. cylindrica*, Lam *Hawórthia umbricàta*, Haw.). Sts. somewhat clustered,



233. Apios tuberosa. (×⅓)

erect, 6–12 in high; about 2¼ in diam., including lvs · lvs broadly triangular-acuminate, biconvex, ½ x 1¼–1½ in., glaucescent, the margin slightly granular infl about 1 ft. high, unbranched, fls greenish, ½in. long, more than twice as long as the pedicels Cape DC., Pl Gr 56 Jacq., Fragm. 110. B M 1455. Salm, Aloe §1 f 1 Dillenius, Eltham 13. Commelin, Præl 32

BB. *Fls. smooth lvs sometimes granular in the first.*

5. pentagòna, Willd (*Alòe pentagòna*, Haw *Hawórthia pentagòna*, Haw.) Fig 232 St mostly solitary, erect, 6–12 in high; about 4 in diam., including lvs lvs. distinctly 5-ranked, broadly triangular-lanceolate, acute, biconvex, somewhat low-keeled, ¾ x 1½–2 in., green, slightly (sometimes granularly) white-dotted, the margin slightly granular infl. 1½ ft high, sometimes forked; fls greenish, ⅜in long, twice as long as the pedicels Cape. Jacq., Fragm 111 B M. 1338. Salm, Aloe §1. f. 4 Berger 40.—Varies into forms with lvs. less obviously 5-ranked large, in somewhat evident oblique ranks, var. **Willdenòwii,** Baker (*A. spiràlis* Willd *Alòe spiràlis*, Haw. *A. pentagòna spiràlis*, Salm-Dyck), Salm, Aloe §1 f 5, smaller, scarcely in distinct ranks, var **spirélla,** Baker (*Alòe spirélla*, Salm-Dyck *Hawórthia spirélla*, Haw.), Salm, Aloe §1 f. 3.

6 congésta, Baker (*Alòe congèsta*, Salm-Dyck) St. solitary, erect, about 1 ft. high and 4 in diam., including lvs : lvs. broadly ovate, acuminate, rather flat above, more or less keeled, 1–1¼ x 1½ in., green, glossy, the margin granular infl 1¼ ft high, simple, fls greenish, nearly ⅝in long, with rather large spreading segm.-tips, thrice as long as the pedicels Cape Salm, Aloe §2.f

7. deltoídea, Baker (*Alòe deltoídea*, Hook.) Sts. somewhat clustered, 6 in or more high, about 2¼ in diam., including lvs lvs distinctly 5-ranked, ovate, sub-acute, somewhat concave and low-keeled, 1 x 1¼–1½ in., green, glossy, the margin and keel serrulate· infl 1 ft high, simple, fls nearly sessile, yellow-green, about ⅜in long, the rather large spreading white segm.-tips at first rosy Cape B M 6071 —Varies in a form with more turgid lvs less obviously 5-ranked, var **túrgida,** Berger (*A. túrgida*, Baker), and a smaller form with evidently 5-ranked sometimes blush lvs., var **intermèdia,** Berger

8 folioldsa, Willd (*Alòe folioldsa*, Haw *Hawórthia foliolosa*, Haw.) Sts somewhat clustered, erect, at length a foot or more high, 1½ in diam., including lvs lvs broadly ovate-acuminate, flat above, acutely keeled, ⅜ ⅝in long and wide, green, glossy, the margin granular infl over 1 ft high, simple, fls greenish, about ⅜in long, twice as long as the pedicels Cape B M 1352 Salm, Aloe §2 f 4 Berger 40



234. Fruit of Aplectrum hyemale
Nearly natural size.

WILLIAM TRELEASE

ÀPIOS (*pear*, from the Greek, alluding to the shape of the tubers) *Leguminòsæ* Hardy twining herbs, with tuber-bearing roots, infrequently planted

Leaves pinnate, of 3–9 mostly ovate-lanceolate scarcely stipellate lfts fls in dense, short racemes, papilionaceous, the standard broad and reflexed, keel incurved and coiled, stamens 9 and 1 pod linear and flat, several-seeded —Two species in E N Amer., and 3 others in Asia

tuberòsa, Mœnch GROUNDNUT. WILD BEAN Fig 233 Four to 8 ft., climbing over bushes root bearing strings of edible tubers, 1–2 in long. lfts 5–7, ovate-lanceolate fls fragrant, chocolate-brown, the standard very broad and turned back, the keel long, incurved and scythe-shaped July, Aug —Common in low grounds and swamps The fr. often fails to mature Prop by the tubers, 2–4 of which should be planted together at a depth of 3–4 in also, by seeds Grows well in the wild border, in any loose, rich soil. Under these conditions, the plant covers a trellis or other support in a comparatively short time Dry tubers offered by seedsmen are likely to start slowly. The brown of the fls. is a very unusual color in hardy herbs. Likely to become a weed in rockeries and wild gardens.

A Fórtunei, Maxim , is occasionally cult in Japan for its small, ovate, edible tubers A G 13 77 —1 *Princana*, Rob , native to Kentucky, may be expected to appear in the trade root a single large tuber, becoming 6–7 in diam fls pale rose-color a vigorous climber, first described in 1898 (Bot Gaz 25 451, with illus).

ÀPIUM: *Celery* L. H. B.

APLÉCTRUM (Greek, *with no spur*). *Orchidàceæ.* A small orchid, with smallish dull-colored fls in a raceme, on a leafless scape, which springs from a large corm-like tuber. Single species (or possibly two), in woods in the northern states

Flower spurless and sacless; petals and sepals similar, narrow, lip 3-lobed and crested, deflexed, fertile anther 1, the pollen-masses 4, smooth and waxy, column free, compressed, the anther borne below the top

hyemàle, Nutt (*A spicàtum*, B S P) PUTTY ROOT ADAM-AND-EVE Fig 234 Sends up a pointed green lf 2–6 in long, which lasts through the winter, and in spring a stalk about a foot high, bearing a raceme of rather large greenish brown fls , which are succeeded by hanging, oblong-pointed pods (Fig 234) —Hardy May be grown in rich, loamy borders Interesting, but not showy L H B

APLOPÁPPUS (Greek, *simple pappus*) Syn , *Haplopappus Compósitæ* Herbaceous perennials, sometimes offered for the hardy border.

Leaves mostly stiffish or rigid, alternate heads radiate, many-fld , the rays pistillate, involucre hemispherical, with several series of closely imbricated bracts: pappus simple, of many unequal bristles, the achene short and narrow —A genus of about 115 species



235 Aponogeton distachyus (×⅓)

of herbaceous perennials, rarely shrubs, mostly from Calif and Chile Fls yellow, in summer and autumn Separated only by technical characters from Bigelovia, into which it insensibly grades (Bigelovia has discoid few-fld heads and pappus in single row) The only 3 species known to have been in the American trade are

lanuginòsus, Gray Hardy alpine herb, woolly, 4 in high, from creeping rootstocks lvs soft, narrowly spatulate, or upper linear, 1–2 in. long rays 15–20. Mts of Wash. and Mont —Intro. 1889, by F H. Horsford

Párryi, Gray Alpine herb, 6–18 in high, green and almost glabrous lvs oblong-obovate, 2–4 in long· fl -heads about ½in high, pale yellow, the involucral bracts oblong and obtuse; rays 12–20, small and narrow. —Suitable for rockwork.

crôceus, Gray St about 1½ ft , erect and stout, and with radical lvs a foot or less long· cauline lvs ovate-oblong to lanceolate, partly clasping· fls showy, saffron-yellow, the rays about an inch long, the inner involucral bracts ragged Rocky Mts. June–Oct.

A ericoïdes, Hook & Arn Shrub, 2–5 ft high lvs very numerous, filiform, those of the dense fascicles, 2 or 3 lines long fls very numerous G C.III 20 301 N. TAYLOR †

APÓCYNUM (Greek for *dog-bane*). *Apocynàceæ.* DOG-BANE INDIAN HEMP Native herbs, sometimes planted in borders

Flowers small, the calyx with acute teeth; corolla bell-shaped, with 5 appendages inside, stamens 5, inserted deep in the corolla, the filaments very short; style 0 seeds silky —Tough perennial herbs, with milky juice, chiefly of north temperate zone, with oblong or ovate, opposite lvs , milkweed-like fls in small cymes, and slender follicles or pods About 25 species, 10 native to N Amer

androsæmifòlium, Linn. SPREADING DOG-BANE. Three ft or less high, usually glabrous, the branches spreading: lobes of corolla revolute and tube of corolla longer than the calyx· lvs oval or ovate, mucronate, short-petioled cymes loose, axillary and terminal, fls. bell-like, white or pink N N Amer , common B M. 280 —Sold by dealers in native plants Useful for the hardy border as it will stand dry open places Root used in medicine, sometimes gathered by drug-collectors for *A cannabinum*, but as its action is different, it should not be substituted.

cannabìnum, Linn Branches erect or nearly so: lobes of corolla nearly erect, the tube not longer than calyx lvs ovate to lance-oblong, short-petioled. cymes dense, fls greenish white Northern states, common — Not known to be in the trade, but likely to be confounded with the above. Root emetic, cathartic, diaphoretic, expectorant, and diuretic The tough fibrous bark of the stalks formerly used by the Indians for making twine L. H B

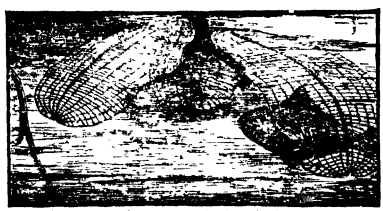
APODOLÍRION (Greek combination, *footless lily*, the peduncles not being evident) *Amaryllidàceæ.* Greenhouse bulbs of S Afr , of which one or two of the half-dozen species are rarely cult Bulb tunicated: fl. 1, borne or hidden in the bulb-neck in the manner of crocus, white or reddish lvs usually not appearing with the fls , narrow **A. Éttæ,** Baker, and **A. lanceolàtum,** Baker, are probably best known as cult plants. The former has a white, tinged red fl. 3 in long and crocus-like lvs , the latter (*Gethyllis lanceolàta*, Linn. f) has a much shorter fl , white or whitish, and a solitary lanceolate lf. appearing with the fls. The apodolirions are prop. by offsets or seeds.

APONOGÈTON (Greek name, referring to its habitat in the water) *Aponogetonàceæ* Aquatics, mostly with flat floating lvs and emerging spikes of fls Includes Ouvirandra

Submerged herbs, with tuberous rhizomes and fibrous roots lvs long-stalked, oblong or linear, sometimes lacking the parenchyma and having a lattice-like character fl -characters those of the family (p. 13). —About two dozen species of warm countries, Asian, African and Australian Krause & Engler, Das Pflanzenreich, hft 24 (1906) There are two main species in cult , the aponogeton proper with solid lvs , and the ouvirandra with open-work lvs The former is grown mostly out-of-doors, the latter in warm greenhouses.

distàchyus, Linn f. CAPE POND-WEED. WATER HAWTHORN (from the fragrance) Fig 235. Fls in twin spikes on the emersed ends of long scapes, wholly naked, but subtended by a double row of petal-like bracts, very fragrant, with purple anthers:

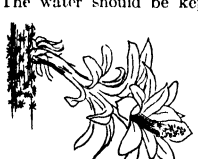
lf-blade floating, oblong-lanceolate, round-based, parallel-veined, 3–6 in long. Cape of Good Hope. B M 1293. F R. 1. 463. P.G 4 106. G W. 5. 195. Gng 2 25. —A charming and interesting plant. In a protected pool, especially if it can be covered in winter, the plant is hardy in the N., blooming nearly all summer. Removed to tubs in the fall, it blooms nearly all winter, or it can be grown permanently in tubs or deep pans in the house Requires about 2 ft of water, or out-of-doors it may have twice that depth Prop chiefly by seeds, but fls should be pollinated and kept above water at least 24 hours afterward, and seeds not be allowed to become dry Var **Lagrànget**, Hort (*A. Lagrànget*, Hort), is a rare and beautiful variety, with violet bracts and lvs. violet beneath It props slowly. R H 1895 380



236. Aponogeton fenestralis, the lace-leaf plant Known to gardeners mostly as Ouvirandra

fenestràlis, Hook f. (*Ouvirándra fenestràlis*, Poir). LACE-LEAF LATTICE-LEAF Fig 236 Lvs oblong, 6–18 in long and 2–4 in broad, reduced to skeletons, floating just under the surface of the water· fls small, consisting of 6 stamens, 3 pistils and 2 white petal-like bodies, numerous, in 2 spikes each about 2 in long, which are united at the base, and borne on the top of a scape a foot or so long. Madagascar A F 7 67 A G 15.169 B M. 4894 Gt 1863 387 G M 38 830. Gn. 30, pp 344, 345 Mn 6, p 231 F S. 11·1107 I H 8 300 G W 10.595 (var *major*) —The lvs are merely a tracery of nerves and cross-veins, but despite their lace-like delicacy they can be handled with considerable roughness The venation of the lace-leaf plant is like that of the common aponogeton, and now and then a lf occurs in which the spaces between the veins are partly or wholly filled with green matter. There is another species with skeletonized lvs (*A. Bernerianus*), but the open spaces are smaller and the plant is less desirable for cult

The lace-leaf plant can be grown in a tub in a warm greenhouse For some unknown reason the plant seems rarely to succeed in a jar or glass aquarium Some cultivators think that the water must be changed every day, but this is not necessary If confervæ appear, introduce a few tadpoles and snails, these will devour the green scum, and help to keep the plant in good health by furnishing oxygen See *Aquarium* The plant should be potted, and plunged not more than 18 in. below the surface of the water. For potting soil use a rich compost, such as is recommended for water-lilies The water should be kept clean and sweet, and a temperature of 65–70° provided. Avoid direct sunlight In Madagascar the streams often dry up, and the tubers carry the plant over the dry season In imitation of nature some cultivators take the tubers out of the soil, and leave them on a shelf in a hothouse during the month of Feb It is doubtful whether this is necessary. Potting should be done while the plant is in active growth, not dormant Prop. by division The lace-leaf is cult. in all the finest collections of aquatics, and is prized as a curiosity.



237. Aporocactus flagelliformis (×½)

A. angustifòlius, Ait. (A. capensis, Perry) Like A. distachyus but much smaller fls small, white S Afr —*A. Bernerianus*, Hook f., differs from A fenestralis in having smaller open spaces in the lvs., and pinkish 4-parted spikes —*A. Dinteri*, Engl & Kr Tuber globose floating lvs oblong, rounded or somewhat emarginate at base, long-nerved, not lace-like inflorescence 2-spiked, yellowish German S W. Afr G W 14 659 —*A. Henckelianus*, Hort Allied to A fenestralis, but rhizome larger and not creeping lvs pale green, less lasting Madagascar G C III 40 270 —*A. monostachyus*, Linn f (A natans, Engl & Kr) Lf linear-oblong infl in 1 spike, pink India, Austral G W 9 62

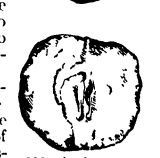
L. H B.
WM. TRICKER.

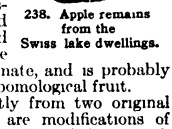
APOROCÁCTUS (Greek, *impenetrable* and *cactus*). *Cactàceæ* A very slender vine-like creeping, clambering, or hanging cactus, sending out aerial roots fls rather small, slender, somewhat irregular, bright red fr. small, globose, reddish, setose —Three species recognized, the one below and *A. flagriformis*, Lem., and *A. leptophis*, Britt & Rose Only one appears to be in cult These plants are commonly referred to Cereus.

flagellifórmis, Lem (*Cèreus flagellifórmis*, Mill) RAT-TAIL CACTUS Fig 237 Sts about ½in diam., branching ribs 10–12 fls 2–3 in long Trop Amer —This is commonly hybridized with other species It is a well-known window-plant It is easily grown and is a great favorite with people who know little about cacti It is often grafted on other cacti and worked into various fantastic designs It is rather a a free bloomer, and with proper care a most charming plant can be obtained J N ROSE.

APOSÈRIS. An alpine composite, now included in the genus *Hyoseris*, which see

APPLE. *Rosàceæ* The fruit and tree of *Pyrus Malus*, one of the rosaceous group The name is also applied, with qualifications, to many other edible fruits, as may-apple, pond-apple, rose-apple

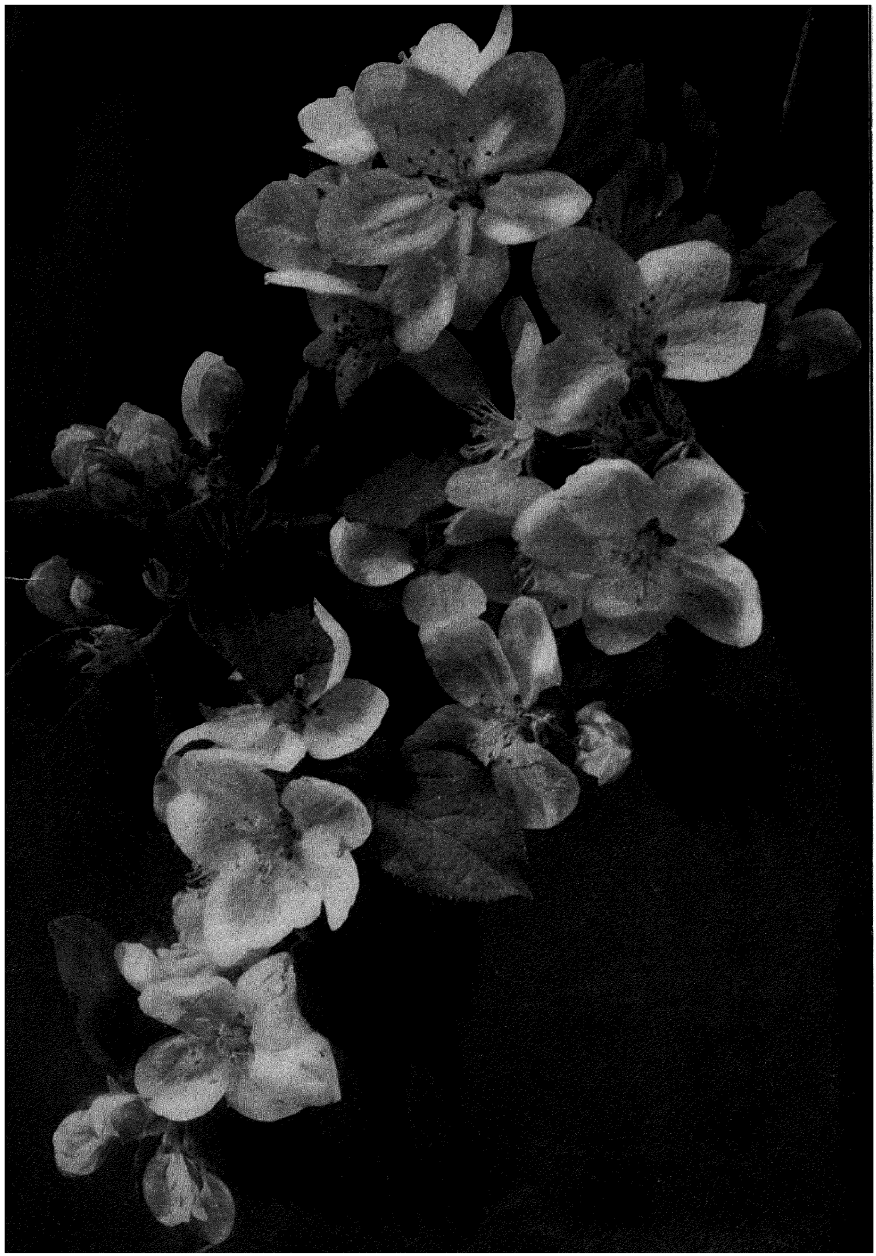




238. Apple remains from the Swiss lake dwellings.

The apple is native to southwestern Asia and adjacent Europe It has been cultivated from time immemorial Charred remains of the fruit are found in the prehistoric lake dwellings of Switzerland (Fig 238) Now widely cultivated and immensely variable, the apple is grown in every temperate climate, and is probably the most important commercial pomological fruit.

The apple has come apparently from two original stems All the common apples are modifications of *Pyrus Malus* (see *Pyrus*), a low round-headed tree, with thick and fuzzy irregularly dentate, short-stemmed leaves and fairly compact clusters of woolly-stemmed flowers The crab-apples are derived chiefly from *Pyrus baccata*, commonly known as the Siberian crab This species is probably of more northern or eastern origin than the other It is of smoother and more wiry growth, with narrower and thinner essentially glabrous long-stemmed leaves, and more open clusters of glabrous-stemmed flowers The apple is small and hard, and the calyx-lobes fall at maturity, leaving the eye or basin of the fruit smooth and plain. Hybrids between these species apparently have given the race of large-fruited crab-apples, of which the Transcendent and Hyslop are examples. The race known to pomologists as *Pyrus prunifolia* is perhaps a hybrid group. Certain apples are native to North America Two species, *Pyrus coensis* and *P. coronaria*, are of interest to the pomologist. The former is the prairie-states crab, and is the more promising. In characters of growth, leaves



VII. The flowers of the apple tree.

and flowers, it bears a striking resemblance to forms of *Pyrus Malus*. The fruit is spherical or spherical-oblong, short-stemmed, very hard, and remains green-colored. The fruit of the eastern-states crab, *Pyrus coronaria*, is distinctly flattened endwise, and is long-stemmed The leaves are deep-cut and often three-lobed There are no improved varieties of this eastern species, and no authentic hybrids between it and the common apples The fruit is sometimes used by settlers, but it has little comestible value. *Pyrus ioensis* has produced a number of promising hybrids with the common apple, and this mongrel race is known as *Pyrus Soulardii* The Soulard crab is the best known of these Its value lies only in its extreme hardiness The pomological value of the native crabs is prospective For a completer account of the native apples, see Bailey, "Evolution of our Native Fruits"

One of the most perfect apple regions of this country—considering productiveness, quality, long-keeping attributes, longevity of tree—is that which begins with Nova Scotia and extends to the west and southwest to Lake Michigan Other important regions are the Piedmont country of Virginia and the highlands of of adjacent states, the Plains regions, the Ozark and



239. Spur and fruit-bud of apple.

240. Only one fruit may set in a cluster

Arkansas region; the intermountain region from Montana to New Mexico, the Northwest, including both large and small areas in British Columbia, Washington and Oregon, and the Pacific region, comprising the foothills and parts of the coast in California All parts of the United States north of Florida and the Gulf borders, and excluding the warm-temperate parts of the Southwest, are adapted to the apple in greater or lesser degree North America is the leading apple-growing country of the world A full crop for the United States and Canada, of all kinds and grades, is probably not much less than 100,000,000 barrels, although it is doubtful whether more than one-third of this vast quantity is marketed in a fresh state The apple is a cosmopolitan fruit, and, since it thrives almost anywhere, it is commonly neglected

The apple was early introduced into this country In the first days it was prized chiefly for cider It is an ancient and common notion that any apple is good enough for cider; and this is one reason for the neglect in which the apple plantation was commonly allowed to stand.

Brief or summary statement.

The best results in apple-growing are to be expected in general when the land is tilled The reasons for tilling the orchard are those that apply to other crops,—to make plant-food available, to extend the area in which the roots can grow, to conserve moisture It is especially important, in our hot and sunny country that the roots extend deep enough to escape the disastrous effects of drought The ideal treatment of orchard land is to fit the ground deep before the trees are planted, to plow deep for a year or two or three in order to force the roots down and thoroughly to ameliorate the soil, and to practise shallow tillage to conserve moisture Since trees make most of their growth early in the season, the tillage should be begun as soon as the land is fit in spring, and it may be discontinued by midsummer or August This cessation of the tillage allows of the growing of some cover-crop or catch-crop late in the season, in order to provide humus and to improve the physical texture of the soil If the land is well handled in the first few years, it will not be necessary to turn a furrow in the orchard frequently thereafter, but merely to loosen the surface in the spring with a spading-harrow, spring-tooth harrow, or other tool, to reestablish the surface mulch The only reasons for turning a furrow will occur when the land is so hard that the surface tools cannot mellow the surface, or when it is desirable to turn under a green-manure crop Even hard lands may be got in such condition, by means of tillage and green-manures, that they may be worked up with harrow tools when the orchard comes into bearing Plowing the orchard, therefore, has two legitimate objects to mellow and ameliorate the land to a considerable depth, so that the roots may forage deep, to turn under a cover-crop The former purpose should not be necessary after the first few plowings An incidental object of plowing is to facilitate the making of the annual surface mulch; and this mulch is to save the moisture



241 Showing the side bud that is to continue the spur the following year

On good lands in which there is a sufficient natural supply of moisture, the sod-mulch treatment may take

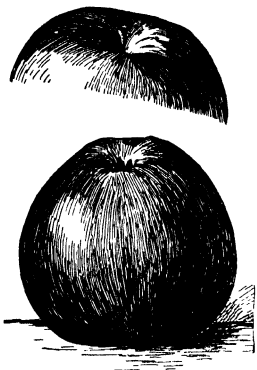


242 The flower-cluster and the leaf-cluster.

the place of tillage This procedure keeps the land in sod, and the grass is mown and allowed to remain on the ground or is spread under the trees.

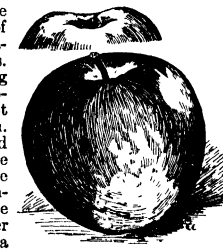
The apple thrives in a variety of soils Lands that yield good crops of wheat and corn may be expected to be good apple lands, if other conditions are right Rolling, inclined, or somewhat elevated lands are generally considered to be most desirable Their value lies in the better drainage of water and air The trees may be set in either fall or spring Forty feet apart each way is the standard distance for apple trees; but some varieties, as the Wagener and the crabs, may be set closer In the South and on the plains, trees may

be set closer, as they do not attain such great size as in the northeastern states. In general, it is best to devote the land to apples alone; but persons who are willing to give the plantation the best of care may plant other trees between the apples as fillers. The more diverse the kinds of trees which are planted together, the more difficult it is to give the proper care to each Some of the shorter-lived varieties of apples make excellent fillers in the apple orchard; and in special cases dwarf apples may be used



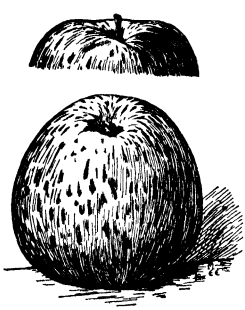
243. Baldwin (×⅓)

Although it should be the general purpose to till the apple orchard throughout its life, whenever the trees seem to be growing too rapidly, the plantation may be seeded down for a time That is, tillage is the general practice, seeding down and sod-mulching are the special practices For the first few years, annual crops may be grown in the apple orchard, but every year a more open space should be left about the trees As often as the land becomes crusted it should be tilled On strong lands which are well handled, it is rarely necessary to apply concentrated fertilizers until the trees are old enough to bear What fertilizers are then needed, and how much to apply, are to be determined by the behavior of the trees If the trees are making insufficient growth, and the foliage lacks color, one or all of three things may be the trouble the trees may need water; they may be suffering from insects or disease; they may lack nitrogen. If it is thought that they lack nitrogen, this material may be supplied in the form of nitrate of soda, sulfate of ammonia, or the unburned animal substances, as blood and tankage. Two to three hundred pounds to the acre of the nitrate of soda or sulfate of ammonia are liberal applications on well-tilled lands. If the trees are making vigorous growth, the probability is that they are not in need of more nitrogen. Potash and phosphoric acid may then be applied. Three hundred pounds of muriate of potash, or other concentrated material, should be sufficient for an acre, under ordinary conditions As a rule, all orchards in full bearing should have a liberal annual application of fertilizing materials In the East, apple trees should be in profitable bearing at twelve years from planting, and should continue for thirty years In recent years, lime has been applied in many cases with good results, about 1,000 pounds to the acre every four or five years.



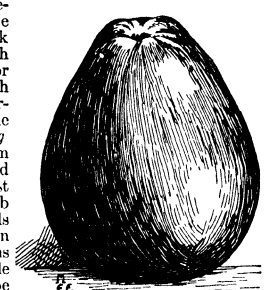
247 Gano (×⅓)





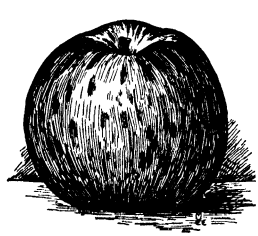
244. Ben Davis. (×⅓)

The two staple enemies of the apple are the apple-worm (the larva of the codlin-moth), and the apple-scab These are readily held in check by spraying,—with arsenical poisons for the worm, and with lime-sulfur or bordeaux mixture for the scab See *Spraying* Spraying for the worm should be performed as soon as the last petals fall, for the scab as soon as the buds are well burst In badly infected regions and on very susceptible varieties, it may be necessary to spray first



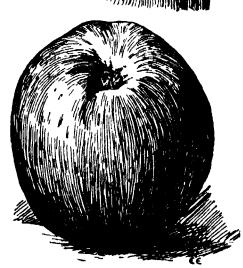
248 Black Gilliflower (×⅝)





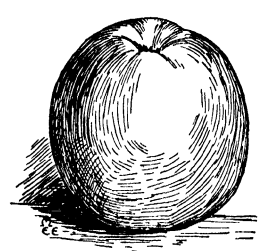
245. Blue Pearmain. (×⅜)





246. Esopus (Spitzenberg). (×⅜)





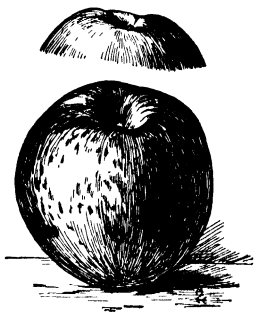
249. Grimes. (×½)

for the scab before the buds swell. Since there are insects (as canker-worms, case-bearers, bud-moth) that appear before the flowers open, it is advisable to add arsenical poison to the fungicide at the early spraying The number of times to spray depends on the thoroughness of the work, the pests to be combated, and the season, but it is a good rule to expect to spray with the combined fungicide and insecticide mixture when the buds burst, and again when the petals have fallen. In the plains country, less spraying may be necessary for the fungous diseases

The apple commonly bears on spurs The fruit-bud is distinguished by its greater size (usually somewhat thicker than its branch), its greater width in proportion to its length, and more conspicuous pubescence It is also distinguished by its position A fruit-bud is shown in Fig 239 A fruit-scar is shown near the base of the branch If this fruit was borne in 1912, the side branch grew in 1913 from a bud which came into existence in 1912 If we go back to the spring of 1912, the matter can be made plain A cluster of flowers appeared One flower set a fruit (Fig. 240). This apple is at the end of the branchlet or spur The spur cannot increase in length in the same axis Therefore, a bud appears on the side (Fig 241). The fruit absorbs the energies of the spur. There is little nourishment left for the bud. The bud awaits its opportunity; the following year it grows into a branchlet and makes a fruit-bud at its end (Fig 239), and thereby there arises an alternation in fruit-bearing, although not all alternating in fruit-bearing may be attributed to this cause The difference between fruit-buds and leaf-buds becomes apparent when the buds burst (Fig 242)

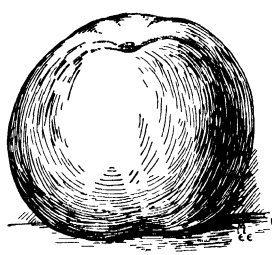
The apple is budded or root-grafted on common apple seedlings. These seedlings are usually grown from seeds secured from cider mills. In the East, budded trees are preferred In the upper Mississippi Valley, root-grafted trees are preferred, largely because own-rooted trees of known hardiness can be secured. In Russia, seedlings of *Pyrus baccata* are used as stocks They prevent root-killing, and give earlier fruit-bearing Apple trees are usually planted when two or three years old

Apples are dwarfed by working them on various kinds of Paradise and Doucin stocks These stocks are merely naturally dwarf forms of the common apple, and which, in some remote time, have originated probably from seeds Dwarf apples are much grown in Europe, where small-area cultivation and wall-training are



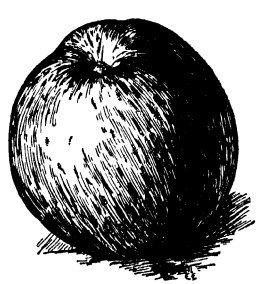
250. Hubbardston (×¾)





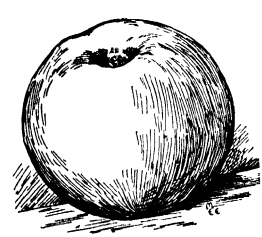
251 Yellow Newtown (×½)





252. Northern Spy. (×⅓)

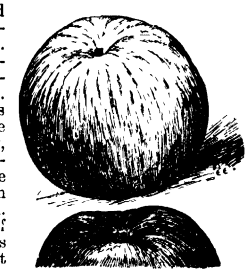




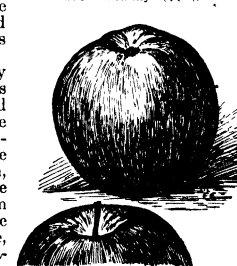
253. Rhode Island Greening. (×⅓)



254. Rome Beauty. (×⅓)



255 Wealthy (×¼)

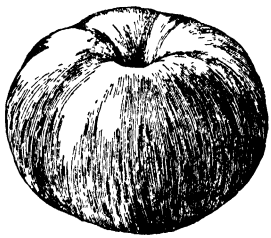


256. Stayman (Winesap) (×⅜)



257. York Imperial. (×⅜)

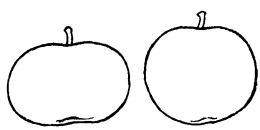
common, but they are little known in America, and, because of economic conditions, are usually not profitable here. See *Dwarfing*.



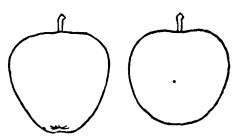
258 Tompkins King,—the flat or oblate American apple. (×½)

Varieties.

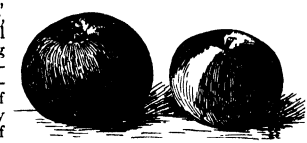
The varieties of apple trees actually on sale in North America in any year are not far from 1,000 kinds Each great geographical area has varieties that are particularly adapted to it In the northern Mississippi Valley, there are few of the eastern-states apples that thrive Varieties have been introduced from Russia with the expectation that they will be adapted to the region; but more is to be expected of their progeny than of themselves. Varieties of local origin, coming from various stem types, are now providing that region with satisfactory apples In the selection of varieties, one should be guided by this adaptation to the region, and by the purpose for which the fruit is designed to be grown Consult the recommended lists of the state horticultural societies, ask persons who have had experience in the given region, write to the experiment station, enquire at the markets The leading commercial varieties in North America are Golden Russet (N. Y), Red Astrachan, Baldwin (Fig 243), Ben Davis (Fig 214), Blue Pearmain (Fig 245), Oldenburg (Duchess of), Esopus (Spitzenberg) (Fig. 246), Fameuse, Gano (Fig 247), Black Gilliflower (Fig 248), Gravenstein, Grimes (Fig 249), Hubbardston (Fig 250), Ralls, Jonathan, Tompkins King, McIntosh, Missouri (Pippin), Newtown (Albemarle) (Fig 251), Northern Spy (Fig 252), Peck (Pleasant), Fennock, Rhode Island Greening (Fig 253), Rome Beauty (Fig 254), Shockley, Twenty Ounce, Wealthy (Fig 255), Willow (Twig), Winesap and Stayman Winesap (Fig. 256), Wolf River, Yellow Bellflower, York Imperial (Fig. 257), King (Fig. 258). Baldwin and Ben Davis, the former of secondary quality and the latter of worse, hold the supremacy in American market apples The apples of the eastern and central country tend toward flattened or oblate shape (Figs 258-9) The typical form of the so-called long or conical American apple may be seen in Fig 260. Many odd and unusual varieties are grown for dessert, one of which is shown in Fig 261



259 The oblate and spherical forms of apple



260. The conical and ovoid forms of apple



261. Lady, a small dessert apple. (×½)

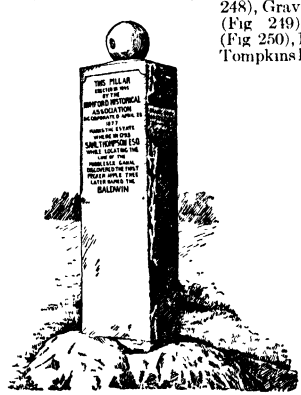
Monuments or markers have been erected to a few of the most noted varieties of apples Fig 262 shows the monument erected in Wilmington, near Lowell, Mass, in 1895, to the Baldwin, with the following inscription:

THIS PILLAR ERECTED IN 1895
BY THE
RUMFORD HISTORICAL ASSOCIATION
Incorporated April 28, 1877
Marks the estate where in 1793 Samuel Thompson, Esq, while locating the line of the Middlesex Canal, discovered the first Pecker apple tree. Later named the
BALDWIN

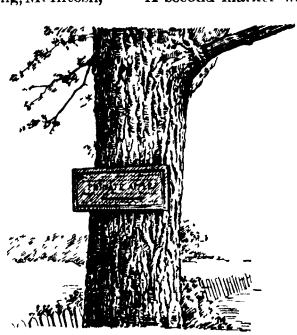
The first tablet in New York state in memory of any apple was erected in the town of Camillus, Onondaga County, on the original site of the Primate apple tree (Fig 263) John T Roberts, Syracuse, N Y, on September 11, 1903, caused a bronze tablet to be erected there On this tablet is the following inscription:

On this farm Calvin D Bingham, about 1840, produced the marvellous
PRIMATE APPLE
Named by Charles P. Cowles
GOD'S EARTH IS FULL OF LOVE TO MAN

A second marker was erected in New York in 1912 to the Northern Spy, Early Joe and Melon apples, at Bloomfield, by the Ontario County Fruit-Growers' Society (Fig 264), with the following tablet.



262 Monument to the Baldwin apple



263. Tablet to the Primate apple.



264 Northern Spy monument. (4 ft high)

THE ORIGINAL NORTHERN SPY APPLE TREE

stood about 14 rods south of this spot, in a seedling orchard planted by Heman Chapin about 1800.

THE EARLY JOE AND MELON APPLES
ALSO ORIGINATED IN THIS ORCHARD

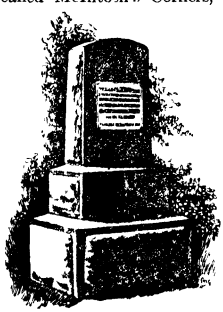
The McIntosh apple (McIntosh Red) is commemorated (Fig 265) by a monument at Dundela, Dundas County, Ontario, as follows

THE ORIGINAL McINTOSH RED APPLE TREE

stood about 20 rods north of this spot. It was one of a number of seedlings taken from the border of the clearings and transplanted by John McIntosh in the year 1796

ERECTED BY POPULAR SUBSCRIPTION 1912

The history is that John McIntosh came to Canada with the United Empire Loyalists After spending some time along the frontier, he settled on his homestead in the county of Dundas in 1790 at a place later called McIntosh's Corners, although that place has now become extinct and Dundela has taken its place In the year 1796 while clearing some forest land, he came upon a clump of young apple trees, about twenty in number As apples were at that time a luxury, the apple trees were left unharmed, and a few days after were replanted in a clearing nearer his house Most of the trees thrived for a few years but finally died In 1830 only one tree out of the twenty remained As this apple was unnamed, Mr McIntosh combined his own name with the color of the apple and christened it "McIntosh Red" From the time it was transplanted, it grew rapidly and in a few years bore an abundance of fruit the color and flavor of which attracted the attention of the earlier settlers It was situated about fifteen feet from the house, and when in 1893 the house was burned, the tree also received its share of the fire and one side was badly burned Nevertheless, the other side continued to bear until 1908 That summer the leaves began to wilt and the apples to fall off until it was entirely bare Thus the old tree which had withstood the storm of 112 years was forced at last to submit to the injuries received from the fire of 1893 (Fig 266) The wide circulation of the McIntosh apple is due to his son, the late Allen McIntosh, who, fully appreciating the fruit, wished others to enjoy it also and started propagating by grafting and budding from the original tree This has been repeated year after year since 1836.



265 Monument to the McIntosh apple. (5 ft high)

The origin of the Wealthy apple, the leading variety of the upper Mississippi Valley, is commemorated on the monument erected to the memory of Peter M Gideon, Excelsior, Minnesota (Fig 267) The tablet was unveiled and dedicated with appropriate ceremonies on the old farmstead, where he passed the last forty-six years of his life, at 2 o'clock on the afternoon of Saturday, June 15, 1912 The memorial consists of a block of granite, raised on a platform of solid concrete, surrounded by a chain supported by a number of black iron posts On the sloping top of stone is a bronze tablet bearing this inscription

This Tablet commemorates Peter M Gideon
who grew the original
WEALTHY APPLE TREE
from seed on this his homestead, in 1864
Erected by the Native Sons of Minnesota, June, 1912

The triangular piece of ground on which this is placed containing approximately a half-acre, is surrounded by a chain and post fence This ground, the gift of O P Briggs, is dedicated as "Gideon Memorial Park" It lies on the main traveled boulevard between Excelsior and Minnetonka Beach, a few hundred feet south of the Manitou station on the electric line



266 Original McIntosh apple tree.

Special literature

Several books devoted wholly to the apple have appeared in North America Warder, Apples, 1867, Todd, Apple Culturist, 1871, Waugh, The American Apple Orchard, 1908, Burritt, Apple Growing, 1912, Woolverton, Canadian Apple Grower's Guide For varieties, the two volumes, Beach, Apples of New York, published by the New York Agricultural Experiment Station, at Geneva, are invaluable Consult, also, Vol 25, Nebraska State Horticultural Society, 1894, The Apple, a report of the Kansas State Horticultural Society, 1898 Nearly all the fruit manuals devote space to the apple L H B.

Apple-growing in the northeastern states.

Although the eastern region (New England, New York, Pennsylvania) early developed an apple industry, it had few commercial orchards until near the middle of the last century About that time many named varieties of American origin were disseminated At first the product was used largely for the making of cider Gradually there arose a demand for fresh fruit,



267 Monument to Peter M Gideon and the Wealthy apple.

and as transportation facilities improved and the business became more profitable, there was a rapid increase in the number and size of the orchards The production of apples increased more rapidly than the facilities for distribution and soon the supply apparently exceeded the demand The low prices received in the following years discouraged the growers from further planting Many growers, being attracted by the

alluring settlement of the West and others by the opportunities in the rapidly growing manufacturing centers, forsook their orchards Of those who remained, many cut down the trees to make room for more profitable crops The orchards that remained were mostly neglected and many of them may still be found, although few of them are now profitable There have been two or three attempts at reviving the industry and these mark well-defined epochs of orchard planting

With the phenomenal amassing of population in the eastern cities and with the marked improvement in transportation facilities, there has developed within the past ten years a remarkable opportunity in the growing of apples As a result, enormous areas are being planted and many of the old and neglected orchards are being revived Many persons from the cities are being attracted to the cheap lands in the East and most of them are planting apple trees It is difficult to ascertain, even in an approximate way, the number of trees being planted in any section The thirteenth census shows that there are over 7,425,000 apple trees in the eight states under discussion that had not reached the bearing age in 1910, and there has been much greater activity in tree-planting in the three subsequent seasons than ever before. Many of the old orchards, however, are fast passing out of existence From the census reports it may be seen that despite the number of young orchards coming into bearing in the ten-year period, there were 10,488,000 more trees of the bearing age reported in 1900 than in 1910.

The question of the probability of over-production immediately arises Most of the growers are still optimistic, thinking that for various reasons many of the orchards will never reach the bearing age and that with the rapidly growing population, the increasing opportunities for exporting, the raising of varieties of better quality, and with better methods of grading and packing, the supply will not exceed the demand for any considerable time

Apple regions

It is remarkable that the apple industry has reached its highest development in certain restricted regions When pomologists speak of the western New York fruit-belt or the Champlain Valley district, a fairly definite area is understood Usually such districts are marked by exceptionally favorable soil or climatic conditions The conspicuous apple regions of the Northeast, although frequently hundreds of miles apart, possess about the same set of conditions This is especially true within the same parallels of latitude. The distinctive features of these regions are:

(1) A favorable climate, that insures protection from extreme temperature, affords sufficient rainfall in summer, and that furnishes long days and abundant sunshine throughout the growing season

(2) A favorable soil, that insures good drainage, ease of cultivation, and a spacious feeding-ground for the roots

(3) A suitable topography, that affords adequate atmospheric drainage and insures protection from frosts and freezes Lands adjacent to large bodies of water, however, are not necessarily dependent upon variations in altitude to insure protection from frost.

While favorable soil, climate and topography often are determining factors and are considerations of great importance, there is now known to be much greater latitude in this respect than was generally considered In recent years, apples have been successfully and profitably grown under conditions that formerly were thought to be very undesirable This is mentioned here to show that the proper selection of varieties and the adoption of special methods of treatment are also important factors, and that the "fruit-belt" is not the only controlling factor

The accompanying table gives some information regarding the number of apple trees and the production of apples in the states under consideration One column also shows the relation of the production of the various states to the total production of the United States.

VARIOUS APPLE STATISTICS FOR THE NORTHEASTERN STATES, ACCORDING TO THE CENSUS REPORTS FOR 1900 AND 1910

State	Bushels 1899	Bushels 1909	Per cent of total production of U S 1909	Trees of bearing age		Trees not of bearing age 1910
				1900	1910	
Maine	1,422,000	3,636,000	2 48	4,185,000	3,477,000	1,047,000
N Hampshire	1,979,000	1,108,000	08	2,034,000	1,241,000	207,000
Vermont	1,177,000	1,460,000	10	1,675,000	1,184,000	220,000
Massachusetts	3,023,000	2,550,000	1 73	1,852,000	1,367,000	356,000
Rhode Island	339,000	213,000	01	214,000	152,000	55,000
Connecticut	1,709,000	1,541,000	1 04	1,107,000	799,000	212,000
New York	24,111,000	25,409,000	17 22	15,055,000	11,248,000	2,829,000
Pennsylvania	4,641,000	11,048,000	7 49	11,771,000	8,000,000	2,501,000
Total	10,401,000	46,965,000	31 83	37,956,000	27,468,000	7,425,000

By comparing the production from the various counties, it is easy to determine the conspicuous apple sections The following table shows the production from the twenty-four highest producing counties in the northeastern states.

TABLE SHOWING PRODUCTION OF APPLES FROM THE TWENTY-FOUR HIGHEST PRODUCING COUNTIES IN THE NORTHEASTERN STATES, CENSUS OF 1910

County	State	Bushels
Wayne	New York	3,304,000
Monroe	New York	2,592,000
Niagara	New York	2,367,000
Orleans	New York	2,229,000
Ontario	New York	913,000
Columbia	New York	893,000
Dutchess	New York	795,000
Ulster	New York	668,000
Chautauqua	New York	646,000
Middlesex	Massachusetts	633,000
Greene	New York	630,000
Wyoming	New York	625,000
Erie	New York	623,000
Worcester	Massachusetts	595,000
Genesee	New York	581,000
Cattaraugus	New York	558,000
Albany	New York	528,000
Cayuga ..	New York	481,000
Oxford	Maine	443,000
Berks	Pennsylvania	426,000
Oswego	New York	406,000
Tioga	Pennsylvania	399,000
Kennebec	Maine	392,000
Franklin	Maine	389,000

It will be seen that of the twenty-four counties, seventeen are in New York state, three in Maine and two each in Massachusetts and Pennsylvania

The territory under consideration lies mostly between the 68th and 81st degrees of longitude and the 40th and 46th degrees of latitude It possesses, on the whole, a very irregular topography, resulting from glacial deposits It is drained in almost all directions by rivers of various sizes. It includes many fertile valleys, elevated plateaus, and several mountainous areas. Along

the coast in many sections, and on the shores of the Great Lakes are fairly broad low-lying plateaus These areas, with the broad river valleys and their bordering slopes, are of great importance from a fruit-growing standpoint

In a rough way, the lands may be divided into two main groups. The first embraces the river valleys, including the valley slopes, and the lower plains adjacent to the Great Lakes, and certain areas near the coast To this group belong the most conspicuous apple-growing areas, such as those along the valleys of the Connecticut, the Hudson, the St Lawrence, the Mohawk, the Susquehanna and other smaller rivers, and the shores of Lake Erie, Lake Ontario, Lake Champlain and various inland lakes

The second group of lands embraces the uplands, composed usually of more or less rolling land with innumerable hills, narrow valleys, and great plateaus This territory embraces much rough mountainous land that is of little value except for forestry In general, the upland territory is devoted mainly to diversified farming As a rule, only the hardier varieties of apples are grown, but in the uplands there are innumerable areas of restricted dimensions that are well adapted to the growing of apples in conjunction with other interests

In the East apples are extensively grown for home use and for local market For this reason the apple industry is not so centralized as it is in some other regions, although there are many large commercial orchards Many individual orchards are small, being on diversified farms According to the thirteenth census, the average value of farm lands throughout the eight states is $23 28 per acre The price recorded for the states of Pennsylvania, New York, Massachusetts, Connecticut and Rhode Island was about the same, averaging $33 92 per acre, while that for the remaining three states, Maine, New Hampshire and Vermont was much lower, averaging $13 31 per acre

The apple-growing area in the northeastern states is rapidly extending and comprises much of the cheaper lands of the territory. In New England, the area embraces the southern half of Maine, New Hampshire, and Vermont, projecting somewhat northward along the western border of the latter state, and extending southward to include the greater part of Massachusetts, Connecticut, and Rhode Island Here the leading varieties in the older orchards are Baldwin, Rhode Island Greening, Northern Spy, Roxbury, Ben Davis, Fameuse, Tolman, Hubbardston, Oldenburg, Red Astrachan, Bethel, Twenty Ounce, McIntosh, Yellow Bellflower, and Wealthy The later plantings are mostly of higher quality varieties, including Northern Spy, McIntosh, Wealthy, Fall Pippin, Sutton, Wagener, Red Canada, Esopus (Spitzenberg), Gravenstein, Yellow Transparent, Red Astrachan, Fameuse, Tompkins King, and Williams The Baldwin, however, continues to be the most popular variety in New England

In New York, the main apple-growing section extends along the south shore of Lake Ontario, but the industry is rapidly developing in many other parts, including the Hudson, Champlain, St Lawrence, and lower Mohawk valleys, and the lands surrounding the central lakes The leading varieties in the bearing orchards are Baldwin, Rhode Island, Northern Spy, Tompkins King, Roxbury, Hubbardston, Esopus (Spitzenberg), Golden Russett, Ben Davis, Tolman, Black Gilliflower, Twenty Ounce, Swaar, Westfield, Pumpkin Sweet, Fameuse, Fall Pippin, Yellow Bellflower, McIntosh, Wealthy, Oldenburg, Red Astrachan, Jonathan, Yellow Newtown, Green Newtown, Maiden Blush, Gravenstein, Blue Pearmain, Early Harvest, Alexander, and Yellow Transparent. Many of these varieties are still being planted, but the tendency is to set fewer varieties and more of the leading commercial sorts

The apple-growing area in Pennsylvania is limited largely to the southeastern part of the state The industry has reached its highest development in the Cumberland Valley, especially in Cumberland, Adams and Franklin counties Much planting is now being done along the upper Susquehanna in Luzerne, Lackawanna, and Wyoming counties In the southwestern part of the state, Bedford and Somerset counties also have many commercial orchards Southern Pennsylvania has a longer growing season than New York and New England and this is plainly shown by the nature of the varieties most commonly grown. The older orchards are composed mainly of York Imperial, Baldwin and Northern Spy, but the newer plantings are mostly Stayman Winesap, McIntosh, Delicious, and Northern Spy.

Cultural peculiarities.

While there is diversity of opinion regarding cultural methods, the common practice embraces a system of clean culture with cover-crops In some regions, especially on the heavier soils, it has been found that this treatment, if practised year after year, produces too much growth In such cases, the cover-crop, instead of being turned under, is allowed to stand till about June, when it is cut and allowed to remain on the surface as a mulch In New England, clover is most commonly used as a cover-crop In New York and Pennsylvania, various crops are used for the purpose; among these the most common are clover, vetch, rye, buckwheat, turnips, cowpeas, and soybeans Some growers in various parts have secured good results from growing their trees in sod, mowing the grass and leaving it as a mulch The success of this method depends largely on the quantity of herbage that can be grown in the orchard If the orchard does not produce enough, it must be supplemented with some form of coarse material from other sources A system of this kind may be very satisfactorily employed in various parts of Pennsylvania, New York and New England, where there is much land that, although well adapted to apple-growing, is oftentimes too steep for cultivation.

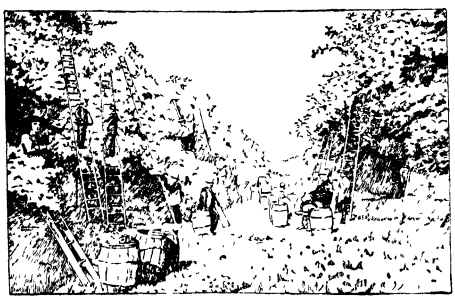


268. Apple orchard at bearing age, as seen in the northeastern states.

As a rule, chemical fertilizers are used in the orchard Since the supply of humus may be maintained in the orchard by the use of cover-crops, most growers prefer to use the available stable manure for crops like corn, hay, or vegetables, that are not so easily adapted to cover-crop treatment. Stable manure, however, is

often used in sod orchards to supply additional mulch as well as the elements of plant-food. Many growers are coming to realize that the apple tree does not require heavy applications of fertilizers More important than fertilizers is moisture supply, and this is maintained by increasing the humus and by cultivation Very few growers are applying much nitrogen, depending upon leguminous cover-crops to keep up the supply As a source of phosphoric acid, raw ground bone is the most common material In recent years, very large quantities of basic slag have been used, 600 to 800 pounds per acre usually being applied Potash is usually applied in the muriate form, but some growers prefer to use the sulfate of potash Recently, growers have realized the necessity for applying lime, and this is being used largely in the form of ground limestone

There is a growing feeling that in the past young trees have been pruned too severely. Progressive growers think that the young apple tree should not be pruned very severely during the dormant season. With this is associated the idea that when much pruning is necessary, some of it, at least, should be performed in the growing season. This practice tends to bring the



269 Harvest time in the apple orchard.

trees into bearing earlier and to make better-shaped trees. Summer pruning, when employed, is usually performed about July 1 or just before growth ceases Mature trees tend to overbear, and pruning them in the dormant season is the rule

A striking feature in the work of renovating old orchards is the severity with which many of the trees are pruned High-headed trees, especially those that are very weak, are cut back to mere stubs on which the growth of water-sprouts is encouraged From these sprouts new heads are formed Trees treated in this way often produce fair crops of fruit, when properly trained, the fourth or fifth year following the treatment. Other trees that are in better shape to start with, are dealt with less severely, only the higher branches being removed and the remaining ones shortened in

Spraying practices are about the same throughout the various regions of the Northeast. The concentrated lime-sulfur wash, either prepared or home-made, has become the standard remedy for scale In some sections and especially for use on old apple trees, the miscible oils are preferred. For the various fungous troubles, of which scab, black-rot, rust and sooty-blotch are the most conspicuous, a weak lime-sulfur preparation is generally employed. Applications are usually made just before the blossoms open, again after the petals fall, and one or two later applications at intervals of three or four weeks Arsenate of lead is usually added for the control of insects In New England, the lime-sulfur as a summer spray has not given satisfaction, and the tendency is to use regular bordeaux mixture for the first application and a very weak bordeaux for the subsequent treatments. With most varieties, and under ordinary conditions, the one application is sufficient to control the various diseases. One or two applications of arsenate of lead, either with or without bordeaux, is usually applied after the blossoms have fallen

The practice of thinning apples is becoming somewhat general among the commercial growers of New England and in most sections of New York and Pennsylvania The work is usually performed about July 1, or just after the so-called "June drop" In some sections in western New York, where the evaporating trade takes the greater part of the crop, the practice is almost unknown.

Marketing.

The apple crop in general farming districts is mostly disposed of within the limits of the territory and usually in the local market The more extensive growers, however, ship large quantities to the eastern cities, and varying quantities, depending upon the supply, are exported Progress in grading and packing has been slow, chiefly because of lack of necessity. There is great demand in the manufacturing centers for a medium grade of fruit and in such places it has not paid to increase the price of apples by fancy grading and packing Some growers, even at the present time, say that they make as much from their lower grades as from their higher grades This applies especially to sections where peddlers come to the orchard, take the fruit away and bring the barrels back The enormous number of varieties has also affected progress in the way of improved methods. Methods of packing and selling are very diverse. The barrel still remains the most popular package, although the box is being largely used In the vicinity of the large cities and towns, special packages are used for the retail trade Around Boston, a slatted bushel box is in common use In Connecticut, the common Jersey peach basket is largely used, with a growing tendency toward the climax basket Near Philadelphia, the familiar hamper is still in use. The box package as used in the West has been adopted by many growers in New York and in northern New England In Connecticut, there is a movement to adopt a distinctive package, like the climax basket, for the fancy retail trade and to continue to use the barrel for the general crop

C. D. JARVIS.

The apple in Canada.

Apples have been cultivated in Canada for about 300 years In the early part of the seventeenth century, the French settlers brought with them seeds and trees to the banks of the St Lawrence River, along which the first settlements were made In that part of Canada which in the French régime was known as Acadia, now the province of Nova Scotia, apple trees were planted early in the seventeenth century also Trees were top-grafted in Nova Scotia as early as 1764, and some of these old trees are still alive On account of poor transportation facilities in Canada until comparatively recent years, the development of apple-growing was slow for a long time and it has been only during the past fifty or sixty years that a rapid growth in the industry has taken place Now, however, the production of apples is large and is increasing very fast. In 1911 the number of bushels of apples grown in Canada was estimated at 10,384,985.

Regions

The area in Canada over which apples can be grown is very large In the provinces of Ontario and Quebec, there is a belt of about 700 miles in length, where apple trees can be successfully grown, while in the province of Ontario alone the best winter apples can be

grown over an area of about 350 miles long by 30 to 150 miles in width Over this great winter-apple area, which may be roughly divided into, first that part bordering on Lake Ontario and extending for 30 and more miles inland; second, that bordering Lake Huron and for several miles back, and third, the southwestern part of Ontario,—the Northern Spy, Baldwin, Tompkins King and Rhode Island Greening are the predominant winter varieties of the better class

Nova Scotia has long been noted for its winter apples, which ship and keep well The most favored parts are the Annapolis and Cornwallis valleys, which have a total length of about 100 miles and vary in width from 6 to 11 miles Here apples of British or European origin, such as Blenheim, Ribston, Gravenstein, Cox Orange Pippin, and Yellow Bellflower do particularly well But it is being found that winter apples can be grown successfully along the southeastern part of Nova Scotia, and a large area will no doubt be eventually planted to apple trees there In the northern part of Nova Scotia, the hardier apples, including some winter varieties, do well Prince Edward Island, the smallest province in Canada, produces excellent apples, and here may be found, perhaps, the longest-keeping fruit in Canada of the varieties grown, due no doubt to the cool autumn The season is somewhat short for some of the latest-maturing varieties The province of New Brunswick has for a long time shown its adaptability for apple-culture, and in this province some of the highest-colored and best-flavored apples are grown. The climate over a large part of New Brunswick is much the same as the southern part of the province of Quebec and eastern and central Ontario, and over this great area such apples as Wealthy, Fameuse, McIntosh, Alexander, Wolf River and others are grown to great perfection

In the far West, British Columbia has many districts and valleys well suited for summer, autumn and winter varieties of apples, but some varieties do better in one district than in another At present the three most important parts are, first, that comprising the damp climate of the lower mainland near the coast, and Vancouver Island, second, the dry interior country where irrigation is, as a rule, necessary, including the Okanagan and other valleys, and third, the Kootenays, East and West, the Salmon Arm, and other districts where irrigation is in most places unnecessary Many valleys farther north than the present commercial orchards extend are being found suitable for apple-culture.

In the prairie provinces of Manitoba, Saskatchewan and Alberta, few apples have as yet been grown, but it is thought that before long some parts of these provinces will be producing large quantities of apples In southern Manitoba the Russian varieties of apples are succeeding well in places where cared for, and considerable quantities of fruit have been obtained there The chief causes of failure in the prairie provinces appear to be, first, too late growth, preventing proper ripening of the wood, and due, we believe, to the rich soil with its large percentage of available nitrogen, second, to the drying out of the trees in winter on account of their being exposed to dry and very cold winds for a long period, and third, on account of early growth in spring followed by hard frosts All of these causes of failure may in a large degree be overcome by planting the hardiest varieties in well-drained, light soil, protecting them from winds in winter by means of windbreaks, and choosing exposures where growth will not start early In the wooded country in northern Saskatchewan and Alberta, where the springs are cooler and where there is natural protection, it is thought that ultimately large quantities of apples will be grown. At present crab-apples are being grown in a number of places and also the small hybrid apples originated by William Saunders.

The farthest north that apples have been grown in Canada east of the Rocky Mountains, of which we have a record, is at Fort Vermilion, Peace River, in latitude 56°, where, in 1910, fruit was grown of the hybrid apples referred to.

Varieties of apples recommended for different parts of Canada.

ONTARIO (districts bordering Lake Ontario and Lake Huron, and southwestern Ontario) *Summer*—Red Astrachan, Oldenburg *Fall*—Gravenstein, Wealthy, Alexander, McIntosh, Fameuse, Blenheim *Winter*—Tompkins King, Rhode Island Greening, Baldwin, Northern Spy, Cranberry, Stark

NOVA SCOTIA (Annapolis, Cornwallis, and adjacent valleys) *Summer*—Red Astrachan, Oldenburg *Fall*—Gravenstein, Wealthy, Blenheim, Ribston *Winter*—Tompkins King, Yellow Bellflower, Wagener, Cox Orange Pippin, Rhode Island Greening, Stark, Northern Spy, American Golden Russet, Fallawater, Roxbury Russet (Nonpareil), and Ben Davis

NOVA SCOTIA (northern and colder parts) NEW BRUNSWICK, QUEBEC (except coldest parts), EASTERN AND CENTRAL ONTARIO *Summer*—Transparent, Lowland Raspberry, Oldenburg *Fall*—St Lawrence, Wealthy, Dudley, Alexander, McMahon *Winter*—McIntosh, Fameuse, Wolf River, Bethel, Milwaukee

PRINCE EDWARD ISLAND *Summer*—Transparent, Oldenburg. *Fall*—Wealthy, Dudley, Gravenstein (which keeps well into winter here) *Winter*—Alexander, Wolf River, McIntosh Stark Such varieties as Blenheim, Ribston, Tompkins King, Northern Spy, and many others can be grown on Prince Edward Island, but are not so reliable for commercial purposes

BRITISH COLUMBIA (lower mainland, Vancouver Island) Yellow Transparent, Oldenburg, Gravenstein, Wealthy, Tompkins King, Grimes For irrigated districts of Southern British Columbia Transparent, Red Astrachan Oldenburg, Wealthy, McIntosh, Jonathan, Wagener Rome Beauty, and in addition for the most favored parts, Esopus, Yellow Newtown, and Winesap Other temperate parts where irrigation, if practised, is not general, including the Kootenays Salmon Arm, and Armstrong district Yellow Transparent, Oldenburg, Gravenstein Wealthy, McIntosh, Jonathan, Wagener, Grimes and Northern Spy

Hardiest varieties for coldest parts of Canada *Summer to Autumn*—Blushed Calville, Lowland Raspberry, Oldenberg, Charlamoff *Autumn to Winter*—Antonovka, Wealthy, Hibernal, McMahon, Longfield, and Patten *Crab-apples*—Whitney, Virginia Martha, Transcendent, Hyslop and the small hybrid apples originated by Wm Saunders

Up to comparatively recent years, Canada had depended mainly on the other parts of the world for varieties to plant, but some excellent apples of Canadian origin are now in commerce, such as Fameuse, McIntosh, St Lawrence, and Baxter Within the past twenty years under the direction of the Dominion Government, many new varieties have been originated with a view to furnishing suitable kinds for the prairie provinces, and secondly to obtain apples of the best color and quality which would succeed over a wider range than those on the market at present. The results so far have been very promising

General outlook

Canadians are fully alive to the importance of practising the best methods of apple-culture, and in those parts of the Dominion where the industry is an important one, the methods employed and culture given are equal to those in other countries

The cooperative movement is strong in Canada, and there are many cooperative associations for the buying of horticultural supplies and for the marketing of fruit. There has been an Act in force in Canada since 1899 by which Dominion inspectors may examine fruit packed in closed packages before shipment in any part of Canada The Act empowers the inspectors to mark the package "Falsely Marked" if the fruit within the package is not of the grade or quality indicated by the marks outside, and the person who packs the fruit and marks the package is liable to a fine

There is a minimum standard or legal barrel of 96 Imperial quarts for apples throughout Canada, and a uniform box of 10 x 11 x 20 inches, inside measurements The barrel is still the popular package in eastern Canada, although the use of the box is steadily increasing In British Columbia, however, the box is used practically altogether

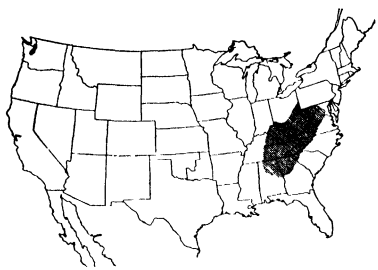
The outlook for apple-growing in Canada is bright. The market for Canadian apples appears to be

unlimited, if the fruit is well packed and properly distributed, and the quantity of apples that Canada is able to produce is enormous For further information, see *British North America, Horticulture in.*

W. T. MACOUN.

The apple in the southern Alleghany Mountain region. Fig 270

With respect to climatic conditions, the Alleghany region presents the widest range of extremes within short distances in eastern North America Extending through nearly seven degrees of north latitude, its great



270 The Alleghany apple region.

valleys, plateaus, detached hills and long ridges vary in elevation from 500 to more than 4,000 feet above sea-level, presenting in their varied slopes almost every angle of exposure to the sun Correspondingly varied soils occur also, often in close proximity, so that within short distances, combinations of soil and climatic conditions adapted to more widely differing types of plants are found than elsewhere in the humid regions of the United States The extreme contrasts occur in western North Carolina, where in the sheltered valleys and thermal belts of the eastern slopes of the Blue Ridge, the fig and the European grape are grown with a fair degree of success within a few miles of higher lands well adapted to a wide range of winter apples

While fewer chronological records have been preserved of the earlier history of apple-culture in this region than is true of some of the more northern apple districts, it is evident from scattered references that in some localities in Virginia and North Carolina, rather systematic culture of this fruit was undertaken in a small way at a very early date

It is known that as early as 1686 there was one apple orchard of 2,500 trees in Virginia, mostly grafted, and that by the close of the seventeenth century, few plantations in that state were without orchards In these, the apple was the leading fruit along with the peach, the pear, the plum, the quince and some others As early as 1773 Thomas Jefferson recorded in his "Garden Book" the grafting of "Newtown Pippin" in Albemarle County, Virginia, and in 1778 the planting of these grafted trees on his Monticello estate This variety had apparently reached that section from the vicinity of Philadelphia as early as 1755 in the form of cions brought in the saddle-bags of Dr Thomas Walker, the commissary officer of the Virginia troops in Braddock's army, when he returned after the disastrous defeat of that year (See Bulletin 5, Division of Pomology, U S Department of Agriculture, p. 360 –1898)

But if written records were entirely lacking, the large size and evident age of the surviving trees about farm dwellings and the abundant distribution of seedling apple trees of great age and large size at the present time would sufficiently establish the fact of early introduction and the general adaptability of the conditions to the requirements of the apple The late T K Bruner, of North Carolina, cites an example of an

orchard in Haywood County in that state in which, though never cultivated, a hundred trees had attained a size of full 3 feet in diameter of trunk, the largest having a girth of 11 feet and 9 inches. While these exceptionally large trees are usually found in the lower slopes or in mountain coves where the wash from the mountainsides above brings to them the moisture and fertility of considerable areas of land, many unoccupied benches and gradual slopes exist where such soil conditions could be approximately duplicated by the orchardist.

Varieties of the Alleghany region

While less attention has probably been given in this region to the systematic study of the seedling fruits that have originated there than in most of the earlier settled parts of the country, upwards of fifty varieties of the 319 included in the last catalogue of fruits of the American Pomological Society are traceable to this region These include such commercially important varieties as Ben Davis, Grimes' Golden, Kinnard, Paragon and Willow, together with such highly esteemed home-use sorts as Bonum, Buckingham, Gilpin, Pilot, Red June, Shockley, Summer King, Terry and Virginia Beauty R L Watts, working in Tennessee, and C C Newman, in South Carolina and Georgia, have made a beginning in the canvass of the region for valuable seedlings in connection with their experiment-station work, but this region undoubtedly remains at the present time the most promising field in America for the searcher after promising new varieties of apples.

As in most of the earlier settled parts of the country, commercial development of orchards in this region is comparatively recent The first plantings were solely for home-supply. Later, small orchards were planted for the production of sun-dried apples, cider, apple-brandy and similar products in a commercial way, rather than for the sale of the fresh fruit on any extensive scale So long as these uses determined the selection of trees for planting, little attention was paid to varieties, or, in fact, to the perpetuation of varieties at all, hence the numerous small seedling orchards persisting throughout the less accessible portions of the region at the present time. Gradually, in certain localities, the quality of fruit produced gave the more durable winter varieties a money value for marketing by wagon, river-boat or railroad to more distant markets The longer-keeping Winesap and other winter apples of Tennessee found profitable wagon-market demand in the lower valleys of Alabama and Georgia where this



271 A mountain orchard, Virginia.

fruit did not succeed The Willow, Gilpin and Bentley of the northern Panhandle of West Virginia found eager buyers when transported by boat down the Ohio and Mississippi Rivers as far as New Orleans The Yellow Newtown, rechristened Albemarle Pippin in the county of that name (under the impression that it was a dis-

tinct sort) found its way from Virginia by railroad to the eastern seaboard cities and at an early date moved across the Atlantic in considerable quantities, where its durability and fine dessert quality created an active demand at prices that yielded a good profit to the grower

Extent of the planting.

Gradually commercial orcharding has been differentiated from ordinary farm fruit-growing and a considerable number of farms have become distinctively orchard farms on which the apple is the main crop, with merely such cereals and forage crops as can be grown without interfering with the essential orchard operations, such as orchard cultivation, spraying, harvesting, and the like

Most of the systematically planted and cared for orchards are under thirty years of age and a large proportion of the acreage in these has been planted since 1900 Accurate statistical information regarding the acreage or number of trees of orchard fruits in the United States is lacking, and this is peculiarly true of those regions in which, because of varying topography and the resulting eccentricities of climate and variations in soil, the orchard areas vary greatly in size and form, as is true of much of this region. Outside of the Great Valley of Virginia, and Tennessee, and those portions of the Piedmont region of Virginia that are adapted to orcharding, most of the best orchard sites occur as coves, benches or broken slopes, possessing at the same time suitable depth and character of soil, and adequate atmospheric drainage (Figs 271, 272) Some of the best orchards are strung out along the lower slopes, varying in width in accordance with particular soil types This is especially true of the "pippin orchards" in the Blue Ridge district of Virginia and North Carolina where certain particular combinations of soil and slope are considered important for the Yellow Newtown

The following summary of the number of trees, both bearing and non-bearing, and of yield and value of crop in the eight states comprised in the region, is compiled from the advance sheets of the census of 1910

APPLE IN SOUTHEASTERN UNITED STATES, CENSUS OF 1910

	Trees, April 15, 1910		Product, 1909	
	Of bearing age	Not of bearing age	Bushels	Value
United States	151,323,000	65,792,000	147,522,000	$83,231,000
Virginia	7,005,000	3,436,000	6,104,000	3,130,000
W Virginia	4,571,000	2,272,000	4,225,000	2,461,000
N Carolina	4,910,000	1,835,000	4,776,000	2,015,000
S Carolina	582,000	269,000	363,000	276,000
Georgia	1,878,000	822,000	896,000	556,000
Alabama	1,468,000	738,000	888,000	621,000
Tennessee	4,839,000	2,117,000	4,640,000	2,172,000
Kentucky	5,538,000	2,106,000	7,368,000	3,067,000
	30,791,000	14,095,000	29,260,000	$14,298,000
	20 per cent	20 per cent	19 per cent	17 per cent

It will be observed on comparison of these tables with those of the United States as a whole that this region is credited with approximately 20 per cent of both bearing and non-bearing trees, and that the product of the region in the crop year of 1909 was of somewhat smaller proportion (19 per cent) and value (17 per cent)

Outlook for the Alleghany region

In contrast with the more northern apple districts, most of this region was until recently somewhat at a disadvantage so far as commercial production is concerned. Higher humidity favored the development of certain injurious diseases in foliage and fruit; the warmer weather commonly prevalent in autumn accelerated ripening and therefore shortened the storage durability of the fruit, relatively long hauls from orchards to railroad station over rough roads resulted in much bruising and, by prolonging the exposure of the fruit to the weather, still further impaired its keeping quality The development of efficient remedies and spraying equipment, and the improvement in methods of handling the fruit, coupled with the marked improvement in roads that has been accomplished in many sections is rapidly changing this The railroads also, in recognition of the need have accelerated and improved their service so that certain parts of the region are handling their apples as well as the best eastern or barrel-fruit districts, and better than in much of the older commercial apple territory



272 Apple orchard in Piedmont region of the Alleghanies

The conspicuous essentials of success in orcharding in this region, as in others, are

(1) *Suitability of site*, as regards character of soil and adequacy of atmospheric drainage

(2) *Adaptability of varieties to the soil and climate of the location* — The standard northern varieties, though growing and frequently bearing well, are unreliable in most localities, especially below elevations under 200 feet, although in certain localities succeeding well under careful management The thoroughly proved and distinctively important commercial sorts of the region are York Imperial, Winesap, Stayman Winesap, Rammel, Ben Davis, Yellow Newtown, Grimes, Willow and Rome Beauty In some sections less well-known sorts, such as Paragon, Arkansas (syn Mammoth Black Twig), Bonum, Virginia Beauty, Lowry, Shockley, and Terry, are considerably planted in commercial orchards

Gano, Delicious, Jonathan and some other sorts of Mississippi Valley or northern origin are promising in certain localities, but these have not yet been sufficiently tested to justify extensive planting

Summer varieties, though succeeding well throughout most of the region and universally found in sufficient quantity for home use, have not become so important commercially as in the lower lands of the tidewater districts and of the Mississippi Valley This is in a large measure due to the earlier ripening of the fruit at lower elevations, which frequently gives it a distinct advantage in northern markets Recently, considerable plantings of Yellow Transparent, Williams, Oldenburg, Gravenstein and some other sorts have been made in the more northern districts of the region, especially in West Virginia and western Maryland

(3) *Abundance of water for spraying* — The necessity of thorough and systematic spraying of orchards to protect against insects and fungi makes the orchard water supply an important factor In many places, flowing springs are available at considerable elevations from which the supply can be piped by gravity to convenient mixing stations, thus permitting prompt distribution without long wagon haul of liquid The use of complete air-spraying-outfits, charged at conveniently located air-compressing and spray-mixing stations, has developed more largely in the lower Shenandoah Valley part of this region than elsewhere, but the gasoline engine is the prevailing type of equipment

(4) *Adaptability of land to cultivation* — While occasional orchards in this as in other humid regions do well without systematic tillage, especially if heavily mulched with stable manure straw or other humus-producing material, annual or at least alternate-year plowing and cultivation, supplemented by leguminous crops, is rapidly becoming the generally accepted best practice of the region Some sites otherwise admirably adapted to apple-growing are too rocky or too steep to plow, and therefore of doubtful value to the orchardist Much can be done on such sites by contour-terracing, however, both to dispose of loose rocks and to reduce washing of the slopes, thereby conserving the soil moisture against droughty periods

(5) *Adequacy of transportation facilities* —This includes both railroads and highways Some of the earlier-planted commercial orchards were located as much as 15 to 25 or even 30 miles from the shipping station The expense incident to this long haul and the ill effect of the jolting and exposure of the fruit to the weather are evident Every additional mile beyond a distance of 3 miles from the station over a good road is a handicap which the orchard

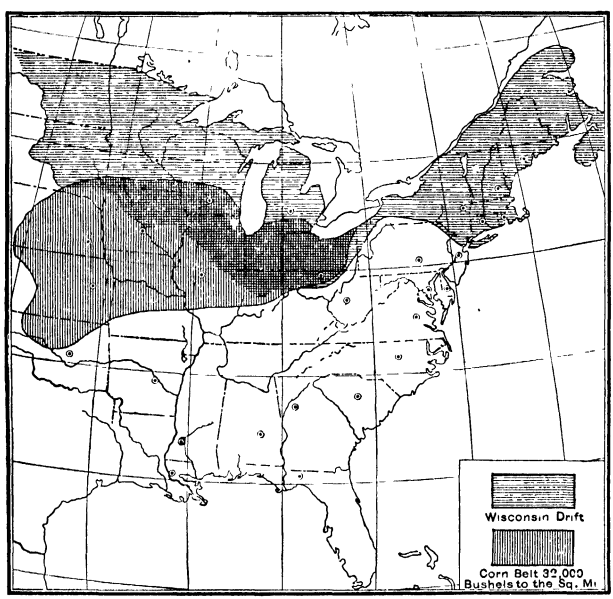
planter should avoid unless it is overbalanced by other important advantages As roads are improved, the practical distance will increase

Several of the State Experiment Stations, as well as the United States Department of Agriculture and the North Carolina Department of Agriculture, have published bulletins bearing on different phases of apple-orcharding, especially Maryland, Virginia, West Virginia, Tennessee, and South Carolina

WM. A. TAYLOR.

The apple in mid-continental or plains districts

In that vast region of the interior of the United States which lies between the Great Lakes, Ohio, Kentucky, and Tennessee on the east and the Rocky Mountain states on the west, the Canadian boundary on the north and the Gulf states on the south, the leading fruit is the apple This mid-continental territory includes the greater part of that exceptionally rich agricultural region which has come to be known as the corn-belt of America (Fig 273) It extends also into the northern wheat-belt of the Upper Mississippi Valley plains and into the wheat and livestock country of the Great Plains Plateau of Oklahoma, Kansas, Nebraska, and the Dakotas



273. The mid-continental corn-belt, in which the apple is the leading fruit, and the Wisconsin drift, on which the Ben Davis family is not at its best.

Geography.

The topography may be indicated in a very general way by the statement that this region takes in the Upper Mississippi Valley plains, a large part of the Great Plains Plateau, and all of that more limited area known as the Ozark Plateau Its great river valleys are those of the Ohio, Mississippi, Missouri, Arkansas, and Red A limited area in Minnesota and the Dakotas lies in the valley of the Red River of the North and a rather narrow strip along the northeast boundary lies in the basin of the Great Lakes

The larger part of this mid-continental district, as outlined, has an elevation of 500 feet to 2,000 feet above sea-level The southwest point of Indiana, southern Illinois, southeastern Missouri, and eastern Arkansas have an elevation of less than 500 feet The remainder of Indiana and Illinois, much of Missouri, and a portion of southern and eastern Iowa lie between 500 feet and 1,000 feet elevation The range of elevation of 1,000 to 2,000 feet takes in the remaining parts of Iowa, most of Minnesota, and the eastern part of the Dakotas, Nebraska, Kansas, Oklahoma, and the Ozarks The remainder lies to the west in the Great Plains Plateau at an elevation above 2,000 feet.

In the more northern and western districts of this region, there is little or no commercial orcharding Only in their more favored localities are apples produced at all, and the lists are restricted to the hardier varieties This is because the recurring extremes of temperature and of drought make the environment unfavorable to the apple, at least during critical periods But throughout the states of the corn-belt, the apple is very generally grown for home use and certain sections show a notable development of commercial orcharding (Figs 274, 275) In fact, the most extensive individual apple orchards known are found in parts of Arkansas, Missouri, Kansas, and Illinois, some of them being several hundred acres in extent

Orchards well located and rightly managed are proving to be profitable in different sections of the corn-belt states With the rapid growth of the United States in population and wealth, must come a corresponding increase in the home-market demand for good apples at remunerative prices This, with the improvement and extension of storage and transportation facilities and the contemporaneous expansion of our foreign trade, tends to make the outlook encouraging for the apple-growing industry in this region The more general adoption of up-to-date methods of marketing and of orchard management will help to put the industry on a more stable basis, and gradually to enlarge it and extend it

Rank in apple-production.

According to the United States census reports of 1910, approximately 40 per cent of the bearing apple trees of the United States is found in the territory above outlined, together with 33 per cent of the young trees not yet of bearing age In the census year of 1909, it produced approximately one-fourth of the apple crop of the entire United States

Following is a list based on United States census reports, which indicates something of the relative standing For comparison they are also ranked as to their averages in apple-crop production for 1905, 1907, and 1909, combined on the basis of the crop reports published in the American Agriculturist Yearbook

RANK OF MID-CONTINENTAL STATES IN YIELD OF APPLES Fig 274

Name of State	1909 Rank in United States	1909 Yield in bushels	1899 Rank in United States	1899 Yield in bushels	1905-7-9 Rank based on combined averages
Missouri	4	9,969,000	9	6,496,000	16
Iowa	6	6,747,000	18	3,129,000	19
Nebraska	15	3,321,000	24	1,343,000	26
Illinois	16	3,093,000	5	9,178,000	11
Indiana	17	2,759,000	7	8,620,000	13
Arkansas	20	2,296,000	20	2,811,000	21
Wisconsin	21	2,232,000	33	303,000	27
Kansas	27	1,356,000	16	3,214,000	25
Minnesota	29	1,044,000	40	120,000	
Oklahoma	32	742,000	41	111,000	
S Dakota	40	192,000		*	
N Dakota	47	4,000		*	

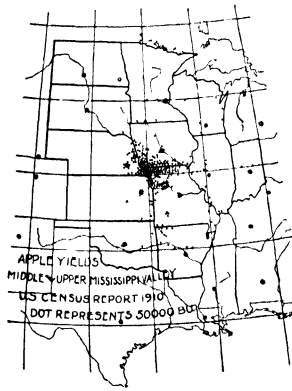
*Record included with other states.

RANK OF MID-CONTINENTAL STATES IN NUMBER OF ORCHARD TREES IN CENSUS YEAR 1909 Fig 275

	Bearing Trees Rank in United States	Bearing Trees Number	Non-bearing Trees Rank in United States	Non-bearing Trees Number
Missouri	1	14,360,000	3	3,625,000
Illinois	3	9,901,000	7	2,548,000
Arkansas	6	7,650,000	2	3,940,000
Kansas	9	6,940,000	24	1,116,000
Iowa	10	5,847,000	17	1,913,000
Indiana	11	5,765,000	16	1,962,000
Oklahoma	18	2,956,000	14	2,060,000
Nebraska	19	2,937,000	27	967,000
Wisconsin	21	2,430,000	21	1,409,000
Minnesota	26	1,380,000	19	1,572,000
South Dakota	41	275,000	34	461 000
North Dakota	47	16,000	44	70,000

Apple belts

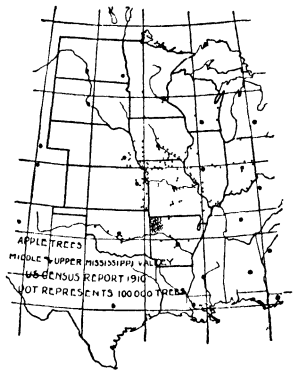
In comparing the great apple-growing regions of the continent it is convenient to designate each by its leading variety In the eastern part of the continent, there is the Fameuse or Wealthy belt on the north, the Ben Davis belt on the south, and the Baldwin belt lying intermediate between these two It is seen that varieties differ greatly as to their adaptability to different regions The degree of soil aeration and of soil moisture and the range of atmospheric and soil temperatures are among the most important determining factors of the geographical range of commercial apple-growing with any variety



274. Apple areas in the Mississippi Valley—Yields, 1909 crop.

Passing westward into the mid-continental region, it is found that the Baldwin belt does not extend west of Lake Michigan The climatic extremes are here too severe for that variety and many of its eastern associates of a similar degree of hardiness In all that vast territory which extends westward from the Great Lakes, these varieties disappear and do not again appear till the states of the Pacific Coast are reached Instead, the Wealthy belt extends southward till it reaches the region where Wealthy yields leadership to Ben Davis

In this connection it is worthy of note that from the Atlantic Coast westward to the Missouri River the north margin of the Ben Davis belt approximately coincides with the southern boundary of the geological area covered by the Wisconsin drift (Fig 273)



275. Apple areas in the Mississippi Valley —Trees

Wealthy belt. —The mid-continental territory in which Wealthy is, generally speaking, the leading variety, includes northern Illinois, the north half of Iowa, and practically all of the apple-growing districts of Wisconsin, Minnesota, South Dakota, and northern Nebraska Among the more important varieties associated with it are, for the more northern parts, Oldenburg, Okabena, Patten (Patten Greening), and Malinda Among the very hardiest of the large-size apples for the North are those of the Hibernal group, but their fruit is so austere that it is esteemed of little value except for culinary uses In the southern part of the Wealthy belt are grown hardy varieties of more or less local value such as Salome, Windsor, Black Annette, and Colorado Orange, varieties which as yet have not established themselves in the great world markets but which are valued where better varieties cannot be satisfactorily grown.

Ben Davis belt —Generally speaking, Ben Davis is the leading variety in central and southern Illinois, the south half of Iowa, and the apple-growing districts of Arkansas, Oklahoma, Missouri, Kansas, and the south half of Nebraska With its close kin, the Gano and the Black Ben Davis, which evidently are highly-colored bud-sports of Ben Davis, it probably produces at least one-half of the commercial apple-crop in this region Winesap and Jonathan appear to be next in order of importance, with Winesap perhaps in the lead Other important varieties are Grimes, Rome Beauty, Willow (Twig), Missouri (Pippin), Minkler, and Ralls York Imperial is gaining ground Stayman Winesap is one of the newer kinds which will be more largely planted. Delicious, also, is attracting attention, particularly because of its agreeable dessert quality and good appearance The Stayman and Delicious are being planted to some extent in the southern part of the Wealthy belt, as Jonathan and Grimes have been

Varieties

The following varieties of apples are those most commonly grown in the prairies and plains regions:

Arkansas (Mammoth Black Twig)	Jonathan.	Salome
Ben Davis	Minkler	Stayman
Black Ben Davis	Missouri.	Wealthy
Gano	Oldenburg	Willow (Wilow Twig).
Grimes Golden	Ralls (Ralls Genet, Genton)	Winesap
Ingram	Rome Beauty	Yellow Transparent
		York (York Imperial).

Status of the apple industry in the mid-continental states.

Wisconsin —Apples are grown mostly in small plantings about homesteads The crop is important chiefly in supplying the home and the local markets with summer and fall fruit The varieties are those of the Wealthy belt

Minnesota —Apple-growing is chiefly confined to the southeastern quarter of the state, although crab-apples and the very hardiest apples are being planted in other sections From Minneapolis southward to the Iowa line, many farm orchards are found and some commercial plantings Heretofore, these have seldom produced enough fruit to supply the local demand at any time and then for a brief period only However, apple-production is gradually increasing in the state and apple-planting is being slowly extended It will doubtless assume greater proportions as late-keeping varieties are developed which are hardy and desirable

North Dakota —This state raises but very few apples or crab-apples and those only of the kinds most resistant to cold and drought It ranks next to the bottom of the list in apple-production among the states of the Union.

South Dakota —Apples are produced in very limited quantities and chiefly near the Missouri River in the southeast corner of the state and in the Black Hills district The varieties are those of the northern section of the Wealthy belt The recommended list of the State Horticultural Society includes Northern District—first degree of hardiness—Hibernal, Oldenburg (Duchess), second degree of hardiness—Patten (Greening), Anisim, Wealthy Southern District—in addition to the above—Northwestern Greening, Malinda, and, in favorable locations, Ben Davis. Planting increases slowly

Nebraska —Apples are grown in the eastern third of the state and under irrigation in some places farther west It has some important commercial orchards, the majority of them being in the southeastern part of the state and within three counties of the Missouri River. The northern third of the state grows the varieties common to the Wealthy belt In the southern two-thirds are grown the Ben Davis and its kin and also Winesap, Grimes, Arkansas or Mammoth Black Twig, Jonathan, Missouri (Pippin), Willow (Twig) and others of the Ben Davis associates Planting is not active, but growers are beginning to take a more lively interest in modern methods of orchard management

Iowa —In the amount of crop produced, Iowa was ranked sixth in the Union by the 1910 census, but often it drops as low as the eighteenth or nineteenth place The greater proportion of the crop is grown in home orchards and goes to supply home and local market demands, but in the aggregate there is a considerable number of commercial orchards These are found in all parts of the state They are sparsely scattered in the north and gradually increase in number to the southward, being most abundant in the south tier of counties The most important commercial apple district includes the counties bordering the Missouri River in southwestern Iowa Here Grimes and Jonathan of superior quality are grown Northern Iowa grows the varieties of the Wealthy belt The southern Iowa list is almost identical with that given for southeastern Nebraska Planting is not active Modern methods of management are being adopted by a few of the more progressive growers but most orchards suffer from neglect.

Illinois —At present, Illinois takes second rank in apple-production among the mid-continental states, being surpassed by Missouri only Northern Illinois, like Wisconsin, grows apples chiefly for home use and the varieties are those of the southern area of the Wealthy belt Central and southern Illinois contain altogether many large commercial apple orchards In good-crop years, they produce in the aggregate large quantities of winter apples, including Ben Davis, Black Ben Davis, Gano, Arkansas or Mammoth Black Twig, Winesap, Jonathan, Grimes, Missouri, Willow, Ralls, and several other varieties commonly found in the Ben Davis belt. Winter injury and late spring freezes have often seriously diminished the general crop Injurious insects together with blight, cankers, bitter-rot, blotch, scab and other diseases, have also caused great losses Clean tillage and other up-to-date orchard methods would doubtless be more generally practised if crops were more reliable Planting is not very active, although the number of trees of bearing age is gradually increasing

Missouri —The 1900 census gave Missouri ninth rank and the 1910 census gave it fourth rank in apple-production, but it often falls as low as the sixteenth place among the states of the Union On the whole, it may be regarded as the leading apple state of the mid-continental region Apples are very generally grown for home use and local market throughout Missouri, but the more important commercial apple districts are in the Ozark country of southwest Missouri and the loess soil region along the Missouri River in the northwest quarter of the state The apple industry in Missouri has been retarded by troubles similar to those described for Illinois, but undoubted progress is being made in knowledge of the methods for holding them under control.

Arkansas —The apple districts of Arkansas are mostly located in the northwest third of the state, particularly in the two northwest counties of Benton and Washington, which have from four to five million trees planted. There is also an undeveloped west-central region. The older plantings include about 90 per cent Ben Davis, Arkansas or Mammoth Black Twig, and Winesap The later plantings are made up principally of Gano, Black Ben Davis, Jonathan, Grimes, Winesap, Stayman Winesap, with some Ingram, Collins, King David, and Delicious Arkansas has enough apple trees of bearing age to produce a very large crop, but as in Missouri and Illinois, within recent years unfavorable climatic conditions with diseases and injurious insects have proved a rather serious handicap to the progress of the apple industry Generally speaking, planting is not now being rapidly extended The planting of thousands or even hundreds of acres under one management is fortunately no longer generally regarded with favor, and the trend is distinctly towards reducing the individual holdings to a size that is compatible with careful and thorough orchard management The future will see a large development of commercial apple-growing in this region

Kansas —Northeastern Kansas from Topeka northward to the Nebraska line and northeastward to the Missouri River forms a part of an important apple-growing region which takes in southeastern Nebraska, southwestern Iowa, and northwestern Missouri Here Jonathan and Grimes are grown to a high degree of perfection, together with Ben Davis, Gano, Winesap, and other varieties of the Ben Davis belt There is another important apple district which is located in the Arkansas Valley from Hutchinson to the Oklahoma line In recent years, this has taken the lead in crop-production in this state The older Kansas orchards were largely of Ben Davis, Gano, and Missouri. The newer plantings have more of York Imperial, Jonathan and Grimes Other varieties common to the Ben Davis belt are also found

Oklahoma and northwest Texas —In Oklahoma, the apple has not yet developed very large commercial importance Planting is gradually increasing in the Red River section and also in west Texas where the altitude reaches 2,000 feet. Here Ben Davis, Missouri and Arkansas Black are among the most important commercial varieties.

Establishing and managing the orchard on the prairies and plains Fig 276

Preparation of land —The fundamental principles of proper preparation of soil for orchard planting in the mid-continental country are much the same as those that are set forth for other regions, although they may differ somewhat in relative importance One of the first things to be considered is the matter of putting the soil in such condition that the entire root-system of the apple tree may withstand, without injury, any period when the soil is filled with water Unfortunately, the importance of this is not generally nor fully realized, even among experienced orchardists The principle that apple roots must have a constant supply of air in order to do their work should never be lost sight of. Stagnant water cuts off the supply of air to the roots and very quickly impairs the health of the root-system Excepting on such soils as deep porous loess, or when the subsoil is of such a sandy or gravelly nature as to



276 A ten-year-old Nebraska apple orchard
The trunks are protected from the sun by board jackets.

let the surplus water pass off readily, it may be laid down as a general principle that thorough tiling is fundamental to the highest degree of regular and abundant crop-production and longevity of the apple tree On land where the general slope is sufficient to carry off the surface water and even on hillsides, tiling may be, and often is, essential to the best success The lines of tile should be not less than 4 rods apart and in many cases 2 rods apart gives enough better results to more than repay the extra expense Even in arid regions, progressive orchardists are learning that, under irrigation, in many places it becomes necessary to under-drain the land so as to prevent the seepage and waste-water from water-logging the soil and damaging the root-system of the trees

Humus —It is highly important that the orchard soils have an abundance of humus to begin with, and that the supply be continually kept up by the use of either green manures or barnyard manure or both. The humus not only puts the soil in a more fertile condition but increases its moisture-holding capacity and gives it greater ability to withstand drought The necessity of promptly getting rid of surplus water in the soil has already been emphasized It is equally important to conserve soil moisture so as to carry the tree unharmed through any periods of drought that may occur either in summer or winter Generally speaking, this can best be done in the mid-continental regions by thorough tillage during the growing season, followed by the growing of cover-crops In places where soils wash so badly that this practice cannot be followed, perhaps the next best way to develop the capacity of the soil to hold moisture is by the use of barnyard manure and the growing of clovers or other crops that can be mowed twice or more during the season and allowed to rot on the ground

It is well to grow grain or some cultivated crop on the land the season previous to planting the orchard The land may then be fall-plowed to a good depth and disked in the spring, or it may be plowed in the spring and disked just before planting North of the latitude of southern Iowa, spring planting is always to be preferred, while to the southward, orchards may be planted either in fall or spring In the case of fall planting, two or three furrows should be turned towards the tree on each side of the row as a matter of protection from alternate thawing and freezing about the roots and to turn away surface water from the trunk

In planting the tree it is essential that the first earth that is put in the hole should at once be tramped about the roots, and this process repeated as the hole is filled. Great care must be taken in this region to keep the trees from drying out in handling them while they are being transferred from nursery to orchard Trees should be kept perfectly dormant till planted Nursery stock should be neither accepted nor planted after its buds have started growth Sometimes when such stock is transferred promptly from nursery to orchard on a rainy day, it may grow well, but as a rule it dies or makes but feeble growth

Budded apple trees should not be planted in any part of the upper Mississippi Valley for the reason that when such trees are set in the orchard the point of union between the top and the seedling root comes at or near the surface of the ground, thus exposing the root to greater liability of suffering winter injury than when it is buried more deeply By using a long cion grafted on a short piece-root, it is possible to produce a nursery tree that will permit of planting the seedling root deeply During the history of apple-growing in the more northern parts of the mid-continental apple districts, it has repeatedly happened that when the hardier cultivated varieties have been budded on some tender seedling roots, the roots have been winterkilled, while the top remained uninjured until it died from the lack of live roots to support it In many cases when root-grafted trees of the very hardy varieties had sent out roots from the lower part of the cion, they were able to withstand the severest winters uninjured, while trees of the same kinds which were not thus established on their own roots died from winterkilling of the roots Such experiences have led fruit-growers to demand root-grafted apple trees

The methods of spraying now being followed by the more intelligent and progressive apple-growers of mid-continental America do not differ materially from those of the best growers east and west

Pruning —Pruning is, generally speaking, sadly neglected by the ordinary apple-grower In recent years, the tendency of orchard practice in the Mississippi Valley has been towards the methods of heading and pruning apple trees which are most commonly practised in the intermountain and Pacific coast districts Very high-headed trees are comparatively scarce except in old closely planted orchards in which the lower limbs have been lost by over-crowding The trees are headed rather low, commonly at about 18 to 24 inches from the ground to the first limb The leader is taken out at a height of 28 to 36 inches, leaving for the framework of the tree from three to five ascending main limbs which should be at least 6 inches apart. In regions where the trees are comparatively short-lived or with varieties that are not expected to live more than from twenty to thirty years, this is doubtless the best practice, but with longer-lived trees it is open to the very serious objection that when loaded with fruit or weighted with ice and snow these large limbs sometimes break at the trunk, leaving an injury which can never be healed, and as a result the whole tree goes down within a few years On the other hand, trees that are trained with a central leader may lose very large branches and yet heal over such wounds and live

to old age in good condition In training trees in this way, it is best to cut off the leader at the proper height when the tree is planted This tends to force the growth of the branches which are needed to form the main framework of the tree One of these branches may be allowed to grow in the center of the top so as to form a new leader

Aside from shaping the tree so as to give it right mechanical framework for supporting heavy loads of fruit, it needs to be kept sufficiently open to permit light and air to reach the foliage throughout the top This will favor the best development of abundant and strong fruit-buds and perfect fruit It also leaves the top open so that all of its foliage and fruit may be readily sprayed Thick, dense tops are to be avoided and trees should not be allowed to grow so close together as to crowd each other

Tillage —As before stated, the best system for general practice in conserving soil moisture and fertility is tillage throughout the growing season, till late July or early August, followed by a good cover-crop The greatest care must be used not to bruise the trees when cultivating In this interior climate, it often happens that such wounds do not readily heal and they may result in the loss of the tree within a very few years If a wound happens to be made, the loose bark should be at once cut away and the exposed surface coated with a thick paint of pure white lead and raw linseed oil and kept thus protected till completely healed over

Mice and rabbits —For the last few years in the writer's experience, lime-sulfur sprayed on the trunks and low branches of the trees as soon as the leaves drop has prevented attacks of mice and rabbits Use at same strength as indicated for the dormant season

Handling the crop —At the present writing, the apple crop of the mid-continental regions is marketed locally, either in bulk, open packages, or in barrels, or it is shipped in barrels or in bulk Box-packing is practically unknown here It is just beginning to be practised by a few scattering enterprising fruit-growers It would extend more rapidly but for the fact that very few persons in this region know how to pack apples in boxes The Iowa Experiment Station has taken the lead in introducing box-packing among the apple-growers of the interior by arranging for schools of instruction in apple box-packing in that state and assisting in introducing them into other states The effect of this work is already shown in the rapidly growing local interest in improved methods of grading and packing apples for market.

The methods followed in barrel-packing and in handling apples in bulk do not differ materially from those which are prevalent in the eastern states So also the handling of apples in cold storage follows the general lines of this business as practised by eastern growers and dealers, but the storage facilities are not yet developed as extensively as in eastern apple-growing sections, although many strictly up-to-date storage establishments are found

Fruit-growers' organizations —There are as yet comparatively few apple-growers' organizations in this mid-continental region Generally speaking, these are organized along lines similar to those which characterize the fruit-growers' organizations of the Rocky Mountain and Pacific coast states, except that in no case are they yet combined in a fruit-growers' exchange With the increase of intensive orcharding, it may reasonably be expected that apple-growers' organizations in this region will become more abundant and more thoroughly systematized

Orchard-heating —The recent advent of the practice of fighting late spring frosts by orchard-heating undoubtedly marks a new era in fruit-growing in the mid-continental regions It reduces the hazards by bringing an heretofore uncertain factor under some degree of control and thus puts the industry upon a more stable basis

The amount of losses in this region during only the past decade from injury to orchard blossoms and fruits by late spring frosts and freezes aggregates an enormous sum, a considerable part of which doubtless might have been saved by proper orchard-heating In the Iowa Horticultural Society Report for 1910, Laurenz Greene estimates the amount of loss from frost injury to the apple crop of Iowa alone from 1905 to 1910 at $5,000,000 to $10,000,000 In some of the other states, the losses have been even greater

The practice of orchard-heating for this region is in many respects still in the experimental stages, and much will need to be learned before all the details shall have been definitely worked out into the most efficient and economical practice Nevertheless, it may now rightly be regarded as a good method of insurance against frost injury

For detailed treatment, see *Orchard Protection*

S A Beach.

Apple-growing in the western mountain states.

Accepting the common geographical grouping of the states, the mountain division embraces the states of Colorado, Idaho, Montana, New Mexico, Utah, Wyoming, Arizona and Nevada According to the census report, these states produced in 1909 a little less than 4 per cent of the total apple crop of the United States, or 5,500,000 bushels While New York alone produced four times this amount, and the New England states more than 10,000,000 bushels, these mountain states are competitors worth considering in commercial apple-growing In 1910, these states reported only 40 per cent of their total acreage of apple orchards in bearing, while the New England states, as well as New York, reported about 80 per cent of their apple trees of bearing age.

The mountain states.

In the two years that have passed since these figures were gathered, at least five of the mountain states have greatly extended the plantings of apple orchards, and it is safe to say that in no group of states is the apple industry growing more rapidly Of this group, Colorado stands first in production, Idaho second, Utah third, Montana fourth and New Mexico fifth In total acreage planted to apple trees, Colorado ranks first, Idaho second and Montana third Colorado has a substantial lead and promises to hold its place for some years to come Comparing Utah and New Mexico, it would be unsafe to say which leads in total acreage of apple orchards The same is true of Arizona, Nevada and Wyoming The fruit-growing industry of the region has grown up in comparatively recent years and, with the exception of Arizona and Nevada, all states reported the larger per cent of the apple trees too young to bear in 1910 The status of the apple-growing industry in these states individually may be briefly summarized as follows

Colorado —In 1910, Colorado reported 1,688,000 apple trees of bearing age and 1,973,000 trees not bearing In 1909 the state produced, according to census figures, 3,559,000 bushels of apples The state's principal apple-growing sections are the Grand Valley (Mesa County), the North Fork Valley (Delta County), the Uncompahgre Valley (Montrose County), the Cañon City district (Fremont County); and a new and promising district embracing a large part of Montezuma County The varieties most largely grown are Gano, Jonathan, Rome Beauty and Winesap In the older orchards, there has been a considerable planting of Ben Davis, but many of these are now grafted to the better varieties Little is done in the way of apple-growing without irrigation Most of the orchard land

is found in comparatively narrow mountain valleys or upon the bench or mesa lands of these valleys

Idaho —In 1910, Idaho had 1,006,000 apple trees of bearing age and 1,540,000 trees not bearing The state is credited with the production of 660,000 bushels of apples in 1909. The Snake River Valley is the principal apple-growing section In the north of the state, the Clearwater Valley and the valleys of the Kootenai and Clarke's Fork of the Columbia afford additional possibilities for commercial apple-growing The industry is growing rapidly, and it is probably safe to say that in 1913 the output of the state was double that of 1909 The principal varieties grown are Gano, Jonathan, Winesap and Rome Beauty, with Esopus and Yellow Newtown in the newer plantings In the northern half of the state, the moisture supplied by natural rainfall is generally sufficient to mature the apple crop, while in the southern half of the state additional moisture must be supplied by irrigation

Montana —In 1910, Montana had 697,000 apple trees of bearing age and 1,308,000 trees not bearing The estimates of the State Board of Horticulture placed the total acreage of apple orchards in Montana, in 1912, as 30,000 acres The principal apple-growing sections are the Bitter Root Valley, the Flathead district, which embraces a portion of the valley above Flathead Lake and the land along the lake shore, the Clarke's Fork Valley (Carbon County) and the Yellowstone Valley (Yellowstone County), with newer plantings in the valley west of the junction of the Missoula and Flathead Rivers (Missoula and Saunders Counties) and in the Tobacco Plains and Kootenai Valleys in Lincoln County With the exception of the greater portion of the Flathead districts, all are irrigated The principal varieties grown are McIntosh, Wagener, Rome Beauty Northern Spy and Wealthy A few Gano, Jonathan and Delicious are being planted The Transcendent Crab, largely planted in the older orchards and those just coming into bearing, is being little planted now, on account of its susceptibility to pear blight

New Mexico —The apple industry of this state is comparatively young In 1910 there were 543,000 trees of bearing age and 914,000 trees not bearing In 1909, the state produced 417,000 bushels of apples The orchards are all under irrigation and are located in the Rio Grande Valley from north of Albuquerque to the Texas line, in the Roswell district in the Pecos Valley, and in the Farmington district (San Juan County), which may be said to be a continuation of the Montezuma district of Colorado The varieties grown are Ben Davis, Gano, Arkansas Black, Winesap, Jonathan, White Pearmain and Rome Beauty. The apple industry is growing rapidly, especially in the Roswell and Farmington districts The state bids fair to take third place in the mountain region

Utah —In 1910, Utah reported 517,000 trees of bearing age and 789,000 not bearing In 1909 the total apple-production was 350,000 bushels In the past ten years the state has not shown the growth in apple-production as has Colorado, Idaho, Montana and New Mexico, yet many new orchards are being planted in the Cache Valley (Cache County), Bear Valley (Iron County), Utah Valley (Utah County), and in the Ogden district These are the leading apple-growing sections of the state Gano and Jonathan are most widely planted, although Winesap, Rome Beauty and and other standard winter varieties are grown in smaller quantities The orchards are all irrigated

Arizona —Approximately 1,000 acres were in apple orchards in Arizona in 1910, about one-half being of bearing age The climate over most of the state is too warm for the apple, and in the mountainous sections of the state where apples may be successfully grown, the areas which can be irrigated are very limited in extent There is apparently little chance for development in commercial apple-growing.

Nevada —With a climate similar to that of Arizona, the apple industry has not flourished in Nevada Latest census figures credit the state with little more than 1,000 acres of apple orchards Limited areas located near the Sierra Nevada Mountains in the northwest part of the state are fairly well adapted to apple-culture The rainfall is light and all orchards are irrigated A number of the standard winter varieties are grown

Wyoming —The interest in apple-growing in Wyoming is confined principally to the development of the home orchard The acreage planted is about equal to that of Arizona or Nevada, with a little more interest now manifest in the development of the industry The varieties planted are Wealthy, McIntosh and Jonathan

General practices

Generally speaking, this whole region is arid, little being attempted in the way of apple-growing except with irrigation The atmosphere is dry, and during the summer months there is an exceptionally large amount of sunshine Especially in the mountain valleys, the days are warm and the nights cool The entire region is more or less subject to untimely spring frosts For this reason many of the best fruit sections of the region are found in narrow mountain valleys, protected more or less by cañon breezes, or upon the bench lands of broader valleys, where the air drainage is good Within this region, however, we find many sections afforded this natural protection where the apple crop seldom fails

Soils —Within this group of states, apples are grown on a large variety of soils The great majority of orchards have been planted upon virgin land, and as time goes on, we shall probably learn to consider soil-adaptation a more important factor in apple-growing From the standpoint of ease of cultivation, ease of irrigation and the maintenance of soil fertility, the medium sandy loams are proving the most satisfactory apple soils

Tillage - The orchardists of the mountain states have from the beginning been exponents of clean culture In many sections, however, they are now beginning to feel that this has been overdone, and in the present system of tillage, clean cultivation and cover-crops alternate In some cases the orchard is well tilled during the early part of the season and seeded to field peas, vetch or other crop in midsummer Another practice is to seed the orchard to clover, which is turned under after two seasons' growth. The orchard is then cultivated for one or two seasons and again planted to clover Alfalfa has been used instead of the clover Providing it is kept away from the trees and within reach of the turning plow, alfalfa is not objectionable in orchard lands free from stones On rocky land it is difficult to kill the alfalfa out In this arid region, some such system of tillage must be practised as a means of maintaining soil-fertility

Irrigation —The irrigation practice of the orchardists of these states is not unlike that of the other western states Practically all water is applied by the furrow method, running shallow ditches close together in sandy soils and deep ditches farther apart in the heavy soils The distances between ditches will vary from 2 to 6 or 8 feet The old orchards receive from two to four applications during the growing season The plan is to get the fruit up to size early in the season and then promote coloring by maintaining only a moderate moisture supply during the latter part of the summer In sections where the winters are dry, both the old and young orchards receive one late fall irrigation This is applied after the first frosts when there is no longer danger of starting new growth The young orchards are well watered during the early part of the growing season. After midsummer, little water

is applied. Every effort is made to check the growth of the trees early, for when well matured they withstand severe freezing best

Pruning —The apple-growers of the mountain states are quite unanimous in their choice of the vase-form as the standard to be worked for in training apple trees. While the eastern grower many justly condemn such a system of training on account of limited fruiting area, the objection is without merit in this region where the tendency is for most varieties to overbear In the first three or four years in the orchard, the young trees are severely headed-in each spring, the object being to get a stocky trunk with the first scaffold limb within 12 or 18 inches of the ground and three or four more spaced along the trunk at intervals of 6 inches After these first three or four prunings, little heading-in is done until the trees begin to overbear The trees are then cut back and thinned out sufficiently to induce annual bearing and the production of fruits of desirable sizes with the minimum amount of hand thinning In the commercial fruit-growing sections, the fruit is systematically thinned There is little occasion for summer pruning

Marketing —The bulk of the apple crop of these states is sold in standard apple-boxes, and much of the fruit is wrapped and packed in sizes in tier packs As a rule, the fruit is marketed through cooperative fruit-growers' associations, some of the oldest and most successful associations in the United States being found in this region The fruit is generally distributed in all eastern, southern and western markets where extra fancy boxed apples are in demand.

Diseases and insects —The apple-growers of the mountain states are little troubled with fungous diseases During the summer season the atmosphere is generally dry and the fungi apparently do not thrive. In some of the more humid sections of this region, especially in rainy summers, apple scab becomes a serious menace It is easily controlled, however, with the lime-sulfur sprays Over the entire region, pear blight has attacked some of the more susceptible varieties of apples The planting of Alexander and Transcendent Crab has been discontinued on this account, and in some sections other varieties must be watched carefully and will probably be discarded eventually

Of the apple orchard insects, the codlin-moth is easily the most important, and over almost the entire region up-to-date methods of control must be employed Both the green and woolly aphis are ever-present enemies of the apple orchards, the first troubling young orchards especially The San José scale has not as yet become a troublesome pest in the apple orchards of the greater part of the mountain region The oyster-shell scale, the bud-moth and the green fruit-worm are of only local importance

The majority of orchardists of this region are well equipped with modern power spraying machinery, and as a rule are well posted on spraying methods.

O. B. WHIPPLE.

The apple in Oregon and Washington.

The states of Oregon and Washington are noted for their diversity of fruit conditions. Their soils range from the lightest loam to the heaviest adobe, their rainfall varies from 8 or 9 inches to over 100; their elevations extend from sea-level to the snow line. From the horticulture of each of these states, which is thoroughly described in this Cyclopedia, the readers can get complete details concerning these special characteristics.

In Oregon apple-culture is largely confined to such valleys as the Rogue River, Umpqua, Willamette, Hood River, Freewater-Milton, and Grande Ronde, with certain developments along the coast, especally in such regions as Coos Bay

In Washington the development is largely east of the Cascade Range in such inland districts as Wenatchee, Yakima, Walla Walla and Lewiston-Clarkston.

General considerations.

Apple-culture on the Pacific Coast is characterized by the following

Communal development —In such valleys, for example, as the Hood River (Fig 277) or Wenatchee, one finds that apple-growing is almost the sole industry, and large contiguous areas are devoted to apple-production alone One sees the entire absence of diversity of agriculture in some districts These orchards may occasionally be very large, although in the more highly developed regions the tendency is for small orchards very intensively developed

Intensive tillage —There is practically not a fruit-grower to be found on the Pacific Coast who is not a firm believer in tillage In a few sections, the introduction of shade-crops is supplementing the former intensive tillage, but the almost universal practice is to till very intensively

Systematic spraying —Each orchard is given frequent sprayings, according to a specified program There are very few orchards on the Pacific Coast that are not equipped with power sprayers, capable of maintaining 200 pounds of pressure Pacific Coast apple-growers are thoroughly alive to the value of spraying for pests.



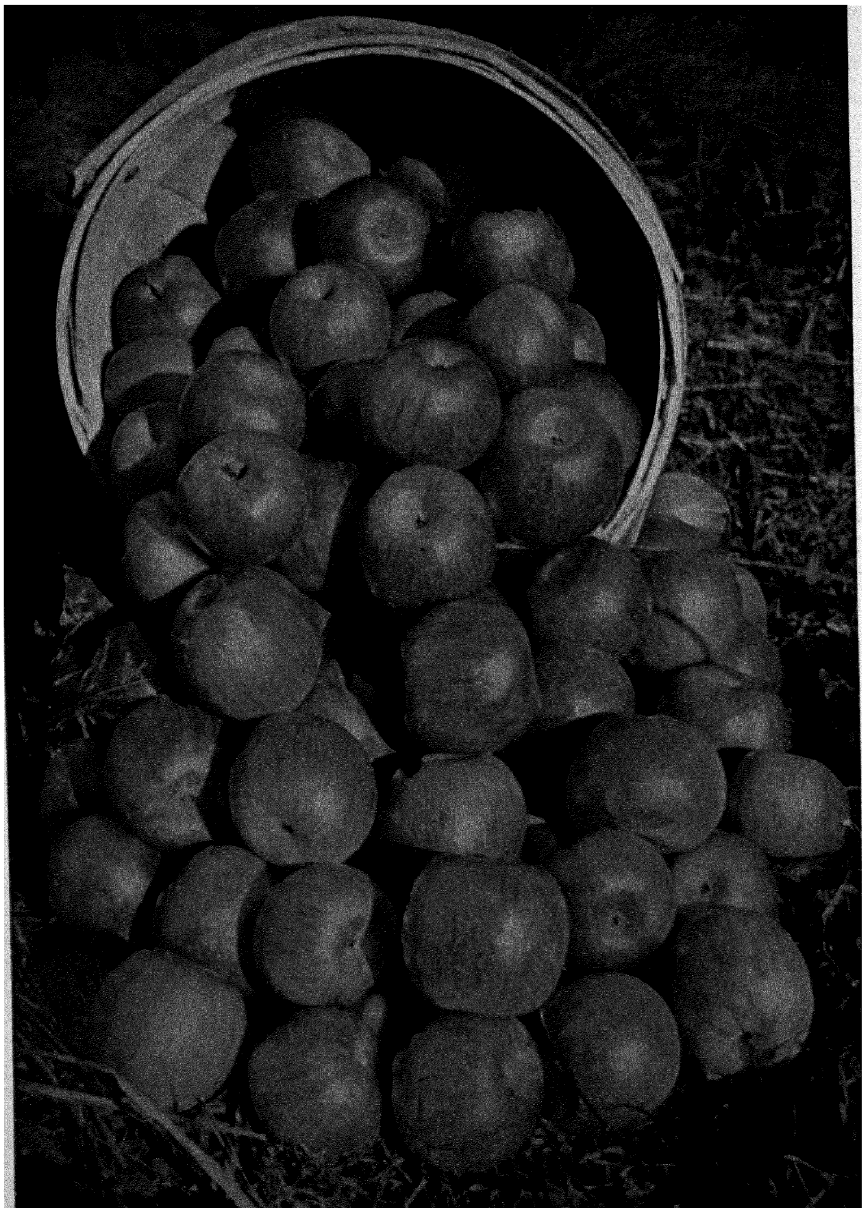
277 Apple orchard in Hood River valley.

Methodical thinning —It would be very hard indeed to find any fruit districts in which the orchardists do not thin regularly They would no sooner give up thinning than eating It is thought by a great many growers that thinning pays a larger dividend on the investment than any other orchard practice

Skillful packing —The Pacific Coast has long been famous for the high-grade packing of its fruit products. Every effort is made to educate the growers to be skillful fruit-packers, and rigid systems of inspection are maintained in order that the high grade of the pack may not be sacrificed.

Spirit of cooperation —Almost every community is thoroughly organized The spirit of cooperation has taken a firm hold with the people and its benefits are thoroughly realized Not only have certain sections organized, but there is every indication at the present time that within the next few years apple interests of the entire Pacific Coast will be consolidated into a central selling agency.

The personnel of the Pacific Coast fruit-growers can be characterized by the large number of young men, especially college graduates, who are engaging in apple-culture In Hood River alone there are in the neighborhood of one hundred and thirty college graduates from all parts of the country engaged in apple-growing and making it a life-work and study There are also large numbers of retired business and professional men from various parts of the country Such men, because of their enthusiasm, are anxious to adopt up-to-date methods in order to make very successful fruit-growers They intend to specialize in making apple-growing a very serious business It is not an uncom-



VIII. The York Imperial apple.

mon thing to find a man devoting his entire energy to the growing of two varieties of apples.

Orchard management

Most of the orchardists practice annual spring plowing. In some of the lighter soils, disking takes the place of plowing, but the present tendency is to plow and harrow down the soil very thoroughly With the heavy loams the plowing is generally followed by light harrowing, supplemented by the use of the clod-masher, corrugated roller or brillion After the ground is placed in good condition, frequent cultivations are made One of the best tools to use in such cases is the Kimball weeder, this stirs the soil and prevents drying or baking of the surface soil. Often as many as eighteen harrowings are given during the summer-time By the middle of August or at such time as the young trees have made sufficient growth, cultivation ceases, but with the heavier-bearing orchards cultivation is generally continued up to the harvesting With the lighter soils, such as many of the volcanic ash, after the ground has been plowed in the spring, the tendency is to compact the ground more by the use of subsoil packers or by dragging the ground with floats Such soils tend to blow out constantly and it is only by these methods that the moisture can be retained in the surface soil

Irrigation —Irrigation becomes more and more a factor to the Pacific Coast apple-grower east of the Cascade Mountains where the rainfall is less than 15 inches Irrigation is made to supplement tillage The water is applied by the furrow or rill system, and as soon as possible after irrigation the ground is thoroughly harrowed and, after becoming smooth, is kept in good shape with smoothing harrows Irrigation is practised more with trees fifteen years of age and up than with young trees

The growers are finding out that an abundant supply of moisture either through intensive tillage or irrigation tends to make the trees produce larger crops, makes them annual bearers, increases the individual size of the specimens and tends to make the fruit more elongated and of a livelier, brighter color In some cases too much moisture is used, resulting in soft, poorly colored fruit of poor shipping qualities

Fertilizers —At the present time no commercial fertilizers are being used The growers, however, are taking hold of cover-crops very enthusiastically Vetch becomes a principal crop,—the forage or Oregon vetch in the region where the climate is mild, and the hairy vetch where the climate is severe The vetch is generally combined with rye, oats, or wheat, and is drilled in by the latter part of August, about forty pounds of vetch and ten pounds of rye being the common amount to use to the acre Under normal conditions, from 2 to 3 feet of growth can be realized by early spring

Shade-crops —In the irrigated sections where the tendency to use shade-crops is becoming common, alfalfa and the clovers are the principal crops grown There is a great difference in opinion among the growers whether alfalfa is a suitable crop to use as a shade-crop, clovers being more commonly used Some growers practise growing clover for two years, cutting it and allowing it to mat on the ground, while other growers disk the clover under each year and allow it to reseed itself The practice of growing shade-crops is yet so new that it will be a number of years before the growers unite on some practice, but a larger percentage of growers are resorting to shade-crops each year

Thinning —Nearly all varieties of apples are thinned very carefully The thinning generally begins as soon as the drop is over, in some places before the drop takes place. The apples are thinned at various distances, according to varieties The red apples are generally thinned one to a spur. With yellow apples, there is a tendency to leave two specimens on certain spurs but to remove all the fruit from the remaining spurs The growers think that when this method is followed there is a tendency to maintain the trees as annual bearers The distances apart vary extremely Winesaps are thinned from 8 to 10 inches apart, whereas the larger varieties of apples are thinned rather sparingly, as they often have a tendency to overgrow if thinned too vigorously

Pruning —Most growers practise annual pruning The trees are started very low, the head being 9 to 18 inches from the ground Most of the growers resort to what is known as the open, goblet or vase tree In this tree, most of the branches issue from one point and the trees are kept open constantly by rigorous pruning. The growers think that more light is allowed to play around the fruit by such a system and that a better color is developed During the first three years, the trees are cut back very rigorously each spring, but as they become older less heading-back is resorted to and more thinning-out is practised Many of the growers are now leaning more to the modification of the center tree, growing what is known as the modified center tree, the leaders being allowed to grow for a few years and then being suppressed This system gives a better distribution of the branches and makes a stronger tree, and it also gives a larger fruiting area Some growers contend that varieties like the Yellow Newtown do better if trained as leaders

There is much sentiment among the fruit-growers on the Pacific Coast in favor of summer pruning In their enthusiasm, many of them are overdoing summer pruning On the stronger loams certain varieties like Yellow Newtown are slow in coming into bearing, but on the lighter loams and higher altitudes come into bearing in three to five years In such cases summer pruning is not resorted to

Pollination —Pollination has become a subject to which the Pacific Coast growers are paying a great deal of attention and the orchards are now being planted in oblong blocks of two to six rows of a variety It is felt that where this is practised, a larger set of fruit is secured, that there is a greater uniformity in the crop and a tendency for increase in size of specimens Formerly trees were planted in large blocks, but the heavy shedding of fruit has caused the growers to abandon this system and plant so that interpollination can take place

Frost-fighting —Frost-fighting is resorted to in many of the mountain valleys that are early and subject to damage from frosts The most common method for controlling is smudging with oil in pots The last few years many growers have been very successful in saving the crops under adverse conditions See *Orchard Protection*

Spraying —Practically every grower has a spray calendar which he follows very carefully Power outfits are used extensively and high pressure is maintained. In all the older orchards, high platforms are built on the spray outfits so the trees can be thoroughly covered with spray The principal diseases are the mildew, found more in California and southern Oregon; apple scab, apple tree anthracnose, or black spot These are about the only diseases that receive much attention Of the insect pests, the codlin-moth and aphis are the most serious The codlin-moth is distributed over the entire district with the exception of the coast regions, which are free from this insect pest The green aphis attacks the young trees injuriously, and for the past two years the brown aphis has been of serious menace to the fruit In some regions the brown aphis is now doing more damage than the codlin-moth The scale insects, for the present time, receive very little attention, as they are so easily controlled. Occasionally the red-spider and borers give considerable trouble

Packing —The apples are all packed in boxes known as the Northwest Standard, 10½ x 11½ x 18 inches

All the better grades of apples are wrapped in paper, and lithographs are placed on the boxes The fruit is graded very carefully before packing The present tendency is to use one size of box and pack the apples by what is known as the diagonal pack

Packing-houses —Very large and expensive packing-houses are being erected all over the Pacific Coast and enormous storage plants are being built at all the immediate shipping points In most cases, the packing is very rigorously inspected Most of the states have laws that require the grower to put on the box his name, the grade of fruit and the number of specimens in the package Most associations require the packer to stamp his number on the box, so that in the case of any imperfections it can be easily traced

Marketing —The marketing of the fruit is done largely through associations By cooperating, the growers have been able to improve constantly their pack and have also tended to distribute the fruit more widely At the present time, the Pacific Coast is sending fruit to nearly all the leading ports of the world, and the effort is made to get a wider and wider distribution rather than to send it to a few distributing points like Chicago and New York, which was the system formerly followed.

The willingness of the people to organize, and the cooperative system, which is broadcast in the region, is a very important factor in successful apple-culture on the Pacific Coast C I LEWIS.

The apple in California.

Although the apple was introduced into southern California by the Mission padres nearly a century before the American occupation, and although the Russians established an apple orchard in northern California more than a quarter of a century before the gold discovery, it was not fully demonstrated until about 1880 that the state can produce an apple of character and quality to entitle the region to standing among



278 A California apple orchard

the commercial apple regions of the United States California pioneers were accustomed to concede apple adaptations to Oregon and to claim none for themselves This was chiefly due to the fact that early plantings were made in the mining districts of the lower foothills and on valley lands adjacent to routes of travel thereto from the port of San Francisco Climatic conditions in such situations forced too early maturity of winter varieties, which impaired quality and keeping and, as main commercial desirability was vested in long-keeping, California was conceded to lack adaptations for the production of a good apple, and local supplies of the fruit were drawn for three decades from the orchards in western Oregon Popular judgment was, however, reversed by the notable long-keeping of California apples shown at the New Orleans Fair in 1885, which is explained by the fact that the exhibits were gathered from family orchards in the coast districts and in the high plateaus and mountain valleys where growing conditions are quite unlike those of the lower foothills and adjacent valleys The conclusion from this demonstration was that when the right variety is planted in the right place, in California, superior fruit, both for local use and long shipment, may be secured. Since that time, California apples have been successfully sold in considerable quantities in England and on the continent of Europe, on the Atlantic Coast of America, in Australia and in Eastern Asia—as well as throughout the interior states of the Pacific Slope, in Canada and in Alaska The uprise of a great apple industry in other states of the Pacific Slope has, however, recently excluded the California winter apple from large American areas in which it formerly sold freely; but California still retains in the same areas its market for summer and fall apples because mature fruit can be shipped before the same varieties ripen further north or at greater elevations Fig 278 shows a representative California apple orchard

Summer apples

It is now clear that there are two distinct branches of the apple industry of California, in which, first, effort is concentrated on the production of summer apples in what are known as early districts and, second, fall and winter apples in other districts where slower development is favored by prevalence of lower spring and summer temperatures. In the interior valleys and lower foothills, the forcing heat brings early varieties, like the Astrachans, quickly to notable size, crispness and flavor, and there is an ample demand for such fruit for shipment, providing it is sound and free from pests, some of which, however, are more aggressive than they are in cooler sections Fall apples are successfully grown in the same districts but they also are profitable in the coast district, as is shown by the behavior of the Gravenstein in the Sebastopol section of Sonoma County where "Gravenstein shows" are annually held in August Another instance of specialization is found in the commercial importance of the Yellow Bellflower in the Watsonville district, where it enters largely into the "Apple Annual"—a greater exhibition held the first week in October In these typical fall-apple districts, the winter apples are also important, the Esopus (Spitzenberg) leading these varieties at Sebastopol and the Yellow Newtown at Watsonville These facts emphasize the importance of certain varieties, for specialization is built upon varieties even more than upon the classes to which they belong

Winter apples.

The chief importance does, however, rest with the winter apple in California, in the same way, but perhaps not to such a degree, as in other apple-growing states and countries, and the chief investment and expectation are made upon that basis Aside from the conditions cited, which make nearly exclusively for the summer and early fall varieties, the state has great capacity for the production of winter apples of the type for which the coast has become so famous during the last few years Every county in the state has apple trees, but the requirements of a winter apple are fully met by two main divisions of the state, viz the smaller valleys close to the coast, in fact, in some cases, the coast flats, where the exposure is directly toward the cooling breezes of the ocean which produce a cool summer—a long, slow-growing season, which develops great beauty and high quality in a winter apple Similar results are also produced by the climate found at an elevation of about 2,500 to 5,000 feet on the interior plateaus and in the mountain valleys The coast district has developed a greater commercial apple industry than the mountains, because transportation facilities for shipment are vastly better, but as the state advances, the mountain

districts will be employed in this production much more largely than at present The greatest apple district of the state now is the Pajaro Valley, including parts of Monterey and Santa Cruz Counties, centering at Watsonville, which shipped about 6,000 carloads of apples in 1912 The county next prominent in apple-growing is Sonoma, Santa Cruz and Sonoma Counties have about one-half of all the trees in the state, while many other counties have good apple orchards in less total acreage, in fact, from San Diego on the south to Siskiyou on the north, localities exist which afford the elevation or the coast exposures that favor the production of good winter apples, and planting is progressing in all these districts

Extent

The number of apple trees in California in 1913 is about 2,500,000, occupying, as nearly as can be calculated, 30,000 acres of land The varieties of chief commercial importance, in order of ripening, are White and Red Astrachan, Gravenstein, Yellow Bellflower, Yellow Newtown, Esopus, White Pearmain, Winesap and Rome Beauty. Many other winter varieties have been planted recently in different districts, but their relative importance cannot be predicted. E. J. WICKSON.

APRICOT. *Rosàcex* A tree and fruit somewhat intermediate between the peach and the plum, grown largely in California and in special localities in the East

The apricot tree is a round-headed grower, with dark, somewhat peach-like bark, and very broad or almost circular leaves The fruit, which usually ripens in advance of both the peach and plum, is peach-like in shape and color, with a smoother skin, rich yellow flesh and large flat smooth stone The flesh is commonly less juicy than that of the peach, and, as a rule, perhaps, of higher quality The apricots are of three species, all probably native of China or Japan (1) The common apricot of Europe and America is *Prunus Armeniaca* fr variable, but smooth at maturity, red or yellow, the sweet and firm flesh free, or very nearly so, from the large, smooth, flat stone tree with a round, spreading top, and a reddish, cherry-like or peach-like bark lvs (Fig 279, right) ovate or round-ovate, with a short point and sometimes a heart-shaped base, thin and bright green, smooth or very nearly so below, as are the gland-bearing stalks, the margins rather obtusely and mostly finely serrate fls pink-white and borne singly, sessile or very nearly so, preceding the lvs (Fig 280) The Russian apricot is a hardy but smaller-fruited race of this species (2) The Japanese apricot, in Japan grown for flowers rather than for fruit, is *Prunus Mume* fr small, yellowish or greenish, the flesh rather hard and dry, and adhering tightly to the pitted stone tree like the common apricot, but with a grayer or greener bark and duller foliage lvs grayish green, generally narrower (Fig 279, left) and long-pointed, more or less hairy along the veins below and on the shorter mostly glandless stalk, thick in texture and prominently netted beneath. fls fragrant, borne singly or in 2's, and sessile (without stalks), more lately intro into this country, chiefly under the name of Bungoume plum (3) The third species is the purp'e or black apricot, *Prunus dasycarpa*, which is little cult. fr globular and somewhat plum-like, with a distinct st, pubescent or fuzzy even at maturity, dull dark purple, the sourish soft flesh clinging to the plum-like fuzzy stone tree round-headed, with much the habit of the common apricot, with lvs ovate and more or less tapering at both ends, thin, dull green, on slender and pubescent, mostly glandless, stalks, finely appressed-serrate and hairy on the veins below fls large and plum-like, blush, solitary or in 2's on pubescent stalks ½in or more long, and appearing in advance of the leaves See *Prunus* for related species The apricot-plum, *Prunus Simonii*, is discussed under *Plum*. The plumcot is a hybrid of plum and apricot, accounted for under *Prunus* L H B



279 Apricot leaves
P Mume on left,
P armeniaca on right



280 Flowers of the apricot

East of the Mississippi the apricot is not grown commercially to great extent, although it is a popular fruit for the home orchard and garden As a commercial crop, it does not seem to be increasing in favor There are two important reasons for this the loss of the fruit by spring frosts because of the very early season of bloom, and the great liability to curculio attack Possibly the apricot has not yet been given a thorough test Its value may be more appreciated and the difficulties of its culture lessened when the fruit has received greater study and attention.

The apricot is as hardy as the peach and thrives in similar localities and under the same general cultivation and treatment, but demands very strong soil. The ideal land for this fruit seems to be one that is deep and dry, and loamy or gravelly in character The rolling loamy lands that are well adapted to apples seem to be well suited to the apricot, if the exposure and location are correct The apricot is particularly impatient of wet feet, and many of the failures are due to retentive subsoils The kind of soil has an important bearing also on the stock to be used

Particular attention should be given to the location and exposure of the apricot orchard In the East the best results are secured if the plantation stands on elevated land near a large body of water, for th...e the spring frosts are not so serious as elsewhere Generally a somewhat backward exposure, if it can be had, is desirable, to retard blooming Apricots will be sure to fail in frosty localities

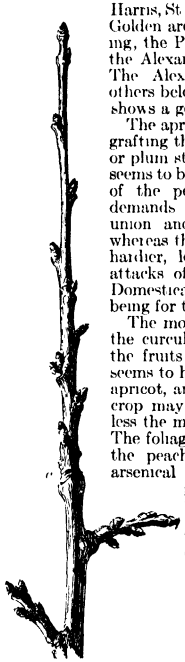
The apricot should always be given clean culture For the first two or three years, some hoed crop may be grown between the rows, but after that the trees should be allowed the entire land, particularly if set less than 20 feet apart Tillage should be stopped late in summer or early in fall to allow the wood to mature thoroughly It is best to raise a cover-crop in the latter part of July or in August to hasten this maturity and also to protect the roots and to improve the physical properties of the soil

The trees are pruned in essentially the same way as plums The fruit-buds are borne both on spurs (two are shown in Fig 281) and also on the wood of the last season's growth on either side of the leaf-bud, as shown in the twin and triplet buds above *a* in Fig. 281 Each bud contains a single naked flower (Fig 280) As the fruit begins to swell, the calyx-ring is forced off over the top (Fig 282) and the injury from curculio may then be expected The fruit is often borne so close together as to appear to be in clusters (Fig 283)

When grown under the best conditions, the apricot may be considered to be nearly or quite as productive as the peach Like other fruit trees, it bears in alternate years, unless the crops are very heavily thinned It can never be recommended for general or indiscriminate planting Only the best fruit-growers can succeed with it Apricots are to be considered as a dessert or

fancy fruit, and therefore, should be neatly packed in small and tasty packages

The varieties mostly in demand in the eastern states in order of preference are. Moorpark, Harris, Alexis, Montgamet, Budd, Early Golden, St Ambroise, Alexander and Peach The Royal and Superb are grown to some extent Of the above-mentioned varieties, the Harris, St Ambroise, Montgamet, and Early Golden are early as regards season of ripening, the Peach and Moorpark are medium, the Alexander, Alexis and Budd are late The Alexander, Alexis, Budd and some others belong to the Russian race Fig 284 shows a good-shaped apricot



281 Fruit-buds of the apricot Borne beside the leaf-bud, as on the peach, and also on spurs

The apricot is propagated by budding or grafting the desired varieties on the peach or plum stock On its own root the apricot seems to be less successful, probably because of the peculiar soil-requirements that it demands The peach seems to give a better union and consequently a better stand, whereas the plum stock gives a tree that is hardier, longer lived, and less subject to attacks of borers Both Myrobalan and Domestica stocks are used, the preference being for the latter

The most serious enemy of the apricot is the curculio, the same insect that attacks the fruits of plum and peach This insect seems to have a particular fondness for the apricot, and as the fruit sets very early, the crop may be expected to be destroyed unless the most vigilant means are employed The foliage of the apricot, as in the case of the peach, is especially sensitive to the arsenical sprays and therefore entomologists have hesitated to recommend paris green and arsenate of lead for the control of the curculio The work of W M Scott and A L Quaintance, of the United States Department of Agriculture, has shown, however, that arsenate of lead in combination with self-boiled lime-sulfur is successful in controlling this pest on the peach It is probable that the mixture will be equally successful in controlling the curculio on the apricot They recommend the use of two pounds of arsenate of lead combined with fifty gallons of self-boiled lime-sulfur applied as follows:

First application —About the time the calyces, or shucks, are shedding from the young fruit

Second application —Two or three weeks later, or about one month after the falling of the petals

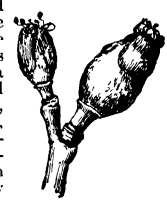
Another method of control of this insect is by jarring the trees, in the same way as with plums and peaches, but the work must be even more thoroughly done than with those fruits The jarring should begin as soon as the blossoms fall, and continue as long as the insects are numerous enough to do serious damage It will usually be necessary to catch the insects for three to six weeks, two or three times a week, or perhaps even every day The work must be performed early in the morning, while the curculio is indisposed to fly The operation consists in knocking the insects from the tree by a quick jar or shake, catching them on a white sheet or in a canvas hopper The catcher formerly used in western New York was a strong cloth hopper mounted on a wheelbarrow-like frame, and run on two wheels The hopper converged into a tin box, into which the curculios rolled as they fell on the sheet One man wheeled the device, by barrow-like handles, under the tree, then dropped the handles and jarred the tree, or sometimes two men went with a machine one wheeling it and the other jarring the trees If the work of spraying, as above recommended, is done thoroughly, it will probably not be necessary to use this jarring device in addition, and the device is now going out of use

The apricot is often trained on walls, where the fruit reaches the highest perfection Care should be taken that the wall does not face the east or the south, or the early-forced flowers may be caught by frost An overhanging-cornice will aid greatly in protecting from frost

C S Wilson †

The apricot in California is one of the leading commercial fruits It was apparently introduced by the Mission Fathers, for Vancouver found it at the Santa Clara Mission in 1792 However, there is no relation between this early introduction and the expansion that quickly followed the American occupation, because the Mission Fathers had only seedling fruits, while the early American planters, shortly before the gold discovery, introduced the best French and English varieties, and were delighted to find that these sorts, usually given some protection in the Old World, grew with surprising thrift of tree and size of fruit in valley situations in California in the open air Upon these facts the apricot rose to wide popularity The acreage has steadily increased during the last fifty years, and with particularly swift rate during the last twenty years, until the number of trees reported in 1899 was about three millions, occupying upwards of forty thousand acres of land Since then, however, the acreage has not increased, because the crop is irregular on account of frost injuries in some districts The fruit is sold fresh, canned, dried and in crystallized forms, in all the regions of the United States, in England and on the Continent, where, by reason of its superior size and acceptable manner of curing, it has achieved notable popularity The year 1905 was the greatest thus far in amount of dried product realized, viz., 36,000,000 pounds The year 1911 was greatest in amount of canned product, which reached upwards of 758,325 cases, each containing two dozen 2½-pound cans The shipment of fresh apricots out of California during the summer of 1910 was 290 carloads

The chief part of the apricot crop of California is grown in the interior valleys. In the low places in these valleys, however, the fruit is liable to be injured and sometimes almost wholly destroyed by spring frosts, although the trees make excellent growth In foothill situations adjacent to these valleys, there is also serious danger of frost above an elevation of about 1,500 feet above sea-level, and the tree is rarely planted for commercial purposes In southern California the apricot succeeds both in the coast and interior valleys But along the coast northward, excepting the very important producing regions of the Alameda and Santa Clara valleys, eastward, and southward from the Bay of San Francisco, the apricot is but little grown, owing to frost troubles In respect to these, the apricot is somewhat less subject to harm than the almond, but it is less hardy than the peach, and has, therefore, a much narrower range of adaptation The average date of the blooming of apricot varieties is about two weeks later than that of the almonds The apricot is adapted to a wide range of soils, because to the rather heavy, moist loams which its own root tolerates, it adds the lighter tastes of the peach root, upon which it is very largely propagated However, attempts to carry the apricot upon heavier, moister soils by working it upon the plum root have not been very successful, owing to the dwarf-

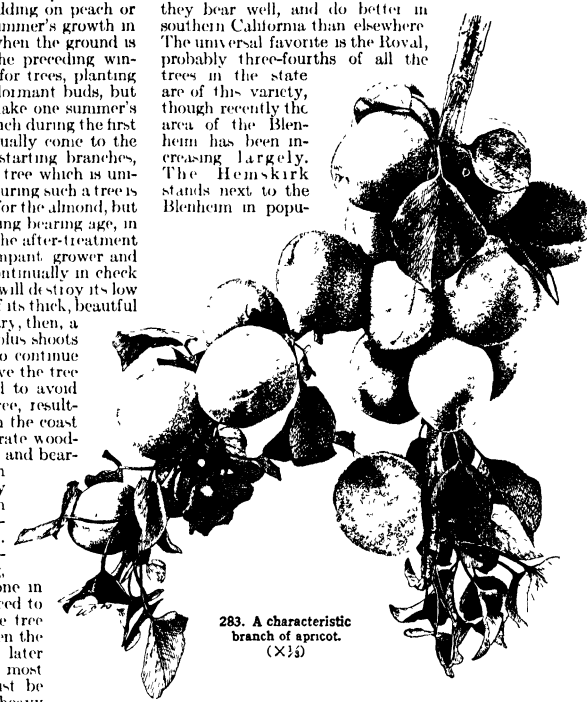


282. Young apricots shedding the ring.

ing of the tree, and the movement toward the light, dry loams, by working upon the almond root, has failed because the attachment is insecure, and the trees are very liable to be snapped off at the joining, even though they may attain bearing age before the mishap occurs The apricot root itself is a favorite morsel with rodents, and is for that reason not largely used The mainstay for the apricot, then, is the peach root, and the soils which this root enjoys in localities sufficiently frost-free are, therefore, to a great extent the measure of the apricot area

Apricot trees are produced by budding on peach or apricot seedlings during their first summer's growth in the nursery row, from pits planted when the ground is moist and warm, at any time in the preceding winter When there is a great demand for trees, planting in orchard is sometimes done with dormant buds, but ordinarily the trees are allowed to make one summer's growth in the nursery The trees branch during the first year's growth from the bud, and usually come to the planter with a good choice of low-starting branches, from which to shape the low-headed tree which is universally preferred The method of securing such a tree is identical with that already described for the almond, but the treatment of the tree after reaching bearing age, in its third year, is very different from the after-treatment of the almond The apricot is a rampant grower and most profuse bearer Unless kept continually in check it will quickly rush out of reach, and will destroy its low shoots and spurs by the dense shade of its thick, beautful foliage There is continually necessary, then, a certain degree of thinning of the surplus shoots and shortening of the new growth, to continue the system of low branching, to relieve the tree from an excess of bearing wood, and to avoid small fruit and exhaustion of the tree, resulting in alternate years of bearing In the coast regions, where the tree makes moderate wood-growth, it can be kept in good form and bearing by regular winter pruning In warmer regions, where the tendency is to exuberant wood-growth, the main pruning is done in the summer, immediately after the fruit is gathered. This has a tendency to check wood-growth and promote fruit-bearing, and where the main cutting is done in the summer, winter pruning is reduced to thinning out shoots, to prevent the tree from becoming too dense and to lessen the work of hand-thinning of the fruit later on In addition, however, to the most intelligent pruning, much fruit must be removed by hand when there is a heavy set of it, in order to bring the fruit to a size satisfactory to shippers or canners, and to reach the highest grades, if drying is practised California apricot orchards are all grown with clean tillage, for the main purpose of moisture conservation In regions of good rainfall and sufficiently retentive loams no irrigation is required, good tillage will suffice for the production of large fruit and perfection of fruit-buds for the following year. As the trees are becoming older and bearing larger crops the demand for moisture increases, and the use of irrigation water is growing In most places, however, one irrigation is sufficient, and that is given after fruit-gathering, to carry the tree through the last half of its season's work In the regularly irrigated regions of the state, water is periodically applied through the growing season, in such amount and at such intervals as the local climate and soils require

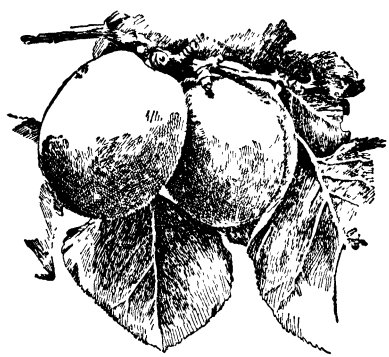
Although probably all the good varieties of the apricot in the world have been introduced into California in the last half-century, and scores of selected seedlings of local origin have been widely tested, the varieties that have survived the tests and are now widely grown are comparatively few in number Most of the rejected varieties met this fate because of shy bearing, and those which now constitute the bulk of the crop are very regular and full bearers, under rational treatment A local seedling, the Pringle, was for many years chiefly grown for the earliest ripening, but this has recently been largely superseded by another local seedling, the Newcastle, which is of superior size and about as early. The European varieties, Large Early and Early Golden, are fine in a few localities where they bear well, and do better in southern California than elsewhere The universal favorite is the Royal, probably three-fourths of all the trees in the state are of this variety, though recently the area of the Blenheim has been increasing largely. The Hemskirk stands next to the Blenheim in popularity The Peach is largely grown in the Sacramento Valley The best apricot grown in California is the Moorpark, in size and lusciousness, when well ripened, it heads the list It is, however, rather shy in bearing, and is forsaken for this fault in most regions It shows the best behavior in the Santa Clara Valley, and is there retained, in spite of frequent lapses, because of the high prices which it commands at the canneries About a dozen other varieties are carried in small number by the nurserymen to meet limited local demands



283. A characteristic branch of apricot. (×⅓)

Apricots for canning and drying are graded according to size Extra, not less than 2¼ inches in diameter; No 1, 2 inches, No 2, 1½ inches; No. 3, 1 inch The first three grades must be sound, clean and free from blemish, and No 3 must be of good merchantable quality The shippers and canners require well-colored but only firm-ripe fruit, because both the long rail transportation and the canning process require it, soft-ripe fruit will neither can nor carry For drying, riper fruit is used, and yet over-ripeness has to be guarded against to avoid too dark color For canning, the fruit must be carefully hand-picked; for drying, much is shaken from the trees The drying process consists in cutting

the fruit in halves longitudinally, dropping out the pits and placing the halves, cavity uppermost, upon light wooden trays Breaking or tearing the fruit open will not do, it must show clean-cut edges When the trays are covered they are placed in a tight compartment, usually called a "sulfur box," though it may be of considerable size, and the fruit is exposed to the fumes of slowly burning sulfur, to ensure its drying to the light golden color which is most acceptable to the trade The production of the right color is the end in view, and different dryers regulate the amount of sulfur and the length of exposure according to the condition of their fruit and their judgment of what it needs The exposure varies from half an hour to two or three hours, according to circumstances After sulfuring, the trays are taken to open ground, and the fruit is cured in the sun Only a very small fraction of the California product of evaporated apricots is cured in an evaporator. It requires about six pounds of fresh apricots to make one pound of cured fruit.



284 Good apricot fruits, one-half natural size.

A moderate estimate of the yield of apricots might be placed at seven and one-half tons to the acre, extreme yields are far away from this both ways

The apricot is, as a rule, a very healthy tree in California It is, however, subject to injury by scale insects of the lecanium group in some parts of the state. During recent years there has been increasing injury by a shot-hole fungus, which perforates the leaves and makes ugly pustules upon the fruit Such fruit is unfit for canning except the fruit be peeled, which is little done as yet It also makes low-grade dried product This fungus can be repressed by fungicides of the copper class

EDWARD J. WICKSON.

AQUARIUM. The aquarium as here understood is a glass tank for live fish, plants, and the like, for the dwelling-house or other suitable place

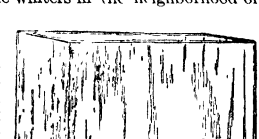
The aquarium should be in a place where it may receive light, but direct sunlight is not necessary, and to keep an aquarium in a healthy condition, living plants in the water are absolutely necessary and plants will not thrive in dark rooms, neither will fish retain their bright coloring The square or rectangular aquarium with open top affords a large breathing-space or air for the fish—which is another requisite, and the fish will be healthier and live longer than in a glass globe with small neck and orifice Another and very important factor in the aquarium is sand and small pebbles These should be washed clean of all soil before placing in the aquarium About 2 inches over the bottom is sufficient The plants should be planted before filling the aquarium with water Figs 285-287 show useful window aquaria

An aquarium, to be in a healthy condition, should contain living plants—oxygenators—which are as necessary as food, as fish must have good air. The aquarium must be kept clean The sediment should be removed from the bottom with a dip tube twice a week, and the inner side of the glass cleaned with a wiper once a week Encourage the growth of the plants at all seasons; admit plenty of light, but no direct sunshine There should also be a few tadpoles and snails in the aquarium These are very essential, as they are scavengers, and devour the confervoid growth that frequently accumulates on the plants In fall, give a thorough cleaning and rearrangement of the aquarium, so that all are in the best condition possible before winter sets in In March it should be carefully looked over, and undesirable plants removed or transplanted Additions may be made or any change if necessary.



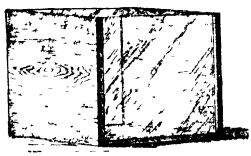
285 A museum-jar aquarium.

Following are some of the best plants to place in the aquarium, all of which can be easily and cheaply procured from dealers who make a specialty of aquatics *Cabomba caroliniana* (commonly called Washington-grass or fish-grass) is one of the very best oxygenators and a most desirable plant for the aquarium and can usually be had in quantity at any season, except late in winter It is usually sold in bunches but after winter sets in, bunches of cabomba will not remain long in a healthy condition in the aquarium without care and attention Plants to be of benefit in the aquarium must be living, and before these bunches of grass can emit roots and be self-sustaining, the fish too often nibble and disturb them to such a degree that, instead of being serviceable to the aquarium, they are a positive injury. *Elodea*, or *Anacharis* (water pest) there are two forms of this useful plant *E canadensis* is a very rapid grower and may be found in ponds in dense masses When once established, it is a pest and hard to eradicate, but being of stem growth, it is not so readily grown in the aquarium The giant form is a very desirable and valuable plant and can be used to good advantage, making a very interesting as well as a valuable plant in the aquarium *Myriophyllum spicatum* somewhat resembles the cabomba, but is of a darker color and stronger in growth and texture It is a hardy plant and will withstand the winters in the neighborhood of Philadelphia When cabomba is unattainable, this may be had in good condition It is also an excellent plant to use for fish spawn during the breeding season This must not be confused with the *Myriophyllum proserpinacoides*, commonly called parrot's feather, as the latter is useless as an aquarium plant *Sagittaria natans* is a very pretty strap-leaf variety of sagittaria and useful for a small aquarium But *S sinensis*, the giant form, is the best of all sagittarias for the aquarium, and is indispensable When planted in the aquarium and allowed to get well rooted before the fish are introduced, it can be relied upon to maintain the aquarium



286. A rectangular glass aquarium

in a healthy condition for several months *Vallisneria spiralis* (eel-grass, tape-grass, wild celery) is a native plant inhabiting streams and rivers, and often used in the aquarium Its long, narrow, strap-like blades or leaves are more flexible than the sagittaria and the tips float on the surface of the water They are light green in color and of softer texture It is a difficult plant to carry over winter, its natural propensity being to die down in winter, just the season when it is wanted in evidence in the aquarium. *Ludwigia Mulertii* is one of the most conspicuous, ornamental and useful plants for the aquarium and is always in great demand It is much larger and a stronger grower than *L palustris* of the middle and northern states It is a native of the southern states, whence come our supplies in winter in small quantities and for high prices, the plants very unsatisfactory at best The difficulty is that plants, or rather sprays, plucked from growing plants and shipped North, receive a violent check in the change of temperature and the closely confined condition of the packing-case The result often is that the plants or sprays lose a great part of their foliage, and when afterward subjected to cold running water are completely ruined The only safe way is to secure stock during the summer or early fall, getting plants established in pots before preparing the aquarium for winter In this condition, the plants will hold their own and winter over, but to attempt to grow southern stock in winter in our northern states is futile There are a few other submerged plants that might be used, but the above-mentioned are the best and the best oxygenators for large or small aquariums Floating plants should be used sparingly in the aquarium, an open, clean surface being most desirable and even necessary for air Moreover, the majority of the floating plants are suitable only for summer culture Another reason why surface or floating plants do not succeed in a house aquarium is that the water is deficient of plant-food suitable for such plants Plants that die in an aquarium would, if transferred to a tub containing a quantity of soil, as well as water, make rapid and healthy growth *Limnocharis Humboldtii* (water poppy) is a plant often used in the aquarium It is necessary to plant this in the sand in the same manner as other aquatic plants, although the leaves are floating, similar to the leaves of a pond-lily *Eichhornia crassipes major* (water hyacinth) is a very desirable plant for catching the fish spawn, but under ordinary conditions lasts but a few days in the aquarium Miniature plants of these are very pretty, and fish are very fond of nibbling at the roots to the detriment of the plants These, with many other plants, are best adapted for the summer aquaria where they can enjoy the benefit of sunlight and open air



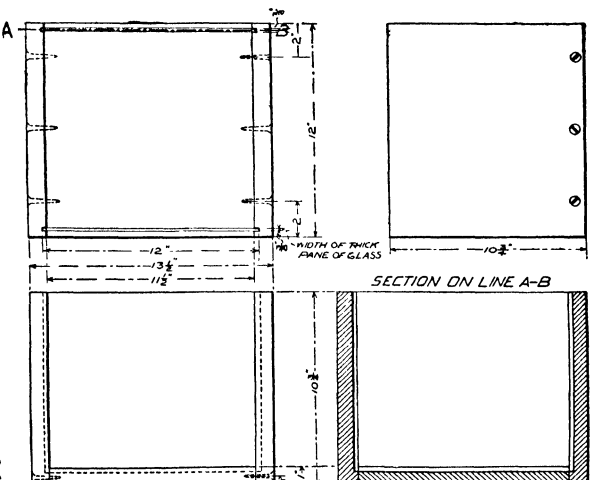
287 Permanent aquarium made of wood and glass

Numerous free-floating plants are adapted to the aquarium, but too many must not be in evidence, or the fish may become suffocated The azollas are very pretty, and the fish will occasionally eat the plants The salvinia is another small plant often seen in the aquarium, but under favorable conditions it grows very rapidly, and forms a complete mat, which must be avoided The European and American frog's-bits (*Lamnobium Spongia, Hydrocharis Morsus-ranæ*) are very attractive plants, their long, silky roots reaching down in the water

In summer the plants and fish should be placed out-of-doors in a fountain basin, pool, or a tub sunken in the ground in a partially shaded place, and a fresh aquarium should be stocked in the fall

Aquariums are rapidly increasing in popularity for home use, and are of great service in nature-study. A permanent aquarium need not be an expensive affair The rectangular ones are best if large fishes are to be kept, but they are not essential A simple home-made aquarium of glass and wood (Fig 287) is described in Jackman's "Nature Study," as follows (the dimensions being slightly altered) "Use an inch board 11½ inches wide and 12 inches long for the bottom, and two boards of the same thickness and length, 10¾ inches high, for the ends Three-eighths of an inch from the edge on either side, with a saw, make a groove ¼inch deep and wide enough to receive loosely double-strength glass Groove the end boards and fasten them to the bottom with screws, so that the grooves will exactly match Partially fill the grooves with soft putty, or, better, aquarium cement, and press into each side a pane of glass By making the bottom board 11½ inches long, an ordinary 10 x 12 window pane will be the proper size When the glass is pressed to the bottom of the groove, draw the two ends in at the top until the glass is held firmly and then fasten them in place by narrow strips of wood, one on each side of the tank, placed on top of the glass and screwed to the end pieces These strips also protect the hands from injury while working with the specimens in the aquarium Before filling with water, the inner surface of the bottom and ends should be well rubbed with oil or paraffin and the grooves inside the glass well packed with putty " After the box is made it would be well to let it stand in water for a day or two The wooden sides will swell and tighten the joints, and leakage will be less probable.

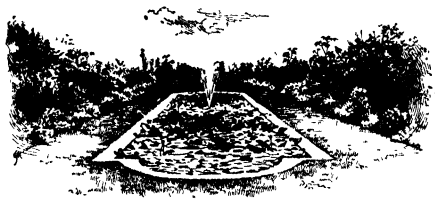
WILLIAM TRICKER.



288 Working drawings for making box shown in Fig 287

AQUATICS. A term applied to plants suited to cultivation only in water, particularly to those grown in ponds and tanks.

North America is the most highly favored country in the world for the cultivation of aquatic plants. Collections can easily be made to furnish a display of flowers from April to October in the open without artificial heat. There are numerous aquatic plants other than nympheas, nelumbiums and victorias. Some very desirable plants are *Acorus japonica variegata* (variegated sweet flag), *Aponogeton distachyus* (Cape pond-



289. Lawn pond of aquatics, with mason-work margin.

weed, or water hawthorn), *Caltha palustris* and *C. palustris fl. pl.* (marsh marigolds), *Cyperus Papyrus* (Egyptian paper plant), himnanthemums in variety. Some of the bog or marsh plants may be used in margins, as many varieties of sagittaria, not omitting the common cat-tail, *Typha latifolia*, the hibiscus of mammoth proportion, and the beautiful new hybrids with gorgeous flowers of all shades from pink to scarlet and crimson See *Bog-gardening* Figs. 289 and 290 show formal and informal lawn ponds.

Soil —All aquatics require a rich soil, and this without limit, a depth of water from 1 to 3 feet, and ample space to spread their succulent leaves. In a natural pond, in which there is an accumulation of humus overlaying a clayey subsoil, nothing more is wanted, but on a sandy or gravelly bottom it is necessary to place a layer of rich earth 12 to 18 inches deep In artificial ponds, built of masonry (Fig 289), a layer of rich soil is necessary if the things are to be planted out, as is best for nelumbiums. The soil best suited for aquatics is a turfy loam, inclining to heavy, and thoroughly rotted cow-manure, two parts of the former to one of the latter, and, when possible, it should be composted some time before using, and turned over two or three times to thoroughly incorporate the manure When cow-manure can not be obtained, other thoroughly rotted manure may be used The next best fertilizer is pulverized sheep-manure, but this, being less bulky and stronger in proportion, should not be used so freely as other manures; one part sheep-manure to nine of soil is sufficient. Chemical manures, ground bone, horn shavings, and the like should not be used unless in extreme cases, and then very cautiously. Tankage may be used to good advantage It contains dried blood, and ground bone It is very desirable for permanent beds or soils that may continue two or more seasons without renewing. The bone is not readily dissolved and has a lasting quality. Blood, being soluble, has immediate effect and is a valuable fertilizer, if used sparingly

Depth of water.—In natural ponds, water-lilies are found growing in water from a few inches to 4 and 6 feet deep, but in artificial ponds a depth of 12 to 18 inches will be found sufficient for most nympheas, and 18 to 24 inches is a good depth for victorias In constructing an artificial pond, a depth of 2 to 2½ feet is ample. Water to the depth of 12 inches above the crowns of the plants is sufficient, and a box containing the soil may be 12 inches deep Thus a pond 2 feet in depth is deep enough, and will allow a man, with hip boots on, to walk between the plants with ease. For a small pond, less than 12 feet over, a plank laid across will suffice for all operations.

Protection —Where severe frosts are prevalent in winter, and ice 12 to 18 inches in thickness is found, there will be danger of the roots freezing. In such cases, an additional depth of 6 inches will be a great advantage, and a protection of bracken, salt hay, green manure, leaves, or any other non-conducting materials should be used to protect the masonry, in severe weather, against expansion and breakage. To protect tubs, small pools or ponds, cover with boards and pile on dry leaves to the depth of 8 or 12 inches, then salt hay or fresh stable-manure to keep the leaves from blowing away This is one of the best means of protection against freezing. The general use of concrete work instead of brick and stone is to be commended. Reinforcement makes the walls frost-proof and water-proof

Planting —All hardy nympheas may be planted any time between the 1st of April and the 1st of September. Those planted early, other things being equal, will give good results the same season, while those planted late will get well established before winter, and will be in excellent condition to start at nature's summons early the following spring The hardy nympheas differ considerably as to rootstocks. Those of the native species are long and of a spongy, soft texture, and rambling in growth, while the European species have a much larger and very firm rootstock, and grow more compact. In planting, all that is necessary is to press the rootstock firmly into the soil, and if there is any danger of the root rising to the surface, place a brick or any weight upon it, to keep it in position until anchored by its own roots Tender nympheas should not be planted until the latter end of May or beginning of June, according to location They should not be planted out before coleus, alternanthera, and other tender bedding plants They require to be started indoors, and will be grown in pots, which are much handier to plant than roots of the hardy varieties, and can be planted under the water with ease and facility Nelumbiums should not be planted until about the 1st of May. Southward the season is earlier. The existing conditions should be such that tubers shall start at once into active growth.



290 A lawn pond.

They should be already "started" before setting out. The tubers should be laid horizontally in a slightly excavated trench and covered with 2 or 3 inches of soil, using a weight, if necessary, to keep the tubers in position Plants established in pots or pans are very convenient for planting, and may be purchased when tubers can no longer be procured, and can be planted a month later in the season with good results.

The *Victoria regia* has always been an aristocrat among water-lilies, and few cultivators could indulge in such a horticultural luxury To grow it satisfactorily, a large surface space with a greater depth of water is necessary than for other aquatics, and a higher temperature is needed at the early stages. It can be cultivated in the open air, but artificial heat must usually be applied and protection afforded, so as to maintain a temperature of 85° F In 1898 the introducer of *V. Trickeri* brought the Victoria within easy reach and culture of all lovers of aquatic plants. *V Trickeri* is entirely distinct from other known varieties and can be grown in the open alongside of *Nymphæa zanzibarensis* and *N. devoniensis*, and under precisely the same conditions. When planted out about the middle of June, the plants grow rapidly, and will develop their gigantic leafage and magnificent flowers in August, and continue to do so until destroyed by frost *V. Trickeri* is none other than *V Cruziana*, which was never introduced into cultivation until 1898 All that existed outside of its native haunts, on the Parana River, South America, was an herbarium specimen of part of a leaf. It is now generally and extensively grown throughout the United States and in Europe where aquatics are cultivated

Enemies.—Aquatics, like other plants, have their enemies in the way of insect pests, although in a less degree than most plants Aphides are sometimes troublesome, or at least very unsightly These, however, have their enemies, especially the coccinella (lady-bird), insectivorous birds, and so on When these do not keep them down, a weak application of kerosene emulsion will make a clearance Another method of getting rid of these pests, especially in a small artificial pond, where an overflow is (or should be) provided, is to take the hose with a spray, using a little force, and drive the insects off the plants, and, as they readily float on the water, the action with the hose will drive them out at the overflow pipe Recently an insect pest that has its home in Florida has migrated northward, causing some annoyance The larva of the moth *Hydrocampa proprialis* eats the leaf, and also cuts out pieces of the same, which it uses for protection, thereby greatly disfiguring the plant, and at the same time making it difficult to get at the enemy. The best remedy for this and the nelumbium moth, which is very much like it, is a lamp trap Any ordinary lamp placed near the plants at night, and standing in a shallow vessel containing kerosene, will attract the insects, which, on striking the lamp, fall into the kerosene and are no further trouble. For other insects, such as leaf-miners and those which eat the leaves of plants, the best remedy is arsenate of lead. Muskrats are more or less troublesome, especially where nelumbiums are grown. They will eat the tubers in winter and early spring, and will make sad havoc with banks. They will also eat the roots of some nymphæas The best remedy for these is the steel trap A sporodic disease has also made its appearance. The leaves are affected with spots, which, under a damp, warm atmosphere, spread rapidly Such climatic conditions, followed by bright sunshine, cause the affected leaves to shrivel up. This greatly weakens and checks the plants This disease yields readily to a weak solution of bordeaux mixture The same remedy is also very valuable in ridding the pond of all confervoid growth

Tub culture should be resorted to only from lack of space, or when no other method can be adopted (Fig. 291). For this system of culture, nymphæas should be chosen that are moderate growers, yet free-flowering, and other miscellaneous aquatic plants The tubs should hold from 4 to 12 cubic feet of soil for nymphæas, according to the variety, some being moderate growers, others vigorous and robust The tubs may remain above ground or sunken If sunken during the warm weather, the roots are kept cooler, and this is desirable, especially if hardy kinds are grown. A great improvement over tubs is a concrete pool 4 or 5 feet in diameter made in the shape of a tub, and 2 feet deep A circular form 4 or more feet in diameter should be made and the ground then excavated 8 inches larger than the form This will allow a wall of concrete 4 inches thick. Wire netting should be used for reenforcing, arranged so as to be in the middle of the wall. Use a mixture of sand,



291 Tub of water-lilies.

gravel or cinders in the following proportion two bags of Portland cement, three wheelbarrows of sand, five wheelbarrows of gravel or finely broken stone or cinders and limonde equal to one-fourth of cement This must be thoroughly mixed before using After the second day, remove the form and lay the bottom with the same material 4 to 6 inches thick This will make a strong, durable, water-tight pool and at a very moderate cost

WILLIAM TRICKER

[The standard book on the American culture of aquatics is "The Water Garden," by Wm Tricker, N. Y., 1897, pp 120, to which the reader is referred for extensive cultural directions and for lists of aquatic plants For botanical descriptions of the various kinds of aquatics, with brief, special cultural directions, the reader may consult the articles in this Cyclopedia, under the various genera, as *Nelumbium*, *Nymphæa*, and *Victoria*.—L. H B]

AQUILÈGIA (from *aquilegus*, water-drawer, not from *aquila*, eagle). *Ranunculàceæ* COLUMBINE Hardy perennial herbs of the northern hemisphere, grown for their profusion of showy flowers in early summer, and the delicate foliage later on in the year. See page 3565

Mostly with paniculate branches, terminated by showy fls , and 1–3 ternately-compound lvs , commonly glaucous the lfts roundish and obtusely lobed. fls large, showy, usually in spring or early summer, sepals 5, regular, petaloid, petals concave, produced backward between the sepals, forming a hollow spur, stamens numerous· fr of about 5 many-seeded follicles — About 30 distinct species. J. G Baker, A Synopsis of the Aquilegia, in G C II 10:19, 76, 111, 203 (1878)

The columbines are among the most beautiful and popular of all hardy plants. The tall and strong-growing

species can be used to advantage in half-shady positions The attractive forms and rich variations in hue of aquilegias come out well when associated with hemerocallis, Siberian irises, thalictrums, polygonatums, *Spiræa Filipendula* and wild ferns In the North, a similar effect is produced by grouping columbines together with white and blue *Lupinus polyphyllus*, *Campanula persicifolia*, *Iris germanica* and *I pallida* var *dalmatica*, Iceland poppies and trollius. For rockeries, the low-growing early alpine species, such as *A alpina*, *A. Stuartii* and *A flabellata* are well adapted Throughout the middle and northern states, columbines need winter protection, dry leaves being preferable for covering

Seeds sown in pans, in coldframes in March, or open air in April, occasionally bloom the first season, but generally the second The different species should be some distance apart, if possible, if pure seed is desired, as the most diverse species hybridize directly They may be propagated by division of the roots in late fall, winter or early spring, but the better way is by seeds. Absolutely pure seed is hard to obtain except from the plants in the wild state, and some of the mixed forms are quite inferior to the true species from which they have come *A cærulea*, *A. glandulosa*, and *A vulgaris* are likely to flower only two or three years, and should be treated as biennials; but *A vulgaris* may be kept active for a longer period by transplanting

A light sandy soil, moist, with good drainage, sheltered, but exposed to sun, is what aquilegias prefer Some of the stronger species, when of nearly full flowering size, may be transplanted into heavier garden soil, even heavy clay, and made to succeed; but for the rearing of young seedlings, a light, sandy loam is essential The seed of most columbines is rather slow in germinating, and it is necessary to keep the soil moist on top of the ground until the young plants are up A coldframe, with medium heavy cotton covering, is a good place to grow the plants The cotton retains sufficient moisture to keep the soil moist on top, and still admits sufficient circulation of air to prevent damping-off of the young seedlings When large enough, the seedlings may be pricked out into another frame for a time, or, by shading for a few days until they get a start, they may be set into the permanent border, or wherever they are to be placed. (F. H. Horsford.)

INDEX.

alba, 9, 15, 16
alba-plena, 13.
alpina, 16
atrata, 9
atropurpurea, 4, 6.
atromolacea, 9.
aurea, 13
bicolor, 10.
blanda, 9
Buergeriana, 6
cærulea, 5, 15
californica, 11
canadensis, 5, 11, 13
caryophylloides, 19
chrysantha, 13.
flabellata, 7
flavescens, 5, 13
flavi flora, 5
flore-alba, 7.
flore-pleno, 9, 10, 11, 12, 15
foliis-aureis, 9
formosa, 11
Garnieriana, 10
glandulosa, 17
grandiflora, 13
Helenæ, 15
hybrida, 9, 11, 15.
Jæschkani, 13
Jonesii, 1
jucunda, 17
lactiflora, 3
leptoceras, 8, 13, 15
longissima, 14
lutea, 15
macrantha, 15
nana, 5, 13.
nana-alba, 7, 11.
nivea, 9
olympica, 9
oxysepala, 2
rubra-pleno, 11.
sibirica, 10
Skinneri, 12, 13.
speciosa, 10
spectabilis, 10
stellata, 9
Stuartii, 18
superba, 11, 16.
truncata, 11
Vervæneana, 9.
viridiflora, 4
vulgaris, 9
Wittmanniana, 9

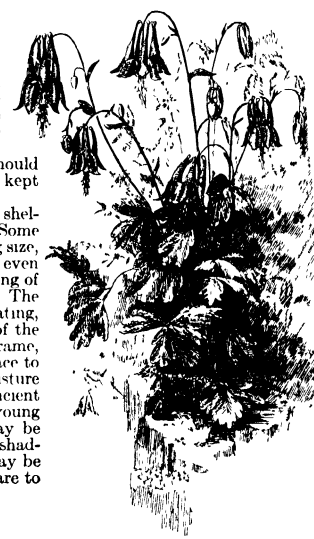
A *Sepals not more than ½ or ¾in long: expanded fls. 1 or 1½ in diam.*

B. *Lamb of petal shorter than the sepal.*

1. Jonesii, Parry. True st very short or almost wanting, soft-pubescent: tufted root-lvs 1–2 in high from the stout, ascending branches of the rootstock, biternately divided; partial-petioles very short or none, lfts very crowded· fls blue, sepals oblong-obtuse, equaling the spurs, and twice the length of the petal-limbs and head of stamens follicles glabrous, large, nearly 1 in. long; styles half as long, peduncles lengthening to about 3 in. in fr July Wyoming and Montana G F 9:365.

2 **oxysèpala,** Traut & Mey Plant 2½ ft, slightly pubescent above radical lvs long-petioled, secondary divisions sessile sepals blue, ovate-lanceolate, much exceeding in length the petal-limbs, which are 6 lines long, white, rounded-truncate; stamens not protruding beyond the petal-limb, spur knobbed, bent inward, shorter than petal-limb follicles pubescent, with styles their own length June Siberia —Said to be one of the first to bloom, and one of the most attractive in the list It is one of the most dwarfed; fls large blue, yellow and white, it comes so much before the others that its pistils, as a rule, all fertilize before any of the other species come into flower" Only recently intro to cult

3 **lactiflòra,** Kar. & Kir St 1½ ft high, glabrous in the lower part: partial-petioles of root-lvs 1½–2 in. long, lfts sessile or short-stalked, 1 in long, many lobes reaching half way down; st-lvs petioled and compound fls about 3 to a st, sepals nearly white or tinged with blue, over ½in long, narrow, petal-limb half as long as sepal, spur ½in, slender, nearly straight, not knobbed at tip; stamens equal in length to the limb June Altai Mts, Siberia —A desirable species, but not much planted



292 Aquilegia canadensis.

BB. *Lamb of petal about equal to sepal*

4 **viridiflòra,** Pallas St 1–1½ ft high, finely pubescent throughout, several-fld the partial-petioles of root-lvs 1–2 in long, lfts sessile or the end one shortly stalked, lobes rather narrow and deep, lower st-lvs petioled, biternate sepals oblong, obtuse, ascending, greenish, equaling the broad, greenish petal-limb, but not reaching the head of stamens, spur straight, slender, ½in long, not knobbed pubescent follicles as short as their styles Summer E. Siberia —Not so much used as the following variety:

Var **atropurpùrea,** Vilm (*A atropurpùrea*, Willd). Limbs of the petals deep blue or lilac-purple, and the sepals and spur somewhat tinged with the same hue. B R 922

5 **canadènsis,** Linn Common Columbine of Amer. Figs 292, 293 Height 1–2 ft primary divisions of petioles of root-lvs 1–2 in, having 3 divisions, 2 or 3 of the st-lvs petioled, biternate· fls several to a st; sepals yellowish or tinted on the back with red, about ½in long, not reflexing, limb of petals a little shorter, yellowish, truncate, spur ¾in long, nearly straight, knobbed at the end, bright red throughout, stamens much protruding follicles ¾in long, with styles half as long May–July Stony banks, east of Rocky Mountains Introduced 1690 B M. 246 L B C. 5: 888 Mn. 5 21 R H 1896, p. 109 F W 1878·33.— There are some beautiful hybrids of this and the blue

species. Var. **nàna,** Hort. Plant 1 ft high or less· fls. like the type.

Var. **flavéscens,** Hook. A pale-lvd yellow-fld. variety Very pretty Intro. 1889. This has often been called *A. flavescens,* Wats., *A. cærulea* var *flavescens,* Lawson; *A. flaviflora,* Tenney, *A. canadensis* var *flaviflora,* Brit. B M 6552 B.



293. Radical leaves of Aquilegia canadensis.

6 **Buergeriàna,** Sieb & Zucc (*A atropurpùrea,* Miq) More slender than *A vulgaris,* 1 ft high, finely pubescent toward the top, branched to form several heads, bearing 2–3-petioled, biternate lvs, partial-petioles of basal lvs ½–1 in long, with 3 sessile divisions fls yellow, tinted with purple, 1–1½ in diam, sepals ¾in. long, acute, spreading, spurs erect, nearly straight, as long as the limb of petals, and about equaling the sepal, head of stamens equal to limb in length follicles pubescent, ¾in. long, style half as long. Early. Japan —Brought from St Petersburg, 1892.

AA. *Sepals about 1 in. long expanded fl about 2 in. diam*

B *Spurs shorter than the petal-limb, and incurved*

7 **flabellàta,** Sieb. & Zucc St 1–1½ ft, few-fld partial-petioles of root-lvs 1 in or more, lfts nearly sessile; st-lvs large and petioled fls bright lilac, or pale purple or white, sepals 1 in long, obtuse, limb of petal half as long, often white in the lilac-fld form, spur shorter than the limb, slender toward the end, much incurved, stamens not protruding beyond the petal-limbs follicles glabrous Summer Japan R H 1896, p 109 Var **nàna-álba,** Hort (var *flòre-álba,* Hort) Fls pure white plant dwarfish R B 15.157 B.M 8354 (var *nivea*)

BB *Spurs at least as long as petal-limb.*

C *Stamens short, not much protruding*

8 **leptocèras,** Fisch & Mey St several-fld, about 1 ft high partial-petioles of root-lvs over 1 in, lfts sessile, st-lvs petioled biternate fls violet, with the tips of the sepals greenish, and tips of the short petal-limb yellow, spur slender, slightly curved, ½in long, not knobbed, stamens protruding a little beyond the limbs of petals follicles slender, glabrous, nearly 1 in long. Summer E Siberia B R. 33 64. F S 3 296 — Little used in Amer

9 **vulgàris,** Linn (*A stellàta,* Hort *A atràta,* Koch) Common Columbine of Eu Sts 1½–2 ft high, many-fld, finely pubescent throughout root-lvs with 3 partial-petioles 1½–2 in. long, secondary branches certain, ultimate lf-lobes shallow and roundish, texture firm, lower st-lvs petioled and biternate fls violet, furnished with a claw, acute, 1 in long, half as wide, petal-limb ¾in long, equaling the head of stamens, spur about same length, stout, much incurved, knobbed follicles densely pubescent, 1 in long, style half as long Summer. Eu, Siberia, and naturalized in Amer Gn 12, p 288, 70, p 16 (as *A stellata*) G W 3, p 229 Var **flòre-plèno,** Hort Fls much doubled, ranging from pure white to deep blue Here belong many horticultural varieties with personal names. Var **Verværeàna,** Hort. (var. *fòlus-aùreis,* Hort Var. *atrovolàcea,* Hort) Lvs with yellow variegated lines.

Var **nívea,** Baumg (var *álba,* Hort) Munstead's White Columbine Often 2–3 ft high a great profusion of large, pure white fls for several weeks in early spring Var **nívea grandiflòra,** Hort, is much like this

Var **olýmpica,** Baker (*A olýmpica,* Boiss *A Witt mannidna,* Hort *A blánda,* Lem). A fine variety, with several large fls, sepals light lilac or bright purple, 1 in or more in length, petal-limb white. I H 4 146 R H 1896, p 108

Var **hýbrida,** Sims Much like the last variety, but with stout, lilac-purple spurs as long as the sepals, only slightly incurved —Probably a hybrid of *A vulgaris* and *A canadensis* B M 1221.

10 **sibírica,** Lam (*A bícolor,* Ehrh *A. Garnerìana,* Sweet *A speciòsa,* DC) St 1½–2 ft high, many-fld, often nearly glabrous throughout partial-petioles of root-lvs 1–2 in, sometimes showing 3 distinct branches, terminal lfts 1 in or more broad, lobes rather shallow and rounded, lower st-lvs petioled and biternate fls pale or bright lilac-blue, oblong sepals fully 1 in long, spreading or reflexed a little, petal-limb half as long, equaling the head of stamens, and often white, spur rather stout, ½in or more, very much incurved, or even coiled follicles glabrous, 1 in long, style ¼in Summer E Siberia S B F G II 1 90 Var **flòre-plèno,** Hort (*A bícolor* var *flòre-plèno,* Hort) Fls much doubled by the multiplication of both the limbs and the spurs

Var **spectábilis,** Baker (*A spectábilis,* Lem) A large, bright lilac-fld var, petal-limbs tipped yellow. Amurland I H 11.403

CC *Stamens long, protruding far beyond the petal-limb.*

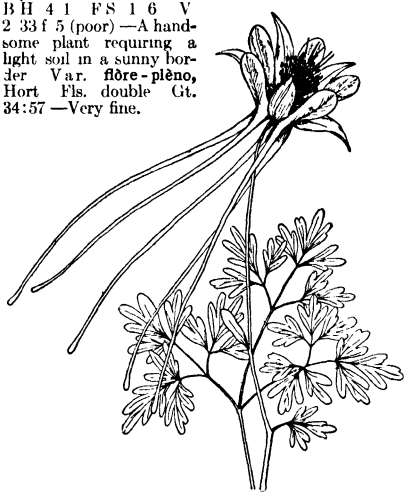
11 **formòsa,** Tesch (*A canadénsis* var *formòsa,* Wats) Habit as in *A canadensis* root-lvs and st-lvs like that species, but fls brick-red and yellow, or wholly yellow, and sepals larger, quite twice as long as petal-limb, spurs more spreading, somewhat more slender, and often shorter May–Aug Sitka to Calif, and east to the Rockies Intro 1881 B M 6552 F S 8 795 Gt 32 372 R H 1896, p 108 G C 1854 836. Var **hýbrida,** Hort. (*A californica* var. *hybrida,* Hort *A supérba,* Hort) Fls. large, with scarlet sepals and yellow petals, spurs spreading, long and slender. —A supposed hybrid with *A chrysantha* F M 1877. 278 V. 2 33 f 2 Var **rùbra-plèno,** Hort (var. *flòre-plèno,* Hort). Fls as in var *hybrida,* but several whorls of petal-limbs Var. **nàna-álba,** Hort Fls. pale, often nearly white plant not exceeding 1 ft



294. Aquilegia chrysantha. (×⅓)

Var **truncàta,** Baker (*A truncàta,* Fisch *A californica,* Lindl) Fls with short, thick spurs and very small sepals and a small petal-limb. Intro 1881 F S. 12: 1188 (as *A eximia,* Hort)

12 **Skinneri,** Hook St 1–2 ft high, many-fld, glabrous root-lvs long-petioled, with both primary and secondary divisions long, lfts cordate, 3-parted, several st-lvs petioled and biternate sepals green, keeled, lanceolate, acute, never much spreading, ¾–1 in long; petal-limb greenish orange, half as long as sepal, spur bright red, tapering rapidly, over 1 in long, stamens protruding far beyond the limb, styles 3 fr, at least when young, bearing broad, membranous, curled wings After flowering, the peduncles become erect July–Sept Mts of New Mex B.M. 3919 P M 10 199. B H 4 1 F S 1 6 V 2 33 f 5 (poor) —A handsome plant requiring a light soil in a sunny border Var. **flòre-plèno,** Hort Fls. double Gt. 34:57 —Very fine.



295 Aquilegia longissima. (×½)

BBB. *Spurs very long, several times the length of petal-limb*

13. **chrysántha,** Gray (*A leptocèras* var. *chrysántha,* Hook) Fig 294 Height 3–4 ft root-lvs with twice 3-branched petioles, lfts biternate, st-lvs several, petioled fls many on the plant, 2-3 in across, sepals pale yellow, tinted claret, spreading horizontally, petal-limb deep yellow, shorter than the sepals, and nearly as long as the head of stamens, spur rather straight, very slender, divergent, about 2 in long, descending when fl is mature follicles glabrous, 1 in long, style half as long May–Aug New Mex and Ariz Gn 16 264, 51, p 385 B M 6073 R H 1896, p 108 F R. 2 169 Gt 33 84 G C 1873.1501 F M 1873 88 V 2 33 f 3 F S 20 2108 H F 4 120 H U. 3, p 324 Var **flavéscens,** Hort (*A aùrea,* Junk *A canadénsis* var *aùrea,* Roezl) Fls yellow, tinged with red, spurs incurved, and shorter than in the type Gt 21 734 Var **álba-plèna,** Hort (var *grandiflòra álba,* Hort) Fls very pale yellow or nearly white, with two or more whorls of petal-limbs Intro 1889 V. 12:311 G W 8, p 375 Var **nàna,** Hort (*A leptocèras* var *lùtea,* Hort) Like the type, but plant always small, not exceeding 1½ ft Var **Jæschkanii,** Hort About the same height as last· fls large, yellow, with red spurs —Thought to be a hybrid of *A chrysantha* × *Skinneri,* hence sometimes called *A Skinneri* var. *hybrida,* Hort

14 **longíssima,** Gray Fig 295 Tall, somewhat pubescent with silky hairs, or smoothish root-lvs biternate, even in the petioles, lfts deeply lobed and cut, green above, glaucous beneath, st-lvs similar, petioled. fls pale yellow, sepals lanceolate, broadly spreading, 1 in. or more, the spatulate petals a little shorter, about equaling the head of stamens; spur with a narrow orifice, 4 in long or more, always hanging. Distinguished from *A chrysantha* by its longer spur with contracted orifice, by the narrow petals, and by the late season of flowering. Late July to Oct. 1. Ravines S W Texas into Mex G F 1.31 (adapted in Fig 295).—The seed must be obtained from wild plants, as those cult usually fail to produce seed, hence not much used

AAA *Sepals 1¼–1½ or even 2 in. long· expanded fls. 2½–3 in diam, stamens not protruding.*

B *Spurs long and not incurved*

15 **cærùlea,** James (*A leptocèras,* Nutt. *A. macrántha,* Hook & Arn) St 1–1½ ft, finely pubescent above, bearing several fls lower st-lvs large and biternate, basal-lvs with long 3-branched petioles, lfts 3-lobed on secondary stalks fls 2 in across, whitish, but variously tinted with light blue and yellow, sepals often blue, oblong, obtuse, twice as long as the petal-limb, spurs long, slender, knobbed at the end, rather straight, but curving outward, head of stamens equaling the petals follicles pubescent, 1 in long, style ½in Apr–July Lower mt regions, Mont to New Mex B M. 4407, 5477 Gn 16 264 Mn 6 61 V 2 33 f 4 F S 5 531 F R 10 165 Gn. 59, p 147 G 28 241 Var **álba,** Hort Fls of same size but entirely white Intro 1883 Var **hýbrida,** Hort Sepals some shade of blue or pink, or mixed, and petals nearly white or yellow, also called var **lùtea,** Hort The true form of this is probably *A cærulea* × *A. chrysantha* Gn 51, p 385 R H 1896 108 A G 15 315 I H 43 61 Var **Hélenæ,** Hort, is very probably a form of this hybrid, very robust, fls. numerous, blue and pure white G W 6 212 Var. **flòre-plèno,** Hort Fls longer and very showy, more or less doubled toward the center

BB *Spurs incurved and hardly longer than petal-limbs.*

16 **alpìna,** Linn (incl var *supérba,* Hort) Fig 296. St nearly 1 ft high, finely pubescent upwards, 2–5-fld, bearing petioled, biternate lvs partial-petioles of basal-lvs 1–2 in long, with 3 nearly sessile divisions, deeply lobed expanded fl 1½–2 in across, blue, rarely pale or white, sepals 1¼ in long, half as broad, acute; petal-limb half as long as sepals, often white, spur stout, incurved, same length as the limb, head of stamens not protruding follicles pubescent, 1 in long, style much shorter May, June Switzerland L B C 7 657 Gn 9 384 F W 1879 353 B M 8303 Var **álba,** Hort Fls pure white



296. Aquilegia alpina. (×¼)

17 **glandulòsa,** Fisch Fig 297 St 1–1½ ft high, glandular pubescent in the upper half, 1–3-fld partial-petioles of root-lvs 1–2 in long, each with 3 distinct divisions, lft-segms narrow and deep, st-lvs few, bract-like fls large, nodding, sepals bright lilac-blue, ovate, acute, about 1½ in long and half as broad, petal-limb same color, but tipped and bordered with creamy white, less than half the length of the sepals, very broad, spur very short, ¼–½in, stout, much incurved; stamens

not protruding: follicles 1 in. long, 6–10 in number, densely hairy, with short, falcate style. Allied to *A. alpina*, but a taller plant, with shorter spurs, larger fls., and a greater number of follicles May, June Altai Mts. of Siberia. B. 5.219. F.W 1871 353 Gn. 15·278; 45, p 193, 64, p 26 Gt 289 f 1—One of the handsomest



297. Aquilegia glandulosa (×⅓)

Var **jucúnda,** Fisch & Lall Fls rather smaller than in the type, petal-limb white, more truncate at the tip, stamens as long as limb B R 33 19 F S 5 535—A fine variety, with some tendency to double

18 **Stûartu,** Hort A recorded hybrid of *A glandulosa*×*A vulgaris* var *olympica* Fls very large and beautiful It very much resembles the latter in form of sepals and petals, and the former in shape of spurs and coloration May, June Intro 1891 Gn 34 344, 61, p 409 G M 54.416

19 **caryophylloìdes** is a garden name given to some very mixed forms, with a great variety of colors Special characters seem not to be well fixed

A baikalensis, Hort Fls large, violet-blue, spurs long—*A haylodgensis*, Hort , and its var *delicatissima*, Hort , are much like *A chrysantha*, and resemble it in habit and color of fls but the spurs are not so long

K C DAVIS

ÁRABIS (*Arabia*) *Cruciferæ* ROCK-CRESS Small perennial or annual herbs, with white or purple flowers, grown mostly on borders and in rockwork

Flowers mostly in terminal spikes or racemes, small but often many or appearing for a considerable period of time lvs mostly undivided siliques long, linear, flat stigma 2-lobed In temperate regions, about 100 species, several native to this country, some of them are alpine Usually prop by division, also by seeds and cuttings Hardy, requiring plenty of sun, and thriving even in poor soil The following four species are perennials

A *Fls purple or rose*

muràlis, Bertol (*A ròsea*, DC) A foot high, with a rather dense raceme of pretty fls lvs oblong, sessile (the radical ones with a long narrow base), prominently and distantly blunt-toothed, sparsely pubescent Spring and summer Italy B.M 3246.

AA. *Fls white.*

serpyllifòlia, Vill (*A nivàlis*, Guss). Tufted, 2–6 in radical lvs entire or few-toothed, the st.-lvs small and sessile, not clasping fls in a short cluster, the calyx as long as the peduncle, the limb of the petals linear-oblong and erect Eu

álbida, Stev (*A caucásica*, Willd) Fig 298 A few inches high, pubescent lower lvs narrow at the base, the upper auriculate-clasping, all angle-toothed near the top fls in a loose raceme, the calyx shorter than the pedicel, the petal-limb oval and obtuse Eu B M 2046 Gn 62, p 280; 72, p 67, 74, p 620 F E 16 611. —Blooms early, is fragrant, and is well adapted for rock-gardens and edgings, and covering steep banks

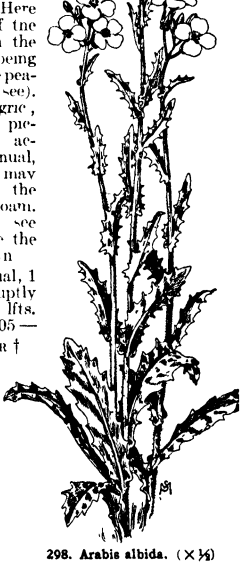
Var **flòre-plèno,** Hort. Double Gn. 65, p. 306 Var **variegàta,** Hort , has yellow-white stripes on lvs Gt 45, p 108 Var **Billardièri,** Boiss (*A Billardièri*, DC) Hoary-pubescent, slender lvs small, very obtuse, entire or with 1 or 2 teeth at base pod long, slender and spreading. fls often tinged. Eastern. Gn 63, p. 422

alpìna, Linn Fls smaller than in the last, plant only slightly pubescent and hairy lvs somewhat clasping but not auriculate, small-toothed nearly or quite the entire length, the cauline ones pointed Eu B M 226 G C III 30.239—Blooms very early, and is one of the best rock-plants Var **variegàta,** Hort Var **nàna compácta,** Hort , a dwarf form Gt 44, p 203 Var **flòre-plèno,** Hort Fls full-double, handsome Gt 51, p 211 G 26 199

A arenòsa, Scop Fls rose varying to white lvs pinnatifid, those on the st deep-toothed Lu—*A aubrietioides* Boiss Much like *A albida*, but pale pink China—*A blepharophylla*, Hook & Arn Fls large, rose-purple lvs sharp-toothed sessile or clasping, the margins hairy Calif B M 6087—*A Ferdinandi-Coburgi*, Kell & Suendern Lvs gray in rosettes, becoming green in winter fls small, yellowish Macedonia—*A lucìda*, Linn f Fls white lvs shining, obovate, clasping There is a variegated form Eu—*A mollis*, Stev Fls white lvs pubescent, large-toothed, the lower ones rounded and long-stalked Eu—*A pubèa*, Lam Fls white lvs toothed, the radical ones often parted, the st.-lvs oblong-linear Eu—*A præcox*, Waldst & Kit—*A procurrens*—*A procurrens* Waldst & Kit Fls white lvs entire, those on the st entire and sessile, the others stalked stoloniferous A variegated var Eu—*A Sturii*, Hort A compact but vigorous garden form with large clear white fls—*A turcica*, R Br Annual hairy fls large, purple lvs oblong-ovate to round-oblong, the upper ones clasping, rather coarse-toothed Eu B M 3331

L H B.

ÁRACHIS (Greek, *without a rachis*) *Leguminòsæ* PEANUT GOOBER The peanut is sometimes grown in the economic house of botanical gardens, and also as a curiosity in outdoor gardens The genus has nine species, of which eight are Brazilian Lvs abruptly pinnate fls 1–3, yellow, in a dense, axillary, sessile spike, ovary stipitate, inclosed within the tube of the calyx, the stipe at first short, subsequently elongating and carrying the immature fr beneath the ground Here develops what is one of the most anomalous frs in the whole Leguminosæ, it being wholly indehiscent,—the peanut of commerce (which see). See also Cyclo Amer Agric , Vol II, pp 514-519 for pictures and agricultural account As a hothouse annual, the seeds of the peanut may be sown in heat, and the plants potted in sandy loam. For outdoor culture, see *Peanut*, by which name the plant is commonly known



298. Arabis albida. (×⅓)

hypogæa, Linn Annual, 1 ft or less high, lvs abruptly pinnate, with 2 pairs of lfts. and no tendril Mn 7.105—Procumbent N TAYLOR †

ARACHNÁNTHE (Greek for *spider-flower*) *Orchidàceæ* Included under *Renanthera*

ARÀLIA (derivation obscure) *Araliàceæ* Ornamental herbs, shrubs or trees grown chiefly for their bold foliage

Stems often spiny lvs

alternate, deciduous, pinnate to 3-pinnate· fls. small, whitish, in umbels usually forming panicles, pedicels articulate; calyx-lobes minute, petals imbricate in bud; stamens 5, ovary 5-, rarely 2-celled, with the styles free or connate only at the base fr a berry-like drupe with 2–5 compressed stones —About 20 species in N Amer., Asia, Malay Archipelago and Austral

The aralias are large herbs, shrubs or small trees, often spiny, with large decompound foliage, small whitish flowers in umbels forming large terminal panicles and followed by small usually black berry-like fruits.

The species are hardy or nearly hardy North They prefer rich or heavy soil They are often planted as single specimens on the lawn for the bold subtropical effect of their foliage Propagation is by seeds sown in spring, which do best with slight bottom-heat, or by root-cuttings, also with bottom-heat

There are also a number of tender shrubby plants cultivated as ornamental greenhouse or stove plants, which have been provisionally referred to the genus Aralia, as their flowers and fruits are not yet known, therefore it has not been possible to determine their true botanical affinity. In the present work they are referred to other genera. They should be looked for under *Polyscias*, *Pseudopanax*, *Schefflera*, *Oreopanax*, *Panax*, *Sciadophyllum*, *Dizygotheca* Other related genera, perhaps not including any horticulturally important forms, are Heptapleurum and Monopanax.

A. *Prickly shrubs or rarely low trees lvs bipinnate, 2–3 ft long umbels numerous, in a large, broad, compound panicle styles distinct*

spinòsa, Linn ANGELICA TREE HERCULES' CLUB. DEVIL'S WALKING-STICK. Sts very prickly, 40 ft. high lvs 1½–2½ ft long, usually prickly above; lfts. ovate, serrate, 2-3½ in. long, glaucous and nearly glabrous beneath, mostly distinctly petioled, veins curving upward before the margin Aug Southern states north to Tenn S S. 5 211. Gn 50, p 126 —The stout, armed sts, the large lvs, and the enormous clusters of fls give this species a very distinct subtropical appearance Not quite hardy N Bark possesses medicinal properties.



299. Aralia chinensis.

chinénsis, Linn (*A japónica,* Hort *A mandshùrica,* Hort *Dimorphánthus elàtus,* Miq. *A spinòsa* var. *canéscens,* Franch. & Savat.) CHINESE ANGELICA TREE Fig 299 Sts less prickly, 10 ft lvs 2–4 ft long, usually without prickles; lfts ovate or broad ovate, coarsely serrate or dentate, usually pubescent beneath, nearly sessile, 3½–6 in long, veins dividing before reaching the margin and ending in the points of the teeth. Aug., Sept. China, Japan M D G 1897:461. Gn. 1, p. 561. G.W. 5 509 —In general appearance very much like the former species, but considerably hardier Grows well also in somewhat dry, rocky or clayey soil Var **glabréscens,** Schneid. (*A. spinòsa* var *glabréscens,* Franch & Savat *A. spinòsa* var. *canéscens,* Sarg *A. canéscens,* Sieb & Zucc.) Lvs. often prickly above, lfts glabrous beneath, except on the veins, dark green above More tender Var **mandshùrica,** Rehd (*Dimorphánthus mandshùricus,* Maxim). St prickly lfts pubescent only on the veins beneath, more sharply and densely serrate than the foregoing variety and hardier. G.C. II. 10.592; 23:313 Var. **variegàta,** Rehd (*A japónica variegàta,* G C) Lfts. bordered with white I H. 33 609 G C. III 31 231. Gn 63, p 379 Var **aùreo-variegàta,** Rehd (*Dimorphánthus mandschùricus elegantissimus fol var.,* Hort.). Ltts variegated with yellow.

AA. *Unarmed herbs styles united at the base*

B. *Umbels numerous, in elongated puberulous panicles: 3–10 ft high.*

racemòsa, Linn SPIKENARD. Height 3–6 ft glabrous, or slightly pubescent: lvs quinately or ternately decompound, lfts cordate, roundish ovate, doubly and sharply serrate, acuminate, usually glabrous beneath, 2 6 in. long fls greenish white July, Aug E N Amer west to Minn and Mo B B 2 506 —Rootstock employed medicinally, properties similar to those of sarsaparilla.

californica, Wats Height 8–10 ft resembles the preceding lfts cordate, ovate or oblong-ovate, shortly acuminate, simply or doubly serrate panicle loose, umbels fewer, larger, and with more numerous rays Calif M D G 24:343.

cordàta, Thunb (*A edùlis,* Sieb & Zucc). Height 4–8 ft lvs ternately or quinately decompound, pinnæ sometimes with 7 lfts , lfts cordate or rounded at the base, ovate or oblong-ovate, abruptly acuminate, unequally serrate, pubescent on the veins beneath, 4–8 in long Japan. Gt 13 432 (as *A racemosa* var *sachalinensis*) R H 1896, p 55 A G 13, pp. 6, 7. Young stalks edible: see *Udo*

cachemírica, Decne (*A cashmeriàna,* Hort *A. macrophylla,* Lindl) Height 5–8 ft lvs. quinately compound, pinnæ often with 5–9 lfts ; lfts usually rounded at the base, oblong-ovate, doubly serrate, glabrous or bristly on the veins beneath, 4–8 in. long. Himalayas

BB. *Umbels several or few on slender peduncles; pedicels glabrous 1–3 ft high.*

híspida, Vent. BRISTLY SARSAPARILLA. WILD ELDER Height 1–3 ft , usually with short, woody st , bristly· lvs. bipinnate; lfts ovate or oval, rounded or narrowed at the base, acute, sharply and irregularly serrate, 1–3 in long umbels 3 or more in a loose corymb; fls. white. June, July. From Newfoundland to N C , west to Minn. and Ind. B.M. 1085. L.B C. 14:1306 —Bark diuretic, alterative.

nudicaùlis, Linn WILD SARSAPARILLA SMALL SPIKENARD. Stemless or nearly so usually 1 lf , 1 ft.

high, with 3 quinately pinnate divisions; lfts oval or ovate, rounded or narrowed at the base, acuminate, finely serrate, 2–5 in long umbels 2 or 3; fls greenish. May, June Newfoundland to N C, west to Mo B B. 2 506 —Rootstock employed medicinally; properties similar to those of sarsaparilla.

A japónica, Thunb =Fatsia japonica —*A papyrífera*, Hook = Tetrapanax papyriferum —*A pentaphýlla*, Thunb =Acanthopanax pentaphyllum —*A quinquefólia*, Decne & Planch =Panax quinquefolium —*A Sieböldii*, Hort =Fatsia japonica —*A trifólia*, Decne & Planch =Panax trifolium (See also *Ginseng*)

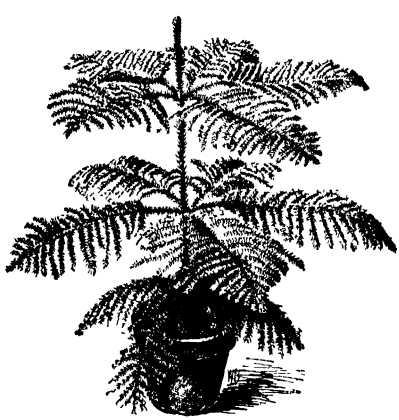
ALFRED REHDER

ARATICÚ: *Annona* and *Rollinia*

ARAUCÁRIA (Chilean name) Including *Columbea* and *Eutacta* *Pinàceæ* Large South American and Pacific Australian evergreen trees (about a dozen species), grown in their juvenile state in greenhouses and windows and often used in summer for lawn decoration, they are very decorative pot-plants

Tall erect or widely branching conical trees: lvs. small, scale-like and stiff, clothing all the branches uniformly and usually closely imbricated fls mostly dioecious, the staminate terminal and solitary or disposed in fascicles, anthers 6–8-celled, pistillate fls in ovoid or globose heads that become large woody cones with only 1 seed underneath each scale —The South American species (Columbea) have scarcely winged cone-scales, the cotyledons 2, and the germination hypogeal (cotyledons remaining below ground), the Australian and Pacific species (Eutassa) have winged scales, cotyledons 4, and germination epigeal

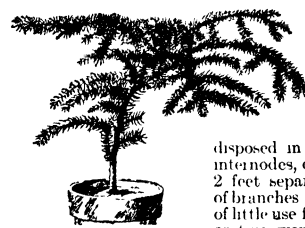
Araucarias are probably the most prized pot evergreens in cultivation They are much used in house decoration, particularly at Christmas time, as they are not only attractive but will stand much hard usage. *A excelsa* (Fig 300) is the one commonly seen in residences Propagation is by seeds and cuttings, as given under *A excelsa* below Symmetrical plants are secured from the leading shoots Side shoots are likely to make misshapen specimens, as seen in Fig. 301. The araucarias need cool treatment The temperature should not be above 60° at night If kept too crowded or not given sufficient light, they become ragged and straggling, as in Fig 302 In summer the plants should be protected from direct burning sun



300. A good specimen of Araucaria excelsa.

The species thrive in the open in southern Florida and in parts of California *A imbricata* is the hardiest It is rarely seen in greenhouses *A Bidwillii* is apparently the second hardiest, and also one of the best species for all purposes *A. excelsa* and its allies are about as hardy in southern Florida as crotons and acalyphas

The commonest species in greenhouses is *A excelsa*. It is grown on an enormous scale in many nurseries for decoration as window or table plants When raised from seed the plants grow rapidly and the branches are invariably disposed in tiers with wide internodes, often as much as 2 feet separating each tier of branches Such plants are of little use for ordinary decorative work and recourse is made to plants raised from cuttings This practice has grown up as it is found that plants raised from cuttings assume a dwarf compact habit, with the tiers of branches placed close together, and that they do not grow into large specimens until many years old The plants for stock purposes are usually raised from seed, and when they have formed some three to six tiers of branches the tops are taken out and put in as cuttings in light sandy compost in a close house or case at a temperature of about 60° F They are kept shaded from hot sun and damped over frequently until rooted The stock plants are kept growing and soon break out into new growth in the axils of each of the upper branches These are all "leaders" growths, and when long enough they each furnish a suitable cutting which is treated in the same way as the primary growth or leader After each of these has been removed for stock, the stem of the stock plant is cut off to the next tier of branches, which in turn will furnish another set of cuttings and so on until the plant is reduced to the bottom layer of branches, when it is discarded and another stock obtained again from seed It should be pointed out that the branches themselves may be rooted as cuttings, but they always retain their flat asymetrical shape and are useless for stock purposes. (See Fig 301.)



301. Unsymmetrical Araucaria excelsa, grown from a side shoot.

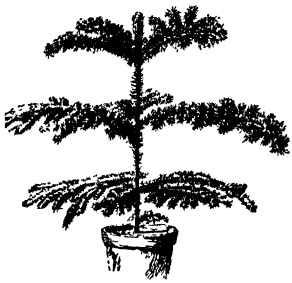
INDEX.

aurea, 3.
Balansæ, 4.
Bidwillii, 6
brazilıana, 7.
columnaris, 3.
compacta 5.
Cookii, 3.
Cunninghamii, 2
elegans, 4, 5, 7.
excelsa, 1
glauca, 1, 2, 3.
Goldieana, 5.
gracilis, 7
imbricata, 8.
platifolia, 8
polymorpha, 5.
Rudolfiana, 7
robusta, 1
Rulei, 5
virgata, 1

A. *Lvs.* (*or most of them*) *awl-like, at least at apex*

1. **excélsa**, R Br NORFOLK ISLAND PINE Figs. 300–303 Plant light green branches frondose, the lvs. curved and sharp-pointed, rather soft, ⅓–½in long, and densely placed on the horizontal or drooping branchlets Norfolk Isl F R 2 411 —The commonest species in this country, being much grown as small pot specimens A blue-green form is cult as var **glaùca**, (or *A glaùca*) It is a form in which the tips of the growths are white when young; has recently been intro. under the name of "Silver Star" It is a most beautiful plant and sure to have a great future as a market plant There is also a strong-growing, large variety, with very deep green foliage, var **robústa**, Hort Var **virgàta**, Hort, primary branches with no secondary branches, or very short ones In its native wilds *A excelsa* reaches a height of over 200 ft and a diam of even 9 or 10 ft The solid, globular cones are 4 or 5 in. diam.

F S 22: 2304–2305 —An excellent house plant, and keeps well in a cool room near a window In summer it may be used on the veranda, but must be shaded



302. Araucaria excelsa, a poor specimen because too crowded or not sufficient light.

The timber is used for ship-building

2. **Cúnninghamii,** Sweet Plants less formal and symmetrical than *A. excelsa*, the upper branches ascending and the lower horizontal lvs stiff and very sharp-pointed, straight or nearly so There is also a glaucous form (*A. glaùca*), also a weeping form. Austral, where it reaches a height of 200 ft, yielding valuable timber and resin Locally known as hoop pine, Moreton Bay pine, colonial pine, coorong, cumburtu, coonam

3 **Coóki,** R Br. (*A columnàris*, Hook) A slender columnar tree, much narrower in shape than *A. excelsa* which it closely resembles when young branches disposed as in *A excelsa*, but tree tending to shed the lower ones, branchlets crowded on the branches and turning upwards in a boat-like form young lvs. alternate and rather closely arranged on the branchlet and ¼in long, broad and slightly decurrent at base, slightly curved, mucronate, adult lvs densely imbricated, short and ovate, obtuse, cones 3–4 in. diam and somewhat longer New Caledonia, where it reaches a height of 200 ft, making very straight and imposing shafts B M 4635. A F. 12.559 —Named for Captain Cook Var **aûrea,** Hort, has golden-yellow foliage There is also a var. **glaûca,** Hort, with silvery lvs.



303. Araucaria excelsa. (×½)

4 **Balánsæ,** Brongn & Gris (*A. élegans*, Hort. Bull) A dwarf-growing species of slow growth (when grown as a pot-plant) and with few loosely arranged tiers of branches, usually 5 in a tier, branchlets distichous, narrow and deflexed with age lvs imbricated, short, stiff, ⅛in long, falcate, more or less obtuse, dark olive-green in color male cones cylindrical-conical, 2–3 in long, female cones globose or elliptic, 4 in long. New Caledonia —Rarely grown. The narrowest and most slender-branched species in cult

AA. *Lvs broader, usually plane and imbricated.*

5. **Rûlei,** Muell Fig 304. Leafy branchlets very long lvs oval-elliptic, imbricated, concave, arched towards the branch, nearly or quite obtuse, with a prominent dorsal nerve, silvery gray on the upper and rich glossy green on the lower side. Variable at different ages. When young, the branches are often drooping and the lvs. compressed and obscurely 4-angled and nearly or quite subulate, var. **polymórpha,** R.H 1866, p 350 There is also a var **compácta.** New Caledonia Reaching 50 ft. in height. R.H. 1866 390, and plate I I



304. Araucaria Rulei (×½)

22.204 A strikingly beautiful plant and somewhat rare in cult. The figure in G C 1861.868, is *A. Müelleri*, Brongn & Gris, a broader-lvd. species. Var **Goldieàna,** Hort (*A. Goldieàna*, T. Moore). A variety with narrower lvs and with branches rather more erect than the type. F. 1877.39. A var **élegans,** Hort, is described ,with smaller lvs., and close-whorled more slender branches: dwarf

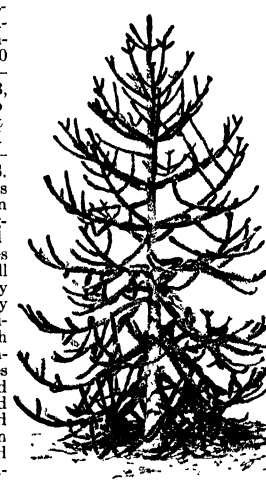
6 **Bídwillii,** Hook Fig 305 Rather narrow in growth, especially with age, the branches simple lvs. in two rows, lanceovate and very sharp-pointed, thick, firm and shining Austral., where it attains a height of 150 ft, and is known as bunya-bunya R H 1897, p 500, desc G C. III 15 465, showing the pineapple-like cone.—One of the best and handsomest species for pots



305 Araucaria Bidwillii. (×½)

7 **braziliàna,** A Rich (*A gráculs*, Hort) Branches verticillate, somewhat inclined, raised at the ends, tending to disappear below as the plant grows lvs. alternate, oblong-lanceolate, 1–2 in. long, somewhat decurrent, much attenuated and very sharp-pointed, deep glaucous green, loosely imbricated cone large and nearly globular S Brazil, reaching a height of 100 ft F S 21 2202 Var **élegans** (*A elegans*, Hort), is a form with very numerous branches and more crowded and often glaucous lvs Var **Ridolfiàna,** Gord, is a more robust form, with larger and longer lvs

8 **imbricàta,** Pav MONKEY PUZZLE Figs 306, 307 A striking tree of pyramidal habit branches generally in 5's, at first horizontal, with upward-curving (sometimes downward-curving) tips, but finally becoming much deflexed, branchlets in opposite pairs, curved upward when young, and continuing to grow until several feet long when adult lvs imbricated and persisting, even on the trunk, ovate-lanceolate, very stiff, leathery, and sharp-pointed, 2 in long on the primary st and branches, 1 in long on the branchlets, slightly concave at the base, bright green on both sides cone 6–8 in diam Western slope of the Andes in Chile, reaching a height of 100 ft F S 15 1577–1580 R H 1893, p 153; 1897, pp 271, 319, desc Gt 44 115. G.C III 21·288, 24:154 — Hardy in the S. This is the species which is grown in the open in England and Ireland The hardiest species in cult Thrives well in a heavy loamy soil in a moist valley or position sheltered from rough winds in mild climates. The branches are heavy and rather brittle and the beauty and symmetry is soon destroyed if planted in an exposed position The timber is



306 Araucaria imbricata. California.

valuable The seeds constitute the chief food of the aborigines in some sections of S Amer Var **platifólia,** Hort , is a form with very broad lvs

A albospica, Hort =A excelsa —4 *Bómbyn*, A Rich =A imbricata —4 *intermédia*, R Br Tall and erect, sparingly branched, nearly denuded of foliage lvs sessile, imbricated, cordiform, obtuse, green and shining New Caledonia —4 *Lindleyana*, Van Houtte =A brazileana —4 *montana*, Brongn & Gris Tall lvs scale-like, curved, ovate, obtusish, more or less concave, with white spots in many series New Caledonia —4 *Muelleri*, Brongn & Gris Lvs almost flat, with whitish spots in series New Caledonia —4 *Norpäschkii*, Baumann Branches wide-spreading with long drooping side branchets perhaps a form of A Rulei R B 31 p 132 —4 *subulata*, Vieill Like A intermedia, but trunk less naked, and lvs linear-subulate New Caledonia



307 Araucaria imbricata ($\times \frac{1}{12}$)

L H B
C. P. RAFFILL

ARBORETUM.—A living collection of trees and other woody plants

Collections of trees have found a place in the botanic gardens of all countries since the physic garden at Tokyo was founded eight hundred years ago, and for more than three centuries individuals have made such collections for the decoration of estates or for purposes of study In Europe the largest collection of the woody plants of temperate regions is found in the Royal Gardens at Kew, and in the Dutch Colonial Garden at Buitenzorg on the island of Java is the most important collection of the trees of the tropics Small experimental arboreta composed chiefly of timber trees of supposed value have been planted in connection with most of the forest schools or forest institutes of Europe

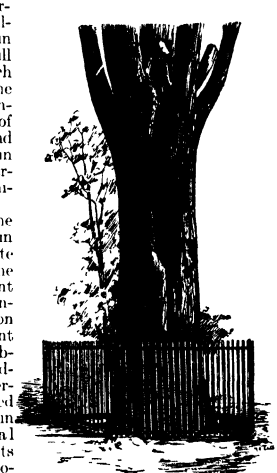
Historical sketch

As early as the middle of the sixteenth century, a collection of trees was made at Touvoye in France by René du Bellay, Bishop of Mans, who received the seeds of a number of exotic trees from Pierre Belon, physician and traveler, who first brought to Europe some of the trees of western Asia In its day the garden at Touvoye was pronounced by the botanist Gesner the richest and most beautiful in France, Germany and Italy Like most of the early collections of trees made by individuals, all traces of the trees planted by René du Bellay have disappeared

Nearly two centuries later, the head of the French Marine, Duhamel du Monceau, a man of scientific attainments, wealth and social influence, gathered from Europe and North America large collections of trees on his two estates of de Veigny and du Monceau and formed what must be considered the first arboretum made with scientific purpose Du Monceau undertook a critical study of his collections and published in 1755 his "Traité des arbres et arbustes qui se cultivent en France" His arboretum is said to have contained a thousand species of woody plants belonging to one hundred and ninety-one genera Duhamel's publications and example had much influence and led to the introduction of many exotic trees into French parks and plantations Noble specimens of the cedar of Lebanon, the deciduous cypress of the southern United States and other trees planted by him, are still living

The arboretum established in 1825 in France at Les Barres near the village of Nogent-sur-Vernisson (Loiret) by Pierre Philippe André de Vilmorin is still one of the most important dendrological stations in Europe Vilmorin was especially interested in the different geographical forms or varieties of the principal timber trees of Europe and made large plantations of these and of a number of exotic trees In 1866, after the death of the founder, the arboretum at Les Barres was purchased by the French Government and now, greatly improved and enlarged by new plantations, is known as the Arboretum National des Barres and is used as a school of sylviculture In 1906 a critical catalogue of this collection, prepared by Monsieur L Pardé, Inspector des Forêts, and accompanied by an atlas of plans of the arboretum and pictures of many of its principal trees, was published in Paris The value of the arboretum at Les Barres has been increased by the formation in its immediate neighborhood of the Fruticetum Vilmorinianum This collection of shrubs, which is the most complete in Europe, was established in 1894 by the grandson of the founder of the arboretum at Les Barres, Monsieur Maurice L de Vilmorin, who has been successful in introducing many interesting plants into gardens through his relations with French missionaries in China A catalogue of the Fruticetum Vilmorinianum was published in 1894

In 1857 Monsieur Alfonse Lavallée began to plant an arboretum at Segrez in the Department of Seine-et-Oise This was a scientific enterprise and the value of the living collections was increased by the establishment at Segrez of a botanical library and herbarium Aided by the professors of the Museum d' Histoire Naturelle in Paris, it had become in 1875, when the "Enumération des Arbres et Arbrisseaux Cultivés à Segrez" was published, one of the largest collections of woody plants that had been made up to that time This catalogue was followed in 1880 by the "Arboretum Segrezianum" in which appear critical descriptions and figures of some of the rare plants cultivated at Segrez Six parts with thirty-six plates of this work appeared M Lavallée died suddenly in 1884 and his publications and a few trees in the park at Segrez are the only monuments left of his zeal and industry in the study of trees In 1858 Monsieur G Allard began the arboretum at la Maulévrie, near Angers in France, which he still maintains, and which contains one of the largest and most interesting collections of the oaks of Europe and southwestern Asia in the world, and is particularly rich in conifers



308 Old Deciduous Cypress in Bartram's Garden This tree still stands, although dead

At Muskau in the valley of the Neisse in Silesia, on the estate made famous by the beauty of arrangement given to it by Hemrich Hermann von Puckler, an important arboretum was established by Prince Frederick of the Netherlands, who purchased the Muskau estate in 1845 The critical catalogue of the plants in the Muskau Arboretum by Petzold & Kirchner, published in 1864, and entitled "Arboretum Muscaviense," is a standard work on cultivated trees and shrubs Many of the trees planted by von Puckler are still living, but the arboretum is now conducted as a commercial nursery

In Great Britain, no important scientifically managed collection of trees and shrubs, with the exception of those connected with general botanic gardens, has been attempted The arboreta, however, connected with the

national gardens at Kew, Edinburgh and Dublin have greatly increased the knowledge of trees and stimulated the taste for planting not only in Great Britain but in all civilized countries. At Kew is to be found probably the largest number of species of trees and shrubs which has yet been gathered together, for in England more plants can be made to grow together than flourish in any one country on the continent of Europe or in any one place in the United States. Kew, as a garden in connection with royal residences has existed since the middle of the sixteenth century, in 1841 it was created a national garden and its growth and improvement have continued uninterruptedly ever since. In the older parts of the garden many noble trees testify to the age of the establishment, but it was not until 1848 that the systematic planting of an arboretum was begun by Sir William Hooker, the first director of the national garden. The reputation of the succeeding directors of Kew, its scientific standing and the interest of the nation in its garden have made it possible to gather there plants from all parts of the world, and although much of the soil occupied by the arboretum is not well suited for the growth of trees, and the smoke of the city makes the cultivation of conifers and many other evergreen plants difficult and sometimes impossible, every serious student of trees must avail himself of the great opportunities for study which this arboretum affords. A collection of trees was once planted by the Horticultural Society of London at its gardens in Chelsea, this was given up by the Society many years ago. On many of the large private estates in England, Scotland and Ireland there are important arboreta, and the desire of the owners of British estates to cultivate new trees, especially conifers, stimulated the botanical explorations in all the temperate parts of the world in the first half of the nineteenth century undertaken by the Horticultural Society of London and by some of the large firms of European nurserymen. Some of these private collections have been of great value to students.

In connection with the Quinta Normale and the Museum of Natural History in San Diego in Chile is a small but remarkable arboretum in which are found the oaks, hickories, magnolias and other trees of eastern North America flourishing as they flourish nowhere else outside the United States, and with these the poplars and birches of northern Europe are growing with the cypresses and pines of California, and the eucalypti of Australia.

Few interesting collections of trees have been made in North America. In 1728 John Bartram, a Pennsylvania farmer and later distinguished as a traveler and botanist, purchased a piece of land on the banks of the Schuylkill River about three miles from Philadelphia and established a botanic garden in which he planted a number of American trees collected in his various journeys, which extended from the shores of Lake Ontario to Florida, or received from his correspondents in Europe, among these were some of the famous botanists of the day. Bartram was appointed botanist to the King of England and, through his labors, many American trees were introduced into England and many Old World plants first reached America. Bartram died in 1777. Later his garden was used as a nursery and, after having passed through the hands of various owners, was bought in 1891 by the city of Philadelphia and is now a public park. A few only of the trees planted by John Bartram are now standing. Fig. 308.

Bartram by his own labors and through his European correspondents attained much influence, and is one of the most interesting figures among those who have increased the knowledge of American trees. Not the least important of his good works was the inspiration which his cousin, Humphrey Marshall, another Pennsylvania farmer, derived from his example and advice. Marshall in 1773 made a garden and planted a number of trees near the Bradford Meeting-house now in the village of Marshalltown, a few miles from West Chester, traveled widely to study and collect plants, and in 1785 published the "Arbustum Americanum," a description of the trees and shrubs indigenous to the United States. This was the first book on plants written by a native-born American. Many of the trees planted by Marshall have grown to a great size and are still in a flourishing condition. His arboretum is now the most interesting of the old collections of American trees.

The garden and arboretum planted about 1830 by John Evans, another Pennsylvanian, in Delaware County about twelve miles west of Philadelphia, contained for many years one of the largest collections of plants in the United States. Evans kept up an active correspondence with Sir William Hooker, the Director of the Royal Gardens at Kew, from whom he received the seeds of many Himalayan and other rare and little-known plants. A few only of the trees planted by Evans, who died in 1862, are now alive, among them is probably the largest specimen of the European hop hornbeam in the United States.

In 1841 Henry Winthrop Sargent, of Boston, bought Wodenethe, an estate of twenty-two acres above Fishkill Landing, New York, overlooking the Hudson River. A friend and pupil of his neighbor, A. J. Downing, Sargent through Downing's influence became interested in the cultivation of trees and especially of conifers. At Wodenethe every coniferous plant that could be obtained was tested, and for forty years it remained the most important place in the United States for obtaining information on the value of these plants for cultivation in this country. If the results of Sargent's experiments were largely negative, that is if they were more successful in showing what trees were not suitable for the eastern states than in adding numerous species to the number of conifers which can be permanently grown here, they were of great interest and value to the country. For many years the influence of H. W. Sargent among lovers of country life in the United States was considerable and has done much in the last sixty years toward increasing the knowledge of trees and directing sound horticultural taste. To this influence is largely due the horticultural careers of his relatives, Horatio Hollis Hunnewell and Charles Sprague Sargent.

In 1852 Mr. Hunnewell began the development of an estate in the valley of the Charles River at Natick (now Wellesley), about twelve miles west of Boston. Here, with the aid of his relative at Wodenethe, he planted coniferous trees for which the well-drained gravelly soil proved to be suited. Past middle life when he began to plant his trees, he was able to see many of them attain a large size and his pinetum, in number of species and beauty of individuals, the most important in the United States. In the hands of a younger Hunnewell, it is constantly enlarged and improved, and Wellesley is still one of the most interesting places in America for the lover of cultivated trees.

About 1870 Josiah Hoopes, author of "The Book of Evergreens," the only American book on the subject, planted in connection with his nursery in West Chester, Pennsylvania, a large number of coniferous trees. This at the time was one of the best collections of these plants that had been made in the United States. Twenty-five years later, and after Mr. Hoopes' death, although a large number of the species had disappeared, many survived to show their beauty and value as ornamental trees. The Hoopes pinetum should be visited by everyone interested in the cultivation of conifers.

In 1874 Charles A. Dana, the distinguished journalist, bought Dosoris, an island about fifty acres in extent off the north shore of Long Island, near Glen Cove, and began planting trees. Great intelligence and industry was shown in this undertaking, and in the Dosoris collection are still found many rare trees and

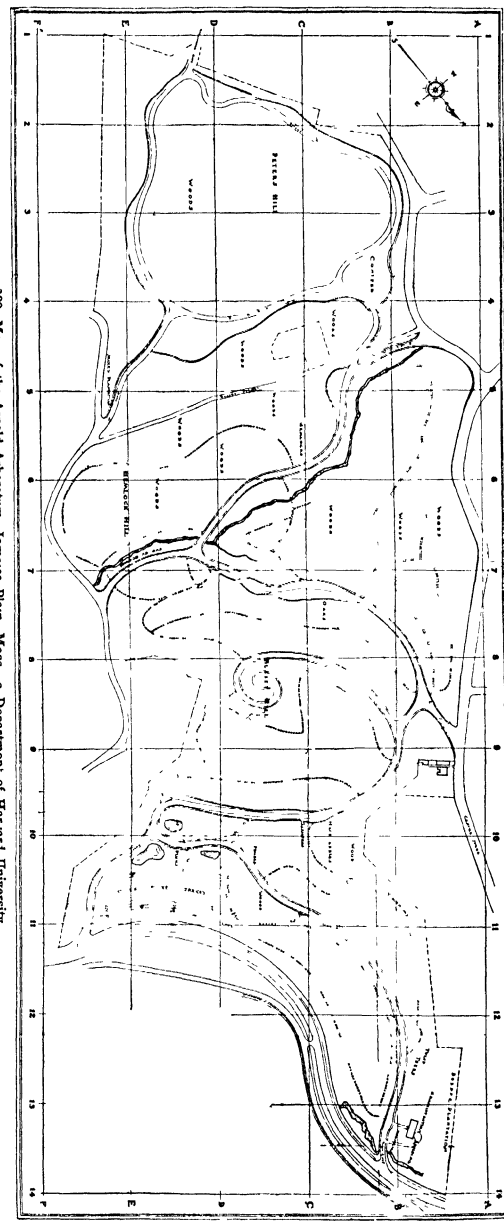
shrubs of exceptional size and beauty, but with the change of owners this, like most private collections of trees in the United States, is probably destined to suffer from neglect or to entirely disappear

In Highland Park, Rochester, New York, on grounds admirably situated for the purpose, the park department of that city has established an arboretum which contains one of the largest collections of trees and shrubs in the United States and which, situated as it is in a great center of commercial horticulture, cannot fail to become a powerful factor in horticultural education Equally important in educational possibilities is the excellent arboretum which has been established by the Government of the Dominion of Canada on its Central Experimental Farm at Ottawa Placed in a region of great winter cold, the lessons which the Ottawa Arboretum can teach of the hardiness of plants will be of special value to Canada and to the northern borders of the United States

The influence of American nurserymen by their introduction and multiplication of trees and shrubs must not be overlooked, and American lovers and students of trees will always gratefully remember such names as Kenrick and Hovey of Massachusetts, Price and Parsons of Long Island, Ellwanger and Barry of Rochester, New York, Thomas Meehan of Pennsylvania, Berckmans of Georgia, and Robert Douglas of Illinois The arboreta which they planted in connection with their nurseries offered in their time valuable object lessons, and the influences of their publications are often of lasting value

The Arnold Arboretum Figs 309–311

It has been left to Harvard University to establish an arboretum on a large scale and in a manner which seems destined to make it permanent This arboretum owes its origin to Mr James Arnold, a merchant of New Bedford who died in 1868, leaving to the trustees of his estate $100,000 to be devoted to the advancement of agriculture or horticulture One of these trustees was George B Emerson, the author of "The Report on the Trees and Shrubs of Massachusetts" Mr Emerson, realizing the benefit which the world might derive from the establishment of a scientifically managed collection of trees in the neighborhood of Boston, proposed to turn over Mr Arnold's legacy to the President and Fellows of Harvard College to be used to develop and maintain an arboretum, provided they would devote to this purpose a part of the farm in West Roxbury which had been given to the university by Mr Benjamin Bussey This plan was carried out in 1872, and 125 acres were set aside for the Arnold Arboretum, in which the University undertook to grow a specimen of every tree and shrub able to support the climate of eastern Massachusetts In December, 1882, a contract was made between the university and the city of Boston under which the city agreed to add certain adjoining lands to the arboretum, to construct and maintain under the direction of its park commission a system of carriage-drives and walks



309 Map of the Arnold Arboretum, Jamaica Plain, Mass., a Department of Harvard University.

planned under the direction of Frederick Law Olmsted, to police the grounds and to assume all taxes which might be levied on the property during the thousand years for which the contract was made In return for this assistance, the university agreed to open the arboretum to the public from sunrise to sunset during every day of the year, reserving, however, entire control of all the collections and of the grounds with the exception of the drives and walks Work on the roads was begun by the city in 1885, but through various delays in construction, the planting of the principal collections of trees and shrubs was not undertaken until the following year In 1894, seventy-five acres, known as Peter's Hill, and a part of the Bussey farm, were added to the arboretum by the President and Fellows of the university, and in 1898 were opened to the public by an encircling road built by the park department of the city This contract with the city of Boston is of great value to the arboretum, for, as it cannot be moved from its present location without the consent of the university and the city, there is little chance that, however valuable the land may become, the people of Boston will ever consent to give up a public park of unusual character and great beauty The assumption of all taxes by the city during 1,000 years insured by this contract may become an important contribution to the arboretum

The Arnold Arboretum occupies 220 acres of meadow, hill and valley It forms one of the series of Boston parks with which it is connected by a broad parkway It is close to the Forest Hills station of the New York, New Haven & Hartford Railroad, and it can be reached from all parts of the city by two lines of electric cars Its natural features are a broad meadow along the northeastern boundary, and three high hills separated by narrow valleys through one of which flows a small stream One of these hills is covered by a remarkable growth of hemlock trees, and natural woods, in which large individuals of many of the trees of eastern New England are found, cover other parts of the arboretum

The purpose of the Arnold Arboretum, as this has been understood by its management, is to increase the knowledge of trees and other woody plants To accomplish this, something more than the collection of living plants hardy in eastern Massachusetts contemplated by the trustees of James Arnold's will was necessary, and the Arnold Arboretum as now organized is, first, an out-of-door museum in which the public can see the trees and shrubs of the north temperate zone conveniently arranged, second, a dendrological station and laboratory in which the scientific study of trees is carried on, and third, a bureau of publication, exploration and exchange through which botanical exploration in different parts of the world is undertaken and the results and products of these explorations made known and distributed

In the arrangement of the out-of-door museum—the living collection of trees and shrubs—the species to facilitate study have been arranged in groups of genera and families in a natural sequence whenever conditions of soil and situation have made this possible, a further attempt being made to arrange the planted groups in harmony with the native woods and the other natural features of the ground All the groups of trees, shrubs, and all the natural woods are easily reached by grass paths which extend to all parts of the grounds In the case of the trees of North America, several individuals of each species have been planted, but want of space has generally made it impossible to plant more than one individual of an Old World species In the groups of American trees, one specimen is planted with abundant space for the full development of its branches and the others are arranged in a compact group to show their habit under such conditions

For the convenience of students, the shrubs of genera in which there are no hardy trees, and all vines, have been arranged in a sequence of genera in long parallel beds near one of the principal entrances, but the shrubs belonging to genera in which some of the species are hardy trees have been planted in connection with the groups of trees of these genera In addition to the shrubs in the general shrub collection, supplementary



310 Kalmia in bloom at the Arnold Arboretum

collections of several of the large genera of shrubs have been established, usually in sheltered positions, in which are planted new or imperfectly known species or species that require unusual care or special protection.

The collections of the Arnold Arboretum are rich in the woody plants of eastern North America, northern Europe, Siberia, China and Japan, and contain the largest number of species and varieties of these plants to be found in any American collection, and gradually the Arboretum, with its hills and valleys, its native woods and varied vegetation, has developed into one of the most beautiful of all the public gardens of the world

A large part of the trees and shrubs planted in the Arboretum has been raised in its nurseries from seeds collected in those parts of the region occupied by the species in which the climate most resembles that of New England A record of the origin and history of all the plants is kept on the cards of a catalogue, and the position of every tree permanently planted in the groups is recorded on the sheets of a large scale map, and with this is kept the detailed history of each tree Labels giving the Latin and English names and the region that they inhabit are placed at the height of the eye on the trunks of prominent native trees standing near drives and walks, and these labels are found on the trunks of many of the planted trees in the different groups Metal labels with raised letters are used for the plants in the shrub collection and for shrubs and small trees near some of the walks Wooden stakes giving their names are placed before many shrubs and small trees, and to every plant, whether otherwise labeled or not, a small zinc label is attached

In order to make the Arnold Arboretum a scientific station and something more than a collection of living trees, an herbarium of woody plants intended eventually to represent the ligneous vegetation of the world and a library now containing 29,000 bound volumes and 6,000 pamphlets have been formed. An herbarium and library connected with such an institution are essential for the determination and correct labeling of the living collections and make possible original scientific work A report on the forest wealth of the United States, the reports of state and national commissions appointed to study American forest conditions, the illustrated "Silva of North America," the "Manual of the Trees of North America," a "Forest Flora of Japan," "Trees and Shrubs," a monograph of the genus Lonicera, a monograph of the pines of Mexico, many of the articles on trees and shrubs in this Cyclopedia, the ten volumes of Garden and Forest, the Jesup collection of North American woods in the American Museum of Natural History in New York, are some of the contributions to knowledge which the arboretum as a scientific station has been able to make For several years, it has been actively engaged in bibliographical studies, and the results of these studies are being published in the "Bradley Bibliography," of which two volumes have appeared An elaboration of the woody plants of China is in progress, based largely on the collections of E H Wilson, one of the arboretum explorers, and is now being published by the arboretum in the "Plantæ Wilsonianæ"

In connection with its work in search of material for its collections, officers and employees of the arboretum have visited nearly every part of North America, have traveled in Peru and Chile, and explored the Caucasus, Japan, Korea, and northern and western China Through these explorations, the Arnold Arboretum has been able to introduce into the gardens of the United States and Europe a large number of new plants or plants that have been long lost to cultivation, and through these introductions it has established relations in all countries with the principal botanic gardens, the important nurserymen and many individuals interested in trees and their cultivation

The work the Arnold Arboretum attempts and the demands which are made on it are national in scope and extent, but for a national American arboretum a more temperate and equable climate than that of Massachusetts is desirable Its situation, however, in the midst of a population famous for its generosity and actively interested in horticulture, and the stability it enjoys from its connection with a great university, and from its contact with the city of Boston, are favorable to it It is impossible, however, to cultivate in one collection the trees which grow naturally or can be made to grow in all the different regions of the United States, and the American national arboretum of the future must first of all be an institution, like the Arnold Arboretum, of long life and continuous control; and this central institution properly equipped with laboratories and material for research must be in a position to establish branches in Florida, Arizona, California and in some central regions of the continent, for in such branches managed by the central institute, it would be possible to collect and to study nearly all the trees of the world suitable for different parts of the country, and so make possible in the United States an arboretum really national in character



311 Trees still standing in the Humphrey Marshall collection

Herbaria are chiefly valuable when they supplement collections of living plants, and it is now becoming gradually acknowledged that accurate knowledge of trees and of many other groups of plants can be obtained only by a comparative study of the plants themselves The opportunity for this will be found only in establishments in which plants in large groups can be assembled and grown under conditions favorable for their best development Today the palms of the tropics, especially those of the Old World, can be satisfactorily studied only in the great collection of these plants gathered together in the botanic garden at Buitenzorg in Java Some groups of northern trees and shrubs can now best be observed in the Arnold Arboretum, but to obtain exact information of others the student must make long and sometimes difficult journeys Until, for example, collections of the cactaceæ and of plants like the agaves and yuccas are assembled in a region favorable to their growth, like southern New Mexico or Arizona, it will be impossible to obtain a true understanding of these plants which, when grown in northern greenhouses or in regions unsuited to their peculiar needs, more often mislead than illuminate Comprehensive collections of the species of eucalyptus, acacia and other Australasian plants established in California would be of great value to that state, and collections of tropical and subtropical plants in southern Florida would immensely benefit not only

the southern part of that state but all the West Indies and other tropical countries.

A nationalized arboretum.

The arboretum, therefore, worthy to be considered national in scope and accomplishment in a country of such varied climates as North America must consist of a number of stations in different parts of the country under one management and with one central head from which the work of the different stations should be directed and superintended and which should be the bureau of publication of the results obtained in them. The position of the central station in the country is of little importance in comparison with its permanence, endowment and freedom from all dangerous influences. Such conditions of permanence and freedom in this country will best be obtained in connection with one of the great endowed universities rather than with the national or with any state government, for political association is not conducive to the best scientific research, and for the next hundred years at least, and until a real knowledge of the vegetation of the earth has been obtained, the National Arboretum must be organized primarily for research

By the information it could accumulate, such an institution would be able to aid the agricultural experiment stations and state universities, which are the natural and proper organizations for popularizing the results of long-sustained scientific investigations, for which they are not equipped and which, with the uncertainty of their resources, they cannot hope successfully to carry on Forestry and landscape-gardening are based on a knowledge of trees, and in the study of trees are found pleasures which increase with knowledge and endure through life

The Arnold Arboretum endeavors to popularize its knowledge by the publication of Bulletins of Popular Information and by courses of popular field instruction; and it should further be the duty of a national Arboretum to aid in the establishment of arboreta in connection with agricultural colleges and experiment stations, on the grounds of universities not equipped with botanic gardens, and on the grounds of high-schools Collections of trees properly labeled are needed in every institution of learning and in every large center of population Until such collections are established, the people of the United States can hope to know little of the beauty and value of their native trees and of those exotic trees which can safely be introduced into different parts of the country

C S. SARGENT.

ARBORICULTURE. Arboriculture is the growing or cultivation of trees It is distinct from sylviculture, which grows trees in forest plantations for the production of a timber-crop Sylviculture is a part of forestry

What constitutes a tree is not easy to explain in a short and well-defined statement A given species may assume a tree-like habit or remain shrubby, according to the climatic conditions, soil and other circumstances. Usually a tree is defined, under normal conditions, as a woody plant rising from the ground with a single stem and attaining a certain height, fixed by some at 20, by others at 15 feet, or even less A more exact definition has been given by B E. Fernow "Trees are woody plants the seed of which has the inherent capacity of producing naturally within their native limits one main erect axis continuing to grow for a number of years more vigorously than the lateral axes and the lower branches dying off in time"

Trees are the most prominent feature of the vegetable world and surpass all other organic beings in height, magnitude and longevity The greatest height known has been reached by *Sequoia sempervirens*, which attains 340 feet Not very far less is *Eucalyptus amygdalina*, of which the highest tree actually measured is given as 325 feet; it is, therefore, the tallest of the hardwood trees. The sequoias, however, are of more majestic and gigantic appearance than the eucalyptus on account of their massive trunk (see *Sequoia*) *Pseudotsuga taxifolia* and *Pinus Lambertiana* occasionally attain 300 feet. A number of other conifers, chiefly American, grow to a height of 150 to 300 feet Some deciduous trees, as *Platanus occidentalis*, several species of oak and *Liriodendron Tulipifera* exceed 150 feet in height The jequitiba of southern Brazil (*Couratari legalis*, one of the Myrtaceæ) is also a gigantic tree (see Bot Gaz. 31, p 352)

The greatest diameter has been observed in *Castanea vesca*, of which a tree with a partly decayed trunk at the foot of Mt Etna in Sicily measures more than 60 feet in diameter After this the greatest diameter observed is in *Taxodium mucronatum*, about 40 feet, and in *Platanus orientalis* about the same, in *Sequoia gigantea* 35 feet, in *Taxodium distichum* 30 feet, and somewhat less in *Adansonia digitata*

The age attributed to many of the tallest trees is based more or less on speculation, and opinions often differ widely *Dracæna Draco* is believed to reach 6,000 years of age, *Adansonia digitata* 5,000, *Taxodium mucronatum* and *Platanus orientalis* 4,000, *Cupressus sempervirens* and *Taxus baccata* 3,000, *Castanea sativa*, *Quercus pedunculata*, *Sequoia gigantea* and *Cedrus Libani* more than 2,000 years

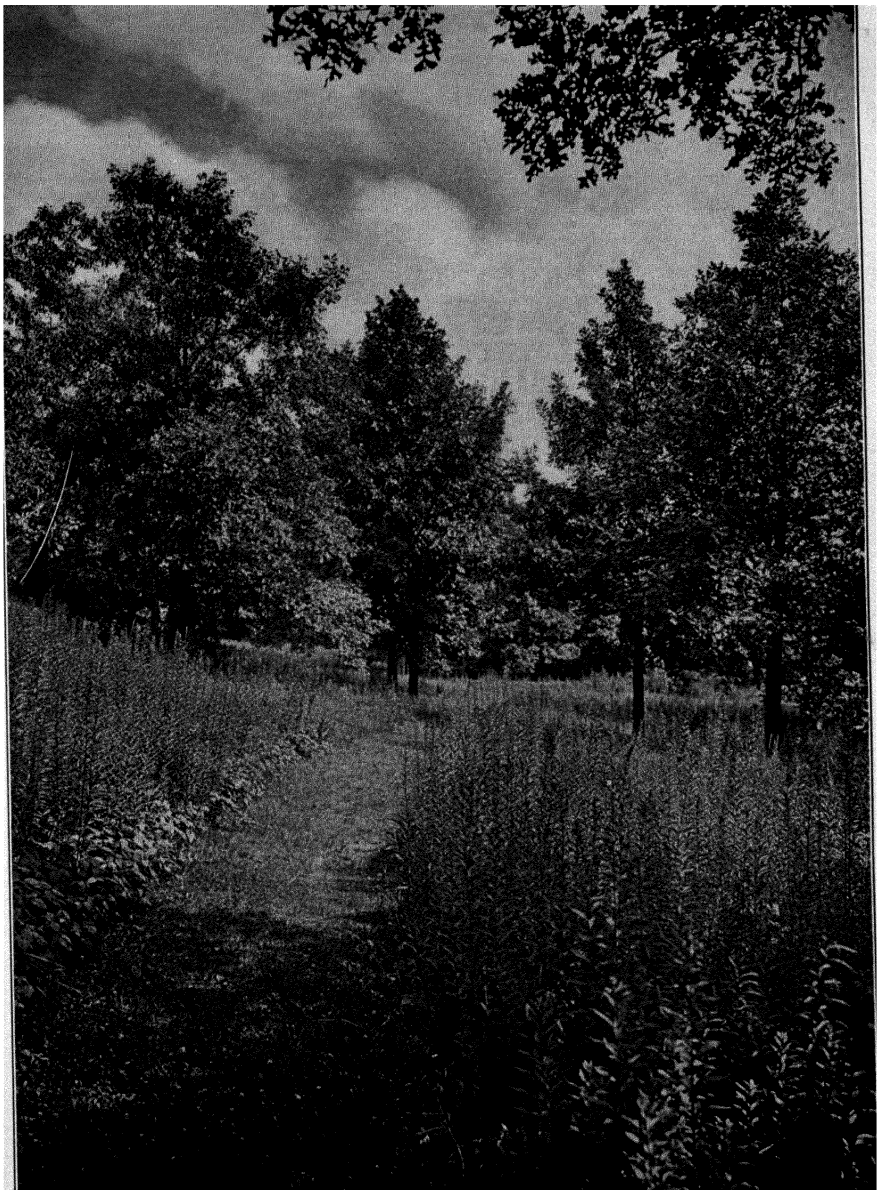
Although the trees are the most conspicuous features of the vegetable kingdom, they represent only a small percentage of it as regards the number of species In the United States, where about 600 trees occur, they represent only about 3½ per cent of the whole phanerogamic flora, in Europe even less As a rule, towards the tropics the number of tree-like species increases, towards the arctic regions it decreases Remarkably rich in trees is the flora of Japan, where the proportion of trees to the whole phanerogamic flora is more than 10 per cent, which percentage surpasses by far that of any other country in the temperate regions

Trees belong to many different natural orders, but of the orders of monocotyledonous plants only a few contain trees and none of them is hardy North None of the larger orders contains trees only, but there are some which consist exclusively of woody plants and include a large proportion of trees, as Pinaceæ, Fagaceæ, Salicaceæ, Juglandaceæ, Magnoliaceæ, Sapindaceæ, Elæagnaceæ, Ulmaceæ, Hamamelidaceæ, Lauraceæ, Anacardiaceæ, Ebenaceæ, Styracaceæ and others

The uses of trees are manifold, and a country from which the forests have been destroyed becomes almost uninhabitable and worthless to mankind The forests furnish wood and timber, exercise beneficial influences on the climate, act as regulators of the waterflow, prevent erosion and also the removal of soil by the wind Besides furnishing wood and timber, many trees yield other products of great economic importance, especially the numerous kinds bearing fruits The æsthetic value also of the tree must not be underrated, although it cannot be counted in money

The science of trees and shrubs is *dendrology*. The art of growing trees is arboriculture, while the rearing and maintaining of forests and the production of timber-crops is sylviculture. Arboriculture is sometimes used in a broader sense, like dendrology, to include also the growing of shrubs. Orchard culture is a branch of arboriculture or of horticulture, and deals with the cultivation of fruit trees; it is usually included under pomology, which comprises both the science and practice of fruit-growing.

As ornamental subjects, trees are more permanent, easier of cultivation and cheaper in the long run than herbs. It is curious to note how little attention the average gardener who has the care of a park or garden gives to the most prominent feature of his domain. He



IX. Arboretum.—Plantation of American oaks at the Arnold Arboretum: Solidago canadensis underplanting.

usually knows fairly well the greenhouse plants and herbaceous perennials, which cost most in time and money, but the trees and shrubs he often disregards This is apparently due to the fact that after being once planted, and often not by himself, the trees and shrubs do not need his perpetual care, and usually grow without his aid and interference.

To the landscape gardener a thorough knowledge of trees is absolutely essential. He ought to know the ornamental properties of the trees, their rate and mode of growth, their peculiarities in regard to soil, situation and climate As the trees are, after the surface of the ground, the most permanent element of the landscape, they ought to be planted with careful deliberation as to the intended artistic effect and their fitness to the soil and climatic conditions, for mistakes in planting of trees are afterwards not easily corrected and rarely without injury to the original artistic design

The available number of trees from which selection may be made is large There are in American and European nurseries and gardens more than 600 species in cultivation that are hardy in the northern and middle states About 250 of them are American, more than 200 from eastern Asia, about 100 from Europe and 70 from western and central Asia About forty natural families are represented, of which the most important are the Pinaceæ, Fagaceæ, Salicaceæ, Rosaceæ, Leguminosæ, Juglandaceæ, Sapindaceæ, Urticaceæ, Magnoliaceæ, and Oleaceæ The number of all the cultivated varieties and garden forms is, of course, considerably larger than that of the botanical species and may be estimated at about 3,000 Comparatively few horticultural varieties are found in American nurseries as compared with European, but this need not be regretted, as horticultural varieties are mostly merely curious or monstrous forms. In planting, one must rely chiefly on the types and use the horticultural varieties sparingly, for restfulness should be the prevailing character of the masses and groups of trees.

ALFRED REHDER.

CONTENTS TO THE ARTICLES IN "ARBORICULTURE."

The cultivation of trees, Mulford, page 353
The conifers in particular, Fernow, page 358.
The transplanting of large trees, Hicks, page 362.
Types of insect injury to trees, Brues, page 364
Some types of tree diseases, Rankin, page 368
Choice of trees for special purposes, Rehder, page 372.
Choice of street trees for special regions, Mulford, page 374
Ornamental trees for the middle and southern states, Berckmans, page 374
Trees on the great plains, Bessey and Watrous, page 376
Trees grown for shade and ornament in California, Davy and Morrison, page 378.

The cultivation of trees.

From earliest times man's instinct has been to seek the protection of trees In locating his home the first necessity has been the proximity of water; second, pasture for his flocks, third, the presence of trees; in warm countries it has been necessary to provide protection from the hot sun's rays, in cool countries for the sake of fuel and protection from the elements As civilization has progressed and man has developed more elaborate abodes, he still desires the protection of trees to make his home more comfortable, to protect it from the winter wind, or the summer sun, or both.

To meet the needs in different localities, as one or another protection may be more important, different kinds of trees are used In the extreme North, the coniferous evergreens act as windbreaks twelve months in the year In the south Atlantic and Gulf regions, the broad-leaved evergreens give shade the year through. In the intermediate country and overlapping both, the deciduous trees afford much summer protection and a little winter protection The chief æsthetic value of trees is due to the suggestion of comfort that they give In winter, a house snuggling against a group of evergreens may be attractive, and yet, if lacking a well-placed shade tree, may in summer appear glaring or otherwise uninviting These feelings are the same with regard to native woodlands or man-made clumps more remote from dwellings The different kinds of forest attract because of suggestions of comparative comfort and of pleasures To those who have lived in the heart of a large city all their lives, such scenes are likely to be unattractive because of lack of suggestiveness Some of the interesting and varied forms of trees are displayed in Figs. 312 to 359.

In planting trees for ornament, these elements of protection suggest two uses, that of windbreaks and that of producing shade at appropriate places In addition are the partial hiding of buildings from important viewpoints, enhancing the beauties of the building or permitting only the most desirable features to be seen, covering the outlines of ugly buildings, or completely hiding objectionable objects, either nearby or distant, forming frames for distant views or nearby objects, making knolls and hills look higher by groves on their tops, or valleys look deeper because of wooded sides, making irregular sky lines either by accentuating existing conditions by planting tall trees on the high places and low trees in the low places, or in level countries making a similar sky line by tall and short trees, or forming irregular and natural appearing boundaries to lawns or meadows



312 A group of old sugar maples, with irregular and broken heads.

To accomplish any of these results, some trees are inherently better suited than others, climate and soil, however, may make their use impracticable or impossible Coniferous evergreens make the ideal windbreak and screen, but they are satisfactory only in the northeastern section of the country and on the Pacific Coast, the hot sun of the South, the dry winds of the central plains and the smoke of cities making most species impossible in those regions The broad-leaved evergreens are next in importance, but they are adapted only to the south Atlantic and Gulf seaboards, and the Pacific Coast north of San Francisco. For adaptabilities see special lists, for no other sweeping generalizations of adaptabilities can be made except that the use of bronze, yellow or variegated-leaved trees, and trees of unusual drooping habit or of other striking form, should be limited to special times and places A tree to be satisfactory for ornamental planting must suit the

climate and maintain the appearance of healthy growth on the soil where planted, must be hardy, and must be free from serious insect and fungus attacks

The location of trees is a detail of the design of the place. This is intimated in the preceding paragraphs and more fully discussed under Landscape Gardening, but a few cautions may be in order Do not so surround the house with trees that they exclude all the sunshine. Except in the extreme South, use deciduous trees next the house so as to have full benefit of the winter sun. Plant the evergreens at a little distance For specimen trees of the larger kinds, plant 50 to 100 feet apart, depending on the kind For thickets and quick masses of foliage, the same kinds may be planted 15 feet apart. Theoretically, planting more trees than are ultimately necessary and then thinning is excellent Practically, it is dangerous as there is not one chance in ten that it will be done in time Plant irregularly both as to distance and direction unless the design is strictly formal, in which case plant with mathematical precision.

When and how to plant.

There is great difference of opinion as to the best time to plant In climates with the temperatures of Boston, Rochester, Chicago and farther north, spring planting is probably best for most plants Fall planting is increasingly more satisfactory as one goes south On the western plains where strong, dry winter winds prevail and the soil is either so dry or freezes so hard that a newly planted tree cannot replenish the moisture taken out by the winds, spring planting is most successful The character of soil may also have its influence. Magnolias and tulip trees should always be planted in spring Coniferous evergreens should be



313. A commanding white oak on a bank margin.

planted either when growth has started in spring or, when vigorous, in late summer or early fall. Other evergreens should be planted when entering the period of most active growth so as to be able to form roots quickly to support the foliage that is always present. The period of generous moisture in air and soil is most favorable for the planting of evergreens In adverse seasons, these conditions may be in a measure produced by liberal watering of the soil and frequent spraying of the tops Deciduous trees should be planted when dormant, in order that roots may become well formed before there is foliage to support.

Large holes should be prepared for planting, at least 2 feet larger in diameter than the spread of the roots of the lifted tree, and 2 feet deep. If the soil is good, no further special preparation is necessary beyond a liberal mixture of well-rotted manure or raw bone-meal with the soil to be replaced in the hole, and supplying new topsoil to replace any subsoil excavated in digging the hole In poor ground, a hole at least 6 feet across and 2 feet deep should be dug for a tree up to 8 feet high, and for larger trees proportionately larger holes to give them good ground for beginning growth It is becoming common to dynamite holes for trees Just how far this is desirable is yet problematical In tough subsoils, it appears to be eminently successful It seems reasonable to suppose that in most subsoils such a loosening would be permanently beneficial Careful observers have noticed that trees usually thrive better on filled ground than on nearby soil where the land has been undisturbed, even though the fill appears poor in comparison This does not have reference to city ash and garbage dumps The ashes are too inert to support tree growth, the dump is frequently poisonous In large plantings, the watering of deciduous trees and the staking of trees under 10 feet is usually omitted in the moist regions in which strong winds do not prevail, the replacing of any losses being considered more economical than this additional expense Larger trees need special attention

The size of trees to choose varies with the kind, the purpose, and the need for quick results Trees may be successfully transplanted from one- or two-year-old seedlings to those 12 or 16 inches through and 10 feet high, success depending largely on the skill of the planter. Usually trees 6 to 12 feet high are best for deciduous trees, 3 to 6 for coniferous Some species succeed better with small sizes, as tulip tree, magnolias and hollies. Nursery-grown trees that have been frequently transplanted are best, as they transplant with less loss because they have an abundance of fibrous roots Collected stock of some kinds is satisfactory for mass-planting but the loss will run from 50 to 90 per cent, depending on kind and condition Trees that are very small are not desirable to use, as they grow no better than larger nursery-grown trees and the cost of cultivation is more when planted permanently than when in the nursery row Trees above the sizes mentioned are expensive to handle and the loss is likely to be greater When immediate results are important, these are worth using with a mixture of smaller trees to take their place in case they should be short-lived.

Pruning and tree-doctoring

At planting, all broken limbs should be removed as well as any crossing through the head or below it If the top is still crowded, some limbs may be removed by cutting them off at the nearest fork Heading-in or shortening the limbs is undesirable with most species. The magnolias and tulip tree are exceptions to this, they need severe shortening-in when transplanted All roots should have the broken ends cut off with a smooth, clean cut, as this freshly cut surface seems to facilitate the formation of new rootlets or at least to prevent decay If a newly planted tree is very slow in starting, it is sometimes induced to grow by a severe pruning.

Desirable varieties of shade trees seldom need any heading back An annual inspection with slight pruning to shape the tree and remove surplus branches is all that will be required A tree should be grown into shape, not pruned into shape, and should be allowed to develop its own characteristics

Evergreen trees, with the exception of the evergreen oaks and *Magnolia grandiflora*, should be trained so that their foliage rises directly from the turf. As it

grows old, the white pine is likely to bare its trunk in spite of other training Spruces and other coniferous trees are ruined if pruned to show the trunk Figs 318, 319 Many deciduous trees are also most attractive when their lower limbs rest on the ground, as beeches, the Norway maples, hornbeams and many more any tree in fact whose natural habit will permit such a form

Old trees, owing to neglect, or more often, improper pruning, frequently need the saw Protruding stubs should never be left, whether the tree is large or small The cut should always be made close to the remaining limb and parallel with it It will not require over two years for the callus to show all around a properly made cut If it does not show then, the work should be done over again All dead wood should be kept out Crossing limbs, even if large, should be removed A tree should not be dehorned, i e , cut back to stubs 3 or 4 inches or more in diameter, except as a last resort for a failing tree

Pruning is employed for two distinct ends: to train and shape a young tree as it grows, and to re-form or adapt a tree of some maturity, especially if somewhat decrepit The so-called "tree-doctoring" or "tree-surgery" is applied especially to the latter phase A tree that has become weakened by transplanting, or from lack of proper nutrition, from lack of proper fertility, or scarcity of water, or from other undetermined causes, may often be forced into active vigorous growth by a severe cutting-back It may even be allowable, in such cases, to pole or dehorn a tree, that is to remove most of the small limbs, cutting the large ones so close to the tree as to leave stubs as large as one's wrist or arm or even larger It never happens that several trees in a row need such treatment unless their feeding-ground has been greatly depleted

Trees that have been badly pruned, broken by wind, storms or otherwise bruised or mistreated, frequently have badly decayed spots in their trunks and limbs. It has become the custom to "doctor" such trees,— that is, thoroughly to clean out rotten wood, treat the exposed surface with a solution of corrosive sublimate or sulfate of copper to kill any fungous growth that may be present, with bisulfide of carbon or other insecticide for insects, and then coat the surface with tar as a preservative After this the cavity is carefully filled with concrete of the strength commonly used in construction work It is absolutely essential to success that the joint between the wood and cement be water-tight The surface should also be given a smooth finish of the general outline that the tree would assume had it grown normally The finished surface should coincide with the inner edge of the cambium layer so that the growth of the tree will proceed over the cement just as it would over a properly cut stub Zinc caps are frequently used both to cover cement fillings to keep out the water and to cover large cuts when the wood is solid but when it will take several years to heal on account of the size of the wound Cavities must be absolutely clean, thoroughly disinfected, and the filling positively water-tight or decay will begin behind the filling and the tree will be destroyed while every confidence is being felt that it is safe The cement work is frequently reinforced with rods of iron Its principal value is to hold the cement from cracking The only value of such cement work is as a preventive of decay where there are cavities When properly done, it gives a smooth surface over which the growth may proceed The supporting value of the cement to the tree is slight

With many hardwood trees in important locations such treatment is warranted, but at the present time many trees are thus treated that should be cut down, while many others are left that should have attention The first requisite to warrant the treatment of a large cavity is a good type of tree in an important location, for example a large tree protecting the home from the mid-afternoon sun, or a bad individual in an avenue of otherwise good specimens In large plantations, treatment of a preventive nature is of course warranted, but the filling of large cavities is not worth the cost except to those to whom money is little object It is better to start new trees than to spend fifty dollars on patching up an old one One must exercise careful judgment in selecting old trees for treatment, to make sure that the tree is worth it Trees worth doing work on are the oaks, sugar, swamp and Norway maples, hickory, ash, elm and the slow-growing native trees Those not worth treating in this way are the poplars, willows, silver- and ash-leaved maple and sycamore or plane



314 Picturesque old apple trees

tree A street tree with a large cavity would better not be doctored unless it is of special value and of a kind likely to last a long time

Badly branched trees often show a tendency to split in the crotches It is well to attend these trees before they begin to split and either chain or bolt the offending limbs together They may be chained by putting lag-screws in the limbs, drawing the limbs together and dropping a link of the chain over the turned up end of the screw Rods and turn-buckles may be used in the same way, the bolts for the rods being put through the limbs, not around them Because bolts have to be placed closer to the weak point than the other remedies, they are not so effective but are often useful If a tree splits, there is danger of decay The splitting should be anticipated and prevented whenever possible.

The best time for pruning is not a question of invariable rule The period of most active growth in most places June, is usually regarded as the best time The period of starting into leaf is probably the worst time, although the maples are about the only good shade trees that seem much affected by pruning at this season

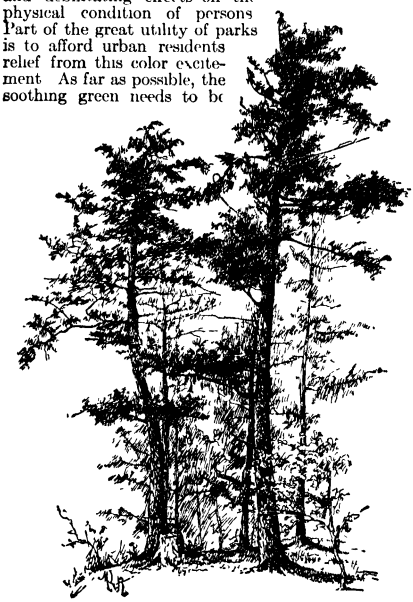
Large cuts or wounds should be immediately painted with a good grade of paint or with tar, care being taken to cover the exposed wood but not to allow the paint to come into contact with the cambium layer, or growing part of the bark

Root injuries should be as zealously guarded against as injuries to the top If a large part of the roots must be removed, the top should be correspondingly thinned. Changes of grade are a great source of damage to shade-trees, even when the roots are not actually touched The filling of 2 or 3 feet of soil over the roots of a tree is, for most varieties, as sure death to the roots as cutting them off close to the trunk This filling prevents the aeration of the soil and smothers the soil life on which healthy root-action seems to depend This may be

prevented by a good layer of loose stones, open at intervals to the air, placed over the surface before filling, or, in some cases, by the use of agricultural tile drains on the old surface at close intervals and so arranged as to facilitate a free circulation of fresh air through the tiles.

Street trees.

In the development of towns and cities, the need of trees as a protection against wind has been reduced to a minimum since the closely built houses protect one another This close building, however, has brought about another untoward condition that needs ameliorating; this is the replacing of the vast extent of green, common to the open country, by a motley array of discordant colors Many of these colors have been demonstrated experimentally and practically to have exciting and debilitating effects on the physical condition of persons Part of the great utility of parks is to afford urban residents relief from this color excitement As far as possible, the soothing green needs to be



315 A group of surviving hemlock spruces.

taken into the city streets to rest the tired nerves through the effect on the eye Also, the shade helps to reduce the temperature by absorbing the sun's rays, the large amounts of water the tree transpires also helps to cool the air These beneficial effects make it worth while to expend effort and money to secure well-shaded streets Figs 323, 324

The conditions in urban communities are adverse to tree growth Streets are narrow and the trees crowded; roadway and sidewalk are paved with impervious materials preventing both water and air getting into the soil, and effectually keeping in sewer-gas and illuminating-gas that may be discharged into it from below. The air is dust-laden from constant traffic, and, what is far worse, contaminated by soot and poisonous compounds from numberless badly-fired chimneys. As though this were not enough, there are the self-styled tree-trimmers, knowing nothing of the work, then the linemen cutting ruthlessly, caring nothing for the tree, and with an occasional gnawing horse adding its dem-

ARBORICULTURE

olition. And the sewer-layer, pipe- or conduit-layer and finally the curb-setter do their worst. After all of these, come the insects and diseases that affect trees everywhere and which here find an easy prey because of the fewer birds in city streets and the weakened condition of the trees.

The first essential to successful street tree-planting is competent municipal control of all such work The street trees should be under the care of an unpaid commission of three or five men, one named every two years by a local court, or by the mayor, for a term of six or ten years, and confirmed by the legislative body Such commissioners usually need to be trained, and therefore they should have considerable experience in their work before coming into full responsibility The restrictions on the appointment of the executive officer should be stringent, so that only thoroughly trained and experienced men could be employed The expert should have the full confidence of the commission and be the leader in the work To fill such a position, a man should have thorough knowledge of trees and the soils and conditions under which they grow, their characteristics, æsthetic values and habits of growth under city conditions, the methods of aiding trees to withstand these conditions, and a knowledge of the insects and diseases to which the different species are liable and the methods of combating them The work is neither forestry nor pomology, as it has nothing whatever to do with the products of tree growth or the growing of trees for their fruits

Powers vital to the success of this commission are the right to plant suitable kinds of trees in a proper way, and to collect benefits for work so done, to control absolutely all pruning, removal and care of trees, and the right to invade private grounds for the control of insects and diseases Of course, sufficient funds must be available to support the work.

Many city streets are too narrow from building-line to building-line for satisfactory planting There is absolutely no excuse for this in the newer sections There should be at least 100 feet from building-line to building-line on any street and on principal streets considerably more Forty feet may be all that is needed for roadway and sidewalks, at present The abutting dwellers need the air-space provided by the remaining area which is legitimately used as front lawns This will leave ample space for trees If the city grows and more space is needed for traffic, it can be secured with no sacrifice to buildings and the dwellers in the interval have had better living conditions It is this arrangement that makes Washington such a beautiful city, and the lack of it on Fifth Avenue that is costing New York City so much money to widen that thoroughfare In the older parts of cities, species must be chosen that are appropriate to the width of the street Most kinds should be planted not closer than 40 feet apart and such varieties as oaks, elms and sycamores would be better at 50 feet Most planters use 35 and 40 feet because of the public demand for quick shade, and at the greater distances the trees look far apart when first planted Theoretically, the planting double the number of trees needed at maturity or the placing of fillers of a quick-growing inferior type, is desirable, but practically it is dangerous, as there are not many cases in which public opinion will tolerate the thinning at the proper time In city work an excavation 2 feet deep, with the removal of at least 2 cubic yards of dirt, should be made for each tree This should be filled with good top-soil mixed with well-decomposed manure Of most varieties, trees 10 to 12 feet high and 1½ to 2 inches caliper should be used These should be nursery-grown They should have been frequently transplanted and have a well-developed head, 6 to 8 feet from the ground. The roots should be abundant and fibrous In planting, the roots should be spread out and separated to their full length, the ground worked all in amongst them, and then thor-

oughly firmed by tramping Before the hole is completely filled, the tree should be well watered and the remainder of the soil put in loosely A strong stake 8 feet long should be placed beside the tree when planted At least 30 inches of this should be in the ground The tree may be attached to the stake by a piece of old garden hose attached to each side of the stake and put around the tree in such a manner as to make a cross between the stake and the tree

All young trees should be protected by boxes or guards Many forms are used Any of them are good if the box reaches from the ground to a height of 5 feet and will prevent horses biting the trunks and boys swinging on the guard.

Notes on ornamental trees

Acer Negundo (box elder) Too short-lived, brittle and subject to insect attack Its use may be warranted in semi-arid and very cold regions

Acer platanoides (Norway maple) Moderate grower, healthy, but too dense for close city streets

Acer rubrum (swamp maple, scarlet maple) A good-sized tree, good grower, fine foliage, especially brilliant in autumn Also a bright red in spring due to blossoms and young leaves Not suited to the interior of large cities

Acer saccharinum (silver maple, soft maple) Rapid grower, but too brittle and short-lived, and the shallow roots prevent the growth of grass under it and also destroy sidewalks

Acer saccharum (sugar maple) Does not thrive on heavy clay soils or under severe city conditions but most excellent where it does grow Moderate grower, doing best north of the 40th parallel

Ailanthus altissima (ailanthus, tree of heaven) A large, handsome tree, the staminate and pistillate flowers appearing on different trees, the latter very ill-smelling A most useful tree in the center of large cities The staminate form only should be planted

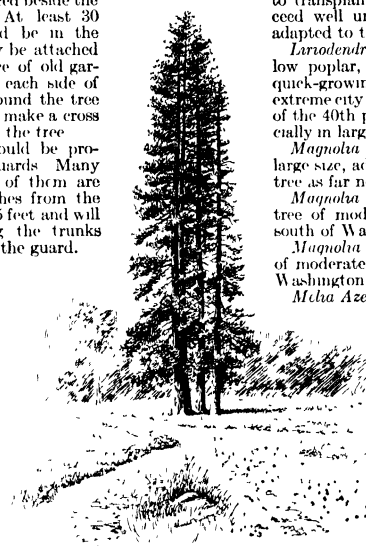
Celtis mississippensis (southern hackberry) An excellent tree in those regions in which the "witches-broom" does not attack it One of the promising trees to withstand the hot winds of the plains as far north as Denver A large tree and good grower

Celtis occidentalis (hackberry) A good tree where the disease known as "witches' broom" does not attack it It is for regions north of the 36th parallel what the foregoing species is for the region south of it

Fraxinus americana (ash, white ash) A good tree for suburban conditions Moderate grower, attaining large size.

Ginkgo biloba (ginkgo, maidenhair tree) An excellent tree of peculiar pyramidal form when young Moderate grower, attains good size and is free from insect and fungus attacks

Gleditsia triacanthos (honey locust) A large, quick-growing, handsome tree Except for its thorns, this tree would probably be a most desirable tree for the semi-arid regions of the West There is a thornless form that may sometimes be obtained, which is good



316 Pinus ponderosa.
Giant specimens 225 ft high, grown in the deep, moist soil of the Yosemite Valley

Liquidambar Styraciflua (sweet gum). A handsome and valuable native tree but little used Moderate grower, good size, handsome fall coloring A little hard to transplant, especially in large sizes Does not succeed well under extreme city conditions, and is not adapted to the extreme northern sections

Liriodendron Tulipifera (tulip tree) Miscalled yellow poplar, and tulip poplar. A handsome, large, quick-growing tree, little used, but valuable except for extreme city conditions and much of the country north of the 40th parallel A little hard to transplant, especially in large sizes, and should be moved only in spring

Magnolia grandiflora A broad-leaved evergreen of large size, adapted to the extreme South A good lawn tree as far north as Washington

Magnolia acuminata (cucumber tree) A handsome tree of moderate size, good for suburban conditions south of Washington and St Louis

Magnolia tripetala (umbrella tree) A handsome tree of moderate size, good for suburban conditions south of Washington, and St Louis

Melia Azedarach (umbrella tree) A small, attractive tree, good for temporary effects from North Carolina south and west

Nyssa sylvatica (sour gum, tupelo) A large, handsome tree, adapted to suburban conditions Brilliant fall foliage and winter berries

Platanus occidentalis (sycamore, buttonwood) A large tree, rapid-growing, open-topped, and almost scraggly in its growth Considered an untidy tree by some on account of its seed-balls and the bark which is shed in large flakes The white trunk, after the bark is shed, is unusual and attractive In some regions it is subject to a blight just after the leaves start in spring A good tree for severe city conditions

Platanus orientalis (plane tree, orental plane) A more compact grower than the foregoing and a little better suited to street purposes, but not quite so rugged and imposing as the foregoing An excellent street tree

Populus deltoides, including var *carolinana* (cottonwood and Carolina poplar). These two trees are much used for street planting in many places but are entirely unsuited for the purpose. Although the growth of a severely pruned tree is large in any one year, it is the custom to remove a half of this each year so that the net gain in growth is no more than an average tree. Even with this pruning it is liable to be broken by a moderate wind storm, and without the pruning it is even more liable to be broken. Their roots are as bad as willow roots about finding and clogging sewers. Wide-awake cities prohibit the planting of these trees

Populus nigra var *italica* (Lombardy poplar) A tall, short-lived, fastigiate



317. Conifer forms — Pine and spruces.

tree, suitable for narrow streets in the heart of a large city

Quercus alba (white oak) A most picturesque tree, attaining the largest size The gem of American trees, and not so slow-growing as usually considered Dead leaves hang on most of the winter Figs 313, 322

Quercus bicolor (swamp white oak) A large, handsome oak of moderately rapid growth, suited to moist situations It seems to succeed under city conditions A desirable shade tree, almost as handsome as the white oak and a little faster grower

Quercus coccinea (scarlet oak) Comparable to the red oak but not quite so sturdy and vigorous under all conditions, but with a little more brilliant autumn coloring and leaves more finely cut

Quercus laurifolia (laurel oak, water oak). The standard street tree for the South. A large, handsome, deciduous tree, not so desirable as the live oak, but of more rapid growth

Quercus Michauxii (cow oak) A good oak for thin gravelly lands Not so desirable as the other oaks on



318 Spanish Fir.—Abies Pinsapo, showing the verdure from top to base.

good ground and not adapted to the extreme northern sections.

Quercus macrocarpa (mossy-cup oak) A handsome and satisfactory tree, not so large as some of the others. One of the most promising for the plains

Quercus nigra (possum oak, water oak) Another good oak south of Norfolk A little more upright in growth than *Q laurifolia*, but not quite so desirable except possibly in its more northern limits

Quercus palustris (pin oak) A quick-growing, good-sized tree, with pendulous branches when old Handsome cut leaves, brilliant in autumn. One of the best. Its pendulous branches may sometimes be a rather serious objection Dead leaves hang on well into the winter. Fig 323

Quercus phellos (willow oak). A large, handsome tree, moderately fast-growing, satisfactory south of Washington in regions in which it is not attacked by a growth resembling "witches' broom" of the celtis

Quercus rubra (red oak) Almost the best street tree. Large, symmetrical, rapid in growth, fine autumn foliage, head not too dense It is exceeded only by the elm in rapidity of growth among the trees suited for street planting and not by that in the southern half of the country.

Quercus virginiana (live oak). A large evergreen The best street tree for the South, but slower in growth than *Q. laurifolia*

Sterculia platanifolia (varnish tree) A small tree of reasonably rapid growth bearing bright yellow flowers It has a tropical suggestion Good only for the South and its principal value is in its possibilities for the Southwest, especially semi-arid Texas

Tilia americana (basswood, American linden) A large, handsome, quick-growing tree. Young trees are sometimes affected by a disease at the base of the trunk, but the tree is well worth growing except in regions in which the difficulty is known to be present

Ulmus americana (elm, white elm) The shade tree of New England and deservedly ranked first there It loses its preeminence as one goes from New England, but a large, quick-growing tree worth using except in the extreme South Drops its foliage too early to be the ideal shade tree in the middle states and southward. It is subject to the attacks of the elm-leaf beetle in regions in which that has been introduced

F. L. Mulford

The conifers in particular.

The cone-bearing trees (*Pinaceæ* and allies) are decidedly the most important order of forest trees in the economy of civilized man They have furnished the bulk of the material of which our civilization is built The remarkable combination of strength and stiffness with the smallest weight compatible, and the abundance and gregariousness of their occurrence, give them this important position

From the standpoint of the horticulturist, the conifers also take a prominent place among the materials for landscape gardening effects, and, in the more practical use, as windbreaks Their evergreen habit—for all except the larch and ginkgo tribes are evergreen—and their conical form, especially in earlier periods of life, with a branch system persisting to the base for a long time, are the elements that make them desirable. To these graces may be added the peculiar form and striking coloring of their foliage, which, in combination with deciduous trees or in clumps by themselves, or in single specimens, offer striking effects

There are two types of natural or native beauty in the conifers—the symmetrical and verdurous beauty of the young specimen (Figs 318, 319), and the picturesque and rugged beauty of the old and timeworn tree (Figs. 315-317) Aside from these, there are also odd, grotesque and formal cultivated varieties, as typified in the weeping spruce (Fig 320), the columnar junipers, and the various dwarf pines and spruces

The majority of the species belonging to this group, as well as their greatest numerical development, is found in the temperate zones, only a few belonging to subtropical or tropical countries, among which are the araucarias, from South America, the dammara, dacrydium, and phyllocladus, from Australia, and neighborhood

Kinds and adaptations.

The order Coniferæ comprises nearly 40 genera, and about 300 species Our own native flora, with 15 genera and not less than 100 species and subspecies, is among the richest, the bulk of these being found on the Pacific coast The Atlantic side offers 28 species, representing the genus Pinus with 12 species out of 39, 1 Larix out of 3, 3 Piceas out of 7, 2 Tsugas out of 5, 2 Abies out of 12, 1 Taxodium, 1 Thuja out of 2, 1 Chamæcyparis out of 3, 3 Juniperus out of 11, 1 Tumion (Torreya) out of 2, 1 arborescent Taxus out of 2 being without representatives of the genus Pseudotsuga, Sequoia, Libocedrus, and Cupressus There are to be added a large number (not less than 400) of nurserymen's varieties, some of which have been enumerated in Bulletin 17 of the Division of Forestry, United States Department of Agriculture.

There are also a number of exotic conifers that promise satisfactory results if used in suitable localities, climate and soil The Norway spruce (*Picea ex-*

celsa, Fig 356) recommends itself by its elegant gothic form, often with pendulous branchlets, its very rapid growth, and its wide adaptation to soils and climates, together with its ease of propagation and cheapness It excels most of the American spruces in form and rapidity of growth Like all conifers, after the twenty-fifth to fortieth year it must pass through a period of change in form, during which it loses, for a time, its shapeliness. The Scotch pine (*Pinus sylvestris*) has nothing to recommend it which may not be found in native species, except, perhaps, adaptation to the dry climate of the West, and cheapness The Austrian pine, on the other hand, is an acquisition by its stout growth in its youth, although the red pine (*Pinus resinosa*) would probably do as well, so far, its small cones and seed have made the latter expensive The European larch outgrows the native northern one easily, but *Larix occidentalis*, from the interior basin, will probably do as well or better There is no particular commendation for the European fir, but the Nordmann fir, from the Caucasus, is a most decided acquisition, by its beauty and adaptation, so is the most graceful of all spruces, *Picea orientalis*, while the Spanish *Abies Pinsapo* (Fig 318) will always attract attention by its peculiar shape and foliage

Of other ornamental forms, that are without representatives in the United States and hence fill vacancies, may be mentioned as capable of adaptation and more or less in use, from South America, the araucarias, from Africa and eastern Asia, *Cedrus Deodara*, *libani*, *atlantica*, *Abies Apollinis* and *cilicica*, from Korea, the promising, more densely foliaged white pine, *P koraiensis*, from China, Cunninghamia, Biota, Glyptostrobus, Cephalotaxus, Podocarpus, Pseudolarix, and, above all, that interesting remnant of former ages, the maidenhair-tree, *Gingko biloba*, which will maintain itself anywhere along the Atlantic coast if propagated from seed of the proper localities Japan has furnished a number of additions, especially retinosporas, torreyas, taxus, various pinus, piceas and tsugas, with the peculiar *Sciadopitys verticillata*, the umbrella pine, and, the most acceptable of all, the graceful *Cryptomeria japonica*

As with all introductions from one country to another, nay, from one climatic region to another, caution is advised, so it may be laid down as a rule, that exotics should be used with great discretion, and, until their adaptation is amply demonstrated, only in a subordinate way If it is in general true that perennial plants can be transplanted with permanent success only into similar climatic conditions, it must be especially true with the conifers, which do not lose their foliage, and hence must be able to bear summer as well as winter conditions The long-leaf pine of the South, most striking of our pines, may, therefore, not be transplanted far beyond its northern limit, and, if one desires to utilize any of the Pacific coast species in the East, one will have to secure them at least from the highest and driest altitudes and exposures, or if, as in the case of some species, like the Douglas fir and Engelmann spruce, their field of distribution covers the dry slopes of the Rocky Mountains as well as the moist slopes of the coast ranges, one may be successful if one chooses the plant material from these drier slopes.

Of the many native species, a number that are not of any particular value may be discarded, although the distinction could be more readily accomplished from the economic point of view than from the standpoint of the horticulturist and landscape gardener, for almost every one has a distinctive feature of either form or adaptation to soil or other interest For each climatic region the choice must be different, hence it would be impossible to give, in the brief space of an article, intelligent advice as to best selections In general, besides climatic limitations, the following considerations may serve in the choice of native species·

The pines, as a rule, are not to be placed on compact clay soil, and on account of their taproot, not on shallow soils, on which they soon become spindly, they thrive best on loose, sandy soils, and can endure dry soils, the white pine adapting itself perhaps best to the clay soils without detriment to its development. On wet soils pines are, as a rule, decidedly out of place, although the red pine (*P. resinosa*), of the North, and the loblolly (*P. Tæda*), and some other southern species are capable of supporting such conditions For such situations here, however, the cedar tribe furnishes better material,—the chamæcyparis, thuyas and taxodium These trees of the bog and swamp are, however,—it should not be overlooked,—capable of thriving even better on drier soils They are merely indifferent to moisture conditions at the foot

The shallow-rooted spruces are trees of the higher mountain ranges, and are, therefore, more adapted to moist and cool situations, although some of them, the



319 A well clothed conifer —Abies venusta

Norway spruce, the blue spruce of Colorado and the northern white spruce will—the former, at least, during its juvenile period—endure more droughty situations The firs, too, are rather more species of northern climates and high altitudes, the red fir, so-called (*Pseudotsuga taxifolia*), which is not a fir proper, being, perhaps, best capable of supporting drier and hotter situations The most ornamental, and, in many respects, most serviceable of the firs, *Abies Nordmanniana*, from the Caucasus, develops its magnificent dense and dark green foliage in the warm but moist climate of Washington, while our most ornamental *Abies concolor* from Colorado will thrive even in the drier atmospheres of the middle states The fine firs of the Pacific coast will probably not thrive anywhere in our drier and hotter eastern climates for any length of time, unless placed in cool and shady situations

The Douglas fir (*Pseudotsuga taxifolia*) is, perhaps,

most readily acclimated if seed is secured from the dry slopes of Colorado. The Lawson cypress (*Chamæcyparis Lawsoniana*), with its graceful pendulous branches and foliage, and the pyramidal *Libocedrus decurrens* are unquestionably desirable additions to our ornamental stock, while the sequoias, especially *S. gigantea*, the big tree, seems not to be able to support persistently our eastern climate.

One important feature which enters into consideration when grouping conifers is the relative endurance of shade or tolerance which the species exhibit, thereby indicating their use in various positions. The yews and firs are the most tolerant of shade, together with the hemlocks; next may be placed the spruces, arborvitæ (Thuya), and junipers, while the pines are mostly intolerant of shade, excepting the white pine, which is the most shade-enduring of the pines; the larch and the bald cypress are the most light-needing of all, and will perish soon if placed under the shade of any other trees. All species, to be sure, are capable of more shade-endurance when young and on deep, moist soil. Their relative shade-endurance under the same conditions remains, however, the same, and may be studied in the forest by observing the density of the individual crowns, the capacity of maintaining a thrifty foliage under the shade of different species, and especially of young plants to persist in such shade.



320. A "weeping" or drooping form of Norway spruce. This is a so-called horticultural variety, to be planted only sparingly.

Propagation

Most conifers ripen their fruit in the fall, September to November, and are best gathered soon after or before ripening. The pines require two years (some three years) to mature their cones. White pines ripen fruit in the first two weeks of September, and the cones opening shed the seeds at once, the empty cones remaining on the branches. The cones of the firs fall apart upon ripening, hence must be gathered before being quite ripe. Spruces and hemlocks shed seeds from time to time, opening and closing their cones according to the weather through the winter into spring. Some pines, like *Pinus pungens* and *P. serotina*, keep their cones closed for years, and artificial heat must be employed to make them open and give up their seed. In gathering seeds for the trade, such artificial heat is frequently applied with pines in specially constructed seed-roasters, such seed should be carefully inspected, as it sometimes suffers from improper use of the heat.

The proportion of germinating seeds, and the vitality, i.e., the ability of retaining germinative power, varies greatly not only with the seasons in the same species, but from species to species.

The lowest germination percentage and vitality is found in firs and larch, which show rarely more than 50 per cent of good seed, and soon lose their vitality, while spruce and pine, when entirely fresh, may show as much as 95 to 100 per cent germination, and retain vitality for two to five years, losing each year a proportion, Norway spruce five years old still having 10 per cent germination.

In trade, a germination percentage for spruce of 75 to 80; pine, 70 to 75; fir, 30 to 50; larch, 20 to 40, should be acceptable.

Seeds are best kept in a dry, cool garret in tight bags or boxes, excluding the air as much as possible.

All seeds require a short rest or after-ripening of two to four weeks before they are ready to germinate, and some, like the taxus and juniper, lie over, even in nature, for a year or more before they germinate. The latter should be prepared for sowing by macerating them, and removing the pulp in hot water, then mixing with sharp sand in bags, and by friction freeing the seed from the pulp.

In the seed-bed somewhat more care is required than with most other species of trees. A thoroughly mellow, well-pulverized seed-bed of light loamy sand, possibly enriched with well-decomposed manure (cow-dung better than horse-dung) is required, the covering of the seed varying, according to size, from a mere sprinkling for larch to ¼ inch for the heavy-seeded pines. They may be sown as soon as the weather is settled, in northern latitudes the second or third week in May, best in rows not more than 6 inches apart, and preferably in dry weather, when the soil does not clog, for clogging or baking of the earth sometimes prevents seeds from germinating. Mulch between the rows with pine needles or sphagnum moss, or other fine mulch, to reduce necessity of watering and weeding. Conifer seeds need very little water for germination. The seedlings, on the other hand, for the first three months, until they have made their crown bud, need to be either kept well watered or else protected against the drying effects of sun and wind by shading, for which purpose lath screens are best. These latter must be lifted for airing after the sun is gone, especially in muggy weather, to avoid damping-off. For wintering, a covering with conifer branches or very clean meadow hay is advisable (the latter is likely to bring in weeds).

For growing small quantities, the use of boxes, as described by Jackson Dawson, of the Arnold Arboretum, in Proceedings of the Massachusetts Horticultural Society, is highly commendable. In well-drained boxes, sow the seed soon after gathering, pile four or five deep in a pit or sheltered place, cover with boards, and when cold weather comes, cover up with leaves or hay. About the middle of April, move them into a place where they get the early morning sun. Keep the seedlings well watered and free from weeds, and shaded as described. Winter the seedlings in same manner as the seed-boxes, well covered up. They are ready for transplanting next spring, when they are making their first or second set of true leaves.



321. A "weeping" tree, representing a grotesque horticultural variety.—Ulmus scabra var. horizontalis.

Since pine and spruce seedlings take about seven to ten pounds of phosphoric acid, ten to twenty pounds of potash and fifteen to thirty pounds of lime, besides

twenty pounds of nitrogen, per acre from the soil, for continuously used nurseries the addition of mineral materials in the shape of bone-meal and wood-ashes may become desirable.

A large number of seedlings may be grown in a small space; thus 30,000 Norway spruce may be grown on a square rod, requiring about two pounds of seed The quantity of seed sown depends, in part, upon the length of time it is expected to leave seedlings in the seed-bed, besides size and quality of seed, the quantities vary from one-fourth to one-half pound per 100 square feet if sown in drills, and the yield of seedlings will vary from 2,000 to 25,000 seedlings, according to species and seasons.

Transplanting and pruning.

Conifers, like any other trees, may be transplanted at any time of the year, provided the necessary care is taken in moving the plant This care is least required, as with other trees, in the fall and early spring, when activities of root and foliage are, if not at rest, at least reduced Which of these seasons is preferable depends on the locality, and the dependent character of the season On the whole, spring planting will probably be preferable in most parts of the United States which do not suffer from dry spring winds In localities of the Southwest, which have commonly a dry spring followed by a rainy season in July, this latter time



322 An ideal shade tree.—White oak

should be chosen There is a belief that planting in August is specially favorable There is no reason for this belief, unless favorable weather (a rainy season) follows

Conifers may be transplanted later than deciduous trees, even after the buds have started, excepting the larch, which buds out very early, with this species, fall planting may be recommended Cloudy weather, rather than rainy or very dry, should be chosen especially when transplanting into nursery rows

Young trees are naturally more readily and successfully transplanted than older ones, with which there is more difficulty in securing the whole root-system when taking them up Since, however, the seedlings develop slowly for the first one or two to three years, they should be left in the seed-bed for that length of time, root-pruned, and then transplanted into nursery rows Although those with a shallow root-system, like spruces and firs, may be moved even when 30 to 40 feet in height, it is best, even for ornamental purposes, not to take them more than 3 to 4 feet in height In forestry, one- to four-year-old plants, according to species, from 2 to 12 or 15 inches in height, are preferred for reasons of economy.

Much greater care than with deciduous trees is necessary, when transplanting without an earth-ball, in keeping the root fibers from drying out, a large amount of loss in transplanting is explained from neglect in this respect As soon as taken up, the roots should be



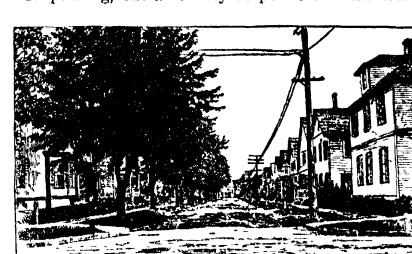
323. Good street trees.—Pin oaks.

immersed into a loam-puddle, or kept protected by wet sphagnum moss or canvas until set into their new place

The question of trimming when transplanting must be considered with more care than is necessary with broad-leaved trees, which possess much greater recuperative power It should be confined to the smallest amount, smoothing bruised roots, and if for proper proportioning pruning at the top becomes absolutely necessary, shortening the leader rather than branches Larch will stand more severe pruning than most other conifers From the artistic as well as physiological point of view, it is barbarism to remove the lower branches, which the tree needs to shade its trunk and standing room, and often, when deprived of the same, will replace first before starting again, in its height growth Attention should, however, be especially paid to preventing double leaders, which are detrimental to future form-development; cut them out as early as possible, preferably in the bud Laterals may be somewhat shortened-in while standing in the nursery, to lengthen the time during which the lower branches are to persist Breaking out buds is, as with all trees, the best method, provided the pruner has an eye for his business Even in after-life, when pruning is performed to keep the tree shapely, the minimum use of the pruning-knife should be the rule

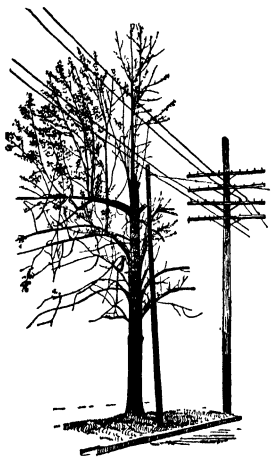
There are three marked periods in the development of conifers - the juvenile period, when the entire tree is a crown, branched symmetrically to the base, the perfection of symmetry, then follows the adolescent stage, when the lower branches die out, a period of unshapeliness, followed by the virile stage, when the straight, cylindrical shaft bears the crown at one-third or one-half of the upper length of the bole The trimming during the adolescent stage requires most consideration It is, in most cases, best to take off only the lowest, dying or dead branches, as it becomes necessary

In pruning, cut as closely as possible to the trunk,



324 Effect of trees on city street compared with no trees

even cutting into the bark, also removing the swelled portion on which the branches are usually inserted, when the callousing will be more rapid and satisfactory in shape



325. Trimmed by linemen.

If at this stage or at any time, the trees show trouble at the top by drying (becoming "stag-headed"), it is a sign that they suffer at the root from lack of moisture Trimming off a few tiers of lower branches, loosening the soil as far as the ambitus of the crown, and mulching will largely correct this If this proportioning of crown to root is not done, the tree itself will do it and not necessarily in desirable form When used for hedges, the treatment is, of course, different For such a purpose the shade-enduring species, spruces and hemlocks, are best, since they are capable of preserving a dense interior foliage, while the pines are bound to thin out.

Enemies.

There are a number of dangers and damage from insects to which conifers are exposed Drought and frost are most dangerous to seedlings in the seed-bed These are obviated by proper location of the seed-bed (protection against sun and wind), by covering with a mulch of moss, straw, pine-straw or the like (which also prevents the heaving out by frost and the washing out by rain, to which young seedlings are liable) By shading and watering the danger of drought is overcome, although at the same time that of damping-off is invited The cause of this disease, consisting in the reddening of the needles and then falling off, is a fungus which can be combated by spraying Birds may be kept away from the seeds by mixing them with red oxide of lead, by lath screens, and the usual methods



326 Showing need of city control This tree on a city street being trimmed for firewood.

Various fungi and insects, too many to mention, some polyphagous, others more or less specific, are at work during the various stages of development A host of leaf-miners, sawflies and caterpillars destroy the foliage, and weevils sap the young shoots Bostrichi, or bark-beetles, mine under the bark, mostly of trees that are sickly from other causes, borers enter the wood of the boles Tortrices bore into the base of leaders and cause them to break off. The best remedies against most of these are preventives, namely providing the trees with such chances of vigorous growth, or satisfactory soil conditions, that they are able to ward off or overcome the enemies Otherwise, watching and destroying the enemies in time, and the usual remedies to kill them, may be employed Literature Veitch, "Manual of Conifers," Carrière, "Traité des Conifères," Beissner, "Handbuch der Nadelholzkunde,' Fernow, "Care of Trees B. E. FERNOW.

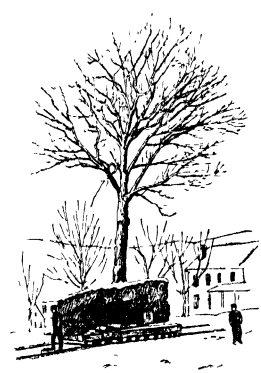


327. Same tree as Fig 326 five years later, showing unattractive bushy top, and bad stumps that will decay instead of healing.

Transplanting large trees (Figs 328–332).

Moving large trees divides itself into two classes: First, with a ball of earth., second, with the earth dissected out from the roots with or without a ball remaining in the center

Start at or near the ends of the roots where they are 1 inch in diameter or less In practice, this results in about 30 feet spread of roots on a tree 12 to 15 inches in diameter An elm 18 inches in diameter on very thin gravelly soil was found to have a root 6 inches in diameter at 15 feet from the trunk, extending toward a horse-shed and cultivated field where it would get more food and water A trench is dug to below the roots, which may be 1½ or 3 feet An under-cut is made and the soil caved down by a picking bar or fork with round pointed tines The earth and roots will be mixed at the bottom of the trench The roots must be carefully picked up with the fingers, bound in bundles and tied out of the way This operation is the point of greatest failure as it takes considerable time, patience and skill, to avoid breaking the roots There are many chances to break a root after it has been carefully dissected out The roots must be promptly lifted up or they will be broken by the shovel in digging out the loose soil at the bottom of the trench The bundles must be untied and rearranged where the roots cross This proceeds until a tree is dug in to a ball about 6 to 8 feet The tree is then tipped over by tackle, cleaving the roots from the subsoil

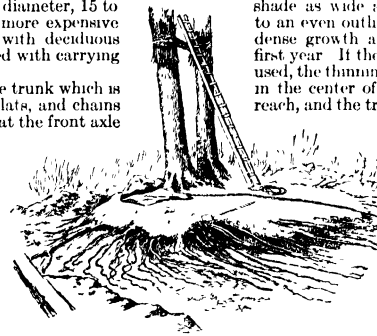


328 Moving a tree in winter, with a large ball of frozen earth.

The amount of earth left in the center depends upon the strength of the truck, character of the roads and power for

hauling To leave a mass of earth 6 to 7 feet wide, 15 inches deep, is practicable with two teams and 6-inch tires over hard dirt roads Such a ball is helpful because there are more roots left undisturbed and they help support the tree during the first summer, especially if the ball is kept to the proper degree of moisture Larger balls, 8 and 10 feet in diameter, 15 to 20 inches deep, can be carried only by more expensive trucks with much wider wheels, and with deciduous trees the advantage is slight as compared with carrying a full circle of roots 30 to 40 feet wide

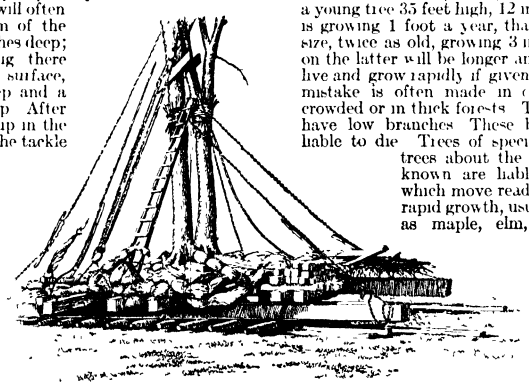
The trees are readily picked up by the trunk which is protected by cushions and clasped by slats, and chains tightened by screws A cradle is hinged at the front axle and tips the tree over in a horizontal position which is necessary on account of overhead wires and bridges There are one or two screws about 9 feet long, 2½ inches in diameter Tipping is accomplished by these screws or tackle or both The roots on the lower side of the tree are tied back underneath the axle



329. A large tree removed from its place The roots are now to be wound in burlap or other material

In transporting, the roots are wrapped in straw and burlap They can be exposed to the air for a day without serious injury, as roots ⅛ inch in diameter do not get dried out and killed in that time In passing under wires, these can be lifted by a T-shaped pole and disentangled from the branches by proceeding a few feet at a time Dangerous high tension electric wires must be handled by linemen employed by the electrical company It is sometimes necessary to raise the wires or take them down and drive over them

In planting, the truck is drawn into the hole and stopped at such a distance from the center that the tree when swung over will be in the right position The holes should be made of such a depth as to keep the roots as near the surface as possible Allowance must be made for the bending of the downward roots below the center of the ball The most frequent mistake is to get the tree too deep, especially the roots at the outside of the ball, which will often drop to the bottom of the hole and be 18 inches deep; whereas when dug there were some at the surface, some 6 inches deep and a few 18 inches deep After the tree is stood up in the hole by means of the tackle and screws, earth is packed under the center by packing-sticks This is difficult and there are liable to be air-holes left vacant A stream from a hose will help to wash mud into these spaces It is best to leave the bundles of side roots tied up while this is going on Before the bundles of side roots are untied, the bottom of the hole should be filled up, if necessary, so that these are 2 to 8 inches below the surface Spread out the side roots and cover with earth.



330. The roots wrapped, and the tree being moved on skids

Anchoring the tree is important It is easily done by three or four anchor posts 4 feet deep with a crosspiece 3 feet long Wires should be put through rubber hose and twisted around the tree The tree is liable to settle, the anchor posts move, the tree lean and require straightening and tightening of the wires by further twisting

Pruning is important, made so by cutting back the tree from 2 to 8 feet all around It is best to cut the most at the apex and the least at the sides, to make the shade as wide as possible If cut back to an even outline, the tree will make a dense growth and look more solid the first year If the thinning-out method is used, the thinning is liable to be too great in the center of the tree, as it is easy to reach, and the tree has to thicken up over a period of four years by making sprouts in the center, the outer branches remaining thin, especially if the tree is not fed and watered enough

Wrapping the trunk with straw may be necessary with thin-barked trees, especially in warm and dry climates The bark is liable to dry out and die on the southwest side The wrapping and anchors may be removed after two years or more.

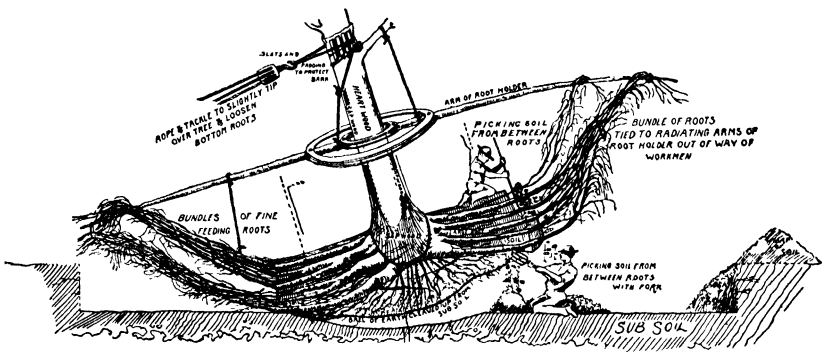
A mistake is often made in choosing trees within two miles, whereas, the area to draw upon is over fifteen or twenty miles radius which will contain much better trees, the time on the road being a comparatively small item in the total cost Trees are often chosen which are growing on thin or rocky soil or in swamps saturated within 6 inches of the surface, both giving much less amount of roots than trees in a friable soil 3 feet deep In a country of hills and valleys, the best trees may often be found in terraces or benches above the river bottom or in the river bottom if drained to allow roots to be 3 feet deep Trees are often chosen which are too old and have made a short, slow growth It is better to move a young tree 35 feet high, 12 inches in diameter, which is growing 1 foot a year, than to take a tree the same size, twice as old, growing 3 inches a year The roots on the latter will be longer and less flexible Each will live and grow rapidly if given favorable conditions A mistake is often made in choosing trees which are crowded or in thick forests The latter may appear to have low branches These branches are weak and liable to die Trees of species difficult to move and trees about the moving of which little is known are liable to be chosen Trees which move readily are those of soft wood, rapid growth, usually native in moist soils, as maple, elm, linden, poplar, locust, catalpa, horse-chestnut, birch, apple and pin oak The following are trees about which less is known Pepperidge, sassafras, plane, chestnut, beech, tulip, white oak, black oak, liquidambar, ailanthus, hickory, walnut and ash The chestnut, beech, magnolia, tulip tree, black oak and walnut do not indicate by their behavior when small that they are readily moved It is to be presumed that the ailanthus and ash are easily moved No species has proved itself impossible to move It is merely a matter of getting the right proportion of roots and top and nursing the tree through the convalescence until it has reestablished itself In moving trees it may be better to move three

trees 8 inches in diameter, 35 feet high, than one tree 16 inches in diameter, 35 feet high From three smaller trees there will result a wider mass of foliage, and it will be easier for those not equipped with large tree-moving apparatus to handle the three smaller trees

If the earth is dissected out from the roots, two trees 8 inches in diameter could be carried by one team They can be loaded on a low stone truck or handy wagon, the trunks of the trees resting on two benches which lessens the breakage of roots and top. Trees can be loaded by the men, the tree being tipped over on the truck which stands beside the hole.

9 feet in diameter with trees 10 to 18 inches, on a low truck consisting of a platform hung under four heavy wheels, the tree being lashed fast to a collar and pole on the rear axle, and pulled over to the rear and then the platform chained fast to the rear axle The roots outside the ball are usually cut off With elm trees carrying a slender top this method succeeds, although the trees are often slow in recovering It succeeds with maples, but they are likely to grow slowly or die back until the tree reestablishes a balance, after several years.

Deciduous trees can be moved in midsummer in full



331. Diagram to illustrate the operation in the removal of a large tree for transplanting

The tree is shifted into position by the men lifting on the trunk, or it may be lifted by a shear pole derrick or single pole Many people hesitate about moving large trees and wait fifteen years for a result they could easily secure in this manner, by collecting wild trees in the vicinity

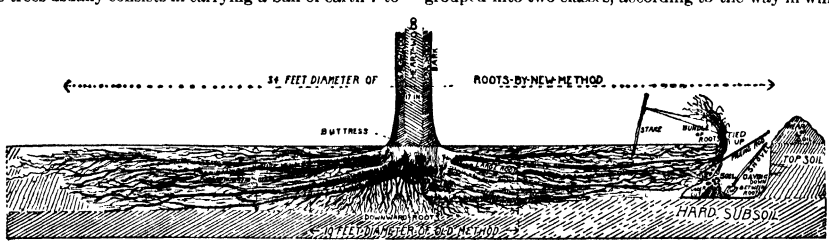
Root-pruning a year in advance may aid in moving a tree, but is not essential. If a trench is to be dug at a radius of 4 feet all the way around a tree 10 inches in diameter, it is better to move the tree with a wider spread of roots and take good care of it A root-pruned tree is likely to be neglected and suffer for moisture The tree can be root-pruned three-quarters of the way around for one season and perhaps be in better condition for moving This is more likely to be beneficial with a tree with long coarse roots and with few fibers in the center, like a black oak A mistake is frequently made in assuming that a ball of earth is all that is essential, regardless of the amount of fibrous roots in the ball and of its area to gather rainfall as compared with the top Frequently trees dug around the roots cut off at a diameter of 10 feet, have the tree-mover sent for when they should have a spread of roots of 30 feet The ball-of-earth method with deciduous trees usually consists in carrying a ball of earth 7 to leaf. Norway maples 7 inches in diameter were well watered to fill them with sap, the next day they were dug with roots spreading 15 feet, leaving a ball of earth 5 feet in diameter in the center. The tree was tipped back and a platform or stone boat moved under, on which it was moved After planting the trees were watered about four times, once in ten days The ball of earth became dry very quickly The bundles of outer roots did not send out fibers for about two weeks Trees with less fibers in the center would probably not succeed so well. See also *Drainage* and *Evergreens* for further discussion

HENRY HICKS

Types of insect injury to trees.

Trees of all sorts are liable to injury by many kinds of insects, so many indeed that it is difficult to present a satisfactory account of their depredations without going into great detail A few insects stand out preeminently, however, among the more common and widespread tree pests and a selected series of these will serve as examples of the various ways in which the trees may be injured by these animals.

Destructive forest- or shade-tree insects may be grouped into two classes, according to the way in which



332 Diagram to show how and where the digging is begun.

they feed, based on the fact that one series feed by chewing and consuming the tissue of the trees, while the members of the other class derive their nourishment from the juices or sap of the trees which they suck out by means of needle-like sucking mouthparts Most insects pass through three, or at least two, preparatory stages, very different from the adult, before they reach maturity. They hatch from eggs deposited by the adult female, as larvæ (grubs, caterpillars, maggots, and so on) and in this larval stage feed till they attain their full size The larval stage is, therefore, the most destructive one When full grown, the larva usually changes to a resting condition or pupal stage (chrysalis), and during this time does not feed Finally the adult appears and the life-cycle is complete Many insects undergo a single generation every year, but a number grow more rapidly, producing several broods each season, while a few require two years or more to mature



333 Lepidopterous caterpillar (¾)

Insects provided with chewing mouthparts may feed on the leaves and are then known as defoliators, or they may feed on the bark, cambium, sapwood, heartwood, or roots, in which case they are known as borers Caterpillars, beetle grubs and saw-fly larvæ are the most important insects of the latter kind

Among the insects with piercing mouthparts, some suck the juices of leaves, while others affect the twigs and branches, or even the roots Plant-lice and scale insects are the most important insects of this kind

Methods of destroying tree-pests

There are five widely different methods of destroying insects which injure trees, and the selection of an appropriate method must depend primarily on the feeding-habits of the species to be dealt with.

(*a*) *All defoliators*, such as caterpillars (Fig 333), saw-fly larvæ (Fig. 334), and those beetle larvæ that feed externally upon the leaves, are best killed by the application of an arsenical poison (Figs 335, 336) This is applied preferably by some sort of a spray-pump that throws a fine mist or spray of water in which the arsenical has been mixed Such spraying machines may be obtained in sizes to suit any needs, from hand-pumps holding a quart of liquid to power sprayers equipped for spraying extensive woodlands thoroughly and rapidly The most satisfactory poison is arsenate of lead, an insoluble arsenical which can be mixed with water in the proportion of six to ten pounds to each 100 gallons of water and sprayed upon foliage without danger of damage to the leaves It is sold commercially as a white paste and is easily handled This substance is far superior to paris green, london purple, and the like It should be applied only in sufficient amount to show after drying as whitish specks upon the surface of the leaves



334 Sawfly caterpillar (Natural size)

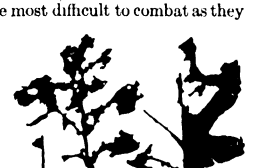
(*b*) *Plant-lice*, since they feed by inserting their beaks into the tissues of the leaves, and other soft parts, are not affected by arsenicals and must be destroyed by spraying with what is known as a contact insecticide, one that kills through the application upon the surface of the insect's body The most generally used, and one of the best contact insecticides is kerosene emulsion This is prepared by dissolving half a pound of common laundry soap in one gallon of hot water and then adding two gallons of kerosene while stirring or churning the mixture violently The creamy mass thus formed thickens on cooling and must be diluted with nine times its volume of water before being sprayed upon the plants. Scale insects feed like plant-lice, by inserting their delicate beaks into the tissue of the tree and sucking out the sap, but usually occur on the thin bark of the branches and twigs rather than on the leaves Each insect secretes a scale-like covering beneath which it lives while growing, and, even when adult, the female never leaves her position beneath the scale As the scaly covering is of a waxen nature, these insects are not so easily destroyed by contact insecticides as are plant-lice, although kerosene emulsion is sometimes effective, especially in the case of young insects which have not yet secreted a thick scale Many older or more resistant scales cannot be destroyed in this way and they may be killed when the trees are in a dormant condition by a spraying with lime-sulfur wash prepared as follows Water, forty gallons, fresh lime, twenty pounds, flowers of sulfur, fourteen pounds These are boiled together for one hour and then applied as a spray to the branches and twigs This wash should never be sprayed upon trees when in leaf



335 Injury by leaf-eating caterpillar of small size

(*c*) *Bark-beetles* —These are small insects that live during the larval stages beneath the bark of the trunk and branches of trees The parent insects enter the bark and excavate a small tubular gallery through the cambium or inner bark Along the sides of this, the eggs are laid and the developing larvæ eat out sinuous burrows through the cambium They thus interfere with the sap-flow and cause a general weakening or even death of the tree Bark-beetles are liable to attack sickly or dying trees, and the only feasible method of lessening their depredations is to remove and burn such trees or branches as are affected, in addition to improving in all possible ways the conditions under which the tree is growing, bearing in mind that healthy trees are much less likely to be troubled by these insects than are weak, poorly nourished ones

(*d*) *Wood-borers* —The larvæ of certain beetles and moths subsist upon the woody tissues of trees, excavating galleries through the wood of both living and dead trees Such larvæ are usually whitish, often with brown head and have powerful jaws, by means of which they can cut through the solid wood They may attack trunk, branches, or twigs, some working in the sapwood, others in pith, while a few feed mainly on the heartwood Insects of this kind are the most difficult to combat as they feed where they cannot be reached by means of insecticides during the greater part of their life Due to their concealed position, they are not so readily noticed and may frequently cause irreparable damage to trees before their presence is recognized Besides cutting out the individual larvæ or destroying them in their burrows by means of a piece of wire, no general method of destruction can be recommended It is important, however, to maintain the trees in as healthy condition as possible, and to remove all dead or dying timber in order to reduce the number of breeding-places for the insects



336. Injury by leaf-eating caterpillar of large size

(*e*) *Leaf-miners* —To this class belong some of the

members of several different groups of insects, certain small moths, a few saw-flies and a small number of flies and beetles All of the leaf-miners are very small insects whose larvæ feed upon the parenchyma of the leaf, leaving intact the upper and lower epidermis In this position they are protected from most sorts of insecticides, although in some cases, spraying with a contact insecticide containing some tobacco compound in combination with soap may be efficacious. One formula recommended is: water, 800 gallons; nicofume, or "blackleaf 40," one gallon, laundry soap, thirty-two pounds Ordinarily, leaf-miners do not present a serious menace to trees, but the presence of their blotch-like or serpentine galleries, which show as faded areas, often greatly disfigure the leaves.



337 Tussock moth larva (×½)

Some of the more important shade-tree pests.

A *Defoliators.*

The tussock moth, *Hemerocampa leucostigma* (Fig 337), is perhaps the most abundant caterpillar on trees, particularly in thickly settled districts The eggs are laid in the fall in white fluffy masses the size of a dime on the trunks of infested trees and hatch in the early summer The larvæ bear several pencils of long black hairs placed at each end and have four brush-like tufts of pale yellow hairs above, with a bright red head These pupate early in July in crevices in the bark and the adults soon emerge to lay the eggs for a second generation of caterpillars which will mature before fall into moths that deposit the over-wintering eggs The female moth is without wings and lays her mass of eggs on the bark where she emerges from her pupa case These caterpillars feed on all sorts of trees except evergreens, but seem to be most destructive to maple, elm and American linden Two related caterpillars have been imported from Europe into Massachusetts, the gypsy moth and brown-tail moth, and although these are at present confined to that neighborhood, they will undoubtedly become widespread before many years have elapsed The gipsy caterpillars feed on many kinds of trees, preferring oaks, they may be recognized by a double line of round spots down the middle of the back, blue, followed by red ones Their life-cycle is like that of the tussock moth, except that there is only one generation passing the winter as a mass of woolly, dull ochre-yellow eggs attached to the bark The brown-tail is a brownish caterpillar with white spots, passing the winter in small woven silk nests containing many caterpillars The nests are attached to the tips of the twigs of infested trees Orchard trees suffer most severely from this species, although all sorts of broad-leaved trees are attacked.



338. Cocoon of bag-worm (×½)

Another common caterpillar of very different habits is the American tent-caterpillar, *Malacosoma americana.* This is an inconspicuous brownish moth which over-winters as a band-like mass of eggs placed around twigs of cherry and a number of other trees These hatch in very early spring and the larvæ spin silken nests in small forks of the branches from which they crawl out to feed upon the opening leaves. They mature in early summer and the eggs are laid in midsummer for the next season's brood.

The bag-worm, *Thyridopteryx ephemeræformis,* is a defoliator at times very destructive, although each larva in his dependent bag does not have a wide range of operations Fig 338. Hand-picking and arsenical sprays are the remedies

The caterpillars of the mourning cloak, *Euvanessa antiopa* (Fig 339), are a very common pest of elm and other shade trees They are black, coarsely spiny caterpillars with red spots along the back, and feed more or less in colonies, usually defoliating single branches at a time The butterfly passes the winter as an adult, appearing in very early spring, and laying its eggs in May. The caterpillars from these eggs become full-grown before July, and the butterflies of another generation appear in July to lay eggs which will give rise to the hibernating butterflies of the next winter.



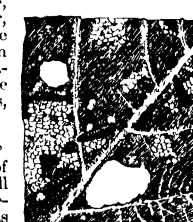
339 Euvanessa antiopa. (×½)

A common saw-fly which occurs on willows is the American saw-fly, *Cimbex americana* The larvæ are much like the defoliating caterpillars of moths and butterflies in appearance and feed in the same way, destroying the entire leaf-tissue The larvæ are pale green, with a blackish line down the back When mature, they descend to the base of the tree, where they spin parchment-like brown cocoons in which to pass the winter on the ground among fallen leaves In the spring, they transform and the adult saw-flies deposit their eggs singly in slit-like cuts made into the tissue of the leaf

Pine trees often suffer from the depredations of saw-fly larvæ of the genus Lophyrus which devour the needles, near the bases of which they later spin their small cocoons

Many saw-fly larvæ feed only on the leaf from one side, leaving the epidermis of the other side intact. Arsenical sprays for the destruction of such species must be directed against the side of the leaves attacked, usually the under surface

Among defoliating beetle larvæ, the imported elm-leaf beetle, *Galerucella luteola* (Fig 340), is probably most important This occurs only in the eastern states but is gradually spreading into the middle West The small, yellow, two-striped adults live through the winter and deposit their bright yellow eggs in small masses on the under side of elm leaves in early spring These eggs hatch into black and reddish slugs which feed on the under surface of the leaves, leaving only the veins and upper epidermis The leaves then dry up and may fall off. The larvæ, now changed to a yellow color, descend to the surface of the ground to pupate and soon emerge as a summer generation of beetles There are two or three annual broods, according to the latitude



340. Larvæ of elm-leaf beetle Holes made by adults, surface marks by larvæ.

B. *Plant-lice and scale insects*

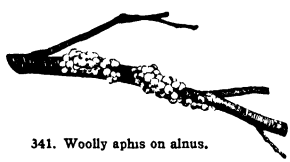
There are many kinds of plant-lice (Fig 341), but all pass through very similar life-cycles In general, this is as follows the winter is passed as a large, shining, elongate-oval egg attached to a twig or branch This gives rise in the spring to a soft-bodied wingless female aphid that gives birth to living young aphids, which in turn reproduce in the same way These suck the juices from leaves, petioles or tender twigs and thus sap the vital-

ity of the tree In addition, the leaves may be disfigured by a sticky substance, known as honey-dew, secreted by the insects In the fall, both females and winged males are produced and the female lays a single winter egg On account of their method of reproduction, plant-lice multiply very rapidly, especially in damp seasons Some species have a more complicated life-cycle, producing winged individuals in the summer which migrate to another food-plant, later to return in the fall to the original one

A few plant-lice living in colonies produce galls, curled leaves, or other malformations on the leaves or twigs of infested trees

Scale insects exhibit a greater variety in their seasonal history, some pass through a single generation each year, while others multiply more rapidly, passing through a number of generations annually The winter is sometimes passed in the egg state, but more commonly as a partly grown insect

One of the commonest and most destructive scales is the oyster-shell scale, *Lepidosaphes ulmi* This occurs on the thin bark of a great variety of trees, appearing as a very small, elongate, flattened body, pointed at one end and rounded at the other, with the upper surface more or less distinctly ridged in a transverse direction



341. Woolly aphis on alnus.

There is a single generation annually, the females maturing in late summer and depositing a mass of eggs which remains beneath the scale through the winter, hatching in the spring and producing full-grown insects by midsummer Sometimes this species is so abundant that the smaller branches appear as if covered by a gray incrustation

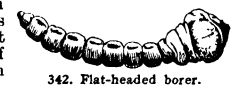
The San José scale, *Aspidiotus perniciosus*, is another important scale, which has been introduced into many parts of the United States It is very destructive, primarily to certain orchard trees, but injures many thin-barked shade trees as well The scale is very small, round in the female and oval in the male, with a minute nipple-shaped projection near its center The females do not lay their eggs till the young insects are ready to hatch, so that they practically produce living young These develop rapidly, five or six broods maturing each season, of which the last hibernates in the half-grown condition In mass, the scales form a gray, granular crust, covering the branches and twigs

In some parts of the country, maples grown for shade trees suffer great injury by the cottony maple scale, *Pulvinaria innumerabilis* This scale is most conspicuous on the twigs in early summer, at which time the females are depositing their eggs It then bears a tuft of fluffy waxen substance resembling a bit of white cotton The young scales appear soon after, when they migrate to the leaves and feed till early fall before returning to the twigs, where they finally pass the winter in a half-grown condition

Practically all sorts of trees suffer at times from scale insects, of which there are many kinds The common forms are divisible into two groups, the soft scales and armored scales. The former are soft and convex like the cottony maple scale, in which the "scale" is the back of the insect itself, the latter are usually smaller, like the San José scale, in which the "scale" is a separate waxen cover secreted by the insect.

c *Bark-beetles.*

These insects are small black or brown beetles that live in the larval stages beneath the bark, feeding on the inner bark and cambium, and all have very similar habits The parent beetle enters the bark through a small hole about the size of a pencil-lead, and excavates a single primary or egg-gallery through the cambium, usually grooving the sapwood This tunnel varies from one to several inches in length, and along its sides the female cuts out little pockets, in each of which an egg is laid On hatching from the eggs, the larvæ excavate individual mines usually more or less perpendicular to the egg-gallery. When full grown, the white legless grub-like larvæ pupate in cells excavated in the bark, from which the beetles emerge by chewing out a circular tunnel to the surface Trees from which beetles have emerged appear as though the bark had received a charge of buck-shot, from the presence of the small circular emergence holes Some forms, like the genus Dendroctonus, attack fine healthy coniferous trees and kill much valuable timber, but shade trees are more commonly attacked by the species that live in the bark of deciduous trees, more particularly those that are in a sickly condition



342. Flat-headed borer. (Natural size)

A common form is the hickory bark-beetle, *Eccoptogaster quadrispinosa*, that attacks hickories. The beetles appear in June and July, to excavate the primary galleries which extend vertically for an inch or two. Forty or fifty eggs are placed in notches on the sides and the larvæ bore out at right angles, thus girdling the cambium and weakening or killing the branch This species undergoes only one generation annually, although some others pass through two or more each season. There are many other kinds, all scarring the bark or surface of the wood in a similar way

d *Wood-borers*

The larvæ of many beetles and moths, and of a few wasp-like insects, injure trees by excavating their food-burrows through the solid wood

Birches, grown for shade or ornamental trees, often suffer great injury from the presence of a flat-headed borer, the bronze birch-borer, *Agrilus anxius* The small elongate bronze-green beetles appear in May or June and deposit their eggs on the branches, at first near the crown of the tree. The larvæ penetrate the bark, beneath which they cut irregular flattened galleries till grown, when they cut out cells in the wood in which to pass the winter before emerging in the spring. The upper parts of the tree suffer first and begin to die, and the following year the larvæ appear nearer to the ground Chestnut is attacked by *Agrilus bilineatus*, the two-lined chestnut-borer

Most other kinds of trees suffer similar injury from related beetles, many of which multiply also in dead trees and stumps

Another flat-headed borer, the larger flat-headed pine-borer, *Chalcophora virginiensis* (Figs 342, 343), extends its flattened burrows deep into the wood of the tree, a method of feeding exhibited by many borers of this group attacking deciduous trees also. The larvæ grow to a length of 2 inches before cutting out their transformation cells in the bark



343 Chalcophora virginiensis, adult of flat-headed borer. (Natural size.)

Round-headed borers are similar in habits, but belong to another family of beetles in which the larvæ are less distinctly flattened near the head and excavate more nearly cylindrical burrows

One of our commonest species is the locust-borer, *Cyllene robiniæ*, which attacks yellow locust trees. The elongate medium-sized black beetles, with brilliant yellow markings, appear in the early fall to deposit

their eggs on the bark of the trees. The eggs soon hatch into larvæ which feed for a time and then over-winter in a small cell beneath the bark Next year they bore through the living wood and transform in August to beetles This species can destroy healthy locust trees rapidly and is a very serious pest wherever the tree is grown All infested trees should be pruned or felled and burned to destroy the larvæ, in the fall or winter Sugar maples suffer from a similar insect, as do practically all sorts of trees



344 Injury to tip of white pine sapling by white-pine weevil. (×½)

White pine trees are commonly deformed by the larvæ of the white-pine weevil which feed exclusively beneath the bark of the terminal shoots of young trees of this species (Fig 344)

The carpenter moth, *Prionoxystus robiniæ*, is a large common mottled gray insect with pale yellow black-headed and black-speckled larvæ 2 inches in length, that bore in the branches of many kinds of trees Oak suffers most, but maple, ash, locust, willow and cottonwood are often infested The moth lays its eggs on the bark late in the summer, and for two or three seasons the larvæ feed on the wood, cutting large circular burrows They transform in the burrow, the pupa working its way partly through the bark for the eclosion of the moth The brown pupa-case may then remain projecting from the mouth of the burrow for some time A related European insect, the leopard moth, *Zeuzera pyrina*, has recently become abundant along the northern Atlantic coast region, attacking elm and all sorts of other trees and shrubs. It feeds in the same way and bids fair to become one of our worst shade-tree pests The larvæ of many other moths injure trees in a more or less similar way

The pigeon horn-tail is a large cylindrical yellow-brown and black insect with grub-like larvæ that bore



345. Phylloxera galls on chestnut. (× ½)

in elm, maple, and other trees. The females insert their eggs deep into the tree by means of a needle-like ovipositor They frequently fail to extricate the ovipositor and may be seen dead, but still attached to the tree trunks

E *Leaf-miners.*

Small larvæ belonging to several orders of insects live as miners in leaves, the most abundant forms often greatly disfiguring the foliage of affected trees

Deciduous trees of all sorts are affected by the leaf-mining larvæ of various small moths, but it is very difficult to distinguish the different species without minute study Oaks are particularly susceptible and are commonly disfigured by the sinuous or irregularly rounded mines that appear as pale streaks or blotches. Even pines suffer from such larvæ, which enter a needle and eat out the tissue, causing the tip to dry and become yellow Occasionally insect larvæ cause malformations or swellings of the leaves or twigs, known as galls. (Figs. 345, 346.)

Yellow locust suffers from a leaf-mining beetle larva, *Odontota dorsalis*, that eats out almost all of the leaf parenchyma, causing the leaves to dry and shrivel. Related species affect oak and basswood. Members of another family, belonging to the genus Brachys, also mine in leaves of oak, chestnut, and so forth

One leaf-mining saw-fly is of considerable importance, *Kaliofenusa ulmi*, the larvæ of which eat out the parenchyma of elm leaves between the lateral veins, causing them to assume a seared appearance in spots (Fig 347) Another closely related species mines in the leaves of the hawthorn (Cratægus). The latter may be satisfactorily killed by a spray of tobacco-water, but the species on elm is more resistant. The larvæ of these species enter the ground later in the summer to spin their cocoons

C T Brues



346. Mite-galls on maple (× ½)



347. Leaf-miners' galleries in elm (× ½)

Some types of tree diseases.

Disease in plants is the result of any derangement in the normal form, structure or physiology of the organism The disease condition becomes manifest by different symptoms, according to the nature of the disorder Such symptoms as stag-head, cankers, leaf-spots, witches' brooms, and so on, are examples of the effect produced in the tree by some disease-producing agent or combination of agents The variety of functional disorders alone that may arise in trees is large Such causes as insufficient or excessive soil water, malnutrition, excessive heat or cold, or rapid variations in temperature are capable of producing effects called physiological diseases On the other hand are those diseases that are produced by the activities of parasites, such as certain of the fungi, and bacteria Accurately to place a new or little-known disease in one of these two classes is often difficult for the expert, even after much study There is relatively less known concerning the physiological diseases of trees than of those caused by parasites, not because of their less importance so much as of the difficulty of studying them It is to be deplored that the diseases of forest, shade and ornamental trees have not received their due share of study and investigation by pathologists

How fungi cause diseases of trees.

The fungi consist of a group of plants that do not contain chlorophyll, upon which all green plants depend for the synthesis of carbohydrates. Consequently, not being able to manufacture their own food, the fungi must secure it from their environment, by dissolving and utilizing organic materials from dead or living plant or animal bodies. By far the vast majority, luckily, belong to the class of scavengers which attack dead organic material and utilize it for food. These forms are called saprophytes. Other species of the fungi attack living plants and, through their activities, produce the disorders that are termed diseases These are known as parasites or pathogens

In brief, the general action of the fungi that cause tree diseases is as follows: The fungus exists in two stages, the vegetative and the fruiting. The vegetative stage consists of a mycelium, which is an aggregate of long much-branched microscopic threads of fungous cells. This mycelium penetrates and grows in the body of the tree, extracting nutriment from it by dissolving the different structures it can utilize. In this process the tissues of the tree are destroyed and the fungus obtains food for its further development. In time, after sufficient food has been stored in the mycelium, the fungus forms its fruiting bodies. In the case of the larger number of the heart- and sap-wood rots, this fruit body consists of a shelf-like or toadstool-like structure on the exterior of the tree. In these fruiting structures are borne millions of microscopic spores or seeds of the fungus, which are distributed largely by the wind. If by chance one of these spores finds lodgment on an exposed wound in the bark of a tree which it is capable of infecting, it will under proper conditions germinate, producing a mycelium that will penetrate the tissues of the new host.

Seedling diseases

The young seedlings in the nursery beds are often attacked by certain soil organisms that cause a decay of the stem at the surface of the ground, allowing the plant to wilt and fall over. This type of disease is called "damping off," in many cases it is caused by the fungus *Pythium de Baryanum*. This disease is largely induced by very moist soils, a moist atmosphere, high temperature, and little ventilation. By growing seedlings in light sandy soils, well watered but not excessively, and by aerating the beds well to reduce the humidity of the atmosphere around the plants, this trouble is practically avoided. Soils in which it has once occurred should be abandoned, however. In greenhouses in which this disease is often troublesome and the precautionary measures mentioned above difficult to maintain it may be necessary to sterilize the soil with formaldehyde or by steam heat immediately before sowing the seed.

Leaf diseases

Very little serious damage is caused by most leaf diseases of trees other than the unsightly appearance produced. There are a few leaf diseases, however, that are of more or less importance in the United States. Conspicuous among these is the anthracnose disease of oak and sycamore leaves, caused by the fungus *Gnomonia veneta*. Throughout northeastern United States in recent years the plane-tree (*Platanus occidentalis*) has been almost universally affected and the trees often completely defoliated before the first of July. Early in the season the disease becomes manifest by the production of rapidly enlarging brown blotches which are usually produced along the veins of the leaf. If examined closely, the numerous spore clusters can be seen. These clusters are composed of innumerable microscopic conidia which serve for the dissemination of the fungus. The twigs are commonly affected also and on these, as well as the fallen leaves, the fungus winters over. The same fungus produces a similar disease on oaks, especially the white oak, and is often epidemic in certain regions. As a measure of prevention, all fallen leaves and twigs from diseased trees should be carefully collected and burned. All diseased twigs should be pruned off and burned. If desirable, the trees may be sprayed with standard bordeaux mixture from the time the leaves begin to unfold, at periods of two or three weeks, until the first of July.



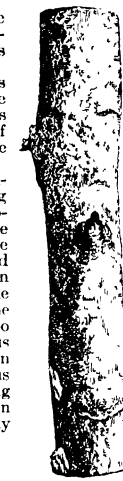
348. Maple leaf affected by the tar-spot fungus, Rhytisma acerinum

The tar-spot disease of the maple caused by *Rhytisma acerinum* is a conspicuous disease but seldom causes serious damage to the tree. Fig. 348. The diseased spots appear as blotches of tar on the upper surface of the leaves. Burning the diseased leaves will materially lessen the chances of attack the coming year since the pathogen winters in them.

Maple trees, at least in the northeastern states, have suffered during the past few summers from a physiological trouble called leaf-scorch. The leaves of one side or the whole of the tree turn brown between the veins and finally dry up. This disease has been ascribed to over-transpiration of the leaf-tissues at a time of year when the roots cannot furnish enough water to the tree to compensate the loss. Thus the leaf-cells are killed by desiccation and the brown blotches appear. It is advised that artificial watering during hot, dry weather will materially lessen the severity of the trouble, especially under city conditions.

Canker diseases

A diseased condition of the limbs or trunk of a tree that results in the death of an area of the bark is termed a canker. These cankered areas may be either sunken or enlarged, and the terms necrotic and hypertrophy cankers are used respectively to designate these characters. Not all cankers are produced by parasitic organisms, some are the result of malnutrition, winter injury, sun-scorch, insects, and the like.



349. Canker disease of the chestnut produced by the fungus, Endothia parasitica. The conidial tendrils are produced from the numerous ruptures shown in the bark

By far the worst epidemic disease of trees in America is the chestnut-canker now prevalent in many of the eastern states. In all, a total loss of $25,000,000 has been ascribed to this disease between the time it was first noticed, in 1904, on Long Island, and the year 1912. The cankers produced on the chestnut are caused by the fungus *Endothia parasitica*. Fig. 349. At present, the question of the origin of this disease in the United States is undetermined. The fungus works rapidly in the bark and sap-wood, killing the tissues. Fruiting bodies of two types are formed on the diseased bark, a conidial stage that appears as long yellow tendrils of gelatinous matter and the reddish yellow to dark brown cushion-like stromata that contain the ascospores. These latter spores are ejected in large numbers at every rainy period throughout the spring, summer, and fall and are carried by the wind, readily causing new infections. On the individual tree, the fungus is rapidly spread by the washing down of the conidia into wounds in the bark. The cankered areas soon cause the death of the parts above by girdling the limb and, in most cases, complete death of the tree follows in two or three years. The state of Pennsylvania has taken steps to eradicate this disease by seeking out diseased trees and compelling owners to cut all affected trees in the western half of the state. The extremely virulent nature of the disease, however, has led more conservative pathologists to question the advisability of expending large sums of money with so slight a chance of ultimate or complete success. The

problem of saving individual trees in affected regions has not been solved. The very nature of the disease precludes spraying, and tree surgery methods have not given anything more than temporary success Incipient cankers are so difficult to locate and, by producing conidia when only three or four weeks old, serve to spread the fungus so rapidly over the tree that human efforts so far have failed



350. Stem of white pine tree attacked by the white pine blister-rust fungus, Cronartium ribicola The fruiting stage is here shown in the process of rupturing the bark.

Rust diseases

The most destructive and important rust diseases of trees are those caused by different species of the Peridermiums on coniferous trees These rust fungi attack the needles, twigs, or limbs of coniferous trees, often producing defoliation or complete death of the tree Notable among these diseases is the white-pine blister-rust caused by the Peridermium stage of the fungus *Cronartium ribicola* (Fig 350) which has its Cronartium stage on species of currants and gooseberries The fungus is not native to this country but has recently been imported from Europe In Europe the disease has practically exterminated the white pine (*Pinus Strobus*) in many localities, and in this country the danger of a similar destruction of this species is now being faced, if the fungus acts with the same virulence as in its native environment In 1912 the Federal Board of Horticulture placed a quarantine on most of the countries of Europe, which prevents anyone bringing white pine trees from these countries into the United States The fungus attacks white pine from one to twenty years old, the mycelium growing in the bark and usually producing a swelling The orange-yellow fruiting bodies burst through the bark in one to five years after infection The spores from the pine can affect the gooseberry or currant leaves only On these hosts other kinds of spores are borne in the fall which can infect the white pine only and thus the yearly cycle is completed The black currant (*Ribes nigrum*) is by far the most virulently affected in this country, and it is advised that plants of this species are therefore extremely dangerous to the white pine industry and their culture should be discouraged By keeping currants and gooseberries at least 500 feet away from white pines, a partial safeguard is provided against the passing of the fungus from one host to the other All plants affected by this fungus should be immediately destroyed Consult Bureau of Plant Industry, U S Dept of Agric , Bulletin 206 for further details.



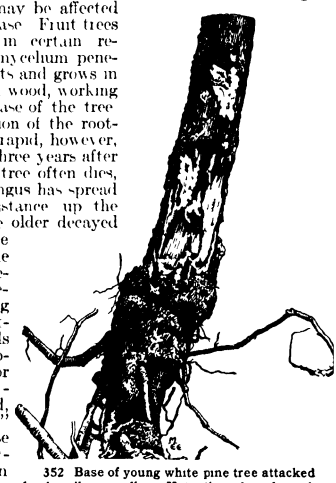
351. Black spruce attacked by the dwarf mistletoe, Arceuthobium pusillum, causing witches' brooms.

Witches' broom diseases.

Excessive branching at any point on a limb, forming a compact cluster of short stubby branches, is often caused by numerous agents, both insect and fungus, as well as by the mistletoes In the South, especially, trees of many species are disfigured by these witches' brooms caused by the American mistletoe, *Phoradendron flavescens* and related forms In the northern states the dwarf mistletoe, *Arceuthobium pusillum* (Fig 351) causes similar brooms on the black spruce (*Picea Mariana*) Witches' brooms on red cedar (*Juniperus virginiana*) are caused by the rust *Gymnosporangium nidus-avis*

Root diseases

The principal root disease of trees that is widely distributed throughout the United States is that caused by the mushroom *Armillaria mellea* Fig 352 The mycelium of this fungus grows in the soil on decaying wood as a saprophyte, but can also become parasitic, killing trees over large areas Almost any of our indigenous trees may be affected with this disease Fruit trees often suffer in certain regions The mycelium penetrates the roots and grows in the bark and wood, working up into the base of the tree The destruction of the root-system is so rapid, however, that two or three years after infection the tree often dies, before the fungus has spread any great distance up the trunk In the older decayed parts of the root and in the soil, the mycelium is aggregated into long black, flattened strands called "rhizomorphs," or more commonly termed "shoe-strings" In the case of coniferous trees, an abundant exudate of resinous sap occurs at the base of affected trees, which forms the surrounding soil into a cake The disease may be recognized by the gradual yellowing of the foliage, decay of the roots, presence of the "shoe-strings" in the soil, and the appearance of the honey-yellow mushrooms around the base of the tree No practical method of treatment is known Diseased trees and the mushrooms should be destroyed



352 Base of young white pine tree attacked by Armillaria mellea Note the cake of earth around the tree due to the exudate of resin, also the white mycelium felts within the bark and the enlarged resin vesicles induced by the fungus The slender strands clinging to the cake of earth are the "shoe strings"

Other soil organisms may enter through wounds in roots and cause diseases Such a disease may, after becoming established in the roots, continue to spread up the trunk Thus wounded root-systems are as dangerous a source of infection as wounded branches Roots often suffer from winter injury largely because the wood ripens from the top of the tree downward, and when severe conditions are undergone early in the winter before the new wood of the roots has ripened, it is killed

Heart-rot diseases.

Most of the wood-rotting fungi belong to a class known as the wound parasites By far the most universally distributed and destructive of these is the shelf fungus, *Fomes igniarius* (Figs 353, 354), which causes the white heart-rot of deciduous trees Infection may occur in any part of the tree where wood is exposed The mycelium, by dissolving the lignin of the woody elements, first causes a brown decay that is later succeeded by a whitish decomposition, at which stage very little of the original woody structures is left This decomposition of the heartwood takes place rapidly and often the tree is blown over The fruiting bodies of this fungus are produced usually at the point of infection They consist of large hoof-shaped bodies, carbonaceous and rough on the upper surface, and brown beneath The under surface is full of small holes which are the openings of long vertical tubes, on the inner surface of which the spores are borne These spores sift out of the tubes and are distributed by the wind.

Another fungus commonly met with, and acting similarly, is *Fomes fomentarius* This is also at times a wound parasite but works mostly in the sapwood first and later spreads into the heartwood A yellowish white, soft decay is produced Large sheets of a chamois-skin-like character are often found in trees rotted by this fungus These sheets are compact masses of the mycelium which have filled up the long cracks produced by the shrinking of the diseased wood The sporophores are essentially different from those of *F. igniarius*, being light gray and smooth on top and light gray-brown beneath, with relatively large pores Numerous other shelf fungi occur as wound parasites and do more or less damage where the bark, when wounded, was not protected until the natural callus could form Some of the fungi which are wound parasites of living trees continue a saprophytic life in structural timbers, causing their ultimate destruction

Winter injury, sun-scald and drought

Many misconceptions are prevalent concerning the real effect of freezing and sun-scald on trees The injury by freezing in trees is due to the action of low temperature upon the water in the cells of the tree or to the tension pressures induced As the temperature approaches freezing, the water in the cell begins to pass out into the intercellular spaces and there accumulates The lower the temperature goes, the more water is extracted from the cell and stored in the intercellular spaces as ice crystals When a certain temperature is reached, the amount of water withdrawn is such that the living elements of the cell can no longer survive, and are killed This specific minimum temperature varies for different species of trees, accounting for the difference in susceptibility to winter injury The living tissues of the tree constitute the bark and sapwood, and when areas of these tissues are killed, serious damage is done to the tree. Either enough damage is done to the roots, trunks, or twigs to cause ultimate death the coming summer, or the areas that were killed serve as infection courts for the various wound parasites like the heart-rot or sap-rot fungi In the case of sun-scald, the action is exactly similar, with the exception that the water is removed from one side of the tree by excessive heat during the growing season, instead of by freezing The cracking and splitting of the bark of trees may be due to the tension pressure set up in the bark by the contracting of the woody cylinder in circumference during periods of low temperature

Norway maple trees planted for shade are especially susceptible to sun-scald because they are grown close together in the nursery to a large size and then, when planted out, they are often injured by the hot sun Care should be taken not to attempt to grow trees farther north than their natural range, which is an indication of their ability to withstand the minimum temperatures.

Trees suffer in dry seasons from drought Water is transpired from the leaves of a large tree, in great quantities The hotter and dryer the atmosphere, the more water is transpired Thus it happens that during continued droughts there is not sufficient soil-water present for the roots to supply the requisite quantity to compensate for this large loss, and the leaves are killed by dessication Dead tops or stag-head ultimately result in cases in which such conditions continue year after year Artificial watering in such cases will relieve this condition and largely prevent the trouble

Excessively wet soil will also act in a similar way Tree roots in saturated soil are unable to take up water because they are suffocated by the lack of oxygen. Hence the tops suffer as from drought

Smoke and gas injury

In manufacturing districts in which large quantities of smoke are produced, extensive injuries to trees as well as other vegetation often result The injurious property of the smoke is mainly due to the sulfur



353 Sporophore of Fomes igniarius var nigricans Spore-bearing surface shown by the lighter color

dioxid that it contains This gas, when dissolved in the cell-sap of the leaf or the soil-water, produces sulfuric acid, which is poisonous to the tree

The roots of trees are also injured by escaping sewer-gas or illuminating gas, which either poisons or suffocates the roots Trees killed by escaping gas in the soil usually shed their outer bark in large patches near the base, the inner bark remaining tightly appressed to the tree

Trees that come into contact with electric wires are injured in proportion to the strength of the current and the duration of the contact Often trees are killed in cities from this cause

Gases arising from recently laid creosoted paving-blocks or macadam bound with tar often cause defoliation of nearby trees, by the poisoning of the cell-contents of the leaves.

Sanitary measures for the prevention of diseases.

(1) As a first means of preventing disease in trees, one should buy clean stock from nurseries regularly inspected by state agents Stock should be bought from nurseries in this country, owing to the great danger of importing diseases which might become epidemic (2) In addition, one should use his influence in getting his neighbors to eradicate diseased trees and diseased parts of trees Clean stock grown in a well-cared-for neighborhood is the problem half solved (3) The litter of leaves or twigs under a diseased tree should be collected

each fall and carefully burned in order to prevent the wintering over of harmful fungi (4) Care should be taken that all wounds made in pruning or by accident be immediately treated with some waterproof adhesive to prevent infection by wound parasites In the absence of anything like accurate knowledge concerning better preparations, coal or gas tar and lead paint are to be recommended The tar will last longer than the paint. The whole idea of wound-protection is to bridge over the time lapsing between the injury and the natural healing of the wound by the callus Wounds previously treated should be gone over at least once a year and a new coating applied if necessary.

Prevention of leaf diseases.

Although the most of the damage done by leaf diseases is mainly to the appearance and not to the life of the tree, it may even be desirable to prevent the unsightly appearance of leaf-spot or other diseases of that nature If, after the sanitary methods described above fail to control the disease, it is desired to spray, this can be done at some little expense if the trees are not too large Bordeaux mixture, full strength or half strength, applied three or four times after the leaves begin to show, at intervals of about three weeks, will probably tend to lessen infection in most cases. Spray mixtures should be applied a few hours previous to general rain periods, the advance of which can be predicted by observing the government weather maps General directions about spray mixtures and spraying machinery is now attainable from almost any one of the State Agricultural Experiment Stations.



354. Cross-section of maple limb affected by Fomes igniarius Note that the frost crack was possibly the infection court A young sporophore is shown just emerging at the top of the picture (×⅓)

Treatment of diseased trees.

When the woody part of the tree is the diseased area, tree-surgery methods must be used Badly diseased limbs and twigs should be pruned off flush Never leave a stub Wounds so made should immediately be coated with a waterproofing Decayed parts of larger limbs or trunks should be carefully dug out with a gouge and mallet, being sure to remove far back on all sides of the cavity into apparently healthy wood. The growing mycelium of the fungus is advancing some distance beyond the decayed area, in what appears as healthy tissue, and must be removed to effect a stoppage of the decay Cavities thus made may be filled with concrete or left open, provided, in either case however, that the entire surface exposed is carefully painted with a waterproofing paint or tar Diseased roots may be treated in the same way At the present time no method of treating diseased trees internally is known The ideas of quacks who may advance such treatments should be doubted, for in the majority of cases such treatments will prove to be harmful The matter of chemeotherapy for the cure of tree diseases is not without hopeful outlook, but much careful investigation by experts must be forthcoming before such methods can be evolved. W. H RANKIN.

Choice of trees for special purposes.

The following lists include trees of proved hardiness and are not intended to be complete but merely suggestive, and chiefly for the northeastern United States and Canada.

1. TREES WITH SHOWY FLOWERS.

A. *Blooming in early spring before or with the leaves.*

Acer rubrum (fls. blood-red)
Amelanchier canadensis (fls white).
Cercis canadensis (fls rosy pink).
Cornus florida (fls white, also pink).
Cornus mas (fls yellow)
Magnolia denudata (fls white)
Magnolia Soulangeana (fls white to purple).
Prunus americana and other plums (fls white)
Prunus Avium and other cherries (fls white)
Prunus Davidiana (fls pink, also white, the earliest of all Prunus)
Prunus pendula (fls pinkish, branches pendulous).
Prunus Sargentii (fls light pink)
Prunus serrulata (fls white to pink)
Pyrus baccata and other species (fls white to pink).
Salix (staminate plants with yellow catkins)

AA. *Blooming late in spring after the leaves*

Æsculus Hippocastanum and other species (fls white or red)
Catalpa speciosa (fls white)
Cladrastis lutea (fls white)
Cornus Kousa (fls white)
Crataegus (fls white)
Fraxinus Ornus (fls white)
Laburnum (fls yellow)
Magnolia hypoleuca (fls white)
Pterostyrax (fls white)
Robinia (fls white or light pink)
Syringa vulgaris (fls white to purple)
Tamarix parviflora (pink)

AAA *Blooming in summer and autumn*

Aralia chinensis and A spinosa (fls Aug and Sept).
Castanea dentata (fls white, July)
Gordonia pubescens (fls white, Sept , Oct)
Koelreuteria paniculata (fls yellow, July, Aug)
Oxydendrum arboreum (fls white, July, Aug)
Rhus semialata (fls white, Aug , Sept)
Robinia neomexicana (fls light pink, Aug)
Sophora japonica (fls white, Aug)
Syringa japonica (fls white, July)
Tamarix gallica (fls pink, Aug , Sept , if severely cut back)

2. TREES WITH SHOWY FRUITS

Acer pseudoplatanus var erythrocarpa (fr bright red).
Acer rubrum (fr bright red in May and June)
Ailanthus altissima var erythrocarpa (fr red)
Cornus florida (fr scarlet)
Cotinus coggygria (ample feathery panicles)
Crataegus mollis and others (fr scarlet or red)
Hippophaë rhamnoides (fr yellow)
Ilex opaca (fr red)
Magnolia hypoleuca (fr scarlet)
Magnolia tripetala (fr pink)
Pyrus baccata and allied species (fr yellow or scarlet).
Rhus typhina (fr scarlet)
Sassafras (fr dark blue with red stems)
Sorbus americana and aucuparia (fr red)
Taxus baccata (fr scarlet)

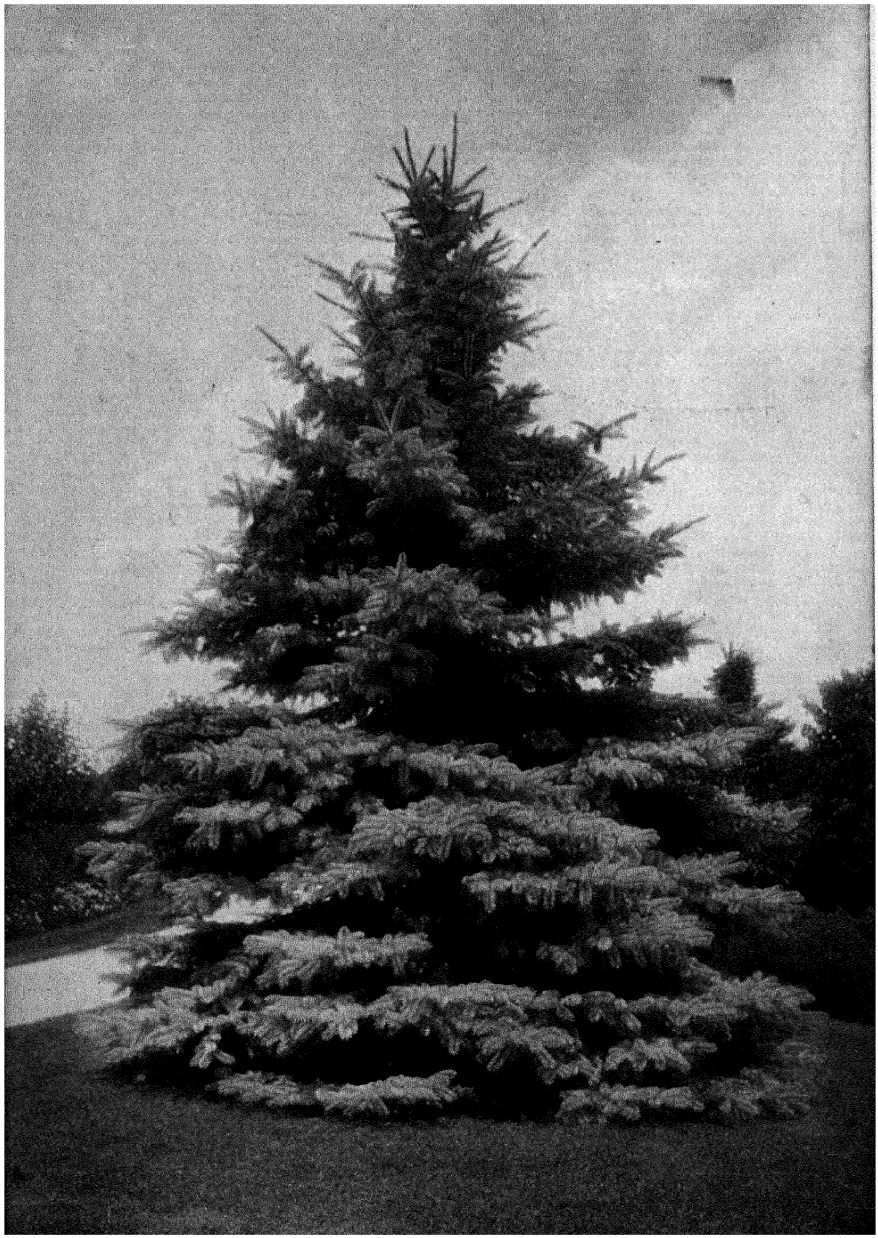
3. TREES VALUED FOR FOLIAGE EFFECTS (See also Section 5, Evergreens, next page)

A. *With colored foliage.*

Acer Negundo var argenteo-variegatum (the most effective of hardy variegated trees)
Acer Negundo var aureo-marginatum (lvs yellow)
Acer palmatum var atropurpureum (lvs purple)
Acer platanoides var Reitenbachii (lvs becoming dark red in summer)
Acer platanoides var Schwedleri (lvs bright red in spring)
Acer pseudoplatanus var Worleei (lvs. yellowish)
Betula alba var purpurea (lvs purple)
Fagus sylvatica var purpurea (lvs purple)
Populus alba var nivea (lvs white beneath).
Populus deltoides var aurea (one of the best yellow-leaved trees)
Quercus pedunculata var atropurpurea (lvs purplish).
Quercus pedunculata var Concordia (lvs yellowish).
Salix alba var argentea (lvs silvery white).
Tilia tomentosa (lvs white beneath)
Ulmus campestris var argenteo-variegata (lvs. whitish).

AA. *With large, bold foliage.*

Acanthopanax ricinifolium	Catalpa speciosa
Acer insigne	Magnolia macrophylla.
Acer macrophyllum	Magnolia tripetala.
Aralia chinensis and A spinosa.	Paulownia tomentosa.
Asimina triloba.	Quercus dentata



X. Arboriculture.—Picea pungens, the Colorado blue spruce.

TREES VALUED FOR FOLIAGE EFFECTS, continued.

AAA. *With small, narrow, or finely cut foliage.*

Acer palmatum var. dissectum.
Acer platanoides var. Lorbergii.
Acer saccharinum var Wieri
Alnus glutinosa var. imperialis.
Betula pendula var. dalecarlica.
Elæagnus angustifolia
Fagus sylvatica var. asplenifolia.
Gleditsia triacanthos
Gymnocladus canadensis.
Hippophaë rhamnoides.
Juglans regia var laciniata
Quercus pedunculata var. filicifolia.
Salix nigra
Sambucus nigra var laciniata.
Tamarix gallica, etc
Taxodium distichum

4. TREES WITH BRILLIANT AUTUMNAL TINTS.

Acer rubrum (scarlet)
Acer saccharum (scarlet and orange)
Cornus florida (scarlet)
Cercidiphyllum (yellow and purple).
Crataegus (mostly scarlet and orange).
Fraxinus americana (yellow or violet-purple).
Liquidambar (scarlet)
Liriodendron (bright yellow)
Nyssa sylvatica (scarlet)
Oxydendrum arboreum
Quercus alba (vinous purple)
Quercus coccinea, palustris (scarlet).
Rhus (mostly scarlet)
Sassafras (orange and scarlet).

5. EVERGREEN TREES.

A. *Conifers.*

Abies	Pinus.
Chamæcyparis	Pseudotsuga.
Juniperus virginiana.	Thuya
Picea	Tsuga

AA. *Broad-leaved evergreens* (only *Ilex opaca* and Rhododendron hardy in the N.).

Ilex opaca	Persea carolinensis.
Magnolia glauca (not fully evergreen as far north as it is hardy)	Prunus caroliniana.
	Prunus lusitanica.
	Quercus virginiana
Magnolia grandiflora	Rhododendron maximum

6. DECIDUOUS TREES VALUED FOR THEIR WINTER EFFECTS

Acer Negundo (branches light green)
Acer pennsylvanicum (striped bark)
Betula nigra (flaky reddish brown bark)
Betula papyracea (smooth, silvery white bark)
Crataegus viridis, C. nitida and other species (red fruit).
Fagus sylvatica (keeps its dead leaves)
Gleditsia (large, flat pods)
Hippophaë rhamnoides (yellow berries)
Liquidambar (corky branches)
Pyrus prunifolia (scarlet or yellow fruit)
Quercus alba, pedunculata and tinctoria (keep their leaves)
Quercus macrocarpa (corky branches).
Rhus typhina (scarlet fruit)
Salix vitellina (yellow branches)
Sorbus americana and S. aucuparia (scarlet fruit).

7. VERY TALL TREES.

Gleditsia triacanthos.	Populus deltoides
Juglans nigra	Quercus macrocarpa.
Liriodendron Tulipifera.	Quercus palustris
Picea excelsa	Quercus rubra
Pinus strobus	Quercus velutina
Platanus occidentalis.	Taxodium distichum.
Populus balsamifera.	Ulmus americana

8. COLUMNAR OR NARROW PYRAMIDAL TREES.

Abies (most species).
Acer saccharinum var pyramidale
Acer saccharum var monumentale.
Betula pendula var fastigiata
Carpinus betulus var fastigiata.
Cephalotaxus Harringtonia var koraiana.
Chamæcyparis Lawsoniana
Chamæcyparis nutkaensis
Juniperus communis var. suecica
Juniperus virginiana (especially var pyramidalis).
Liriodendron Tulipifera var pyramidalis.
Picea (most species)
Populus alba var. Bolleana

COLUMNAR OR NARROW PYRAMIDAL TREES, continued

Populus nigra var. italica
Quercus pedunculata var pyramidalis.
Robinia pseudacacia var pyramidalis.
Sorbus hybrida
Taxodium distichum (especially var imbricarium).
Taxus baccata var. fastigiata
Thuya
Ulmus campestris var monumentalis.
Ulmus scabra var fastigiata

9. ROUND-HEADED TREES.

Acer platanoides var globosum
Æsculus Hippocastanum var umbraculifera.
Catalpa bignonioides var nana
Fraxinus excelsior var globosa
Morus alba var nana
Prunus Mahaleb var globosa
Robinia Pseudacacia var umbraculifera.
Ulmus campestris var gracilis
Ulmus campestris var umbraculifera

10. WEEPING TREES.

Acer saccharinum var Wieri
Betula alba var pendula
Crataegus monogyna var pendula
Fagus sylvatica var. pendula
Fraxinus excelsior var pendula
Fraxinus parvifolia var pendula
Gleditsia triacanthos var pendula
Prunus pendula
Prunus serotina var pendula
Quercus pedunculata var Dauvessei.
Salix babylonica
Salix blanda
Salix vitellina var pendula
Sophora japonica var pendula
Sorbus aucuparia var pendula
Tilia petiolaris
Ulmus scabra var pendula

11. CITY TREES (See also No 12)

Ailanthus altissima (pistillate tree).
Carpinus
Celtis occidentalis
Crataegus oxyacantha
Fraxinus americana
Fraxinus excelsior
Ginkgo biloba
Gleditsia triacanthos
Platanus orientalis
Populus deltoides } (often attacked by borers).
Populus nigra var italica }
Prunus serotina
Robinia Pseudacacia (often attacked by borers)
Sophora japonica
Tilia tomentosa
Tilia ulmifolia
Ulmus americana
Ulmus campestris

12 SHADE AND AVENUE TREES

Besides the trees enumerated under city trees, No 11 (which are to be recommended as street trees in the cities), the following trees are good avenue subjects.

Acer platanoides	Quercus alba.
Acer rubrum	Quercus coccinea
Acer saccharinum	Quercus imbricaria
Acer saccharum	Quercus palustris
Æsculus carnea	Quercus phellos
Æsculus Hippocastanum	Quercus rubra
Catalpa speciosa	Tilia americana.
Liquidambar styraciflua	Tilia dasystyla
Liriodendron Tulipifera	Tilia ulmifolia

13. TREES FOR SEASIDE PLANTING.

Ailanthus altissima.	Populus deltoides var caroliniensis
Crataegus oxyacantha	
Elæagnus angustifolia	Populus tremuloides
Hippophaë rhamnoides	Quercus rubra
Juniperus virginiana	Salix alba
Picea alba	Salix caprea
Pinus nigra.	Sassafras
Pinus sylvestris.	Tamarix

14. TREES FOR DRY SITUATIONS AND DRY CLIMATES.

Acer campestre.	Pinus divaricata
Acer ginnala	Pinus rigida
Alnus rugosa.	Pinus sylvestris
Betula pendula	Quercus coccinea.
Cornus mas	Quercus Prinus
Elæagnus angustifolia	Quercus rubra
Fraxinus pubescens	Quercus velutina.
Phellodendron amurense	Ulmus effusa.

15. Trees for Wet Soil.

Acer rubrum	Picea mariana.
Acer saccharinum	Pinus rigida
Alnus glutinosa	Populus (most species)
Alnus maritima	Quercus alba
Betula alba	Quercus bicolor
Betula nigra	Quercus palustris
Carya laciniosa	Quercus phellos
Chamæcyparis thuyoides	Salix (most species)
Nyssa sylvatica	Taxodium distichum
Picea alba	

Alfred Rehder.

Choice of street trees for special regions

Trees for the Eastern Part of the Continent.

Street trees for New England and northern New York.

Urban	Suburban
Acer platanoides	Acer rubrum
Platanus orientalis	Acer saccharum
Quercus rubra	Fraxinus americana
Tilia americana	Platanus occidentalis
Ulmus americana	Quercus alba
	Quercus palustris

From New York City and Pennsylvania southward even to Georgia along the mountains

Urban	Suburban.
Acer platanoides	Acer rubrum
Ginkgo biloba	Acer saccharum
Platanus occidentalis	Fraxinus americana
Platanus orientalis.	Liquidambar styraciflua.
Quercus coccinea	Liriodendron Tulipifera
Quercus palustris	Quercus alba
Quercus rubra	Quercus bicolor
Tilia americana	
Ulmus americana	

The coast region from Norfolk southward and along the Gulf of Mexico, except southern Florida

Urban	Suburban
Liquidambar styraciflua	Magnolia acuminata
Quercus laurifolia	Magnolia grandiflora
Quercus nigra	Magnolia tripetala.
Quercus phellos	Nyssa sylvatica.
Quercus virginiana.	

North central states.

Urban	Suburban
Celtis occidentalis	Acer rubrum
Native oaks	Acer saccharum
Tilia americana	Fraxinus americana
Ulmus americana	Platanus occidentalis

Add to the above list for points south of Cleveland, Chicago and Omaha.

Urban.	Suburban
Acer platanoides	Liquidambar styraciflua
Ginkgo biloba	Liriodendron Tulipifera
Platanus orientalis	Platanus occidentalis
Quercus coccinea	
Quercus palustris	
Quercus rubra	

Most points in northern Alabama, northern Mississippi, southern Arkansas, Oklahoma, and part of Texas back of the coast region are adapted to the trees of both the northern list and the list for the south Atlantic and Gulf coast regions F L. Mulford

Ornamental trees for the middle and southern states.

Deciduous trees

Acer saccharinum (*A. dasycarpum*) and *A Negundo*, the latter extensively used for street planting —*Broussonetia papyrifera*, formerly planted along streets, but objectionable because of the many suckers which they produce, as is also *B Kazinoki* —*Cercis canadensis* Valuable as an early spring-flowering tree —*Celtis Bungeana*. One of the most distinct trees; an excellent shade tree —*Catalpa* Seldom planted South as an ornamental tree, because of the repeated attacks of caterpillars The latter are frequently used for fish bait —*Cladrastis tinctoria* Very desirable as a flowering lawn tree —*Cornus florida*. The white-flowering species is among the most attractive of our early spring-blooming trees and is largely used in landscape work. The pink- and red-flowering forms are exceedingly beautiful —*Crataegus* Taking into account the various shapes, the foliage and the bright-colored fruit in fall and winter, the best are. *C Phænopyrum* or Washington thorn, *C arborescens*, *C spathulata* and *C. æstivalis* or apple haw —*Chilopsis saligna*, known as *C linearis*, is one of the best for dry soils The typical species produces lilac-colored flowers, but several forms have lately been produced with flowers ranging from light lilac to lilac-purple with yellow stripes inside A pure white-flowering form is very striking but is of more dwarf habit —*Diospyros virginiana* Sometimes planted for shade or for its fruit Adapts itself to nearly all soils There are many forms varying both in the foliage and size and shape of fruit —*Fagus grandifolia* is frequently used for street planting in sandy soils The red-leaved forms of the European species are of little value South, the purple tint of the foliage fading to a dull green at the approach of warm weather —*Fraxinus acuminata* and *F pubescens* Both thrive best in rich soils and are very desirable for street planting, being seldom attacked by insects —*Ginkgo* or *Salisburia* is sometimes used for avenues and street planting where a rigid pyramidal tree is required The foliage is one of its attractions, being shaped like the maidenhair fern —*Gleditsia triacanthos* The fertile tree is sometimes planted for its large falcate pods, which are relished by many for the saccharine acidulated pulp The finely pinnate foliage is very ornamental —*Halesia tetraptera* In the middle sections of the South and in rich, dry soils it grows to a small tree, but in the mountain districts in rich soils along the water-courses, trees 40 to 50 feet high are frequently found Valuable for landscape planting —*Carya* or Hicoria The pecan is the best southern nut tree and is very largely planted for its nuts It is often planted in avenues for its beauty —*Carya myristicæformis* is scarce, but its foliage is more attractive than that of any other species —*Hovenia dulcis* The foliage and the fleshy red peduncles in autumn make it an excellent shade and ornamental tree —*Idesia polycarpa* A handsome tree when grown in partial shade, the bark blisters in full sun —*Juglans J nigra* is one of the most valuable ornamental and economic trees and is extensively planted for avenues The Persian or English walnut and its many forms are being more largely planted than of old, but are often injured by late spring frosts following a warm period during February *J Sieboldiana* is a very ornamental tree and very productive at an early age *J cinerea* is suited only to the mountain regions of the South —*Kœlreuteria paniculata* Very desirable for its pinnate foliage and panicles of yellow flowers, which are succeeded by bladder-like fruits —*Lagerstræmia indica* The crape myrtle is one of the most characteristic features of southern homes It has become almost naturalized South If trained to a single stem, it will form a tree 25 to 30 feet high; otherwise it affects the bush form It is conspicuous for its shining brown bark and the profusion of its beautifully crimped and fringed flowers, which are produced from April until August The colors vary from a pale to a dark pink, purplish red, pure white and glowing crimson No other flowering tree can surpass it in beauty, and by a judicious selection of the various colored flowers a grand effect is produced in landscape work.—*Liriodendron Tulipifera* One of the most valuable and rapid-growing shade and ornamental trees, thrives best in rich soil Trees taken from woods transplant badly They should be grown in nursery and occasionally transplanted until sufficiently large for using in street planting —*Liquidambar* A most symmetrical shaped tree; adapts itself to all soil, valuable for street planting Some trees

assume a deep purple or crimson tint in the foliage during autumn, others a golden yellow —*Magnolia* Of the native deciduous species, *M acuminata* is the most desirable for street and avenue planting All the species are voracious feeders and thrive best in rich soils. *M macrophylla*, or umbrella magnolia, seldom grows beyond 25 feet, but is conspicuous for the length and size of its leaves This tree is called umbrella tree South, whereas this name applies to *M tripetala* at the North *M. Fraseri*, ear-leaved magnolia or wahoo of the western North Carolina mountaineers, is also a very ornamental tree *M tripetala* is objectionable in gardens owing to the unpleasant odor of its flowers Few Chinese species, with the exception of *M hypoleuca*, attain the size of a tree *M denudata* and *M Soulangeana* can be trained to a single stem and made to attain a height of 25 feet All the other varieties may be classed as shrubs The flowers are often injured by late spring frosts —*Melia Azedarach* (Pride of India, Chinaberry) Almost naturalized South It is of very rapid growth and begins to flower at an early stage The flowers are delightfully fragrant, with the perfume of the lilac Extensively planted for shade trees The umbrella form, known as Texas umbrella, assumes a dense, spreading head with drooping foliage It is of unique appearance and can be used with great effect in landscape work — *Morus M rubra* is frequently planted for shade; it is valuable for its wood, which is of great durability for posts *M alba* is naturalized in many sections A form of *M rubra* discovered in middle Georgia some years ago and called the Stubbs mulberry, from the discoverer, produces enormous crops of large, rich vinous fruit This and the Hicks and Downing varieties are often planted for feeding poultry and hogs They should not be planted near dwellings, owing to the dropping of the fruit —*Nyssa sylvatica*. Only desirable in landscape work for the brilliant red tint of its autumn foliage.—*Oxydendrum arboreum*. Desirable for its flowers and highly colored autumn foliage.—*Parkinsonia aculeata* Retama or horse bean of southern Texas A small tree with green bark, feathery foliage and yellow flowers Valuable for shrubberies —*Paulownia tomentosa*. Rapid-growing Almost naturalized in some sections of the South The foliage in young trees is very large Flowers pale violet, very fragrant, in long panicles; they open before the leaves appear.—*Peach* There are many ornamental varieties which are exceedingly handsome while in bloom, especially the double-flowering crimson, white and pink, others are desirable for their peculiar growth, as Pyramidalis, which is as erect as a Lombardy poplar. Weeping, willow-leaved, and golden-leaved varieties are interesting —*Prunus*. Hortulana or Chickasaw plums are sometimes planted for ornament, though commonly for fruit *P. virginiana* is abundant everywhere but not valued owing to being usually infested with tent caterpillars *Prunus Pissardii* is the best purple-leaved tree for the South, as it retains its color during summer —*Pinckneya pubens* This very ornamental small tree is seldom seen under cultivation, as it grows naturally in wet and boggy soils —*Pyrus coronaria* The crab-apple, a small tree with very fragrant flowers in spring, is excellent for shrubberies —*Platanus occidentalis* One of the most desirable trees for street planting —*Populus* The variety used most freely for street planting is *P. deltoides* or *P monilifera*, commonly known in the South as cottonwood. It is of rapid growth and thrives in nearly all soils that are not too arid All southern nurserymen catalogue the Carolina poplar, but the stock is not always true to name — *Pterocarya fraxinifolia*, or Caucasian wing-fruited walnut, is a very rapid-growing tree, with spreading branches and pinnate foliage Very ornamental when covered with pendulous racemes of small winged nuts, which, however, are of no economic value —*Quercus* Nearly all the species of the middle and eastern states are found more or less abundant in the middle South, but the most valuable purely southern species are as follows *Q phellos*, or willow oak, with lanceolate leaves; *Q aquatica*, or water oak, with leaves almost perennial, oblong and obtusely lobed Both are largely planted for streets and shade, as they grow very rapidly and in almost any soil *Q falcata*, *Q laurifolia*, *Q phellos* and *Q. Muhlenbergii* are desirable *Q. virginiana*, or live oak, is a very large tree, seldom exceeding 50 feet in height but covering a large circumference It is native along the seacoast and adapts itself to inland sections, where it does not attain the great size of the coast region There is no southern tree, except *Magnolia grandiflora*, that is more admired, especially when planted in avenues —*Sapindus marginatus* The globose yellow berries are retained during winter Berries when boiled produce a saponaceous fluid —*Stillingia sebifera* Naturalized on the coast of Georgia and South Carolina The acuminate rhomboidal leaves give the tree a unique appearance Requires rich soil and is valuable in landscape work —*Symplocos tinctoria* Not common. Should be available for shrubberies —*Tilia pubescens* A large tree occasionally found in rich soils along the seacoast Differs little in general from *T. americana*, but seems to be better suited to the middle South Very desirable for street planting or shade.—. *Toxylon*, or *Maclura*, is naturalized in many sections of the middle South Grows to a height of 30 feet and the fertile trees are very ornamental when laden with their large, globular fruit. The wood is very lasting when used for posts and takes a beautiful polish —*Ulmus americana* is perhaps more largely planted for streets and avenues than any other deciduous tree —*Viburnum prunifolium* (black haw or possum haw). In very rich



355. Avenue of live oaks, Audubon Park, New Orleans

soils sometimes attains a height of 15 to 20 feet The dark blue berries are retained during winter. Desirable for shrubberies.

Broad-leaved evergreen trees.

Camellia japonica Although these magnificent plants are usually seen in bush form, they can be trained to single stems and attain a height of 20 or more feet in the coast region, where they have found a congenial soil and climate The typical single red variety, a tree of which is growing at Charleston, S C, and planted in 1808, being the first introduced, is now upwards of 20 feet high The double-flowering sorts, while usually of vigorous growth, do not attain the size of the single red —*Cinnamomum Camphora* In southern Louisiana and middle Florida trees grow to a height of 50 feet, in the middle South they affect the bush form or when trained to single stems exceed 15 to 20 feet For the extreme South it is recommended for street planting — *Cyrilla racemiflora* Specimens are occasionally found on shady banks of streams, where the soil is very rich, that will grow 20 feet high, but the tree form must be secured by pruning The foliage assumes a bright red or bronze tint in winter —*Eriobotrya japonica* Flowers produced in January, and if not frost-killed are followed by a golden yellow plum-like fruit of good flavor. Reaches a height of 20 or more feet in the coast belt.—*Gordonia Lasianthus* A stately tree found only in shallow swamps or turfy soils The roots spread almost entirely near or upon the surface of the ground, which makes it difficult to transplant trees taken from the woods Trees grown from seed in pots are best for planting, but a rich moist soil is necessary to their growth —*Ilex I opaca* and *I. Dahoon* are among the most valuable evergreen trees, the former being the best where a large tree is desired Specimens taken from the woods should not exceed one foot in height, as larger sizes almost always fail in transplanting —*Ligustrum L japonicum* often forms a tree 25 feet high Berries blue-black, retained during winter —*Magnolia. M grandiflora* is justly considered the glory of southern broad-leaved evergreen trees There are many forms, based on the size and shape of the leaves and the flowers The superb white flowers, which are seen from May until August and occasionally upon some trees as late as October, vary from 4 to 12 inches in diameter Thrives as far north as Washington, D C *M. glauca* has white flowers 2 to 3 inches in diameter and delightfully fragrant — *Osmanthus fragrans* var *ruber* and *O Aquifolium* var *ilicifolius*, can be trained to single stem The flowers of the first are delicately fragrant and produced twice a year —*Persea carolinensis* Planted for shade in rich soils in the coast belt —*Photinia serrulata*, or Chinese evergreen thorn, has white flowers and dark red autumn foliage —*Prunus carolinensis* Known south as Carolina Cherry, Carolina laurel, mock orange, etc One of the most ornamental southern trees —*Quercus Suber* Acorns were distributed by the United States Patent Office in 1860, and many large trees are now found in several sections of the South, where they have fruited Some small plantations are made for the purpose of producing cork. It grows well in comparatively poor and stony soils — *Sabal Palmetto* is now freely used for street and avenue planting on the coast It is conspicuous for its tropical appearance It is not entirely successful further than 40 miles from the seashore



356. A Norway Spruce.— Picea excelsa.

Conifers or narrow-leaved evergreens

Abies Of this section few specimens are found below the Piedmont region Occasionally the Norway spruce grows to a moderate size —*Cedrus Deodara* An admirable tree and of rapid growth, 40 to 50 feet *C atlantica*. 25 to 30 feet —*Cunninghamia lanceolata* Foliage resembles an araucaria —*Cupressus. C sempervirens* has many forms, from the compact, spiral or shaft-like shape to more spreading habit. *C lusitanica* or cypress of Goa, has numerous forms with foliage of an ashy green and pendulous branches, to others of a more dark tint and rigid form Of *Chamæcyparis Lawsoniana* there are endless forms, from a compact, erect habit and vivid green foliage to those of open or pendulous shape and with glaucous or golden foliage. *Cupressus funebris* has varied less in its seedlings —*Juniperus*. The Irish juniper is of fine pyramidal form, and reaches a height of 15 feet *J excelsa, J chinensis* and *J thurifera* differ in the tint of their foliage and are all of tall growth —*Libocedrus decurrens* The California arborvitæ, with its graceful feathery foliage and conical shape, is one of the most ornamental of conifers —*Pinus* Few of the exotic species are suitable to the South *Pinus excelsa*, or Bhotan pine, is undoubtedly the best adapted to the middle South of all kinds —*Retinispora* is a valuable group of Japanese cypress, but with the exception of *R. obtusa, R Fulleri, R plumosa* and *R squarrosa Veitchii*, all are of dwarf habit —*Thuya*. The Asiatic section is better adapted to the middle South than the American species Of the former the best forms are known to nurseries as *Biota pyramidalis* and var *aurea*, reaching a height of 15 to 18 feet *B japonica* var *filiformis* (*Thuya orientalis*) is a remarkable variety, with thread-like foliage and compact habit to 10 to 12 feet.

In the foregoing list of Coniferæ no mention is made of species or varieties of low or shrub-like growth, such as Podocarpus, Cephalotaxus, Thuyopsis, and Sciadopitys, of which there are many good specimens in various parts of the south Araucarias are also omitted, owing to their liability of failure from extreme heat or other unfavorable climatic conditions. This applies also to Sequoia, and Frenelas (properly Callitris); these frequently make an extraordinarily rapid growth until late in autumn, and are often injured by a cold wave early in winter. P J. BERCKMANS.

Trees on the Great Plains.

The Plains, lying mostly west of the Missouri River, are not absolutely treeless, as strangers often suppose, but the whole vast area is dotted here and there with small groves, or narrow belts that fringe the borders of the streams The number of native species, however, is much smaller than in the rich tree flora of the northeastern United States and Canada The number of species cultivated for shade and ornament, for a long time, at least, must be relatively small, owing to climatic and other causes In general, the people of the Plains are necessarily more interested at present in planting trees for profit than for pleasure, but in the older parts are already to be found many fine public parks and private grounds. To a large extent, however, their point of view is that of forestry rather than horticulture.

In studying the forest trees of the Great Plains of central North America, it is found that most of the species have migrated out upon the Plains from the great forest body of the Mississippi Valley. These trees found their way upon the Plains by way of the forests that border the Missouri River and its tributaries. As we pass down the river, along the eastern edge of the Plains, the forest belt becomes larger and larger, until it eventually merges into the great body of forest trees lying on the easterly side of the Mississippi Valley. The principal trees that have come upon the Plains by this route are the common red cedar, papaw, half a dozen willows, one cottonwood, basswood, two or three elms, hackberry, mulberry, three ashes, wild apple, four or more species of hawthorns, juneberry, wild cherry, choke cherry, wild plum, coffee bean, honey locust, redbud, sycamore, two species of buckthorns, buckeye, one maple, box elder, sumach, two species of walnuts, five or six hickories, nine or ten oaks, ironwood, blue beech, and one birch. But ten species of trees have come from the Rocky Mountain forests, and these have made much less impression upon the forests of the Plains than those that came from the eastern forests. In this list are the bull-pine, the western red cedar, four species of cottonwoods, the buffalo berry, a maple, and two birches.

Although the present forest area of the Plains is not relatively great, it is large enough to be seriously considered in regard to its preservation. There is danger that with the habit acquired by our people in the thickly wooded parts of the United States of cutting down forest trees wherever found, much of this small forest area will be destroyed. It is much easier to preserve an area of forest growth than to create it anew. First, all forest fires must be kept down. When a mass of woodland adjoins the open prairie, fire-guards should be made so that the fires will not sweep into the forest growth. The greatest destroyer of the forests of the Plains in the past has been fire, as it swept over the prairies into woodland. Second, it is absolutely necessary to keep out certain kinds of stock. Swine, if herded in large numbers, will inevitably destroy the trees. They prevent the growth of small trees, and eventually destroy those of larger growth. Cattle, in large numbers, are equally destructive. In fact, when the attempt is made to preserve uninjured the trees in a forest, it is necessary to keep out stock of all kinds, excepting possibly during limited portions of the year. Third, it is necessary to cut out the trees for use with very great care. A forest should be a permanent crop, and the cuttings should be so made that the forest as a whole is not injured. Trees should be cut here and there in such a way that the young trees which are left have an opportunity for growing into usable timber.

Care should be taken to encourage the tendency to spreading which is so strong in nearly all parts of the Plains. With a little care every present living forest area may be made to extend itself spontaneously, or nearly so. The forest should be effectually inclosed by a fence, placed at some distance from its outer border, leaving a belt of unoccupied land between the trees and the fence. This will grow up with weeds, and mingled with these will be the seedling trees springing from the seeds blown or carried from the forest area. In this way the border of the forest will be gradually extended. This can be helped by plowing up these inclosed belts of land, giving better opportunity for the starting of seedling trees. With the weeds and little trees will spring up low shrubs of various kinds. These need give no trouble, for this is merely Nature's way of taking possession of the soil. Little, if any, cultivation need be given to such a nursery belt, as the weeds which spring up, while unsightly, will serve the useful purpose of sheltering the little trees, and eventually the trees will rise above, and choke them out. Grass, however, forming a tough sod, is harmful to the little trees, far more so than the ordinary weeds.

There are many places in which actual planting must be resorted to. In looking about for a site for the new forest plantation, it must be remembered that the best conditions for tree growth are usually to be found near the natural forests. Where there are natural forests, the planting should be around their borders, so as to extend them in much the same way as indicated in the preceding paragraph in regard to natural spreading. Where there are no natural forests at all, it is necessary to select the more favorable places for planting. Since the natural forests on the Plains occupy the depressions rather than the hilltops or the slopes, this should give



357 A good field elm

one a hint as to what must be done. Wherever the land slopes into a depression, one may find favorable conditions for growing trees. These depressions, generally called "draws," may be filled with trees, and when once a growth of a few acres is secured it will not be difficult to extend the forest far up the hillside slopes. On the western parts of the Plains similar positions should be taken under the irrigation ditches. In the selection of trees for the formation of forest areas, one should also take a hint from nature. The rule, which is a very excellent one for the plainsman to follow, is to plant on his farm the kinds that he finds in the nearest forest, and to give his planted trees as nearly as possible the same conditions as those under which they grew in the native forest. On the eastern third of the Plains, the walnut, white oak, shellbark hickory, white elm, red elm, hackberry, white ash, wild cherry, catalpa and honey locust are recommended for planting. On the extreme eastern parts bordering the Missouri River, many more kinds can be planted, but as one passes westward toward the borders of the Sand Hill region the list grows smaller. On the central Plains the list is reduced, and also somewhat changed in species. The two elms may be planted, as also the hackberry, the green ash in place of the white ash, wild cherry, honey locust, and in many places the bull-pine. On the western Plains, especially that portion lying west of the main body of the Sand Hills, and having an elevation above the sea of from 3,000 to 4,000 feet, the list is still smaller. The white elm is still included, also the hackberry, the bull-pine, and in many places the red cedar.

The trees mentioned are of the more durable and profitable kinds. But on all parts of the Plains persons must often have quick-growing trees, which soon produce fuel, but which have little, if any, value for other purposes. In the eastern part of the Plains, the black willow, almond willow, common cottonwood, silver maple, and box elder are useful trees for this purpose. One should not condemn the use of these easily grown, soft-wooded trees. A forest is a crop, and there is no reason why a farmer may not plant a more quickly growing crop if he wishes, but he should at the same time plant the more enduring kinds given in the preced-

ing lists. On the central Plains the quickly grown trees may include the same willows and cottonwood and also the box elder. The silver maple will not do well in the greater part of this central region. On the western Plains the list is essentially the same as for the central portion: namely, the willows, cottonwood, and the box elder, to which may be added, here and there, one or more of the western species of cottonwood.

The horticultural point of view is to be considered. About country homes the first trees are usually cottonwood, silver maple and box elder, followed later by green ash and white elm. Very commonly the red cedar is planted with the first-mentioned species, and often Scotch and Austrian pines are added. It must be remembered that the settler's house on the Plains stands in the open instead of being hemmed in by forest trees, as in the eastern parts of the American continent. The settler's problem is to surround his house with trees, not to clear the trees away. In towns and cities the cottonwood, silver maple and box elder are generally the pioneer trees, since they produce a shade sooner than any others, and later these are gradually replaced by



358. Phœnix canariensis. One of the most serviceable palms in California.

green ash and white elm. Hackberry, black walnut and buttonwood are occasionally planted with good success. The species which are most largely used for windbreaks for orchards and other plantations are common cottonwood, willow (a variety of *Salix alba*), silver maple and box elder. The first mentioned, because of its easy propagation, rapid growth and extreme hardiness, is the favorite tree for this purpose. When landscape gardening is attempted, the Scotch and Austrian pines, Norway spruce and red cedar are generally used, and to these are often added one or more species of the Rocky Mountain spruces. The most generally used deciduous tree for this purpose is the white elm (which here attains to a singular beauty of form and foliage), to which are occasionally added bur oak, black walnut and Russian olive (Elæagnus), and in proper situations, the white willow. The coniferous trees of greatest value for ornamental purposes on the Plains are the Austrian pine, Scotch pine and red cedar. With proper care these may be grown on all parts of the Plains where water enough to maintain life may be obtained. On the extreme eastern border, the Norway spruce and even the balsam fir have proved valuable. Among deciduous trees the white elm holds first place, followed by the hackberry (which is not so much planted as it deserves) and the green ash.

CHARLES E. BESSEY.

TREES FOR PLANTING ON THE GREAT PLAINS. The asterisks (*) indicate those trees that are not native to the regions.

1. *For the eastern plains.*

Abies balsamea.*
Abies concolor.*
Acer platanoides.*
Ailanthus altissima.*
Carya ovata.
Catalpa speciosa *
Celtis occidentalis.
Fraxinus americana.
Gleditsia triacanthos.
Juglans nigra.
Picea alba.*
Picea excelsa* (Fig. 356).
Picea pungens *
Pinus austriaca *
Pinus sylvestris.*
Prunus serotina.
Quercus alba
Robinia Pseudacacia.*
Salix vitellina *
Ulmus americana (Fig. 357).
Ulmus fulva.

and the following quick-growing but temporary trees:

Acer Negundo.
Acer saccharinum
Populus Sargentii.
Salix amygdaloides.
Salix nigra.

2. *For the central plains.*

Catalpa speciosa *
Celtis occidentalis.
Fraxinus lanceolata.
Gleditsia triacanthos.
Picea canadensis *
Pinus divaricata.*
Pinus scopulorum.
Prunus serotina.
Robinia Pseudacacia.*
Ulmus americana.
Ulmus fulva.

and the following quick-growing but temporary trees:

Acer Negundo.
Populus Sargentii.
Salix amygdaloides.
Salix nigra.

and in the southern parts:

Elæagnus angustifolia *
Maclura aurantiaca, Nutt.
Pinus austriaca.*
Pinus sylvestris.*

also black walnut and bur oak if seed is planted where tree is to stand permanently.

3. *For the high western plains.*

Celtis occidentalis.
Juniperus scopulorum.
Pinus divaricata.*
Pinus scopulorum.
Robinia Pseudacacia.*
Ulmus americana.

and the following quick-growing but temporary trees:

Acer Negundo
Populus acuminata.
Populus Sargentii.
Salix amygdaloides.
Salix nigra.

and nearer the mountains:

Acer Negundo.
Acer platanoides.*
Elæagnus angustifolia.*
Fraxinus lanceolata.
Gleditsia triacanthos.*
Juglans nigra.*
Populus Sargentii.
Tilia americana.*

Seeds or seedlings grown in the region in which they are to be planted are the most reliable. Young trees or seedlings succeed better than older and larger ones. Varieties native in moist climates or in foreign countries should be avoided unless their adaptability has been proved. Young plants, like young animals, are easily killed and must have extra care.

C. L. WATROUS.
C. E. BESSEY.

Trees grown for shade and ornament in California.

The mild and equable climate of California allows a wide range of available species from which to select trees for shade, ornament and shelter. There is, nevertheless, some considerable variation in the species, which are characteristic of the plantings in different parts of the state, that has arisen from variations in soil and climatic conditions.

On account of the long rainy season, the low humidity of the atmosphere and the relatively high mean, and freedom from low winter minima in temperatures, the trees that thrive best in middle California are those indigenous to the arid and semi-arid warm temperate regions of the globe, e. g., southern Australia, the Mediterranean region, south Africa, northern Mexico and Chile, together with those native species which deserve a place. As one goes into the southern part of the state, some of these species drop out and others markedly

characteristic of arid regions take their place. The reverse of this is true, as one goes north, where many trees of the temperate humid regions also thrive in this state, particularly in the relatively humid climate of the coast, and are offered by our nurserymen.

I. The Species Heretofore Most Extensively Planted in California.

The following trees are perhaps the commonest species found in the plantings:

1. Eucalyptus globulus.
2. Cupressus macrocarpa.
3. Pinus radiata.
4. Robinia Pseudacacia.
5. Acacia melanoxylon.
6. Schinus Molle
7. Acacia decurrens var dealbata.
8. Acacia decurrens var. mollis.
9. Melia Azedarach var. umbraculiformis.
10. Phœnix canariensis (Fig 358).
11. Magnolia grandiflora.
12. Ulmus racemosa and species.
13. Cordyline australis (Fig. 359) and species.
14. Acer Negundo, and var. californica.
15. Araucaria Bidwillii.
16. Araucaria excelsa.
17. Populus deltoides var. carolinensis.
18. Juglans californica and species.
19. Salix babylonica.
20. Acer saccharinum.
21. Eucalyptus robusta.
22 Eucalyptus viminalis.
23. Eucalyptus rostrata (Fig. 360).
24. Acer macrophyllum.
25 Pittosporum species.
26. Cedrus Deodara and species
27. Betula alba.
28. Grevillea robusta.
29 Washingtonia filifera.
30. Cinnamomum Camphora

II. Trees Being Most Extensively Planted in California at the Present Time.

The following list, arranged in sequence according to the actual number of sales made during the season of 1911–12, is compiled from data furnished by W. B. Clarke, of the California Nursery Company, at Niles. The percentages refer only to the twelve species here enumerated, and not to the total number of trees sold by the nursery, which has a large and varied assortment of species, many of which are more suitable and more effective than those for which there is, at present, the greatest demand.

	Per cent.
Eucalyptus globulus	40 8
Cupressus macrocarpa	12 0
Platanus orientalis	11.4
Eucalyptus rostrata	10 2
Populus nigra italica	6.2
Pinus radiata	5 0
Acacia decurrens dealbata	3.5
Acacia melanoxylon	3.0
Populus deltoides var. carolinensis	2 2
Robinia Pseudacacia var. Decaisneana	2 0
Acer saccharinum	2.0
Schinus Molle	1.7

III. Selections for Special Purposes.

The following lists are from species now offered in the California trade and are intended to be suggestive only, and not by any means complete. New species and varieties are constantly being added to the nursery stocks, some of which will be found particularly well adapted to certain conditions of climate and soil, and will doubtless replace others now in use.

1. *For subtropical effect.*

That there is in California strong appreciation of subtropical effects in gardening is shown by the great demand for dracenas and such large-leaved plants as palms, magnolias, bananas and rubber trees. That the effect produced by the planting of such trees so often fails to be satisfatory is largely due to one or both of two causes,—either unsuitable location of the specimens, or choice and association of unsuitable species. To prevent a repetition of the first-named error, the prospective tree planter is recommended to consult the article on Landscape Gardening; and to avoid the second, a selection from the following list is suggested, with the addition of such large-leaved herbaceous plants as cannas, colocasia, cynaras, funkias, *Gunnera scabra*, pampas grass, veratrums, agaves, yuccas, aloes, *Woodwardia radicans* and *Rodgersia podophylla*, together with such shrubby plants as bamboos, giant reed, the choicer varieties of castor-bean, *Senecio grandifolius*, *Polygonum sachalinense* and *P. Sieboldii*.

A. *Small trees or tall shrubs.*

Acanthopanax ricinifolium.
Aralia chinensis.
Aralia chinensis var. mandschurica.
Aralia spinosa.
Arundinaria falcata.
Chamærops humilis.
Dicksonia antarctica.
Eriobotrya japonica.
Erythea armata.
Musa Ensete.
Prunus Laurocerasus.
Ricinus cambodgensis.
Ricinus macrophyllus.
Ricinus sanguineus.
Ricinus zanzibarensis.
Tetrapanax papyrifera.

AA. *Larger trees.*

Catalpa bignonioides.
Catalpa ovata.
Catalpa speciosa.
Cordyline australis.
Cordyline Banksii.
Cordyline indivisa.
Cordyline stricta.
Corynocarpus.
Erythea edulis.
Eucalyptus calophylla.
Eucalyptus ficifolia.
Ficus Carica.
Ficus macrophylla.
Gymnocladus canadensis.
Jubæa spectabilis.
Livistonia australis.
Magnolia grandiflora.
Paulownia tomentosa.
Phœnix canariensis.
Phœnix dactylifera.
Phœnix reclinata.
Phœnix Rœbelenii (P. humilis var.)
Phœnix sylvestris.
Phytolacca dioica
Trachycarpus excelsus.
Tristania conferta.
Washingtonia filifera.
Washingtonia robusta.

Eucalyptus globulus can also be used effectively if cut down periodically when the falcate leaves begin to appear; it will continue to shoot up vigorously from the same root for several years. *E. robusta* is useful for screen purposes if cut down before it becomes straggling. This can also be said for *E polyanthemos*, *E. rudis*, *E. Risdoni*, and many others. *E polyanthemos* is certainly more beautiful than *E. globulus* and would not need to be cut down so frequently.

2. *Trees with ornamental flowers (for California)*

In making the following grouping, arranged according to relative hardiness, it has been impossible to give precise information as to the exact degree of frost-tolerance of the several species, as only meager published data on the subject are to be found

A. *Susceptible to light frost*

The following would probably succumb to a temperature of 28° F.:

Eucalyptus calophylla.
Eucalyptus ficifolia.
Jacaranda ovalifolia

AA. *Susceptible to heavy frost.*

The following are not likely to stand a temperature of 20° F. Some of them may succumb at 25° F., particularly when young.

Acacia Baileyana.
Acacia cyanophylla.
Acacia decurrens var. dealbata.
Acacia elata.
Acacia falcata.
Acacia longifolia.
Acacia neriifolia.
Acacia pendula.
Acacia salicina, etc.
Bursaria spinosa.
Eucalyptus cornuta
Eucalyptus corymbosa.
Eucalyptus polyanthemos.
Eucalyptus sideroxylon var. pallens.
Hymenosporum flavum.

AAA. *Hardy.*

Acacia pycnantha.
Æsculus carnea.
Æsculus Hippocastanum.
Albizzia Julibrissin.
Catalpa bignonioides.
Catalpa ovata.
Catalpa speciosa.
Cercis canadensis.
Cercis Siliquastrum.
Cratægus mollis.
Cratægus monogyna (vars. Pauli, punicea, alba plena, etc)
Koelreuteria paniculata.
Laburnum vulgare
Lagunaria Patersonii.
Magnolia acuminata.
Magnolia grandiflora.
Magnolia Kobus.
Magnolia Soulangeana.
Magnolia stellata.
Paulownia tomentosa.
Prunus Armeniaca (double.-fid.)
Prunus cerasifera var. atropurpurea
Prunus japonica.
Prunus Persica (white-fid., double red-fid., dark-fid., etc).
Prunus spinosa (double-fid.).
Pyrus Halliana.
Pyrus ioensis (Bechtel's double crab).
Robinia hispida.
Robinia Pseudacacia and var. rosea
Sorbus Aucuparia.

3. *Trees with colored foliage.*

A. *Glaucous.*

B. *Susceptible to frost (20° F. and perhaps less,.*

Acacia Baileyana.
Acacia dealbata.
Acacia glaucescens.
Acacia salicina.
Cocos australis.
Erythea armata.
Eucalyptus globulus (pollarded to produce suckers).
Eucalpytus polyanthemos.
Eucalyptus Risdonii.
Eucalyptus sideroxylon var pallens
Leucadendron argenteum.
Phœnix dactylifera.
Washingtonia Sonoræ.

BB. *Hardy.*

Cedrus atlantica var. glauca.
Cedrus Deodara var. glauca.
Picea pungens var. cærulea
Picea pungens var. glauca.
Sequoia sempervirens var. glauca

AA. *Purple or bronze.*

B. *Susceptible to 25° F.*

Ricinus cambodgensis.
Ricinus communis var. Gibsonii

BB. *Hardy.*

Acer platanoides var. Reitenbachii.
Acer platanoides var. Schwedleri.
Betula alba var. atropurpurea.
Cryptomeria japonica var. elegans.
Fagus sylvatica var. purpurea.
Fagus sylvatica var. purpurea Riversii.
Prunus cerasifera var. atropurpurea.
Prunus Persica, var.

4. *Wide-spreading trees for shade, mostly with rounded outline.*

It frequently happens that the owner of a California garden desires a wide-spreading tree in the back or one corner of his domain, under which to swing a hammock on a hot day; such trees are also useful in the school-yard, affording welcome shade in which the children can eat their lunch.

A. *Deciduous, all hardy.*

B. *Growth rapid or medium.*

C. *Suckers likely to be troublesome.*

Populus alba.
Robinia Pseudacacia.
Ulmus americana.
Ulmus racemosa.

CC. *Suckers not troublesome.*

D. *Requiring a great deal of water.*

Salix babylonica.

DD. *Requiring not much water.*

Acer macrophyllum
Acer Negundo.
Acer Negundo var. californicum.
Acer platanoides.
Acer platanoides var. Reitenbachii.
Acer platanoides var. Schwedleri.
Acer pseudoplatanus.
Acer saccharinum.
Acer saccharinum var. Wieri.
Carya illinoensis (Pecan).
Fraxinus americana.
Fraxinus velutina
Quercus lobata.
Quercus pedunculata.
Ulmus campestris.

BB. *Growth somewhat slow.*

Acer campestre.
Æsculus carnea.
Æsculus Hippocastanum.
Castanea sativa
Fagus sylvatica var. purpurea.
Juglans Sieboldiana.
Liriodendron Tulipifera.
Melia Azedarach var. umbraculiformis.
Platanus orientalis.
Quercus coccinea.
Quercus Kelloggii.
Quercus lobata.
Quercus macrocarpa.
Quercus rubra.
Sophora japonica.
Tilia americana.
Tilia europæa.
Ulmus campestris.

AA. *Evergreen.*

B. *Growth rapid: trees susceptible to 25° F.*

Acacia decurrens dealbata.
Acacia decurrens mollis.

BB. *Growth somewhat slow: trees hardy.*

Arbutus Menziesii.
Ficus Carica.
Olea europæa.
Pinus Pinea.
Quercus agrifolia.
Quercus Suber.
Schinus Molle.

5. *Ornamental trees affording but little shade.*

A. *Outline long or nearly columnar.*

B. *Deciduous.*

Populus nigra var. italica.
Betula alba.

BB. *Evergreen.*

Cupressus sempervirens.
Cupressus sempervirens var. fastigiata.
Juniperus communis var. hibernica.
Taxus baccata var. fastigiata.

AA. *Outline conical or spiral, usually pointed.*

B. *Coniferæ, with mostly narrow leaves.*

C. *Deciduous: hardy.*

Larix decidua.
Larix leptolepis.
Taxodium distichum.
Taxodium mucronatum.

CC. *Evergreen.*

D. *Susceptible to severe frost (about 20° F.).*

Agathis robusta.
Araucaria Bidwillii.
Araucaria brasiliana.
Araucaria Cookii.
Araucaria Cunninghamii.
Araucaria excelsa.
Araucaria imbricata.
Pinus canariensis.

DD. *Hardy.*

Abies balsamea.
Abies cephalonica.
Abies concolor.
Abies nobilis.
Abies Nordmanniana.
Abies Pinsapo.
Cedrus atlantica.
Cedrus Deodara.
Cedrus Libani
Cephalotaxus drupacea.
Cephalotaxus Fortunei
Chamæcyparis Lawsoniana.
Cryptomeria japonica
Cryptomeria japonica var. elegans.
Cunninghamia sinensis.
Cupressus Goveniana.
Cupressus macrocarpa
Cupressus guadalupensis.
Libocedrus chilensis.
Libocedrus decurrens.
Picea ajanensis.
Picea canadensis.
Picea Engelmannii.
Picea excelsa.
Picea mariana var. Doumetti.
Picea torano.
Picea pungens.
Pinus contorta.
Pinus Coulteri.
Pinus densiflora.
Pinus Laricio var. austriaca.
Pinus monophylla
Pinus Pinaster
Pinus radiata
Pinus Sabiniana.
Pinus sylvestris
Podocarpus Totara.
Pseudotsuga Douglasii.
Sciadopitys verticillata.
Sequoia gigantea.
Sequoia sempervirens.
Taxus baccata
Thuja gigantea.
Thuja orientalis.
Thujopsis dolabrata.
Torreya californica.
Torreya nucifera.

BB. *Foliage broad.*

C. *Deciduous: hardy.*

Betula alba.
Betula lenta.
Betula lutea.
Betula papyracea.
Betula populifolia.
Ginkgo biloba.
Quercus Cerris.
Quercus nigra.
Sorbus Aucuparia.

CC. *Evergreen.*

D. *Susceptible to severe frost (probably 20° F. and even less).*

Cinnamomum Camphora
Corynocarpus lævigatus.
Cryptocarya Miersii.
Grevillea robusta.
Sterculia diversifolia.
Tristania conferta.

DD. *Hardy.*

Acacia melanoxylon.
Cerasus lusitanica.
Ilex Aquifolium.
Lagunaria Patersonii.
Laurus nobilis.
Pittosporum crassifolium.
Quercus Suber.
Umbellularia californica.

AAA. *Outline more or less rounded, but trees not as wide-spreading nor as shade-giving as in Class 4.*

B. *Deciduous.*

C. *Susceptible to frost (25° F.).*

Phytolacca dioica.

CC. *Hardy.*

Æsculus glabra.
Fraxinus americana.
Fraxinus excelsior.
Fraxinus Ornus.
Gymnocladus canadensis.
Juglans californica.
Juglans nigra.
Koelreuteria paniculata.
Paulownia tomentosa.
Robinia Pseudacacia.

BB. *Evergreen.*

C. *Probably susceptible to severe frost (20° F., or less).*

Acacia cyanophylla.
Alectryon excelsum
Bursaria spinosa.
Eucalyptus calophylla.
Eucalyptus cornuta.
Eucalyptus corymbosa.
Eucalyptus corynocalyx.
Eucalyptus ficifolia.
Eucalyptus globulus.
Eucalyptus maculata var. citriodora.
Eucalyptus robusta.
Hymenosporum flavum.
Maytenus Boaria.

CC. *Hardy.*

Acacia pycnantha.
Eucalyptus amygdalina.
Eucalyptus Gunnii.
Eucalyptus leucoxylon.
Eucalyptus obliqua.
Eucalyptus rostrata.
Eucalyptus rudis.
Eucalyptus viminalis.
Jubæa spectabilis.
Phœnix canariensis.
Phœnix reclinata.
Phœnix sylvestris.
Pittosporum eugenioides.
Pittosporum tenuifolium.
Pittosporum undulatum.

AAAA. *Drooping trees.*

B. *Deciduous.*

Acer saccharinum var. Wieri laciniatum.
Betula pendula elegans.
Betula pendula laciniata.
Betula pendula Youngii.
Crataegus monogyna var. pendula.
Fagus sylvatica var. pendula.
Fraxinus excelsior var. aurea pendula.
Fraxinus excelsior var. pendula.
Morus alba (Teas' weeping).
Populus grandidentata var. pendula.
Prunus fructicosa var. pendula.
Quercus lobata.
Salix babylonica.
Salix babylonica var Lucku.
Sophora japonica var. pendula.
Sorbus Aucuparia var. pendula.
Tilia americana var. pendula.
Tilia europæa var. pendula.
Ulmus americana var. pendula.
Ulmus campestris var. pendula.
Ulmus scabra var. pendula.

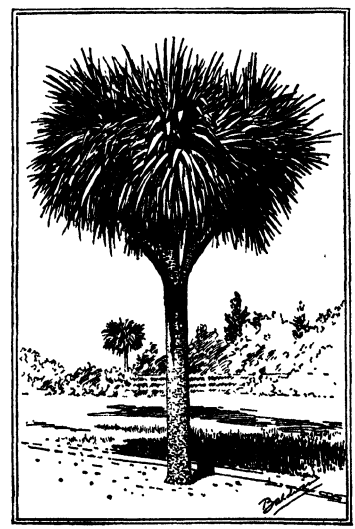
BB. *Evergreen.*

Cupressus funebris.
Cupressus lusitanica.
Schinus Molle.

6. *Trees for streets, avenues and roadsides in California.*

The number of tree species suitable for street planting is limited by the necessarily heavy restrictions, as to height, spread, sewer-penetration and sidewalk-raising, imposed by municipal street departments In European cities the first-named objections are overcome by means of frequent and systematic pruning to a uniform standard; when this necessity can be obviated by the selection of trees which naturally keep within the desired bounds, the labor of maintaining them in a sightly condition is minimized and the result much more pleasing.

For town streets not more than 60 feet in width, it is important to have trees that will not give too much shade and prevent the rapid drying of the roadway after showers, nor be so tall nor wide-spreading as to obstruct the view and shut out sunshine, rendering the adjacent houses dark, cold and damp. On this account, trees with narrow or pyramidal outline are in many cases preferable to those with wide-spreading habit, and, generally speaking, deciduous trees are more suitable than evergreen, although at the time of losing their leaves they make more litter. Exception may be made in favor of such evergreen species as certain palms and cordylines, some acacias and a few other species mentioned below.



359. Cordyline australis or "dracena palm." Common in California.

It is not wise to use trees of very rapid growth on town streets; they soon become too large and require frequent trimming, which is usually equivalent to mutilation, and are likely to interfere with sewers.

It cannot be said that street planting in California towns has, in most cases, been satisfactory. In spite of the much larger variety of suitable material than is available in most of the states, there are few examples of good street planting to be met with. In most of the towns the eye is greeted with a few straggling trees, of which perhaps not more than two are of one kind, recalling F. A. Waugh's apt simile of "nine monstrously different buttons in a row down the front of a Prince Albert coat." There are many pleasing exceptions, however, although few are entirely satisfactory. The repeated attempts to improve the appearance of a town by planting trees along the streets should be encouraged on every occasion, and the object of this discussion is to render assistance by pointing out how some of the mistakes may be avoided. The unsatisfactory results of street planting, so often met with, can generally be traced to one or all of three causes:

(1) Choice of unsuitable species.

(2) The mixing of several species on the same block and even in front of the same lot.

(3) Crowding of trees.

This last-mentioned source of trouble is perhaps the cause of more failures than the first. When trees are once growing, few persons have the heart to thin out the species for the proper distance apart; finally, a newcomer, without personal feeling in the matter and noting only that there is too much shade and too little light, cuts down the whole row and a gap is left in what may have been a fairly uniform block. Spreading avenue trees of large size should not stand closer than 50 feet apart; smaller trees, on narrower streets, should have 40 feet, unless they are slender species such as cordyline or washingtonias, when 20 feet may be sufficient As a rule, one small tree to a 50-foot lot will be found ample; if the whole street is planted uniformly with the same species, and at this same distance, the result will be much more pleasing than if four or five trees are planted in front of every house.

This question of spacing can be determined only by the species in use. If 20 feet is added to the diameter of the spread of the crown, an approximate spacing can be secured. For example, cork elms often attain a 60- or 75-foot spread and should be spaced, accordingly, 80 to 100 feet apart. This advice is given from data gathered in various towns where closer plantings were in order, and have already demonstrated how the air, light and heat are shut off by too crowded plantings.

In towns where the climate is very mild, with few extremes trees are planted only for decorative effect and not for shade,—hence these extreme distances may be used even for species which do not attain great size.

On the other extreme in the interior California valleys, the distances may have to be shortened to allow for the extreme heat, but trees should never be set so closely that the circulation of air is hindered, except of course for windbreak plantings, which are not found on streets as a rule.

A. *For city and town streets.*

B. *Small trees suitable for streets 60 feet wide or less.*

C. *Deciduous.*

D. *Growth rapid or moderate.*

Æsculus carnea.
Betula alba.
Betula lutea.
Betula populifolia.
Catalpa bignonioides.
Catalpa ovata.
Catalpa speciosa.
Koelreuteria paniculata.
Paulownia tomentosa.

DD. *Growth slow.*

Cratægus mollis.
Cratægus monogyna.
Ginkgo biloba.

CC. *Evergreen.*

D. *Growth rapid or moderate.*

E. *Palms and arborescent Liliaceæ.*

Cordyline australis.
Cordyline Banksii.
Cordyline indivisa.
Cordyline stricta.
Erythea edulis.
Livistona australis.
Trachycarpus excelsus.
Washingtonia filifera.
Washingtonia robusta.

EE. *Evergreen trees other than palms and arborescent Liliaceæ.*

Acacia falcata.
Acacia lineata.
Acacia neriifolia.
Myoporum lætum.
Pittosporum eugenioides.
Pittosporum tenuifolium.

DD. *Growth slow.*

Alectryon excelsum.
Bursaria spinosa.
Cinnamomum Camphora.
Eucalyptus ficifolia.
Ilex Aquifolium.
Jacaranda ovalifolia.
Ligustrum lucidum.
Magnolia grandiflora.
Maytenus Boaria.
Olea europæa.
Pittosporum crassifolium.
Tristania conferta.

BB. *Larger trees for streets, avenues and boulevards 80 to 100 feet wide.*

C *Deciduous.*

D. *Growth rapid or moderate.*

Acer macrophyllum.
Acer saccharinum.
Carya (Pecan).
Fraxinus americana
Fraxinus velutina.
Gymnocladus canadensis.
Platanus orientalis.
Quercus pedunculata.
Robinia Pseudacacia.
Ulmus campestris.



360. Eucalyptus rostrata; 11 yrs. planted; 86 ft. high. California.

DD. *Growth slow.*

Gleditsia triacanthos.
Liriodendron Tulipifera.
Tilia americana.
Tilia europæa.

CC. *Evergreen.*

D. *Palms and bananas.*

Erythea edulis.
Livistona australis.
Musa Ensete.
Trachycarpus excelsus.
Washingtonia filifera.
Washingtonia robusta.

DD. *Evergreen trees other than palms and bananas.*

Acacia elata
Acacia melanoxylon.
Angophora intermedia.
Angophora subvelutina.
Eucalyptus amygdalina var. angustifolia
Eucalyptus calophylla.
Eucalyptus cormybosa.
Eucalyptus ficifolia.
Eucalyptus polyanthemos.
Eucalyptus rudis.
Eucalyptus sideroxylon var. pallens
Ficus macrophylla.
Syncarpia laurifolia.
Tristania conferta.
Umbellularia californica.

BBB. *For avenues and boulevards without sidewalks or with wide spaces between sidewalk and driveway.*

For this purpose almost any of the larger and more ornamental species enumerated in the other lists may be selected. Spreading coniferous trees, with broad bases (such as *Sequoia gigantea*, etc.), may often be used to advantage, as well as the wide-spreading feather-palms (Phœnix and Jubæa).

AA. *For country roads.*

B. *Deciduous.*

Acer campestre.
Acer macrophyllum
Acer Negundo
Acer Negundo var. californicum
Acer platanoides.
Acer saccharinum.
Æsculus carnea.
Æsculus Hippocastanum.
Carya (Pecan).
Ginkgo biloba.
Juglans californica.
Juglans Sieboldiana.
Liriodendron Tulipifera.
Paulownia tomentosa.
Phytolacca dioica.
Populus nigra var. italica.
Quercus lobata.
Quercus pedunculata
Robinia Pseudacacia.
Sophora japonica.
Taxodium distichum.
Tilia americana.
Tilia europæa.
Ulmus campestris.
Ulmus racemosa.

BB. *Evergreen.*

Acacia melanoxylon.
Acacia decurrens var. dealbata.
Arbutus Menziesii.
Cinnamomum Camphora
Cryptomeria japonica
Eucalyptus botryoides
Eucalyptus calophylla.
Eucalyptus capitellata.
Eucalyptus cornuta
Eucalyptus diversicolor
Eucalyptus leucoxylon
Eucalyptus rostrata.
Eucalyptus rudis.
Eucalyptus viminalis.
Ficus macrophylla.
Olea europæa.
Pinus radiata.
Quercus Suber.
Schinus Molle.
Sequoia gigantea.
Sequoia sempervirens.
Sterculia diversifolia.
Tristania conferta
Umbellularia californica.

7. *Trees that have been tried in California but have proved unsatisfactory.*

There are many species that have failed to give satisfaction in some localities because of peculiarities of climate or soil; there are some, also, that have proved unsatisfactory on account of habit; from among these may be mentioned:

Acacia species. Nearly all acacias stump-sprout badly, so that for temporary planting they should be avoided. When planted in narrow parkings, they are very likely to raise sidewalks also, but this can be remedied by frequent root-prunings, which they stand admirably.

Acacia melanoxylon is generally debarred from the citrus belt as a breeder of scale: when mature it is said to suffer quickly from the effects of drought. In the moister climate of the immediate vicinity of the coast, near San Francisco, however, it proves entirely satisfactory.

Ailanthus altissima, has a bad reputation on account of its disagreeable odor, but as this is found only in the staminate trees, it can be avoided by planting none but the pistillate (fruit-bearing) trees.

Cratægus species. Of all these species, *C. Oxyacantha* is perhaps the one most commonly used, and through the Santa Clara Valley and Bay regions is disfigured,

in most cases, by sooty mold fungus, resulting from scale infestations. This can of course be remedied, but, in the average case, at considerable more expense than would be warranted.

Eucalyptus corynocalyx becomes straggling and unsightly with age.

Eucalyptus globulus and, in fact, almost all species of the genus, are frequently debarred by town ordinance from growth within 60 or even 70 feet of a sewer, on account of the remarkable length and penetrating power of their roots.

Eucalyptus robusta, a species which is exceedingly handsome as a young tree, has been extensively planted along roadsides and streets in the warmer parts of the state When mature, it becomes straggling and exceedingly brittle, breaking up in an unsightly way.

Eucalyptus rudis. This species has a pendent habit when older that often causes a severe splitting of the crown. As the trees are very picturesque, they are often desirable, provided reasonable attention can be given to prevent this.

Ficus macrophylla is injurious to sidewalks.

Grevillea robusta has brittle wood and is usually much broken in heavy winds, but can be used with satisfaction if kept well cut back.

Melia Azedarach var. *umbraculiformis* is unsatisfactory in the immediate vicinity of the coast; as a sidewalk tree it is exceedingly untidy when losing leaves, and is also very much subject to scale insects.

Paulownia tomentosa is sometimes objected to on account of the somewhat untidy appearance of the persistent seed-pods, which require no little labor if all are to be removed after flowering.

Phœnix dactylifera and *P. reclinata* both sucker objectionably.

Populus alba, *Robinia Pseudacacia* and *Ulmus racemosa* are exceedingly troublesome when used as sidewalk trees on narrow streets; their surface roots often break the cement or asphalt sidewalks, and the suckers come up in the midst of lawns several yards away from the parent tree.

Schinus Molle should be avoided in the citrous belt, as it is found to harbor and become a nursery for scale insects. As a street tree it is also unsatisfactory, becoming too large and straggling, and requires too much pruning to keep it within bounds; its large surface roots often break cement and asphalt sidewalks.

The species of Phœnix and Jubæa should be avoided on account of their low, wide-spreading habit, except for avenues and boulevards where there is no sidewalk or where there is from 20 to 30 feet space between sidewalk and driveway.

8. *Trees for alkali soils.*

There are many places in those parts of the state that enjoy a high temperature and low rainfall, where the percentage of alkali salts in the soil is too great for the cultivation of most of our ornamental trees, and where it is very important that some shade-producing species be grown.

A. *Tolerant of strong "black" alkali (sodium carbonate).*

The most alkali-tolerant tree of those yet tested is *Kœlreuteria paniculata*, a small species 15 to 30 feet high, with feathery, pinnate leaves and ornamental yellow blossoms.

AA. *Tolerant of medium alkali (chiefly "white" alkali).*

Acacia melanoxylon.
Ailanthus altissima.
Albizzia lophantha.
Casuarina equisetifolia.
Eucalyptus amygdalina var. angustifolia (apparently the least sensitive of the eucalyptus).
Eucalyptus rostrata (Fig. 360).
Eucalyptus sideroxiyon var. rosea.
Phœnix dactylifera.
Platanus orientalis.
Quercus lobata.
Robinia Pseudacacia.

AAA. *Only fairly tolerant.*

Acer macrophyllum.
Acer Negundo var. californicum
Cinnamomum Camphora.
Gleditsia triacanthos.
Ulmus species.
Washingtonia filifera.

AAAA. *Tested and found unsuitable.*

Most of those trees of the humid regions, e.g., the eastern states and northern Europe, which have been tried on alkali soils, have been found to suffer and to remain dwarf and stunted. This is particularly true of *Liriodendron Tulipifera*, *Quercus pedunculata* and species of Tilia.

Since writing the above, the following additional information on the alkali tolerance of ornamental trees has been secured through the investigations of R. H. Loughridge of the Agricultural Experiment Station at Berkeley, and has been placed at our disposal.

Total amount of salts found in the upper 4 feet of soil in which the following trees were growing, expressed in tons per acre:

	Tons per acre in depth of 4 feet.
Kœlreuteria paniculata	32
Platanus orientalis	21½
Eucalyptus amygdalina	20
Eucalyptus angustifolia	20
Washingtonia (species not stated)	7½
Phœnix dactylifera	5
Cinnamomum Camphora	3½

Jos Burtt Davy.
B. Y. Morrison.†

ARBOR VITÆ: *Thuja.*

ÁRBUTUS (ancient Latin name). *Ericàceæ*. Ornamental woody plants grown for their handsome evergreen foliage and for their attractive flowers and fruits.

Trees or shrubs with the bark of the branches and younger sts. smooth, and usually red, exfoliating· lvs. alternate, petioled, serrate or entire: fls. monopetalous, globular or urn-shaped, 5-toothed, stamens 10, included; anthers with a pair of reflexed awns, the cells opening by a terminal pore, ovary 5-, rarely 4-celled, cells with many ovules: fr. a globose, many-seeded, berry-like drupe with mealy flesh, mostly granulose outside.—Twelve species in W. N. and Cent Amer., S. and W. Eu , Asia Minor, N Afr , and Canary Isls

The stems and branches are conspicuous by their red smooth bark peeling off in large thin plates, the evergreen foliage, rather large and usually lustrous flowers, white to red, in terminal panicles followed by attractive red fruits. They are of great decorative value for parks and gardens in warm-temperate regions; especially beautiful when adorned with the clusters of white flowers or bright red berries.

Arbutuses grow best in well-drained soil in somewhat sheltered positions not exposed to dry winds. They are very handsome greenhouse shrubs, thriving well in a sandy compost of peat and leaf soil or light loam.

Propagation is by seeds sown in early spring or in fall, or by cuttings from half-ripened wood in fall, placed in sandy peat soil under glass; they root but slowly. Increased also by budding or grafting, usually veneer-grafting, if seedlings of one of the species can be had for stock. Layers usually take two years to root.

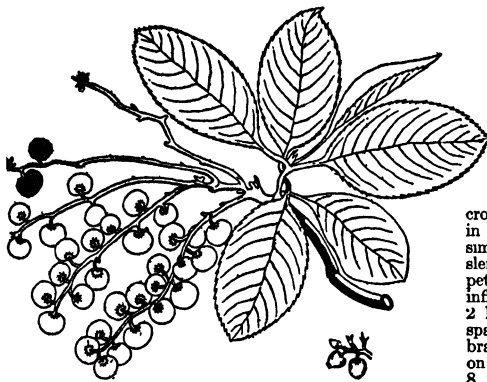
A. *Panicles short, nodding: lvs. usually serrate.*

Unèdo, Linn. Strawberry Tree. From 8–15 ft.: lvs. cuneate, oblong or oblong-lanceolate, 2–3 in. long, glabrous, green beneath: fls. white or red, ovate: fr. scarlet, warty, ¾in. broad. Sept.–Dec. S. Eu , Ireland. L.B.C. 2:123. R.B. 31:36. G.C. III. 14:329. Var. **integérrima,** Sims. Lvs. entire. B.M 2319. Var. **rùbra,** Ait., and var. **Croòmii,** Hort., have red fls. Gn. 26, p. 506; 33, p. 320. F.S.R. 2, p. 375.—Very beautiful in autumn when the tree bears its large scarlet frs. and at the same time its white or rosy fls. Roots and lvs. astringent.

AA. *Panicles erect: lvs. usually entire.*

Ménziesii, Pursh (*A. procèra*, Douglas). Madrona. Fig. 361. Occasionally 100 ft. high; trunk with dark

reddish brown bark: lvs. rounded or slightly cordate at the base, oval or oblong, 3–4 in. long, glabrous, glaucous beneath: fls. white, in 5–6-in.-long panicles: fr. bright orange-red, ½in. long. Spring. W. N. Amer. B.R. 21: 1753. S.S. 5:231. P.M. 2:147. G.F. 3:515; 5:151. Mn.



361. Arbutus Menziesii. (×⅓)

3:85. B.M. 8249. R.H. 1893, pp. 149, 150.—The hardiest and probably the handsomest species of the genus; it stands many degrees of frost. Fig. 361 is adapted from Pacific Railroad Rept.

arizónica, Sarg. (*A. xalapénsis* var. *arizónica*, Gray). Fig. 362 Tree, 40–50 ft.: trunk with light gray or nearly white bark: lvs usually cuneate at the base, oblong-lanceolate, 1½–3 in. long, glabrous, pale beneath: fls. white, in loose, broad panicles 2–3 in. long: fr. globose or oblong, dark orange-red. Spring. Ariz. G.F. 4:318 (adapted in Fig. 362). S.S. 5:233.—The contrast between the white bark of the trunk, the red branches, and the pale green foliage makes a very pleasant effect: fr. and fls. are also very decorative.

A. Andrachne, Linn. From 10–30 ft lvs oval-oblong, usually entire, yellowish green beneath fls. yellowish white fr bright red. Greece, Orient B.M. 2024. B.R. 2.113 G.C. III. 4 724 R.H. 1911, p. 307 (habit) —*A. andrachnoides*, Link (A. Andrachne × Unedo. A. hybrida, Ker A. serratifolia, Lodd. A. Milleri, Hort. A. photiniæfolia, Hort.). Lvs. serrate. panicles drooping; fls. white. B.R. 8 619. L.B.C. 6.580. G.C. II. 9·211. F. 1879, p. 50. —*A. canariénsis*, Lindl. Height 10–30 ft. lvs. oblong-lanceolate, serrate, glaucous beneath panicles erect. fls greenish white. Canary Isls B.M. 1577 —*A. densifólra*, HBK. Height 20 ft.: lvs. oblong or ovate, serrate, downy beneath. fls white. Mex —*A. hýbrida*, Ker=A arachnoides.—*A. laurifólia*, Hook.=A. Menziesii.—*A. laurifólia*, Lindl =A. xalapensis.—*A Milleri*, Hort.=A. andrachnoides.—*A. móllis*, HBK. Shrub or small tree· lvs oblong, serrate, pubescent beneath: fls. white, often tinged greenish red. Mex. B.M. 4595 —*A. pilósa*, Grah.=Pernettya pilosa.—*A. procèra*, Douglas=A Menziesii.—*A. serratifólia*, Lodd., not Salisb. =A. andrachnoides.—*A. texána*, Buckl =A xalapensis.—*A tomentósa*, Pursh=Arctostaphylos tomentosa.—*A. Uva-úrsi*, Linn.= Arctostaphylos Uva-ursi.—*A. xalapénsis*, HBK. (A. laurifolia, Lindl.). Height 10–20 ft : lvs. oval or ovate-lanceolate, entire or crenately serrate, glabrous or downy beneath: fls. reddish; corolla abruptly contracted above the middle. Mex., Texas. S.S. 5:232. B.R. 25:67.

ALFRED REHDER.

ARBUTUS, TRAILING: *Epigæa repens.*

ARCHANGÉLICA (Greek, *chief angel*, from fancied medicinal virtues). *Umbellíferæ.* GARDEN ANGELICA. A genus of 15–20 species of strong-smelling coarse herbs closely allied to Angelica, but differing in highly technical characters associated with the oil-tubes in the fruit.

officinális, Hoffm. A European and Asian biennial or perennial, known also as *Angelica Archangelica;* stout herb, with ternately decompound lvs. and large umbels of small fls.—The sts. and ribs of the lvs. were once blanched and eaten, after the manner of celery, and they are still used in making of sweetmeats. Little known in this country, although it is offered by American dealers. Its chief value to us is its large foliage. Seeds may be sown in the fall as soon as ripe, or the following spring. They are slow to germinate. Root used for its aromatic and carminative properties.

ARCHONTOPHŒNIX (Greek, *majestic phœnix*). *Palmàceæ*, tribe *Arèceæ*. Showy and elegant palms, completely spineless, and with tall stout trunks, which are conspicuously ringed by the annular scars of the fallen leaves.

Leaves divaricate, terminal, forming a large crown pinnately divided, the segms. entire or toothed; in very young specimens the lvs are undivided or simply bipartite; midrib prominent, the nerves more slender; rachis keeled above, convex beneath, the petiole slightly tomentose, and channeled above: infl. appearing much below the lvs., consisting of 2 long, flattened, ultimately pendent and deciduous spathes, inclosing the short-peduncled and much-branched, pedulous spadices: fls. monœcious, sessile on the branches of the spadix; in male fls. the 8 perianth segms. are unique in the family; female fls. with 3 perianth segms., sometimes more: fr. a drupe, globose or elliptic-globose, containing a single fibrous seed.—There are about 10 species, all natives of the Australian or Malayan region. G.C.II. 22.427.

As *Seaforthia elegans*, the second species is well known to all florists and decorators as one of the most graceful and stately palms in cultivation Both species have become very popular in California for outdoor cultivation (see G. C. III. 27·109), where the second species fruits, seeds and germinates readily.



362. Arbutus arizonica. (×⅓)

In the North, they are grown in a temperate house, in a rich soil containing a good percentage of fibrous material and sand mixed with an equal part of rich loam. They require plenty of water.

Propagation is by seeds, which sprout readily in pans or boxes if placed in a warm moist house.

A. *Lf.-segms whitish underneath.*

Alexándræ, H. Wendl. & Drude (*Ptychosp rma Alexándræ*, F. Muell.). Trunk 70–80 ft.: lvs. several ft. long; rachis very broad and thick, glabrous or slightly scurfy; segms. numerous, the longer ones 1½ ft long, ½–1 in. broad, acuminate and entire or slightly notched, green above, ashy glaucous beneath: infl. about 1 ft. long, the fls. greenish yellow: fr. ovoid-globular. Queensland. F.S. 18:1916.—Seldom ripening fr. on plants cult. outdoors in Calif. and rather tender when young

AA. *Lf.-segms. green on both sides.*

Cúnninghamii, H. Wendl & Drude (*Ptychospérma Cúnninghamii*, H. Wendl. *P. élegans*, Blume. *Seafórthia élegans*, Hook.). Trunk and general habit like the preceding, but the segms. acuminate and entire or scarcely notched: fls shell-pink, followed by globular berry-like drupes. Queensland and New S. Wales. B M. 4961, 7345, the first as *Seaforthia elegans*, the second as *Ptychosperma elegans*.—Hardier than the preceding, and fruiting freely in outdoor specimens in Calif.

N. Taylor.†

ARCTIUM (from Greek word for *bear*, probably alluding to the shaggy bur). *Compósitæ*. Burdock. A few coarse perennials or biennials of Temp Eu. and Asia, some of them widely distributed as weeds. Involucre globular and large, with hooked bristles, becoming a bur: receptacle densely setose: pappus deciduous, of short serrulate scales: lvs. alternate, large and soft, whitish beneath: plant not prickly: fls. pinkish or purplish in summer.

Lappa, Linn (*Lappa major*, Gaertn.) Common Burdock. The burdock is a common and despised weed in this country, although it is capable of making an excellent foliage mass and screen. In Japan it is much cult. for its root, which has been greatly thickened and ameliorated, affording a popular vegetable. It is there known as gobo (see Georgeson, A. G. 13, p. 210). Roots collected from plants of the first year's growth are used as an alterative in blood and skin diseases. The seeds and fresh lvs. are used medicinally to a limited extent. *A. minus*, Schk., a European weed, widely naturalized in E. N. Amer. is apt to be confused with *A. Lappa*. N. Taylor.†



363. Arctostaphylos Uva-ursi. (×½)

ARCTOSTÁPHYLOS (Greek, *bear* and *grape*). *Ericàceæ*. Manzanita. Ornamental shrubs grown for their evergreen foliage and also for their attractive flowers and fruits.

Shrubs or rarely small trees: lvs. alternate, entire, evergreen: fls. small in terminal often panicled racemes; calyx 4–5-parted, persistent; corolla urceolate, 4–5-toothed; stamens 8 or 10, included; anthers with a pair of awns, the cells opening with a pore; ovary 4–10-celled, 1 ovule in each cell: fr. a red, usually smooth mealy berry or rather drupe with 4–10 coherent nutlets.—About 20 species in N. and Cent. Amer., 1 species also in N. Eu. and N. Asia. Includes Comarostaphylis.

They are handsome evergreen shrubs, though generally with less conspicuous flowers and fruits than those of the allied genus Arbutus. Some Central American species, however, as *A. arbutoides*, *A. arguta* and *A. polifolia* are beautiful in flower, and well worth a



364. Manzanita.—Arctostaphylos manzanita. (×⅓)

place in the greenhouse or in the garden in temperate regions; of the American species, *A Pringlei*, *A. viscida* and *A. bicolor* are some of the handsomest. Only the trailing species are hardy North. For culture, see *Arbutus*.

INDEX.

bicolor, 9, *californica*, 2, diversifolia, 10. glauca, 5. manzanita, 4. nevadensis, 2. Pringlei, 8 pungens, 3, 4. tomentosa, 7. Uva-ursi, 1. viscida, 6.

A. *Trailing or creeping lvs. ½–1½ in. long: fls. in short and rather few-fld. clusters.*

1. **Uva-ursi**, Spreng. (*Árbutus Úva-úrsi*, Linn.). Bearberry. Fig. 363. Lvs. obovate-oblong, tapering into the petiole, retuse or obtuse at the apex: fls. small, about ¼in. long, white tinged with red. Northern hemisphere, in N. Amer. south to Mex. Em. 2:431. Gn. 14:68 (habit).—Hardy trailing evergreen shrub, like the following valuable for covering rocky slopes and sandy banks. Cuttings from mature wood taken late in summer root readily under glass. Lvs are employed in medicine chiefly for their action on the kidneys and bladder.

2. **nevadénsis**, Gray (*A. californica*, Hort.). Lvs. obovate or obovate-lanceolate, abruptly petioled, acute or mucronate at the apex: fls. in short-stalked clusters, white or tinged with red. Calif., in the higher mts. G.W. 13:326 (habit).

AA. *Erect shrubs: lvs. usually 1–2 in. long: fls. in mostly many-fld. panicled racemes.*

B. *Lvs. glabrous, rarely minutely pubescent.*

C. *Pedicels glabrous.*

3. **púngens**, HBK. From 3–10 ft.; glabrous or minutely pubescent: lvs. slender-petioled, oblong-lanceolate or oblong-elliptic, acute, entire, green or glaucescent: fls. in short, umbel-like clusters: fr. glabrous, about ¼in. broad. Mex, Low. Calif. B.R. 30:17. B.M. 3927.

4. **manzanita**, Parry (*A. púngens*, Authors). Fig. 364. Shrub or small tree, to 30 ft . lvs. ovate, usually obtuse and mucronulate at the apex, glabrous, dull green: fls. in prolonged panicled racemes: fr. glabrous, ¼–½in. broad. W. N. Amer, from Ore. south. G.F. 4:571. G.C. III. 44:163. B.M 8128.

CC. *Pedicels glandular.*

5. **glauca**, Lindl From 8–25 ft.. lvs. oblong or orbicular, obtuse and mucronulate at the apex, glaucescent or pale green: fls. in prolonged panicled racemes; pedi-

cels glandular: fr. minutely glandular. Calif.—Intro. 1891. Lvs. used medicinally like those of *A. Uva-ursi*.

6. **víscida,** Parry. From 5–15 ft.: lvs. broad-ovate or elliptic, abruptly mucronulate, acute or rounded at the base, glaucous: fls. in slender and spreading, panicled racemes; pedicels viscid; corolla light pink: fr. depressed, about ¼in. broad, smooth. Ore. to Calif.

BB. *Lvs. more or less pubescent.*

C. *Branchlets usually bristly-hairy: lvs. dull grayish or bluish green above.*

7. **tomentósa,** Douglas. From 2–6 ft.: lvs. oblong-lanceolate or ovate, acute, sometimes serrulate, pubescent beneath, pale green: fls. in rather dense and short, usually panicled racemes; pedicels short: fr. puberulous, glabrous at length. W. N. Amer. B.R. 21:1791. B.M. 3320.—The hardiest of the erect species.



365. Arctotis grandis. (×⅓)

8. **Pringlei,** Parry. Shrub: lvs. broad-ovate or elliptic, usually abruptly mucronulate, pubescent, sometimes glabrous at length, glaucous: panicled racemes peduncled, usually leafy at the base, many-fld.; slender pedicels and calyx glandular-pubescent: fr. glandular hispid. Calif., Ariz.

CC. *Branchlets tomentose: lvs. bright green and lustrous above.*

9. **bícolor,** Gray. From 3–4 ft.: lvs. oblong-oval, acute at both ends, entire and revolute at the margin, glabrous and bright green above, white-tomentose beneath: fls. in nodding, rather dense racemes; pedicels and calyx tomentose; corolla ⅓in. long, rose-colored: fr. smooth. Calif.

10. **diversifólia,** Parry (*Comarostáphylis diversifólia,* Greene). Shrub, 5–15 ft.: lvs. elliptic or ovate to oblong, 1–2½ in. long, acute, cuneate at the base, spinulose-dentate, often revolute at the margin, grayish pubescent or tomentose beneath: racemes terminal, usually several, 1½–4 in. long, tomentose; pedicels slender; corolla ¼in. long, light pink: fr. ovoid, ¼in. long, scarlet. Low. Calif. May, June: fr. in Aug., Sept. Mn. 5:231.

A. alpina, Spreng.=Arctous alpina —*A. arbutoides,* Hemsl. Five to 6 ft.: lvs. lanceolate, oblong, ferrugineously pubescent beneath, panicles erect, loose. Guatemala. B.R. 29·30.—*A. argúta,* Zucc. (A. nitida, Benth.). Five to 6 ft.· lvs. oblong-lanceolate, serrate, glaucous and glabrous: panicles loose, erect. S. Mex. B.R 31:32. B M. 3904 (as A nitida) —*A. californica,* Hort =A nevadensis.—*A. nítida,* Benth.=A. argúta —*A. polifólia,* HBK Height 1–3 ft.: lvs. linear-lanceolate, glaucous and puberulous beneath: fls. red, in loose, erect racemes. Mex

ALFRED REHDER.

ARCTÒTIS (Greek for *bear's ear,* alluding to the achene). *Compósitæ.* Herbs with long-peduncled heads and more or less white-woolly herbage, of 30 or more African species: achenes grooved, with scale-like pappus: involucre with numerous imbricated scales: receptacle bristly —Two species, both treated as annuals, are sold in this country. Cultivation simple.

breviscàpa, Thunb. (*A. leptorhìza* var. *breviscàpa,* DC.). Stemless or nearly so (6 in high), half-hardy, readily prop from seeds, and to be grown in a warm, sunny place: lvs. usually longer than the scape, incised-dentate: scape hirsute, bearing one large fl. with dark center and orange rays.

grándis, Thunb. Fig. 365. A beautiful annual, forming a bushy clump 2–2½ ft high: lvs much shorter than the scape, repand dentate: fls 2½–3 in diam, white or white and pale violet.—May be the same as *A. stœchadifolia,* Berger.

A. Gumbletonii, Hook. f. Ray fls deep orange-red Namaqualand, S. Afr. B.M. 7796

N. TAYLOR.†

ARCTÒUS (Greek, *boreal,* referring to its distribution). Syn. *Mairánia. Ericáceæ* Ornamental flat shrub, rarely cultivated in rockeries for its bright green foliage and scarlet or black fruits in autumn.

Prostrate glabrous shrub: lvs. alternate, serrate, deciduous: fls. in small terminal racemes; calyx 4–5-parted; corolla urceolate with 4–5-toothed recurved limb; stamens 8–10, included, anthers with a pair of short awns, cells opening with a pore; ovary 4–5-celled: fr. a globose juicy drupe with 4–5 separate nutlets.—One circumpolar species.

This is a plant lying flat on the ground, with shreddy bark, thin deciduous leaves clustered toward the end of the branches, small white flowers appearing before or with the leaves, followed by lustrous, black or red fruits. Adapted for rockeries where it will probably succeed best in peaty soil and in a half-shady position. Propagation is by seeds and by cuttings.

alpínus, Niedenzu (*Arctostáphylos alpìna,* Spreng. *Mairánia alpìna,* Desv.). Lvs. obovate or oblanceolate, narrowed into the short petiole, ½–1½ in. long, reticulate, serrate: fls. 2–4, ½in. long, white tinged pinkish or greenish: fr. ½in. across, globose, bluish black. N. Amer., N Eu., and N. Asia. S.E B. 6:880. B.B. 2:573. M.D.G. 25:138 (habit). Var. **rúber,** Rehd. & Wilson. Fr. bright red, not changing to black. Rocky Mts., W. China.—This variety is handsomer than the type on account of the bright color of the fr.

ALFRED REHDER.

ARDÍSIA (*pointed,* alluding to the stamens or corolla-lobes). Including *Icacórea. Myrsináceæ.* Trees and shrubs, some of which are grown in their juvenile state as pot subjects, or as outdoor specimens in warm climates.

Flowers white or rose, usually in cymes, with 5-parted (sometimes 4- or 6-parted) rotate corolla, 5 stamens attached to the throat of the corolla, with very large anthers and a 1-seeded drupe the size of a pea. lvs. entire, dentate or crenate, thick and evergreen.—Probably more than 200 species in the tropical and subtropical parts of both hemispheres, one of which (*A. crenulata*) is a popular berry-bearing conservatory

and table plant, and a half-dozen others of which are sometimes seen in collections.

Ardisia crenulata is in great demand as a Christmas plant. The other species are seldom seen in this country. They are nearly always propagated from seed, but a plant can be secured more quickly, and better, from a cutting. When plants are over three years old, they often lose their foliage and become "leggy." Good plants can be obtained from the bushy tops by girdling them near the branches, and covering the pieces from which the bark has been removed with wet moss; the moss will be well filled with root in about six weeks, when the tops may be taken off and potted, keeping them in a tight case until they grip the soil. These plants, from which the tops have been removed, are excellent material from which to obtain cuttings, and they will break quite readily if placed in a close, warm atmosphere, about 65°. Cuttings should be taken from young shoots of half-matured wood, and placed in a cutting-bed with a top and bottom temperature of 70°. If these conditions are followed they will root in a month, after which they may be transferred to small pots. Loam, peat and sand in equal parts is the best potting material. As the plant increases in size and vigor, decomposed manure should be added to the mixture, about a fourth part of manure being sufficient. A night temperature of 65° should be maintained for securing the best results.—The advantage of the cutting over the seedling will be apparent, the cutting branching near the pot, whereas the seedling will grow a few inches of stem first. Care should be exercised in selecting the plants from which to propagate, since those grown from seed will vary somewhat in the size and number of berries they produce, and only the best should be selected as stock plants As soon as the plants show signs of flowering, they should be given more air, and wetting overhead should be avoided until the berries are set. They should at all times be kept in a light position near the glass; during the summer months, however, they should be shaded with cheese-cloth on bright sunny days. About the 1st of October, the berries will be well developed and should be given plenty of sunshine to color them well The temperature may be lowered to 50° or 55°, as growth is not wanted at this season. Waterings with soot-water will be beneficial, a handful to an ordinary watering-pot This produces a fine color on the leaves and berries.—The large brown scale is the greatest enemy of this plant; and the best means to keep this in check is to fumigate with cyanide of potassium. Several fumigations will effect a cure. The temperature of the house should never be over 60° when fumigated. (Geo. F. Stewart.)

A. *Fls. red or rose-colored.*

crenulàta, Lodd (*A crenàta,* Sims. *A. crispa,* Hort.). Fig 366 As cult., a compact and neat shrub, with lance-oblong, wavy-margined, alternate lvs. and drooping clusters of small coral-red, long-lasting, handsome frs. fls. in terminal panicles, sweet-scented. Probably native to E. Indies or China. B.M. 1950. L.B.C. 1:2. Mn. 1:58. A.F. 13:558. Var. **variegàta,** Hort., has variegated lvs.

hùmilis, Vahl. Lvs. lance-oblong, shining: frs. shining black. India.

Óliveri, Mast. Lvs. nearly sessile, recurved, oblanceolate and acuminate, 6–8 in. long, entire: fls. pink, in large, dense heads, like an ixora, the limb rotate, ½in. across. Costa Rica. G.C. II. 8:681.—Elegant stove plant.

AA. *Fls. white.*

japónica, Blume. Lvs. short-oblong or somewhat cuneate, whorled, serrate: fls. on red pedicels in drooping racemes: berries white. Dwarf. Japan.—Probably hardy in the N.

polycéphala, Wall. Lvs. bright green, red or wine-colored when young, opposite: fr. black. E. Indies.

AAA. *Fls. purple or black-dotted.*

Pickeríngia, Torr. & Gray (*Icacòrea paniculàta,* Sudw.). MARBLEBERRY. Glabrous, to 24 ft.: lvs. oblanceolate to lance-oblong, entire, narrowed to a petiole: panicle many-fld.; corolla-lobes oval and becoming reflexed: fr. as large as peas, black and shining. E. Fla. Intro. 1891.

A. umbellàta is offered in this country as coming from India. The *A. umbellàta,* Baker (of the botanists), is a Madagascar plant, and it is doubtful whether it is cult in this country. Species with white fls. are *A. acuminàta,* Willd, B.M. 1678, *A. capitàta,* Gray· *A. mamillàta,* Hance, *A. punctàta,* Roxbg., *A villòsa,* Wall. Species with red or reddish fls are *A macrocárpa,* Wall., *A paniculàta,* Roxbg, B.M. 2364, *A serrulàta,* Swartz, *A. Wàllichii,* DC. Recently described ardisias are *A. gigantifòlia,* Stapf., with elliptic lvs 12–14 in. long and 3 in broad fls. small, rose-colored, in long-stalked loose panicle. S. China. *A. Brandmeriàna,* Linden, dwarf, with green-shaded crenulate lvs. Congo. L. H. B.



366. Ardisia crenulata. (×½)

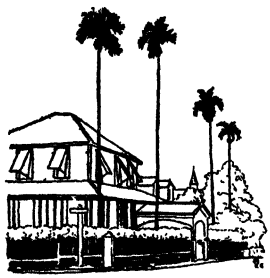
ARÈCA (said to be latinized form of Malayan name). *Palmàceæ,* tribe *Arèceæ.* A graceful and well-known group of spineless palms, the trunks solitary or forming a ring-like clump.

Leaves at first bipartite, and only after several years forming the beautiful and gracefully pinnate adult lvs., which form large terminal clusters; lfts. slender, lanceolate or linear, acuminate; rachis 3-angled, convex on the back, the upper face and the petiole concave: spadix very much branched, appearing from the lowest lf.-base, and by the falling of this ultimately being separated from the lf.-cluster; spathes 3, 1 inclosing the fls., the other 2 usually bract-like: fls. monœcious, the female solitary, surrounded by numerous slender spikes of male fls which are fragrant and white, and much smaller than the female: fr. ovoid, orange-colored, surrounded by the persistent, coriaceous perianth.—There are only about 14 species, confined to the Asiatic and Australian tropics, all the 30 or more species usually credited to the genus belonging in Acanthophœnix, Chrysalidocarpus (*A. lutescens*), Dictyosperma, Eutorpe, Hyophorbe, Kentia (Howea), Oncosperma, Phœnicophorum and others. From Pinanga, the most closely related genus, Areca is distinguished by having not more than 6 stamens and by the female fls. being much larger than the male.

Areca is commercially a very important genus on account of the betel nut (*A. Catechu*). The fibrous spathes and the covering of the fruit are used in packing; the seeds contain a dye, and, most important of all, are the source of the masticatory "betel nut" of the East Medicinally, their principal use is for expelling tape-

worms. More than seventeen varieties of the nut are known in India alone, where the trade in the nuts (seeds) exceeds $30,000,000 yearly. It is also used extensively for medicinal purposes.

The cultivation of arecas is not difficult. They must be grown in a tropical house with a day temperature of 75° to 85° and a night temperature of not less than 60°. Young plants thrive in a mixture of equal parts of peat or leaf-mold and loam, while older plants will do best in a mixture of loam and sand, equal parts, mixed with a liberal amount of well-rotted cow- or horse-manure. Water freely, at least every other day. As young plants, they form beautiful decorations and when old are perhaps the most graceful and delicately foliaged palms in cultivation. G.C. II. 22:427.



367. Areca Catechu.

A *Sts. solitary and exceeding 40 ft. in adult trees.*

Cátechu, Linn. BETEL NUT. Fig. 367. St. solitary, 40–100 ft.: lvs. 4–6 ft., forming a large crown, but with 1 or 2 of the lowest usually pendulous; lfts. numerous, 1–2 ft., upper confluent, quite glabrous: spathe, flattened and, smooth in age, become fibrous when old: fr. 1½–2 in., ovoid, smooth, orange or scarlet. Asia and Malayan Isls.—Frequent in American tropics.

AA. *Sts. usually numerous, often forming a ring, usually not over 25 ft.*

B. *Young growth red: lfts. appearing in bunches of 3.*

Ilsemannii, Hort. Resembles a red-stemmed chrysalidocarpus: young lvs. very dark red, becoming green; fronds slender, arching, with curving pinnæ: fls. and fr. unknown. Oceanica (?). R.H. 1898:261. (as *Linospadix Micholtziana*).

BB. *Young growth green: lfts. not in bunches of 3.*

Alicæ, F. Muell. Sts. several from the same rhizome, 9 ft. or more high, and slender: lvs. 3–6 ft. long; segms. acuminate, several confluent, especially at apex, bright shining green on both sides: fls. paniculate, the panicle coming from between the lvs. Queensland.

triandra, Roxbg. Trunk 15–25 ft. high, 1–2½ in. thick, usually several together, and frequently sending out basal offshoots, cylindrical: fronds 4–6 ft. long; segms. with 6 primary nerves about 1 line apart; petiole about 1 ft. long: fls. as in *A. Catechu*: fr. about as large as an olive, orange-scarlet. India.

A. álba, Bory=Dictyosperma alba.—*A. Baùeri,* Hook. f.=Rhopalostylis Bauer. B.M. 5735.—*A. elegantíssima,* Hort. Trade name(?).—*A. furfuràcea,* Hort.=Dictyosperma furfuracea.—*A. gigantèa,* Hort.=Pinanga ternatensis —*A. grácilis,* Roxbg.=Pinanga gracilis.—*A. grácilis,* Thouars=Dypsis pinnatifrons.—*A. grácilis,* Gieseke=Drymophlœus appendiculatus.—*A. grandiformis,* Hort.=Trade name(?).—*A. lutéscens,* Bory.=Chrysalidocarpus lutescens.—*A. madagascarién̄sis,* Mart. A rare species, with small trunk and few lvs. Madagascar.=Dypsis madagascariensis.—*A. monostáchya,* Mart.=Bacularia monostachya. B.M. 6644.—*A. montàna,* Hort. B.M. 3874 (as Euterpe).—*A. Nibung,* Griff.=Oncosperma filamentosum.—*A. oleràcea,* Jacq.=Oreodoxa oleracea.—*A. pùmila,* Blume=Nenga Wendlandiana. B.M. 6025.—*A. rùbra,* Hort.=Dictyosperma rubra.—*A. rùbra,* Bory=Acanthophœnix rubra.—*A. Sanderiàna,* Hort. Trade name(?).—*A. sápida,* Soland.=Rhopalostylis sapida. B.M. 5139.—*A. speciósa,* Hort. Trade name(?).—*A. tigillària,* Jack.=Oncosperma filamentosa.—*A. Verschaffèltii,* Hort.=Hyophorbe Verschaffeltii.

N. TAYLOR.

ARÉGELIA (named in honor of the botanist, C. von Regel). *Bromeliàceæ.* Epiphytic hothouse plants with the serrate lvs. arranged in a rosette: fls. in a simple dense head among the inner lvs. of the rosette, which are often colored, violet, blue or white.—A genus of about 25 species, inhabiting Guiana and Brazil. The species below are sometimes referred to Nidularum. For cult., see *Billbergia.*

A. *Length of fl. 1¼ in. or less.*

tristis, Mez (*Nidulàrium marmordtum,* Hort., not Morr. *N. triste,* Regel. *Karàtas tristis,* Baker). Lvs. 6–12, from 6–12 in. long and half as broad in the middle, green dappled with brown, somewhat scurfy beneath: fl. purple: bract-lvs. narrow-linear: fr. oblong, white.

AA. *Length of fl. 1½ in. or more.*

B. *Lvs. not barred.*

C. *The lvs. densely scaly.*

Morreniàna, Mez (*Karàtas Morreniàna,* Ant. *Nidulàrium Morreniànum,* Makoy). Lvs. many in a dense rosette, with few very minute spines, not striped, densely scurfy beneath: fls. many, dark purple: bract-lvs. linear-lanceolate

CC. *The lvs. free from scales or nearly so.*

Carolinæ, Mez (*Nidulàrium Carolinæ,* Lem. *N. Mèyendorfii,* Regel. *Karàtas Carolinæ,* Ant. *Guzmània ptica,* Hort. *Billbérgia Carolinæ,* Beer. *B. ólens* Hook.). Lvs. several to many, strap-shaped, rather thick, finely spiny-toothed, 12 in. long, bright green on both surfaces, the bract-lvs. bright red: fls. blue-purple, in a short head nestling in the bright lf.-cup B.M. 5502. I.H. 7:245.

princeps, Mez (*Nidulàrium princeps,* Morr. *N. spectábile,* Hort. *Karàtas princeps,* Baker. *K. Mèyendorfii,* Ant. *A. princeps,* Mez.). Lvs. 15–20, about 10–12 in. long, broadest at the middle, firm, spiny-toothed, lightly glaucous: fls. numerous, violet-purple, surrounded by about 8–10 oval, bright red bract-lvs.

BB. *Lvs. conspicuously barred on the back.*

Binòtii, Mez (*Nidulàrium Binòtii,* Regel. *N. Makoyànum,* Regel. *Karàtas Binòtii,* Ant.). Lvs. 15–20, strong-spiny, scurfy and transversely banded on the back, the inner ones similar in color: fls. many, white. —Not to be confounded with *Bromelia Binotii.*

spectàbilis, Mez (*Karàtas spectàbilis,* Ant. *Nidulàrium spectàbile,* Moore. *N. eximinum,* Hort.). Fig. 368. Lvs. 10–15 in. long, about 1½ in. broad, serrulate, barred on the back, the apex rounded, apiculate, with a red apical spot: fls. milky, pale blue at the apex. Brazil. B.M. 6024.

GEORGE V. NASH.†



368. Aregelia spectabilis. (×⅓)



XI. Arboriculture.—A palm plantation, with Corypha umbraculifera in the foreground.

ARENÀRIA (*arena*, sand, where many of the species grow). Including *Alsine*, *Cherleria* and *Moehringia*. *Caryophyllàceæ*. Low herbs, mostly with white flowers, usually forming mats, and suitable for borders, carpets, and lawn clumps; many of them also used for rockwork and alpine gardens; spring- or summer-flowering.

Annual or perennial, with opposite entire narrow exstipulate lvs.: fls small, terminal or clustered, or sometimes axillary; sepals 5; petals 4 or 5, entire or slightly notched, sometimes wanting; stamens 10 (rarely 8); styles mostly 3: fr. a small caps., opening by valves as many or twice as many as the styles.—Perhaps 130–150 species, as the genus is here defined, throughout the world but rare in the tropics. Only the perennial species are commonly cult. Of easiest cult. in almost any soil. Prop. by division; also by seeds, and rare species sometimes by cuttings. Many species of arenaria may be found in the collections of alpine-garden and rock-garden fanciers; but the prevailing cult kinds are accounted for below Related genera are Cerastium and Stellaria. Monogr. by F. N. Williams, Journ. Linn. Soc. 33.326 (1897–8).

INDEX.

aculeata, 16.
aretioides, 4.
balearica, 3
cæspitosa, 14.
Franklinii, 17.
graminifolia, 9.
grandiflora, 10.
grœnlandica, 8
juniperifolia, 15.
juniperina, 15
lanceolata, 6
macrophylla, 7.
montana, 11.
pinifolia, 13.
purpurascens, 2.
Rosanii, 12.
sedoides, 1.
tetraquetra, 5.
verna, 14.

A. *Petals usually wanting or rudimentary.*

1. **sedoides,** Froel. (*Cherlèra sedoides*, Linn.). Minute green moss-like carpeter, 1 or 2 in. high: fls. unisexual or polygamous, greenish, inconspicuous. Mts., Eu —A choice rock-cover in alpine gardens. Prop. by division or seeds.

AA. *Petals usually present and prominent.*

B. *Fls. purplish.*

2. **purpurascens,** Ramond Alpine, tufted and decumbent: lvs ovate-lanceolate, acuminate: fls. on short tomentose pedicels, 2 or 3 on a branch, the purplish corolla exceeded by the sepals Pyrenees.—A carpeter.

BB. *Fls. white (sometimes purple in No. 16).*

C. *Lvs. ovate-oblong or lanceolate.*

3. **balearica,** Linn. Very low (3 in. high), creeping, with small ovate glossy thick and ciliated lvs . fls. single on long peduncles; sepals erect. Balearic Isls., Corsica —Not hardy in latitude of New York City.

4. **aretioides,** Portens. Densely cespitose, and making a good green carpet: lvs. oblong-lanceolate. obtuse and short-mucronulate, grooved above and 3-nerved beneath: fls solitary, with 4 sepals —High Alps.

5. **tetraquètra,** Linn. Carpeter, 3–6 in , pubescent: lvs. ovate, keeled, 4-rowed. fls. in heads, with sepals stiff and ciliate and nearly equaling petals. France.

6 **lanceolàta,** All. Cespitose-procumbent, the sts. ascending. lvs lanceolate, rounded at base, acute, flat, many-nerved below: fls. 1–3, the sepals lanceolate-acute, equaling the petals. High Alps.

7. **macrophýlla,** Hook Sts. decumbent and angled, pubescent: lvs. lanceolate or lance-oblong, mostly acute: peduncles slender, 1–5-fld., the sepals lanceolate-acuminate. Labrador and Vt. to the Pacific. Intro. 1881.

CC. *Lvs. linear or awl-like.*

D. *Sepals obtuse.*

8. **grœnlándica,** Spreng. Annual: very low, forming mats, the decumbent or erectish sts. bearing 1–5 fls.: lvs. linear and obtuse, ½in. or less long: sepals and petals blunt, the latter sometimes notched. High altitudes and latitudes, but coming to the seacoast in parts of New Eng., and ranging down the mts. to N. C. Intro. 1884.—A neat little alpine.

9. **graminifòlia,** Schrad. A foot or less high: lvs. long and filiform, rough-margined: fls. in 3-forked loose pubescent panicles; petals obovate, exceeding calyx. Eu.

DD. *Sepals acute, pointed or even awned.*

E. *Blossoms solitary, or mostly in 2's or 3's.*

10. **grandiflòra,** Linn. Fig. 369. Ten in. or less high: lvs. flat-awl-shaped, 3-nerved and ciliate, the radical ones crowded: fls. large, solitary or in about 2's or 3's, long-stalked. Eu.—Runs into many forms.

11. **montàna,** Linn. Smaller lvs. linear or nearly so. fls. large, solitary, very long-stalked; sepals acuminate, less than the corolla. S. W. Eu.

12. **Rosànii,** Tenore. (*Alsine Rosànii*, Fenzl). Low (1–2 in.): lvs. linear-lanceolate and mucronate, hairy, striate: sts erect, hirsute, about 3-fld : fls. white, with obovate petals and striate longer sepals. Italy.

EE. *Blossoms 5–7 (or more) together.*

13. **pinifòlia,** Bieb (*Alsine pinifòlia* var. *grácilis*. Fenzl) Cespitose, the branches ascending: lvs. narrowly awl-shaped or bristle-like, often curved: fls. large, in 5–7-fld. corymb, the pedicels equaling the calyx or shorter; sepals linear, hairy, 3-nerved; petals obovate-oblong, exceeding calyx. Asia Minor.— A dwarf compact plant with small pine-like foliage which becomes rosulate on sterile shoots, producing many pure white fls , an attractive edging and rockery plant.



369. Arenaria grandiflora. (×⅓)

14. **vérna,** Linn. (*Alsine vérna*, Bartl.). Dwarf, 1–3 in. high: lvs. linear-subulate, flat, strongly 3-nerved, erect fls. on filiform peduncles, with strongly 3-nerved sepals. Eu. and Rocky Mts —Excellent little rock plant. Var. **cæspitòsa,** Hort., is a compact, leafy form, making dense moss-like masses; all summer.

15. **juniperina,** Linn. (*Alsine juniperìna*, Fenzl. *A. juniperifòlia*, Hort.?). Cespitose, nodes often swollen: sts. simple, bearing clusters: lvs awl-like, mucronate, keeled, about 1-nerved, often recurved and persisting: fls with lanceolate-acuminate 3-nerved sepals, and longer linear-cuneate white petals. E. Eu. and Asia Minor.—Variable.

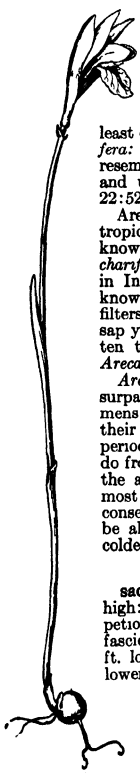
16. **aculeàta,** Wats. Sts 4–6 in. high: lvs. stiff and sharp, glaucous: fls fascicled, white, but often purple. W. Amer. Intro. 1889.

17. **Fránklinii,** Douglas. Sts. 3–5 in. high, nearly or quite glabrous: lvs. in 3–6 pairs, narrow-subulate, sharp-pointed: fls. in dense cymes at the top of the st. W. Amer. Intro. 1881.

L. H. B.

ARÉNGA (derivation unknown). *Palmàceæ*, tribe *Arèceæ*. Tall, usually spineless palms with a thickish, ringed trunk, the upper part of which, and the leaf-stalks are often covered with long black fibers.

leaves pinnate, the lfts. regularly placed on the rachis, sometimes confluent at their bases, the jagged or cut-off appearance of the lfts. peculiar to this genus and Caryota among the horticultural palms, the margin irregularly toothed above the middle; the lvs. paler beneath than above; petiole flattish or convex: fls. monœcious, numerous, and with 2 or more bracts beneath each sessile fl.; spadix 6–10 ft. long in some species, usually smaller, coming from among the lvs. and developing downwards; when the last fl.-cluster reaches maturity some at least of the species die, notably *A. saccharifera:* fr. the size of an apple and somewhat resembling it, containing 2 or 3 oblong and usually dark brown seeds. G.C. II. 22:522.



370. Arethusa bulbosa. (×½)

Arengas are graceful palms, all natives of tropical Asia and Australia, and so far as known are of only eight species. *A. saccharifera* is an important economic plant in India, the black fiber at the leaf-bases known as gomuta fiber being widely used for filters and in the caulking of ships The sap yields "arenga sugar" after the plant is ten to twelve years old. For culture, see *Areca.*

Arenga saccharifera, in a young state, is surpassed in beauty by most palms. Specimens eight to ten years old, however, show their characteristics well, and from that period till they begin to flower (which they do from the top of the stem downwards in the axils of the leaves), they are among the most striking subjects for high and roomy conservatories. The temperature should not be allowed to fall below 55° F. during the coldest weather. (Oliver.)

A. *Trunks at least 20 ft. or more.*

saccharifera, Labill Trunk 20–40 ft. high: lvs. very many, frequently 20–28; petioles smooth; lfts. 115, on each side, fasciculate, in 4's or 5's, linear-ensiform, 3–5 ft. long, 1- or 2-auricled at the base, the lower auricle the longer, 2-lobed or variously dentate at the apex, white or silvery beneath: branches of the spadix long, fastigiate, pendulous: male fls purple, 1 in. long. Malaya.

obtusifòlia, Mart Trunk 20–30 ft. high, 1–1½ ft. thick: fronds 9–13, 12–16 ft long; petiole thickly spiny, especially on the margins, scarcely more than 1 ft. long; segms 1½ in. apart, 2–3 ft. long, 1½–2 in. wide, alternate, lanceolate-linear, unequally acutely dentate, attenuate, 2-auricled at the base, the lower auricle the larger, glaucous beneath: branches of the spadix short, lax, nodding. Java.

AA. *Trunks not over 10 ft.*

Ẽngleri, Becc. About 5 ft. tall: lvs. numerous, with a great many lfts. about 16 in. long and 1 in. wide, much constricted at the base and irregularly toothed at the apex: infl. much branched, borne among the lvs., not more than 1½ ft. long: fr. about ¾in. diam. Formosa.—Not as yet common in this country, but interesting among arengas for its small size.

A. Borréttis, Hort., reported from E. Indies, is a name frequently appearing in hort. literature, not certainly referable.

N. Taylor.†

ARETHÛSA (the nymph *Arethusa*). *Orchidàceæ.* Handsome terrestrial tuberous orchids.

Scapes leafless or with a single lf. 1- to few-fld.; fl. gaping, the sepals and petals nearly alike, arching over the column; lip erect, narrow, entire, adnate to the base of the elongated erect column, and produced into a short spur.—Three species, 2 in N. Amer. and 1 in Japan.

bulbòsa, Linn. Fig. 370. A very pretty hardy orchid, 8–10 in., with one linear, nerved lf. and a bright rose-pink fl. on an erect scape, the lip recurved and bearded. Bogs, N. C., N. and W.; not common. May, June. Mn. 5:141.—Requires a moist and shady, cool situation and open, porous soil. A shady nook on north slope of rockery, where it can be watered in dry weather, is an ideal place. Prop. is by the solid bulbs.

A. sinénsis, Rolfe A terrestrial tuberous herb 4–9 in high: fls. white and red. W. China. B.M. 7935.

George V. Nash.†

ARÈTIA: *Douglasia.*

ARGEMÒNE (Greek name for an eye disease for which a plant was reputed a remedy). *Papaveràceæ.* Argemony Prickly garden annuals, grown for the showy yellow, white or purplish poppy-like flowers

Coarse herbs with yellow juice and sometimes with spotted lvs.: fls. large, short-lived; sepals 2 or 3, petals 4–6; stigmas 6 or less, radiate, sessile or nearly so pod oblong or ellipsoid, prickly or bristly, opening at top by 3–6 valves.—About 10 species of N. and S Amer., cult. as annuals, although sometimes biennial or even perennial. Argemonies are easy to manage from seeds sown where the plants are to stand, or transplanted from pots. They need a light soil and full sunny exposure. Monogr. by Fedde, Engler's Pflanzenreich, hft. 40 (1909).

A. *Fls. yellow or yellowish.*

mexicàna, Linn. (*A. speciòsa,* Hort.). Prickly Poppy. Fig. 371. A moderately prickly-stemmed herb, 1–2 ft. high, sprawling, glaucous: lvs. coarsely sinuate-pinnatifid. fls. sessile or nearly so, the petals obovate and an inch or less long, orange or lemon-colored, to



371. Argemone mexicana. (×½)

2½ in. across when expanded. Trop. Amer., but naturalized in eastern and southern states and in many parts of the world. B.M. 243. —Not much used in this country for medicinal purposes. The plant is said to possess emetic, cathartic, anodyne and narcotic properties; the oil from the seeds acts as a mild cathartic. Var. **ochroleùca,** Lindl. Petals yellowish white, and style longer. Texas. B.R. 1343.

AA. *Fls. white (rarely purple).*

grandiflòra, Sweet Fig 372. Glabrous and glaucous, 1–3 ft. high, almost destitute of prickles, stout lvs. sinuate-pinnatifid, the lobes only weakly spinescent, white-veined: bracts scattered along the fl. branches:



372 Argemone grandiflora. (×⅛)

fls 3–6 near together, 4 in across: caps -valves scarcely crested S W Mex. B R 1264 L B C 16 1546. B M 3073 —Very showy.

platycèras, Link & Otto. Robust, 1½–4 ft, very spiny, the lvs. glaucous lvs sinuate-pinnatifid, spiny. fl -bracts aggregated below the fls; petals truncate, large, white (rarely purple), the fls 2 in or more across: caps -valves crested or spiny Var **hìspida,** Prain (*A. hispida*, Gray) Petals rounded, sepals and caps densely prickly plant hispid Var. **hìspido-rósea,** Fedde Petals rounded, rose or rosy white, sepals narrow, sparsely prickly Var **Hunnemánii,** Fedde Petals rounded, white plant stout —The species is very variable and widely distributed in N and S. Amer Likely to appear in cult in several forms, all of them have thick and densely prickly caps -valves

álba, Lestib (*A. mexicàna* var *álbiflora*, DC) Slender, 1–3 ft, somewhat glaucous. lvs glabrous, pinnate-lobed and sinuate, the lobes oblong-acute, spiny toothed. fls solitary or 2–3 together, on naked peduncles, 3 in. across, white; petals oblong, narrowed at base, truncate at top. Southern states and south. B M. 2342 (as *A. albiflora*).—Sparingly run wild. Caps -valves thin, reticulate spiny. L. H. B.

ARGYRÈIA (*silvery*, referring to the under side of the lvs). *Convolvulàceæ.* Silver Weed Asiatic tender climbers allied to Ipomœa, sometimes grown in the open.

Lvs usually large, silvery, tomentose or villous beneath cymes usually few-fld.; corolla campanulate, sepals 5 —They require too much room before flowering to be popular in Amer *A. cuneata* is one of the dwarfest and most floriferous kinds. Prop. by cuttings or seeds, the former over bottom heat About 25 species.

tiliæfòlia, Wight (*Rivea tiliæfòlia*, Hort) Fls. white, violet or rose-purple, widely funnelform: lvs. ovate-cordate, 2–3 in diam, shortly acuminate or obtuse. Prop. is from seeds. E. Indies.—Intro. 1890 by Peter Henderson & Co

cuneàta, Ker-Gawl. Two to 5 ft.: st. downy: fls. large, bright but deep purple, on hairy peduncles which are shorter than the lvs.: lvs. obovate-cuneate, emarginate, glabrate. E. Indies. B.R.: 661.

A Pierredna, Hort.(?) Corolla funnel-shaped, white tinted with rose. Tonquin R H 1906 560 See p 3566. N. Taylor.†

ÀRIA: *Sorbus.*

ARIOCÁRPUS (*Aria-like fruit*) *Cactàceæ* Top-shaped succulent desert plants, mostly buried in the ground, the broad aerial part covered with angular tubercles bearing no spines fls. from the center of the plant, large, white or pink. fr small, naked; seeds black, roughened —A genus of 6 or 7 species confined to Cent. Mex, except a single species in S. W. Texas A very distinct genus, easily distinguished from Mamillaria by its tubercles

A. *Upper surface of tubercle with a broad and deep wool-bearing longitudinal groove, which widens below*

fissuràtus, Schum (*Anhalònium Engelmannii*, Lem.). Living Rock. The flat tubercle-covered top 2–5 in. across, tapering below into a thick root, tubercles imbricated and appressed, triangular in outline, ½–1 in long and about as wide at base, the upper surface fissured in bands, the outer ones forming an elevated margin fls central, about 1 in long and broad, shading from whitish to rose On limestone hills in the "Great Bend" region of the Rio Grande in Texas, and extending into Mex. I H 16, p. 73, and fig Contr Nat. Herb 13, pl 62

Lloydii, Rose. Fig 373 Plant body with rounded top, 4 in or more in diam tubercles imbricated, ⅛in broad at base, the upper portion rounded, obtuse, broader than thick, the whole surface fissured, but not in definite bands fls purple, about 1¼in long, petals broad, apiculate This species differs from *A fissuratus* in shape and surface of tubercles, in its round top, and more southern range. Cent Mex Contr Nat Herb 13, pl 63.

Kotschubeyànus, Schum (*A. sulcàtus*, Schum) Plants nearly concealed by the ground, often less than 1 in. broad at top, with a deep thick root fl -tube nearly ⅛in. long; petals ⅛in long, rose-pink Cent Mex —Much smaller than the last two Only recently re-intro into cult A very distinct species *A McDòwellii*, **Haage** & Schmidt, is the same or a near species

AA *Upper surface of tubercle not grooved.*

retùsus, Scheidw (*Anhalònium prismàticum*, Lem). The flat top 3–8 in across tubercles imbricate, but squarrose-spreading, sharply triangular-pyramidal and very acute, with a sharp, cartilaginous tip, which usually disappears with age and leaves the older tubercles blunt or retuse, ¾–1 in. long and about as wide at base, the upper surface almost plane and smooth, except that it is more or less pulverulent, and often bears a small tomentose tuft just behind the claw-like tip. fls. rose-color Mts of Mex —*A trigònus*, Schum and *A furfuràceus*, Thompson, are similar species sometimes in cult. J N. Rose



373. Ariocarpus Lloydii. (×½)

ARISÆMA (Greek-made name, of no particular significance). *Aràceæ* Indian Turnip. Dragon Arum. Odd hooded aroids, sometimes grown in hardy borders and some species as pot-plants

About 60 widely distributed herbs, with

tuberous roots, and a spathe rolled in or convolute about the spadix below, and often arched over it: fls. unisexual, the pistillate on the lower part of the spadix, and each consisting of a 1-loculed ovary, and generally ripening into a showy berry Some species are native, and several of them are hardy in the open; others are cult. under cover, as recommended for *Arum* (which see). Monogr. by Engler in De Candolle's Monographiæ Phanerogamarum, Vol. II.

A. *Lfts. 7–11.*

Dracóntium, Schott. DRAGON-ROOT Sending up a solitary lf. 1–2 ft. high, pedately divided into oblong-lanceolate pointed lfts.. spadix long-pointed and projecting beyond the greenish spathe: scape much shorter than the lf. Low grounds in E. Amer —Occasionally grown in borders and rock-work.



374. Jack-in-the-Pulpit, Arisæma triphyllum. (× ¼)

AA. *Lfts. 3.*

triphýllum, Torr JACK-IN-THE-PULPIT. INDIAN TURNIP. Fig 374. Usually dioecious: lvs usually 2, with ovate or elliptic-ovate lfts . spadix club-shaped and covered by the arching purplish spathe Common in woods V. 14:179.—Tuber or corm flattish and large, very acrid, often employed as a domestic remedy. Berries red and showy, ripening in early summer Planted in a moist, shady place, the lvs remain until fall, but in exposed places they die down early in summer. This and the last are very interesting native plants of easy cult , prop by tubers and by seeds

fimbriàtum, Mast. FRINGED CALLA Lf. solitary, the petiole a ft. or less high, sheathed below; lfts broad-ovate and acuminate, short-stalked scape as long as the petiole, bearing a large, purple-limbed, white-streaked, long-pointed spathe: spadix ending in a long and gracefully drooping, feather-like appendage. E. Indies. G C II. 22 689, III. 15:763 B M. 7150 Mn. 8, p. 59. G. 25:626 —A handsome and striking pot-plant, blooming in summer. Grows in rich soil. Dry off the tuber when the lvs. turn yellow after flowering, and keep dry in sand or earth until spring

Other species are *A anómalum,* Hemsl Lfts 3, broad-ovate, acuminate spathe small, purplish and streaked, arching over the short spadix suggests A triphyllum, Malaya B M 7211 —*A concínnum,* Schott Lf solitary, with 10 or more lfts spathe colored, tailed India B M. 5914 —*A. curvátum,* Hook —A tortuosum —*A. Fargèsii,* Bouchet Spathe striped longitudinally with broad purple-brown bands alternating with bands of silvery white W. China —*A flávum,* Schott Lvs pedate spathe green to yellow. Himalaya B M 7700 —*A galeátum,* N E Br Lf. solitary, with 3 lfts spathe purple inside India B M. 6457 — *A. Griffíthii,* Schott Lvs 2, lfts 3, nearly orbicular spathe very large with a spreading and wrinkled limb several inches broad, and rich purple with green veins India B M. 6491 —One of the handsomest of all arisæmas —*A. japónicum,* Blume. Lvs. pedate spathe green, white striped. B M. 7910 —*A nepenthoides,* Mort. Lf. pedate, of 5 narrow lfts . spathe auricled India. B M 6446 —*A ringens,* Schott. Lfts. 3, ovate-acuminate spathe purple, arched. Japan. Perhaps hardy in the open Gn 37, p 577. G. 17.182 —*A. Sieboldii,* De Vriese —A ringens —*A speciósum,* Mort. Lfts. 3 spathe large and very dark purple, spadix with a very long, string-like tip. India. Gn 37:576. B M 5964 G C. II 12 585 —*A tortuósum,* Schott. Lvs usually 2, with several or many lfts spathe purple outside; spadix long-tailed but erectish, greenish India B M 5931 (as *A* curvatum) —*A. úttle,* Hook Lvs 2, with 3 crenate lfts spathe reddish, green-ribbed, spadix purple· tubers eaten by natives in India. B.M. 6474.—*A. viridiflórum,* Franch , has recently been offered in Eu , from China. It has pedate lvs , and a striped spathe —*A Wràyi,* Hemsl. Lf. solitary, pedate, the lfts lanceolate: spathe green or whitish, spadix slender, recurved. India B M. 7105.

L. H B.

ARISÀRUM (old Greek name). *Aráceæ.* Three or four variable species of arum-like plants of the Mediterranean region. Differs from Arisæma, its nearest ally, in having the margins of the spathe connate rather than convolute, and in other technical characters For culture, see *Arum.*

vulgàre, Targ (*Arum Arisárum,* Linn.). A foot high: lvs. cordate or somewhat hastate, long-stalked: spathe purple, incurved at the top —Has many forms and names. Can be grown in the open with protection.

A proboscídeum, Sav. Lvs hastate; scape less than half the petiole. spathe 1–1¼ in long, pale gray, with a long olive tail 5–6 in , the mouth of spathe small, olive-purple Italy B M 6634. G W 5, p 512.

GEORGE V. NASH †

ARISTÈA (name refers to the stiff leaf-points). *Iridàceæ* Mostly blue-flowered spring- or summer-blooming greenhouse herbs or sub-shrubs, and grown in the open far south

Leaves distichous in basal rosettes, those on the st alternate. fls clustered in spikes, not lasting, the perianth with a short tube and oblong, spreading, nearly equal segms that twist up spirally after flowering, stamens short-stalked, borne on the throat of perianth-tube. fr an oblong or cylindrical 3-valved caps —About 30 species in Afr Of easy cult. Prop by seeds and division Not showy

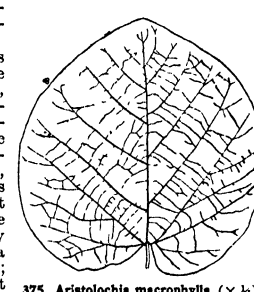
Écklonii, Baker Herb, 1½ ft lvs. linear but not rigid, 18 in. or less long fls in many clusters that form a loose panicle with a flattened rachis, limb of blue perianth ½in long. caps cylindrical, less than 1 in long. Cape Colony.—Reported in Calif , where it is said to make dense dark green clumps, with Sisyrinchium-like fls. in spring

fruticòsa, Pers. (*Nivènia fruticòsa,* Baker). Dwarf shrub: st.-lvs. linear, 2 in or less long: fls. in a single cluster; perianth blue, the tube ½in. long. Cape Colony.

L. H. B

ARISTOLÒCHIA (named for supposed medicinal virtues). *Aristolochiàceæ* BIRTHWORT Perennial herbs or shrubs, many climbing, remarkable for the very odd-shaped flowers, some species grown in the open, but most of them cultivated as odd glass-house subjects

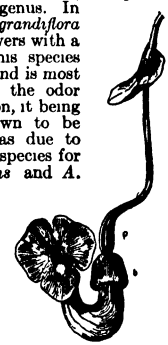
The corolla is wanting, but the calyx is corolla-like, tubular, mostly variously bent, and commonly tumid above the ovary and contracted at the mouth, superior; stamens commonly 6, short and adnate to the style, which is fleshy and lobed fr a naked 6-valved caps ; seeds flat. —About 180 species of warm and temperate regions throughout the earth; mostly woody twiners. Many species are evergreen. The tender species are cult. for the strikingly irregular and grotesque fls The fls. are usually fetid in odor, often very disagreeable. Many species are grown in botanic gardens and in the collections of fanciers, but those usually cult. or planted are to be found in the treatment which follows.



375. Aristolochia macrophylla. (× ⅓)

These plants are mostly climbing vines, *A. macro-*

phylla being perhaps the best known vine for shade purposes. It is vigorous and of rapid growth, and has never been known to be attacked by fungoid or insect enemies For covering outbuildings quickly it has no equal, owing to the heavy growth of foliage and its adaptability to any situation. The flowers are peculiar in shape, giving rise to the popular name, Dutchman's pipe. These are inconspicuous, however, compared with the tropical species of this genus. In contrast with the foregoing, *A grandiflora* var. *Sturtevantii* has gigantic flowers with a tail sometimes 3 feet long. This species must be cultivated under glass and is most suitable for large structures as the odor when in bloom beggars description, it being such that flies have been known to be deceived, thinking its origin was due to putridity. There are other fine species for indoor culture as *A brasiliensis* and *A. Goldieana* These are best propagated from cuttings taken from well-matured wood in early spring or at pruning time. A rich soil is desirable and preference is given to planting the roots in a border or bed that they may be trained up rafters or pillars of warmhouses Pot culture does not give good results Another very pretty species is *A elegans* This is not odorous, can easily be procured from seeds, which are freely produced under cultivation It will bloom the first year under glass, and may be cut back to give light to other plants in winter The outdoor *A macrophylla* (often known as *A Sipho*) produces good seed; this seems to be the only way to increase it as hardwood cuttings do not root readily. (E O. Orpet.)



376. Flowers of Dutchman's Pipe, Aristolochia macrophylla, showing the ovary at *a*, and the swelling of the calyx-tube at *b*. (×⅔)

INDEX

argentina, 8
brasiliensis, 13
californica, 5
Clematitis, 2
cymbifera, 15
elegans, 14
gigantea, 11.
gigas, 11.
Goldieana, 12.
grandiflora, 11.
hastata, 1.
Hookeri, 11.
labiosa 15
macrophylla, 3, 13.
moupinensis, 6.
ornithocephala, 13
ridicula, 9.
Serpentaria, 1.
Sipho, 3.
Sturtevantii, 11.
tomentosa, 4.
triangularis, 7.
tricaudata, 10.

A. *Plant not climbing, herbaceous.*

1. **Serpentària,** Linn VIRGINIA SNAKEROOT. Height 2 ft or less, pubescent, with short rootstocks and aromatic roots lvs ovate or oblong, cordate or halberd-form, acuminate fls near the root, solitary, S-shaped, much enlarged above the ovary, greenish. E U S — Occasionally cult Roots used in medicine. Reputed remedy for snake-bites Var **hastàta,** Duch. Lvs. narrow, sagittate or hastate. Southeastern states.

2 **Clematitis,** Linn. Two ft. or less tall, glabrous· lvs reniform-pointed, ciliate on the margins: fls. axillary and clustered, straight, greenish Eu.—Rarely cult, and occasionally escaped

AA. *Plant twining, mostly woody.*

B. *Cult in the open*

3. **macrophýlla,** Lam (*A. Sipho*, L'Her.). DUTCHMAN'S PIPE. PIPE VINE. Figs. 375, 376, 377. Very tall, twining, glabrous: lvs. very large, broadly reniform or rounded, becoming glabrous: fls. solitary or 2 or 3 together in the axils, U-shaped, enlarged above the ovary, with a 3-lobed, spreading flat limb, purplish. Eastern states. B.M. 534. Gng. 1:53. G.F. 5:509 (habit).— An excellent vine for porches, the great lvs. affording a dense shade.

4. **tomentòsa,** Sims. Much like the last, but very tomentose: lvs. less rounded· fls yellow, with reflexed lobes, the closed orifice purple. N. C. to Ill. and S. B.M. 1369.

5. **californica,** Torr. Silky pubescent, 6–10 ft.: lvs. ovate-cordate, 2–4 in. long, obtuse or acutish, short-petioled: fls. U-shaped, little contracted at the throat, the limb 2-lobed, with the upper lip of 2 broad, obtuse lobes and a thickening on the inner side. Calif.

6. **moupinénsis,** Franch. Branches slender, densely silky, becoming smoothish. lvs. cordate, 5 in. or less long, hairy above, grayish pubescent beneath, the petiole about 2½ in. long fls solitary on axillary peduncles, the tube 1½ in. long, abruptly curved so that the blossom appears U-shaped as it hangs, pale green outside and yellowish inside, the limb obliquely 3-lobed, 1¼ in across, yellowish and purple-marked. From the Moupine region of W. China B.M. 8325.— A rapid grower, reaching 15 ft. in one season. A good pillar and post plant, hardy in England. Allied to *A. Kaempferi* (see supplementary list).

7. **triangulàris,** Cham. Glabrous: lvs. triangular-acute, 3-nerved, pellucid-punctate, the petioles prehensile, the blade 4 in. long by 3 in. broad. fls. solitary, ovoid-inflated at base and then making a sharp angle, the tube funnelform and the limb small and truncate and not large, purple-spotted. Brazil —A climber reported in S. Calif

8. **argentina,** Griseb. Herbaceous, glabrous; st. angular-sulcate· lvs cordate-deltoid, obtuse, pedately 7-nerved· fls. solitary on axillary peduncles, glabrous without and somewhat puberulent within, the tube ovoid at base, bent, the parts of limb broadly ovate and obtuse S. Amer Reported in S Calif

BB *Cult. in greenhouse or warmhouse.*

c. *Fl.-limb of 2 narrow divergent lobes.*

9. **ridícula,** N E Br Very slender, stiff-hairy throughout: lvs round-reniform, cordate: fls. axillary and solitary, 2 in long aside from the limb, with a long sac at the base of the tube, pale yellow with dull purple veining; limb of 2 spreading, deflexed, narrow lobes, glandular, reminding one of donkeys' ears. Brazil. B.M. 6934. G.C. II. 26:361.

cc. *Fl -limb of 3 narrow lobes.*

10. **tricaudàta,** Lem Lvs. 5–8 in. long, oblong-acuminate, rugose, ciliate. fls solitary; tube short and somewhat inflated at the rounded base, suddenly bent, limb wide and concave, maroon-red outside and very dark purple-brown inside, produced into tails 4 in long. Mex. I.H. 14:522. R B 20 37. B.M. 6067 —A fine species of shrubby habit, producing quantities of fls all over the older parts of the growths, down to the base of the old st. A striking plant when well grown under sunny conditions in a temp of 50–55° F.



377. Longitudinal section of flower of Dutchman's Pipe, showing the ovary, and the short column of stamens at *q*. (×1)

ccc. *Fl.-limb 2-lipped, the lips unlike and one of them usually ample and flowing: fls. large.*

D. *Blossoms with one or more long hanging tails.*

11. **grandiflòra,** Swartz (*A. gigas*, Lindl.). PELICAN-FLOWER. SWAN-FLOWER GOOSE-FLOWER. DUCK-FLOWER Figs. 378, 379. Downy climbing shrub· lvs. cordate-acuminate; peduncles striate, exceeding the petiole, 1-fld.: the fl.-bud is "bent like a siphon in the tube, so as to resemble the body and neck of a bird, while the limb, in that state resembles the head and beak thrown back upon the body, as a pelican when that bird is at rest, whence

the name" (Hook. in B.M., vol. 74): the great expanded cordate-ovate limb several inches across, wavy-margined, purple-blotched and veined, terminating in a long and slender ciliated tail: strong-scented. Var. **Stûrtevantii**, W. Wats., is the form chiefly known in cult., being very large-fld., often 20 in. diam., and with a tail 3 ft. or more long. W. Indies, Cent. and S. Amer. B.M. 4368–9. B.R. 28:60. F.S. 4:351–2. G.F. 3:597–599 (adapted in Fig. 379). A.F. 10.157. G.C. III. 19:73. Gng. 3:23. Gn. 50:378. Var. **Hoôkeri**, Duch. (*A. gigantèa*, Hook.), is glabrous, inodorous, with a short-tailed fl. B.M. 4221.



378. Aristolochia grandiflora, var.

DD. *Blossoms not tailed, although perhaps bearing long more or less erect point-appendages.*

12. **Goldieàna**, Hook. Whole plant dying down to a large fleshy rootstock: glabrous: lvs. ovate-cordate or triangular-cordate, acuminate, the base deeply cut: fls. very large, greenish outside but brown-veined and blotched inside, the lower part of the tube straightish and 8 in. long, the upper part sharply bent over and a foot long, with a funnel-shaped, spreading limb a foot or more across, and indistinctly 3-lobed, each lobe terminated by slender appendages; stamens 24. W. Afr. B.M. 5672. G.C. III. 7:521; 21:337. G.M. 33:286.

13. **brasiliénsis**, Mart. & Zucc. Glabrous: lvs. cordate-reniform, obtuse, with deep sinus at base: peduncle 8–10 in. long, 1-fld.: fl. very large, dingy yellow, with marks and reticulations of purple, the limb strongly 2-lipped; tube strongly bent, purple inside; upper lip 4 in. long, violet within, hairy; lower lip not longer than the upper, 5–7 in. wide. Var. **macrophýlla**, Duch. (*A. ornithocéphala*, Hook.). Lvs. large: upper lip 5 in. long, lanceolate-acuminate, projecting from the inflated headlike tube like the long beak of a bird; lower lip on a stalk 2 in. long, then expanding into a flattened, wavy, beautifully marked limb 4 in. long and 4–6 in. across. Brazil. B.M. 4120. Gn. 45, p. 289.—A most odd and interesting species, not infrequent in fine establishments.

14. **élegans**, Mast. Calico Flower. Slender, glabrous, the fls. borne on the pendulous young wood: lvs. long-stalked, reniform-cordate, 2–3 in. across, with wide sinus and rounded basal lobes, the tip obtuse: fls. solitary, long-stalked, the tube yellow-green, 1½ in. long, the limb cordate-circular, 3 in. across, purple and white blotched, white on the exterior, the eye yellow: not strong-smelling. Brazil. G.C. II. 24:301; III. 22:123. B.M. 6909.—A small-fld. and graceful, free-blooming species. A most desirable decorative climber for a warm greenhouse of 55° F. but does not thrive so well in a stove. It is entirely devoid of the unpleasant odor which is characteristic of the fls. of this genus. In Fla. it self-sows freely; and the hanging basket-like frs. are very attractive.

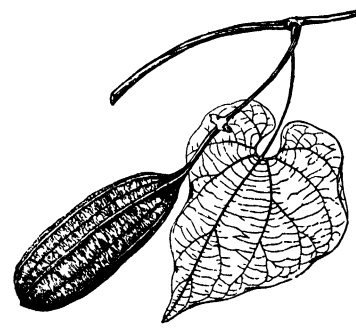
15. **cymbífera**, Mart. & Zucc. (*A. labiòsa*, Sims). Glabrous: st. striate: lvs. reniform, obtuse and deeply cut at the base, pedately 7–9-nerved, long-stalked: fls. long-stalked, 8–10 in. long, strongly 2-lipped; the upper lip short and lanceolate, acute or acuminate; the lower lip (which, by position of fl. may seem to be the upper) very large, dilated at base, and produced into a long, boat-shaped (whence the name, from *cymba*, a boat) usually 2-lobed projection; fl. creamy white, marked and blotched with maroon. Brazil. B.M. 2545. P.M. 6:53 (as *A. hyperborea*, Paxt.).

A. altíssima, Desf. Fls. 2 in. or less long, brownish. Sicily and Algeria. B.M. 6586.—Would probably be hardy with protection in the middle states.—*A. anguícida*, Jacq. Lvs. long-cordate: fls. small, 1–2 in. long, with a long-pointed limb. Colombia. B.M. 4361. F.S. 4:344.—*A. barbàta*, Jacq. Lvs. oblong and cordate: fls. 2½ in., purple. Venezuela. B.M. 5869.—*A. caudàta*, Booth=*A. macroura*.—*A. ciliàta*, Hook., and *A. ciliòsa*, Benth.=*A. fimbriata*.—*A. clypeàta*, Lindl. & André. Lvs. triangular-ovate, pointed: fls. with a large, oval, purple-spotted, tailless limb. S. Amer. I.H. 17:40. B.M. 7512.—*A. Duchártrei*, André=*A. Ruiziana*.—*A. fimbriàta*, Cham. A free-flowering greenhouse species: lvs. small, cordate-orbicular: fls. small, the little limb glandular-ciliate. Brazil. B.M. 3756 (as *A. ciliata*).—*A. hirsùta*, Willd. Lvs. round-cordate: fls. bronze-green, with lobed limb and a hairy beak. Venezuela. B.M. 7073. Allied to *A. brasiliensis*.—*A. Kalmpferi*. Willd. Tall-climbing: lvs. ovate-cordate or hastate, variable: fls. solitary, tomentose, with narrow rim, yellow outside, purple inside. Japan. Probably hardy in the N.—*A. longicaudàta*, Mast. Lvs. ovate and cordate: fls. cream-colored with purple markings, with a large sac-like tube, hairy at the throat, with no expanded limb but a very long tail. S. Amer. G.C. III. 8:493.—*A. longifólia*, Champ. Branches climbing, from a woody rootstock: lvs. thick, linear-lanceolate: fls. U-shaped, with a 2-lobed purple limb 2½ in. across. Hong Kong. B.M. 6884.—*A. macroùra*, Gomes. Lvs. reniform, lobed: fl. dark maroon, 6-spurred, the lip with a twisted cusp. Brazil. B.M. 3769 (as *A. caudata*).—*A. macroùra* ×*brasiliénsis*, a garden hybrid.—*A. odoratíssima*, Linn. Lvs. cordate-ovate: fl. solitary, purple, sweet. Jamaica.—*A. póntica*, Linn. Erect or ascending from a globose rootstock: lvs. large, broadly ovate: fls. very large, curved, greenish purple, ill-smelling. Asia Minor.—*A. ringens*, Vahl. Lvs. round-reniform: fl. 7–10 in. long, green marked with dark purple, hairy inside, with 2 long lips, one of which has a much-expanded limb. Brazil. B.M. 5700.—*A. Ruiziàna*, Duch. Lvs. reniform-cordate: fls. with tube 1 in. or less long, the cordate-ovate limb 3 in. across, and brown-spotted. Brazil. B.M. 5880 and G.C. 1868:516 (as *A. Duchartrei*).—*A. saccàta*, Wall. Lvs. long-ovate: fls. small, U-shaped, with a very narrow rim (suggesting the Dutchman's pipe), red. India. B.M. 3640.—*A. Sálpinx*, Mast. Lvs. ovate-lanceolate: fls. small, with a trumpet-shaped, somewhat 2-lipped mouth, purplish. Paraguay. G.C. II. 26:457.—*A. unguifólia*, Mast. Lvs. 3-lobed: fls. small, brownish and reddish, with a ciliate, tongue-like lip. Borneo. G.C. II. 14:117. B.M. 7424.—*A. Westlandii*, Hemsl. Lvs. oblong-lanceolate: fl. pendulous, with a spreading purple-marked limb 5 or 6 in. across. China. B.M. 7011. A greenhouse climber producing its fls. on the old parts of the plant near the ground.

L. H. B.

ARISTOTÈLIA (after the Greek philosopher Aristotle). *Elæocarpàceæ*. Woody plants sometimes grown in the open in warm countries.

Leaves evergreen, nearly opposite, entire or toothed: fls. polygamous; sepals 4–5, valvate; petals of the same number: berries small, edible.—A genus of 7 species of trees and shrubs from the southern hemisphere, allied to Elæocarpus. Prop. by ripened cuttings, under bell-jar or closed frame.



379. Aristolochia grandiflora. (×⅛)

racemòsa, Hook. f. NEW ZEALAND WINEBERRY. Small tree, 20 ft.: lvs. glossy, ovate or cordate-ovate, thin and membranous: fls white in many-fld. panicled racemes. New Zeal.—Cult. somewhat in S. Calif.

Mácqui, L'Her. Shrub, to 7 ft : lvs. almost opposite, dentate, smooth, shining, oblong and acute at the apex: fls. inconspicuous, greenish, axillary. Chile.—Grown for its foliage. A variegated form, less hardy than the type, is known. Occasionally found in botanical and other collections, particularly in Calif. N. TAYLOR.†

ARMENÌACA: *Prunus*

ARMÈRIA (an old Latin name). *Plumbaginàceæ.* SEA PINK THRIFT Small perennial herbs, with rosettes of narrow evergreen leaves on the ground, planted along borders and walks, used for continuous low edgings and in rock-gardens, sometimes grown as pot-plants.

Scape naked, simple, 2–12 in. high, on which is borne a compact head of pink, lilac or white fls , the head being subtended by small bracts, forming a kind of involucre, fls with plaited funnel-shaped dry calyx, the lobes pointed; 5 petals nearly or quite distinct and tapering at the base, 5 stamens opposite the corolla parts, styles 5, hairy below the middle fr. a utricle inclosed in the calyx —About 50 species in Eu , W. Asia, N Afr. and 1 in N. Amer , much confused

Armerias are of easiest culture, being hardy and free growers. Propagation is by division of the stools; also by seeds.

A. *Calyx-tube usually pilose all over*

vulgàris, Willd (*A maritima,* Willd) COMMON THRIFT Fig 380. Lvs. linear, 1-nerved, somewhat obtuse, glabrous or slightly ciliate: scape low, somewhat villose, calyx-tube about the length of the pedicel and decurrent on it, the limb nearly equal to the tube, with very short ovate, blunt or aristate lobes Eu and Amer., along the seacoast Var. **álba,** Hort White. Var **rùbra,** Hort Fls dark rose-red. Var **purpùrea,** Hort. Purple-red Var. **Laucheàna,** Voss Light rose-color Var **grandiflòra,** Hort Large-fld , light rose-red Var **splèndens,** Hort Bright pink *A argéntea,* Hort , is perhaps another form, with small white fls.; also a white-lvd form.

sibírica, Turcz Lvs. linear, 1-nerved, obtuse, glabrous: scape rather taller, thicker, calyx-tube longer than pedicel, the limb about length of tube, with triangular, short-mucronate lobes; involucre brown; fls. white. Siberia

júncea, Girard (*A. setàcea,* Dehle) Outer lvs. of rosette narrow-linear and subdentate, the inner ones longer and filiform· head small, with pale involucre, the pedicel much shorter than the calyx-tube; calyx-limb short, the lobes ovate-obtuse and aristate; fls. pink. Eu.

AA. *Calyx-tube glabrous, or pilose only on the ridges.*

B. *Lvs. elliptic-lanceolate or broader.*

latifòlia, Willd. (*A. cephalòtes,* Link & Hoffm., not Hook.). Glabrous and glaucous. lvs. broad-oblong, 5–7-nerved, the margin remotely denticulate· head large, the involucre dry; calyx-limb long, with very small or no lobes and long teeth; fls bright pink S. Eu. B M 7313 P M 11.79 (as *Statice Pseudo-armeria*).—*A. formòsa,* Hort , probably belongs here.

mauritánica, Wallr. (*A. cephalòtes,* Hook , not Link & Hoffm.). Lvs. broad-spatulate or elliptic-lanceolate, 3–5-nerved, glaucous green, the margin scarious-white: heads large (2–3 in across), the involucre brownish, the calyx short-toothed and aristate; fls. pink. Eu., Algeria.

BB. *Lvs. linear-lanceolate or narrower.*

alpina, Willd. Glabrous: lvs. linear-lanceolate; equaling the scape, 1-nerved or obscurely 3-nerved: head large, the involucre pale brown; pedicels shorter than calyx-tube, the tube equaling the oblong long-aristate lobes; fls. deep rose. Mts., Eu.

purpùrea, Koch. Lvs. linear, long, 1-nerved, blunt: outer involucre-scales mostly blunt, the inner very blunt and weak. pedicels as long as calyx-tube, limb equaling the tube, and the lobes ovate-aristate; purple Cent. Eu.

plantagínea, Willd Glabrous: lvs. linear-lanceolate, 3–7-nerved, acute or acuminate scape tall; head dense and globular, the involucre white, pedicels as long as calyx-tube, the lobes ovate and long-aristate and as long as tube, pink. Cent and S Eu Var. **leucántha,** Boiss (*A dianthoìdes,* Hornem & Spreng), has white fls.

argyrocéphala, Wallr. (*A undulàta,* Boiss.). Glabrous outer lvs. in rosette, short and lanceolate or linear-lanceolate and 3-nerved and often sinuate, the inner ones linear or setaceous and 1–3 nerved: head large, the involucre white; pedicel nearly as long as calyx-tube, the calyx-limb with long-triangular aristate lobes, fls white, showy. Greece. L. H. B.†

ARMERIÁSTRUM: *Acantholimon*

ARNATTO: *Bixa*

ARNÈBIA (Arabic name) *Boraginàceæ* Annual or perennial hispid herbs, grown as flower-garden or border subjects

Erect or diffuse· root sometimes yielding red tint: lvs alternate fls yellow or violet, in racemes or cymes, the color changing with the age of the blossom; corolla slender-tubed, with 5 obtuse lobes, the throat devoid of scales; stamens included, style usually bifid fr normally of 4 erect nutlets. —A dozen species in Asia and N Afr of easy cult in gardens.



380. Armeria vulgaris. (×½)

echioìdes, DC. (*Macrolòma echioìdes,* Boiss) PROPHET-FLOWER. Hardy perennial, 3–12 in. high, short-hairy, with spreading, obovate-oblong lvs.: fls. in a scorpioid raceme or spike, yellow, with purple spots, fading to pure yellow. Caucasus, Armenia, etc. B M. 4409 G C II 11 689 —Blooms in spring In full sun or in rather dry ground, it is difficult to keep this charming plant in a healthy condition, partial shade is essential to its welfare. One can grow luxuriant specimens on the northern slope of a rockery or close to a building on the east or north side. Prop by seeds, division, or by root-cuttings

cornùta, Fisch & Mey. ARABIAN PRIMROSE. Annual, 2 ft., bushy: lvs. lanceolate or linear-oblong, pointed: fls. ¾in. across, yellow and black-spotted, changing to maroon and then to yellow. Orient. G.C. III. 7.52. J H. III 31·29. A F. 5·400. A G. 11:181 (1890) —An attractive and not very common annual, easily grown in the open.

A Griffithii, Boiss Annual, 9–12 in · lvs narrow-oblong, obtuse, ciliate fls long-tubed, with a black spot in each sinus India. B M 5266 —*A macrothyrsa,* Stapf Perennial, 1 to nearly 2 ft.: fls yellow in dense thyrses. Armenia. L. H. B.†

ÁRNICA (ancient name). *Compósitæ.* Perennial herbs sometimes seen in borders or rockeries.

With clustered root-lvs. and opposite st.-lvs. and large, long-peduncled yellow heads: involucral bracts all equal,

thin, in a single, rarely double series. Native to Eu., Asia, and N. Amer., about 10 species.—Tincture of the European *A. montana* is used in medicine. Grown mostly as alpines or in rockwork; some species also grow well in the common border. Prop. by division, and rarely by seeds.



381. Arnica montana. (×⅓)

A. *Radical lvs. cordate, with slender or winged petioles.*

cordifòlia, Hook. Two ft. or less high, hairy: heads few or even solitary, with inch-long rays; involucre ¾in high, pubescent. Rocky Mts. and W.—To be grown as an alpine.

latifòlia, Bongard (*A. ventòrum,* Greene). Glabrous or very nearly so, the st.-lvs not cordate or petioled, the radical lvs nearly round: heads smaller than in preceding Rocky Mts. and W.

AA *Radical lvs not cordate, often petioled.*

amplexicaùlis, Nutt. Glabrous or nearly so: lvs. ovate to lance-oblong, acute, those on the st. clasping and dentate: st. leafy to the top. Ore. and N.

foliòsa, Nutt. Pubescent: lvs. lanceolate, strongly nerved, small-toothed, the upper ones somewhat clasping: heads sometimes solitary, short-peduncled: st. leafy, strict. Rocky Mts. and W.

montàna, Linn. Mountain Tobacco. Mountain Snuff. Fig. 381. A foot high, the st. sparsely hairy: radical lvs. oblong-lanceolate, glabrous and entire: heads 3–4, large. Eu. B.M. 1749. J.H. III. 34:441. Gn. 24, p. 394. G. 29.215.—The best known species in cultivation and can be grown in the open border, but none of the arnicas is common in American gardens.

A. Clùsii=Doronicum Clusii.

L. H. B.
N. Taylor †

ARÒNIA (modification of *Aria*, a subgenus of the allied genus Sorbus) *Rosàceæ.* Chokeberry. Ornamental shrubs grown for their attractive white flowers and for their handsome fruits, and also for the bright autumnal tints of the foliage.

Low plants. lvs. deciduous, short-petioled, finely and crenately serrate, glandular on the midrib above, convolute in bud. fls. in small corymbs, white; calyx 5-lobed, petals 5, spreading, stamens numerous; ovary 5-celled, woolly at the top, with 5 styles united at the base, the carpels connate but partly free on their ventral suture: fr. a small pome, flesh without grit-cells, top hemispherical.—Three closely related species in E. N. Amer. Closely related to Sorbus, which is easily distinguished by the sharply or doubly serrate, often pinnate lvs. folded in bud and without glands above, by the usually 2–3-celled ovary with the carpels connate on their ventral suture, otherwise often partly free, and by the conical top of the fr.: quite distinct in general appearance and habit and suggesting more an affinity with Amelanchier.

The aronias are small shrubs with simple deciduous leaves turning bright red in autumn and with white flowers in small corymbs followed by berry-like, red, purple or black fruit. Well adapted for borders of shrubberies and quite hardy North. *A. melanocarpa* is handsomest in foliage and bloom, particularly the var. *grandifolia;* its fruit ripens in August, but soon shrivels and drops, while *A. atropurpurea* and *A. arbutifolia* have showier and usually more numerous fruits; those of *A. atropurpurea* ripen in early September and shrivel at the beginning of the winter, while those of the last-named species ripen later and remain plump and bright far into the winter.

They prefer moist situations, but *A. melanocarpa* also grows well on drier and rocky soil. Propagation is by seeds sown in fall or stratified; also by suckers and layers, or by greenwood cuttings under glass.

arbutifòlia, Spach (*Sòrbus arbutifòlia,* Heynh. *Pỳrus arbutifòlia,* Linn. f. *A. arbutifòlia,* Ell. *A. pyrifòlia,* Pers. *Méspilus arbutifòlia* var. *erythrocárpa,* Michx.). Red Chokeberry. Upright shrub, 6–10 ft. high. lvs. short-petioled, oval to oblong or obovate, acute or abruptly acuminate, crenately serrate, glabrous above except some glands on the midrib, whitish or grayish green and tomentose or pubescent beneath, 1½–3 in. long: corymbs tomentose, few- to many-fld., 1–1½ in. broad: fls. white or tinged red, ⅓–½in. across. fr. subglobose or pear-shaped, bright or dull red, about ¼in. across. April. May. N. Y. to Minn., to Fla. and La. B.M. 3668. G.F. 3:417. G.W. 5, p. 245.

atropurpùrea, Britt. (*Sórbus arbutifòlia* var. *atropurpùrea,* Schneid.). Purple Chokeberry. Shrub, to 12 ft., closely allied to the last: lvs. oblong to obovate, grayish pubescent beneath, 2–3½ in. long, corymbs tomentose, many-fld.: fr. ovoid to subglobose, purplish black, about ½in. high. May, June. Nova Scotia to Fla.

melanocárpa, Spach (*Sórbus melanocárpa,* Heynh. *Pỳrus nìgra,* Sarg. *A. nìgra,* Koehne. *Pỳrus arbutifòlia* var. *nìgra,* Willd.). Black Chokeberry. Low shrub, rarely to 6 ft.: lvs. oval to obovate, abruptly acuminate or obtuse, pale green and glabrous or nearly so beneath: calyx and pedicels glabrous or nearly so. fr. globose, about ½in. across, shining black. Nova Scotia to Ont., south to Fla. and Mich. April–June. B.B. 2:237. Var. **grandifòlia,** Schneid. (*Pỳrus grandifòlia,*



382. Aronia melanocarpa var. elata. (×⅓)

Lindl.) A taller, more vigorous shrub with larger, obovate or broadly obovate lustrous lvs. and larger fls. in larger corymbs. B.R. 14:1154. Var. **elàta,** Rehd. Fig. 382. Similar to the preceding, but lvs. narrower, generally oblong-obovate, acute. Var. **subpubéscens,** Schneid. Lvs. pubescent beneath when young.

A. floribùnda, Spach (Pyrus floribunda, Lindl.). Hybrid between *A. arbutifolia* and *A. melanocarpa,* similar to *A. atropurpurea,* but usually more glabrescent. B.R. 12. 1006. G.W. 5, p. 246.—It is of garden origin and several forms of it are in cult.

Alfred Rehder.

ARÓNICUM: *Doronicum.*

ARPOPHŸLLUM (*cimıter* and *leaf*). *Orchıdàceæ.* Epiphytic evergreen orchids, with 1-lvd. sts. arising from creeping rhizomes: lvs. coriaceous or fleshy: fls. numerous, sessile, in dense cylindric spikes; sepals and petals nearly alike, spreading; lip adnate to base of the erect column, narrowed above the somewhat saccate base; pollinia 8.—About 6 species, natives of Mex., Cent. Amer, and W. Indies.

gigantèum, Lindl. Sts stout, up to 1 ft. tall· lvs. 12–16 in. long: spike dense, up to 1 ft. long; fls. rose-purple, the broadly obovate lip deeper. Mex. and Guatemala.

spicàtum, Llav & Lex. Fig 383. Sts. up to 8 in. tall: lvs up to 1 ft. long· spike dense, 3–6 in. long; fls. less than ½in. across, numerous; sepals and petals rose-purple; lip bright purple. Mex. B.M. 6022.

GEORGE V. NASH.

ARRACÀCIA (Spanish name of the plants). *Umbellíferæ.* Also spelled *Arracacha.* Twenty to 30 species of perennial herbs closely allied to Conium, with calyx-teeth very small or wanting, petals broad, acuminate and inflexed, white to dark purple, fls. in large compound umbels· lvs pinnately compound or decompound. *A. xanthorrhìza,* Baner (*A esculénta,* DC), produces edible tuberous roots much eaten by residents of N. S. Amer.; these tubers have branches or lobes the size of carrots, and are boiled. *A. Dugèsıı,* Coulter & Rose, Cent Amer, is reported as a botanic-garden plant It is tall and coarse, aromatic: lvs. much decompound, segm linear.

ARRHENATHÈRUM (Greek *arren,* masculine, and *ather,* awn, in reference to the awned staminate flower). *Gramineæ.* OAT GRASS. Tall perennials with flat blades and long narrow panicles. spikelets 2-fld, the lower staminate, its lemma bearing a geniculate twisted dorsal awn, the upper perfect, short-awned or awnless. Species 6, Medit. region. One species, tall oat-grass (*A elàtıus,* Beauv), is cult as a meadow grass. Dept. Agric, Div. Agrost. 20.95. There has been recently intro. into the eastern states a variety (var *tuberòsum,* Halac *A bulbòsum,* Presl) that bears at the base of the culms a short chain of corms A variegated form of this has been offered under the name *A. bulbòsum variegàtum.*

A. S. HITCHCOCK.

ARROW-ROOT. An edible starch, derived from the rhizomes of various scitaminaceous plants, as Maranta, Curcuma, Tacca, Canna The West Indian arrow-root is mostly from *Maranta arundinacea.* The Brazilian is from *Manihot utilissima.* The East Indian is chiefly from *Curcuma angustifolia* Potato and maize starches are also a source of arrow-root. In the United States starch is secured from Cassava (*Manihot utilissima*) and is used as a substitute for arrow-root. See Cyclo. Amer. Agric., Vol. II, p. 199, with figure of *Maranta arundinacea.*

ARTABÒTRYS (Greek, *suspended grapes,* alluding to the clustered fruit suspended by the hooked peduncle). *Annonàceæ.* CLIMBING YLANG-YLANG. TAIL-GRAPE. Woody tropical climbers or scrambling shrubs, remarkable for their curiously hooked peduncles, and prized for the fragrance of their flowers.

Leaves smooth, evergreen, alternate. petals 6 in 2 series, both series valvate or edge-to-edge, in most species flat but in certain Malayan and African species terete or club-shaped, with a broad excavated base, above which they are constricted and connivent over the essential parts, which they almost conceal, the flat or terete limb above the constriction usually spreading and ascending, sometimes slightly incurved: stamens typically annonaceous, closely packed, wedge-shaped or oblong with 2 dorsal pollen-sacs on the back of the thick filament and connective produced above them in the form of a dilated hood or cap: ovaries several, seldom numerous, each with 2 erect basal ovules side by side; styles variable, sometimes oblong or club-shaped and reflexed, sometimes erect or very small; ripe carpels separate, borne in a cluster on the hardened torus or receptacle, either sessile or stipitate, more or less plum-like or olive-like, and normally containing 2 flattened seeds with hard bony testa, rising side by side from the base, grooved around the margin and containing the wrinkled albumen characteristic of all Annonaceæ E Asia, the Malay Archipelago, and Trop. Afr.—About 40 species thus far described, several of them cult. in tropical countries and grown in conservatories for their fragrant fls.

Several of the most common species have been confused *Artabotrys uncinatus* was described by Lamarck under the name *Annona uncinata* in 1786 It was supposed to be identical with *Artabotrys odoratissimus,* R. Br., the type species of the genus, which was established in 1819. Its flowers, however, are described as having ovate-lanceolate petals with a brownish red upper part



383. Arpophyllum spicatum. (×⅙)

(or limb), and with broad claws at the base, cottony, concave within at the base and constricted between the claw and the blade. It is consequently to be identified with *Artabotrys odoratissimus* of Blume, which is distinct from *A odoratissimus,* R. Br., and which was described as *A. Blumei* by Hooker & Thomson, while *A odoratissimus* of Hooker & Thomson is to be referred to *A hamatus* of Blume, and *A intermedius,* Hassk., is regarded as a variety of *A. odoratissimus,* R. Br.

A. *Shape of petals lanceolate or ovate, flat.*

B. *Petals glabrous, more than an inch long.*

odoratissimus, R. Br CLIMBING YLANG-YLANG. ALANG-ILANG SONGSONG TAIL-GRAPE ALANG-ILANG DE CHINA. A woody climber or half-scandent shrub: young branches puberulous, at length glabrous: lvs short-petioled, oblong or oblong-lanceolate, acuminate, acute at the base, thin, coriaceous, both sides glabrous, glossy, reticulate between the lateral nerves hooked peduncles 1- or 2-fld., extra-axillary, usually opposite a lf. or subterminal; fls. rather large, greenish to yellow, very fragrant; petals flat, glabrous, or silky-puberulous at the base, thick and coriaceous, lanceolate to oblong-lanceolate, nearly 2 in. long when full-grown, constricted near the base and connivent over the essential parts, widely spreading above the constriction, inner petals similar to the outer but slightly smaller; stamens numerous, short and thick, wedge-shaped, with the connective broadly dilated above the 2 pollen-sacs, which are adnate on the back of the fleshy filament and open extrorsely by longitudinal fissures; ovaries

glabrous, several, each with 2 erect ovules at the base; styles linear-oblong or club-shaped: berries plum-like, clustered on the hardened receptacle, oblong, narrowed at the base, nearly sessile, with a small point at the apex, smooth, yellow and fragrant when ripe. S. China, Formosa, India, Ceylon, Burma, Philippine Isls. B.R. 423.—A species widely cult. in the warm countries of the eastern hemisphere and in conservatories, for its fragrant fls and frs. This species is tender in Cent. Fla. and should be banked with dry sand. It needs rich soil and should be well fertilized each year. Easily prop. by seeds.

BB. *Petals tomentose or pubescent, not exceeding an inch in length.*

c. *Fr. ovoid, sharp-pointed: petals ovate-lanceolate, brownish red, pubescent.*

uncinàtus, Safford (*Annòna uncinàta*, Lam). Fig. 384. A shrub with climbing divaricate branches; young branches slightly pubescent at first, at length glabrous, more or less zigzag: lvs. lanceolate or oblong-lanceolate, acuminate, usually acute at the base, glabrous on both



384. Artabotrys uncinatus. (×½)

sides, glossy, and with short thick petioles, 5–10 in. long by 2–3 in. broad: hooked peduncles glabrous, curved downwards almost like a spiral, somewhat flattened, usually opposite a lf., often with the portion of the branch above it more or less aborted, so as to make it appear terminal, calyx 3-parted, the divisions ovate-acute; petals 6, ovate-lanceolate, brownish red on the upper part, with broad claws, woolly or pubescent ("cottoneux"), concave within and constricted between the claw and the limb, the 3 outer petals about ¾in. long, somewhat larger than the inner, and relatively broader, ovaries about 8–12, gradually tapering upward to the obtuse stigmatic apex, clothed with minute hairs, and containing 2 basal collateral erect ovules: frs several, rounded-ovoid, abruptly pointed at the apex, nearly sessile, about the size of a walnut inclosed in its hull, at length smooth, lightly punctate, and inclosing 2 oblong seeds truncated at the base, rising side by side from the base, more or less compressed and bearing a marginal groove around the periphery of the hard bony testa —This species was described by Lamarck from specimens collected by Sonnerat in the E Indies and Madagascar (see figs. Dunal Anon. pls 12. 12*a*). It is very closely related to *A. odoratissimus*, R. Br., from which it apparently differs in the broader shape, reddish brown color, and "cottony" indumentum of its petals. If, as supposed by many botanists, the two species are identical, the specific name *uncinatus* of Blume, which it more closely resembles, the latter, set apart by Hooker & Thomson as a distinct species under the name *A. Blumei*, must yield to the earlier specific name, and *A. odoratissimus*, R. Br., be retained as a species distinct from Lamarck's though supposed by its author and his followers to be identical with it. *A. uncinatus*, like its very close ally, *A. odoratissimus*, is frequently planted in the warm regions of the eastern hemisphere for the sake of its fragrant fls.

cc. *Fr. tapering at both ends· petals linear-lanceolate, tomentose.*

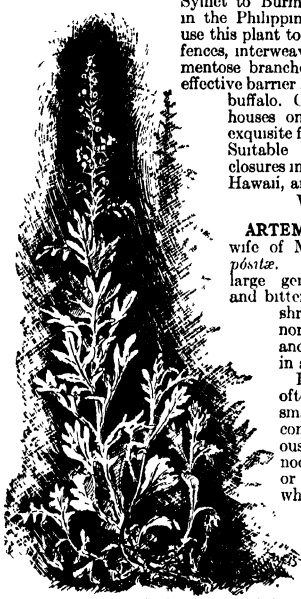
hamàtus, Blume (*A odoratissimus*, Hook. f. & Thomson). A large scrambling shrub with elongate sarmentose glabrous branches. lvs oblong-lanceolate, obtusely acuminate, acute at the base, 2–4 in long by 1–1½ in. broad, coriaceous, glabrous, delicately veined on both surfaces. hooked peduncles flattened, glabrous, spirally curved, several-fld but usually all but one of the fls. abortive; pedicel curved, clothed with short pubescence and bearing at the base a sessile ovate caducous bracteole, fls yellowish **ferruginous;** calyx minute, subtomentose, deciduous, deeply 3-parted, the divisions broadly ovate-acute, spreading and reflexed; outer and inner petals of equal length, 1 in long, linear-lanceolate, obtusely acuminate, thickish, tomentose, excavated and constricted at the base, conniving over the essential parts and almost concealing them, the limb, above the constriction, curving somewhat inward, with a raised median line along the back and a groove within, the outer petals somewhat broader than the inner, receptacle plano-convex, clothed with minute hairs, stamens numerous, thick, club-shaped, obtuse, the connective swollen and rounded above the pollen-sacs; ovaries few, about 5–8, linear-oblong, glabrous, tapering upward into the terete style; mature hardened receptacle bearing 3–5 fruiting carpels 2–2½ in long and 1 in. diam., tapering toward both ends, obtusely acuminate, rather smooth, marked with longitudinal lines within from the base to the apex and spotted with greenish and white, at length turning red; seeds 2, erect, side by side oval, with a hard bony pericarp surrounded by a marginal groove, and a large ruminate albumen. Java, common at the base of high mts.— Widely diffused in India and Ceylon, and planted for the sake of its fragrant fls., often scrambling over garden walls. Closely allied to this species is *Artabotrys intermedius*, Hassk , which grows in the botanical gardens of Buitenzorg, on the island of Java. Its calyx is described as silky within, its petals as green and covered with fine tomentum, the exterior ones a little broader and longer than the inner (an inch long), and ovate-lanceolate in shape, and the ripe carpels obovoid and acutish.

AA. *Shape of petals cylindrical or club-shaped, fleshy: peduncles several-fld.*

suavèolens, Blume. Buffalo Thorn. Durie Carabao. Susong Damulag. A large woody climber or scrambling shrub: young branches puberulous: lvs. elliptic-oblong to oblong-lanceolate, 2–5 in. long by 1–1½ in. broad, acuminate, at the acute or obtuse base usually narrowed into a short glabrous petiole, coriaceous or subcoriaceous, glabrous or pubescent on the midrib beneath, glossy above, conspicuously veined on both sides: peduncles short, recurved or hooked, flattened and fasciated, puberulous, several-fld.; fls. very fragrant, small, yellow, borne on pedicels ½in. long or less; petals all similar, about ½in. long, fleshy, terete or club-shaped, broad and concave at the base, where they connive to form a dome-shaped covering over the essential parts; stamens many, short and thick,

wedge-shaped, with a very broad truncate or flattened connective above the two pollen-sacs; ovaries few, about 3–5, broadly ovoid, subcompressed, terminating in a small stigma and containing 2 basal ovules; fruiting carpels 2 or 3, oblong, obtuse, slightly contracted at the base, sessile; seed usually solitary. All Malayan provinces at low elevations, common; distribution from Sylhet to Burma; also occurring in the Philippines.—The natives use this plant to form hedges and fences, interweaving the long sarmentose branches, which form an effective barrier against cattle and buffalo. Often planted near houses on account of the exquisite fragrance of its fls. Suitable for forming inclosures in Fla., Porto Rico, Hawaii, and S. Calif.

W. E. SAFFORD



385. Artemisia Stelleriana, one of the Dusty Millers.

ARTEMÍSIA (*Artemisia*, wife of Mausolus). *Compósitæ*. WORMWOOD. A large genus of aromatic and bitter herbs and small shrubs, mostly in the northern hemisphere, and most abundant in arid regions

Leaves alternate, often dissected heads small and mostly inconspicuous, numerous, and generally nodding, with yellow or whitish florets, wholly discoid, the involucre imbricated in several rows

In the West, many of the species, particularly *A. tridentata*, are known as sage brush. Grown for their medicinal properties or for foliage effects. The drug product of the artemisias is large *A Absinthium* is the chief source of absinthe; *A. Barrelieri*, Bess., of Spain, is said to be used in the preparation of Algerian absinthe, *A. Cina*, Berger, of the Orient, is the source of santonica. The garden kinds are perennials and thrive in the most ordinary conditions, even in poor and dry soil. Propagation is mostly by division.

INDEX.

Abrotanum, 11.	*endoviciana*, 9.	Purshiana, 10.
Absinthium, 7.	filifolia, 3	sacrorum, 17.
arborescens, 8.	frigida, 4	sericea, 5
arbuscula, 15.	*gnaphalodes*, 10.	Stelleriana, 9.
argentea, 6.	*lactiflora*, 13.	tridentata, 16.
canadensis, 2.	ludoviciana, 14.	vulgaris, 13.
Dracunculus, 1.	pontica, 12.	

A. *Heads with two kinds of florets (heterogamous).*

B *Disk-fls. with both stamens and pistils, but the ovary abortive (not producing seed), style usually entire.*

1. **Dracúnculus,** Linn. TARRAGON ESTRAGON. Herb; green and glabrous, with erect, branched sts. 2 ft. high: radical lvs. 3-parted at the top, st.-lvs. linear or lanceolate, entire or small-toothed: panicle spreading, with whitish green, nearly globular fl.-heads. Eu. R.H. 1896, p. 285.—Tarragon lvs. are used for seasoning, but the plant is little grown in this country. The lvs. may be dried in the fall, or roots may be forced in a coolhouse in the winter. Prop. by division; rarely produces seed. See *Tarragon*.

2. **canadénsis,** Michx Herb, 2 ft. or less high, glabrous or very nearly so: lvs. usually 2-pinnate, with filiform, plane lobes. fls in a long, narrow panicle, with numerous small greenish heads. Wild on banks and plains in the northern part of the country.

3. **filifòlia,** Torr Shrubby, canescent, 3 ft. or less high, very leafy, the branches rigid. lvs 3-parted into linear filiform segms., scarcely $\frac{1}{8}$in wide panicle long and leafy. Plains, W.—Plant has a purplish, mist-like aspect when in fr.

BB. *Disk-fls. perfect and fertile, style 2-cleft.*

C. *Receptacle hairy.*

D. *Racemes not 1-sided.*

4. **frígida,** Willd. Herb, 8–12 in., with a woody base, silvery canescent. lvs much cut into linear lobes: heads small and globular, with pale involucre, in numerous racemes Plains and mts W Intro. 1883.—Good for borders. Known in Colo. as "mountain fringe," and used medicinally

5 **sericea,** Web Sub-shrub or more usually a creeping woody perennial with finely divided silky foliage: lf.-segms distinctly stalked fl.-heads in solitary or paniculately branching racemes, yellowish white. Summer. Siberia.

6. **argéntea,** L'Her Shrubby, erect, 1–2 ft.: lvs. white-silky, 2-pinnate, the lobes linear or lanceolate: heads globular, tomentose, nodding, in racemose panicles Madeira.—Useful for rockwork.

7 **Absínthium,** Linn. WORMWOOD. ABSINTHIUM Almost shrubby, 2–4 ft high, spreading and branchy, white-silky: lvs 2–3-parted into oblong, obtuse lobes: heads small and numerous, in leafy panicles.—Wormwood is native to Eu., but it occasionally escapes from gardens It is a common garden herb, being used in domestic medicine, especially as a vermifuge Wormwood tea is an odorous memory with every person who was reared in the country. See *Absinthe* and *Wormwood*

DD *Racemes 1-sided.*

8 **arboréscens,** Linn. Shrubby, 1–2 ft., the sts erect and angled. foliage finely dissected, silvery white, the upper lvs. almost sessile, the lower petiolate: fls. in somewhat 1-sided racemes, bright yellow. Medit region.—Hardy only as far north as Washington, D. C.

CC. *Receptacle not hairy.*

D. *Lvs. white or silvery throughout.*

9. **Stelleriàna,** Bess. (*A. endoviciàna*, Hort.) OLD WOMAN. DUSTY MILLER. BEACH WORMWOOD. Fig 385. Herb, 2 ft., from a woody creeping base, densely white tomentose: lvs pinnatifid, with obtuse lobes. heads large and many-fld., in a racemose-glomerate infl. N. E. Asia and on the Atlantic coast from Mass. to Del.—Attractive from its whiteness. Useful for borders.

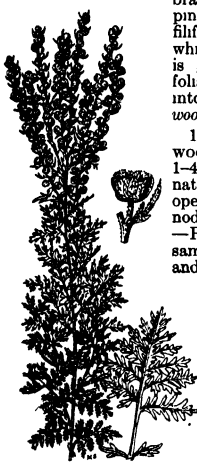
10. **Purshiàna,** Bess. (*A. gnaphalòdes*, Nutt. not Hort.). Sts and lvs. white-woolly on both sides, differing from *A. ludoviciana* in which the lvs. are usually glabrate above when old: lvs. acute or acuminate, overtopped by the spicate-paniculate infl. of white fls. Missouri R. to the Pacific.



386. Artemisia pontica. (×½)

DD. *Lvs white on 1 side only or green throughout.*

11. **Abrótanum,** Linn. SOUTHERNWOOD. OLD MAN. Shrubby, 3–5 ft., green and glabrous, the st much branched and rather strict lvs. 1–3-pinnately divided, the divisions fine-filiform: panicle loose, with yellowish white heads Eu —Soutnernwood is grown for its pleasant-scented foliage; and it sometimes escapes into waste places. See *Southernwood*



387. Artemisia vulgaris. (×⅓)

12 **póntica,** Linn ROMAN WORMWOOD Fig 386 Shrubby, erect, 1–4 ft · lvs canescent below, pinnatisect, the lobes linear panicle open and long, with small, globular, nodding, whitish yellow heads. Eu. —Roman wormwood is used for the same purposes as *A Absinthum,* and is more agreeable A source of absinthe

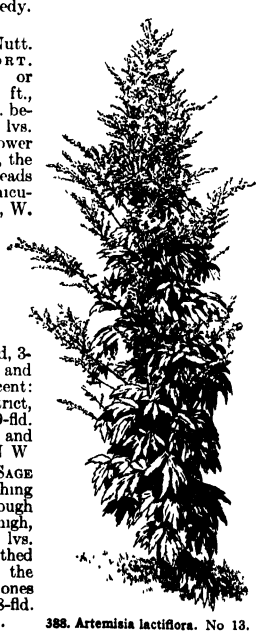
13. **vulgàris,** Linn MUGWORT. Fig 387 Herb, erect, paniculately branched, the sts. often purplish lvs white-cottony beneath but soon green above, 2-pinnately cleft, with lanceolate lobes; upper lvs. sometimes linear: heads many, oblong, yellowish. Eu and N. N. Amer , and naturalized in eastern states —A white-fld. form has been sold as *A lactiflòra.* Fig. 388. It is a beautiful plant with fragrant foliage G 29·409.—Mugwort is grown for the ornament of its foliage. There are variegated-lvd and golden-lvd. varieties. It was once a domestic remedy. Variable.

14. **ludovicìana,** Nutt. WESTERN MUGWORT. WHITE SAGE Erect or ascending herb, 2–3 ft., white-tomentose or lvs. becoming greenish above· lvs. linear to oblong, the lower ones toothed or parted, the upper ones entire heads small, bell-shaped, paniculate. Plains and banks, W. Intro 1891

AA. *Heads with perfect fls. throughout receptacle not hairy.*

15. **arbúscula,** Nutt SAGE BRUSH. Shrubby, a foot or less high: lvs. short, wedge-shaped, 3-lobed, the lobes obovate and often 2-lobed, canescent: panicle simple and strict, often spike-like, the 5–9-fld. heads erect. Plains and mts., Colo and Wyo., N W

16. **tridentàta,** Nutt. SAGE BRUSH. Shrubby, reaching height of 12 ft. although often only a foot high, branchy, canescent: lvs. wedge-shaped, 3–7-toothed or lobed, truncate at the summit, the uppermost ones narrower: heads 5–8-fld. Plains, W. Intro. 1881.



388. Artemisia lactiflora. No 13.

17. **sacròrum,** Ledeb. Annual or biennial, shrubby below. lvs long-petioled, ovate, pinnatisect and the segms. again pectinate, hoary or white-pubescent, the rachis winged· fls. 15–20 in the head, the heads nodding and in separate slender racemes. S. Russia, Siberia, etc. Var. **víride,** Hort., with green foliage, is the attractive SUMMER FIR recently intro., grown as an annual for its neat pyramidal form (3–5 ft.) and much dissected rich green foliage.

A Baùmgarteni, Bess Compact, shrub-like, with small lvs. and yellow fls standing erect above the lvs S Eu —*A landta,* Willd (A pedemontana, Balbis) Low cespitose plant with finely cut, silvery foliage for which it is chiefly grown. Spain.

N. TAYLOR.†



389 Globe artichoke.

ARTHROPÒDIUM (Greek, *joint* and *foot,* alluding to jointed pedicels) *Liliàceæ* Herbaceous perennials, allied to Anthericum, grown in the open in the South and otherwise in greenhouses.

Tufted herbs 1–3 ft. high, with fibrous fleshy roots: lvs. linear or lanceolate, crowded at base of st : scape simple or branched; fls white or violet, in racemes or panicles, on pedicels jointed at the middle; perianth persistent, the segms 6 and distinct and 3-nerved; stamens 6, shorter than perianth. fr. a subglobose caps., 3-valved —About 10 species in Austral , New Zeal , etc. Cult and prop as for Anthericum, requiring no special treatment

cirrhàtum, R Br. Glabrous, to 3 ft : lvs numerous, deep green, 2 ft. or less long scape stout, naked, bearing a much-branched panicle often 1 ft. long, fls. white, star-shaped, 1 in. or less in diam., the segms. oblong-lanceolate, acuminate, filaments bearing 2 tendril-like appendages (whence the name). New Zeal. B.M. 2350.—Reported in S. Calif. L. H. B

ARTHROTÁXIS: *Athrotaxis*

ARTICHOKE (*Cynara Scolymus,* Linn.). *Compósitæ.* The artichoke (or the Globe artichoke, to distinguish it from the Jerusalem artichoke) is a strong thistle-like plant (Fig. 389), grown for the edible flower-heads (Fig 390). It is native in southern Europe and northern Africa, and is not hardy in the northernmost parts of the United States It is perennial, but the plantation should be renewed every two or three years. See *Cynara*

The artichoke is propagated by seed or by suckers. The latter is the preferable method, for a good strain or variety may thus be perpetuated The buds or shoots are detached from the old crown in spring before growth begins. Seeds produce bearing plants the following year, although heads may be secured the same autumn if the season is long and if the seeds are started early under glass.

The soft fleshy receptacle of the flower-head and the thickened base of the scales (or involucre bracts)

are the edible parts. They are sometimes eaten raw, but are usually boiled and served with drawn butter or sauce. The leaves are sometimes blanched after the manner of sea-kale and cardoon, and are cooked as a pot-herb.

In the southern states and California, the artichoke is grown without difficulty. In California, particularly, it thrives as a field crop. In northern gardens, even professional and skilled gardeners have usually given it up after a few trials. It is found in a few gardens on Long Island, in Massachusetts, and perhaps a few other places, and is there grown with fair success, provided that the crown is protected in winter in such a way that snow or heavy mulch is not allowed to choke the plant. This seems to be the chief danger.



390. Edible heads of artichoke. (×⅛)

Instead of covering with manure or litter, place a cap or miniature tent over the crown to give it air and freedom of breathing. The flower-heads are now regularly and commonly found on sale at the green grocers' in our larger eastern cities, and the supply comes mostly from California. The large seeds may need special treatment to make them germinate promptly. The better way, undoubtedly, for the home gardener who may wish to try a few plants, is to secure sucker plants from one of the big seedsmen or professional plant-growers. Set them in fairly good warm soil, 3 feet each way, or 4 by 2, and give clean cultivation. Protect the crowns during winter as suggested, and in following spring thin to about three shoots. Edible heads may be expected in July. They are gathered for use before the flower-heads open. It is better to cut the old stalk down to the ground after the head is removed, for the root is not then weakened and new shoots will spring up. There are a number of varieties, Large Green Paris being the one mostly mentioned in California. In parts of Europe the artichoke is grown with special skill, but it has never been a prominent vegetable in American gardens.

T. GREINER.

ARTICHOKE, JERUSALEM (*Helánthus tuberòsus*, Linn.) *Compósitæ*. The Jerusalem artichoke is the subterranean stem tuber of a native sunflower. Fig. 391. The plant is coarse and upright, and persists as a weed when once introduced. It does not need excessively rich soil, nor high culture, succeeding on any warm well-drained land without attention. It is planted much after the manner of potatoes, and it will grow and produce its many smallish, white, edible tubers.



391. Tuber of Jerusalem artichoke. (×½)

In late fall, the plants may be pulled up, exposing to view the tubers that are clustered around the roots near the main stalks so that they can be easily gathered with the help of a hoe or potato hook, if wanted for use as a culinary vegetable; or, if grown for hog-feed, the hogs may be turned right into the field and allowed to dig their own. All farm stock seems to like the artichoke tubers. If shredded or ground and mixed with meals, they make a good winter ration, as a variety, for poultry. More prolific than common potatoes, and far more easily grown, the artichoke is one of the crops that may be considered for cultivation as a succulent vegetable to feed to cattle, swine, and other farm animals during winter. Raw or boiled and served cold with oil and vinegar, this tuber also makes a very palatable winter or spring salad, and for this purpose it finds a limited sale in our markets. The chief commercial demand for it is for seed purposes. Frost has no injurious effect on the tuber in the ground, and the easiest way to winter it, therefore, is by leaving the plants alone until spring and then digging the tubers. If already harvested, they may be pitted like potatoes, beets, or other roots, and will require very little covering. Mammoth White French is said by some propagators to be an improved strain of the Jerusalem artichoke. If there is danger of the plant spreading and becoming a weed, hogs, when given a chance at it, will soon clear the land of the tubers. It was cultivated by the Indians. See *Helianthus*.

T. GREINER.

ARTOCÁRPUS (*artos*, bread, and *carpos*, fruit). *Moràceæ*. BREAD-FRUIT. Milky-juiced tropical trees, some of them yielding edible fruits, ornamental in foliage.

Leaves alternate, large, thick, entire or pinnate: dioecious; staminate fls. on long spikes, the sepals and

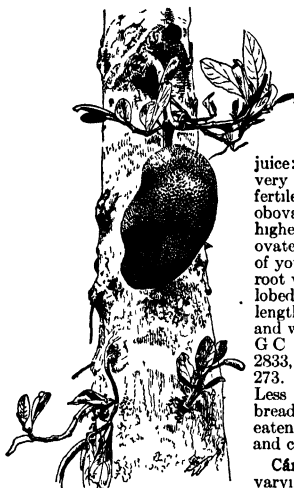


392. Bread-Fruit.—Artocarpus incisa, showing a fruit of edible size. (×⅛)

stamens 2; pistillate fls. in globular heads, with simple 1-ovuled ovary and bifid stigma: fr. a large fleshy mass or syncarp, formed of the aggregated fls.—A genus of 40 species containing many tropical fr. plants, originally from the E. Indies, sometimes cult. with difficulty in northern botanic gardens for their great economic interest, and throughout the world in the tropics. They need a hot, moist atmosphere, much water, and perfect drainage. Prop slowly by cuttings of young lateral growth. Bread-fruit seeds are boiled and eaten.

incisa, Linn. f. (*A. commùnis*, Forst.?). BREAD-FRUIT. Fig. 392. Tree, 30–40 ft., with a viscid, milky juice: branches fragile: lvs. 1–3 ft. long, leathery, ovate, cuneate and entire at base, upper part 3–9-lobed: male fls. in a dense club-shaped yellow catkin, 10–16 in. long; female fls. in a subglobular echinate head, having a spongy receptacle: fr. 4–6 in. diam., typically muricated, but in the best cult. varieties reticulated only, and often seedless. Gt. 39, p. 273. Gng. 5:233, and

B.M. 2869–2871, where the romantic story of its transfer to the W Indies is told —Sparingly cult. in S. Fla. and in warmhouses of botanic gardens Eaten cooked, as a vegetable rather than as a fruit; widely used in tropics.



393. Jack-Fruit —Artocarpus integrifolia

integrifólia, Linn f JACK-FRUIT or TREE. Called also JACA Fig 393 Tree, 30 ft, with milky juice: lvs 4–6 in long, very various; those of fertile branches nearly obovate, entire; those of higher branches more obovate and oblong, those of young shoots from the root very narrow, or 2–3-lobed: fr attaining a length of 18 in. or more, and weight of 30–40 lbs. G C III 20.717. B M 2833, 2834. Gt. 39, p 273. Gn. 35, p 455 — Less palatable than the bread-fruit, and usually eaten only by natives and coolies.

Cánnonii, Bull Lvs varying from cordate to deeply 3-lobed, 1 ft long, red beneath, bronzy crimson and purple above, very showy. Society Isls F S 21 2231, 2232 —Perhaps better included under *Ficus Cannonii*, according to Nicholson, but here retained in Artocarpus

N TAYLOR †

ÁRUM (ancient name). *Aràceæ.* WILD GINGER Tuber-bearing low herbs, of few species, in Eu. and W. Asia, most of them grown in pots

Lvs. simple, the petiole sheathed at the base spathe convolute, variously colored, mostly including the short spadix, pistillate fls. at the base. Monogr by Engler in DeCandolle's Monographiæ Phanerogamarum, Vol II

Arums are grown usually as oddities, mostly under the general name of callas. Some of the species are hardy; others, as *A. palæstinum*, are tender, and require glass-house treatment. The kinds are managed in essentially the same way as the fancy-leaved caladiums Plant the tubers sufficiently deep that roots may form from near the top Give rich soil, and water freely when growing or in bloom. The hardy species should be well mulched in late fall They thrive best in partially shaded places and in rich soil Propagation is by natural offsets; also by seeds or berries, which some species produce freely. Some of the species are acrid-poisonous.

INDEX.

albispathum, 5, 7.
alpinum, 6.
angustatum, 6
byzantinum, 7.
canariense, 7.
concinnatum, 7.
corsicum, 1.
cylindraceum, 7.
cyprium, 2.
detruncatum, 3.
DIOSCORIDIS, 2
elongatum, 5
gratum, 5
immaculatum, 6
intermedium, 6.
italicum, 7
maculatum, 6.
Maltæi, 6
marmoratum, 7.
nigrum, 5.
Nordmanni, 5.
orientale, 5.
palæstinum, 4
pictum, 1
sanctum, 4.
spectabile, 2.
syriacum, 2.
variolatum, 5
vulgare, 6
Zelebori, 6.

A. *Mature lvs. cordate, oblong-ovate.*

1. pictum, Linn. f. (*A. córsicum,* Loisel). Lvs appearing in spring, long-petioled, light green· spathe bright violet, swollen at the base· spadix purple-black, exceeding the spathe. Corsica, Balearica, etc.—Hardy.

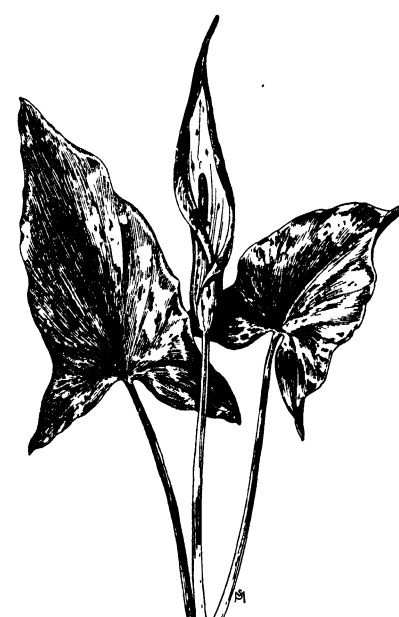
AA. *Mature lvs. hastate or sagittate.*

B. *Tuber round-flattened or oblate, the lvs. and peduncles arising from a depressed center: lvs. appearing before the spathe.*

2. Dioscoridis, Sibth & Smith (*A. spectábile,* Regel. *A. syriacum,* Blume. *A cýprium,* Schott). Lf.-blade oblong-triangular or ovate-triangular· spathe-tube pale within, the limb 6–8 in long, lanceolate-oblong, and colored with large lenticular purple spots spadix short, included Asia Minor.—Runs into many forms, with variously marked spathes Pots.

3. detruncátum, Mey. Lvs more or less truncate at the base, the blade shorter than in the last spathe yellowish green and purple-spotted, large (10–15 in. long) and short-stalked, the limb acuminate. Persia. —Hardy.

4 palæstínum, Boiss (*A. sánctum,* Hort ? BLACK CALLA. SOLOMON'S LILY Lvs cordate-hastate, 6 in. broad across the base and about equal in length, the middle lobe broad-ovate and nearly blunt. spathe about the length of the lf., with a short green tube, and an elongated lance-oblong tapering limb, which is greenish on the outside and continuous black-purple within, the tip sometimes recurving spadix shorter than the spathe, the upper part dark-colored. Palestine. B.M.



394. Arum maculatum. (×⅓)

5509. Gn. 45, p. 311; 59, p. 317; 71, p. 102.—Perhaps the most popular arum at present, being grown in pots as an oddity.

5. orientále, Bieb. A foot high: lvs. brownish, broadly hastate-sagittate, the front lobe oblong-acute: spathe-tube oblong-ovoid and white within, the limb ovate to oblong and intense black-purple (rarely pale), resembling *A. maculatum.*—A hardy species from Asia Minor, running into many forms. Some of the plants

referred here are *A. nigrum*, *A. variolatum*, *A. Nordmannii*, *A. gratum*, Schott; *A. elongatum* and *A. albispathum*, Ster. (not *A. albispathum*, Hort., which is *A. italicum*).

BB. *Tuber ovoid or oblong, propagating horizontally, the lvs. and peduncles arising from the apex: lvs. appearing before or with the spathe.*

6. maculàtum, Linn. (*A. vulgàre*, Lam.). LORDS-AND-LADIES. CUCKOO-PINT. WAKE ROBIN (in England). Fig. 394. About a foot high. lvs. usually black-spotted, hastate or sagittate, the front lobe triangular-ovate, about as high as the spathe: spathe somewhat contracted above the base, the margins of the limb becoming inrolled, spotted with purple: spadix shorter than the spathe, purple Eu.—A hardy species, of many forms. A form with spotless lvs and whitish tube with medial purple zone, is *A. immaculàtum*, Reichb., and *Zelebòri*, Schott. Var. **angustàtum**, Engler (*A. intermèdium*, Schur. *A. Mâlyi*, Schott) has a narrow light purple spathe. Var. **alpinum**, Engler (*A. alpinum*, Schott & Kotschy) has peduncles longer, and an ovate-lanceolate spathe.



395 Arum italicum (×⅛)

7. itálicum, Mill. (*A. cylindràceum*, Gasp.) Fig. 395. Larger than the last: lvs. hastate, nearly truncate below, light-veined: spathe scarcely swollen below, the limb erect and not expanding and including the short spadix (tip sometimes deflexed after flowering), yellowish or white and faintly striate. Eu. B M 2432.—A hardy species; also grown in pots. In the open, the lvs. appear in the fall. A very variable species. Var. **canariénse,** Engler (*A canariénse*, Webb & Berth.), has narrow lf.-lobes and spathe. Var. **concinnàtum,** Engler (*A. concinnàtum* and *A. marmoràtum*, Schott), has broad gray-spotted lvs. Var. **byzantinum,** Engler, (*A byzantinum*, Schott), has spathe-tube oblong, white inside and purple at the mouth, and an acuminate purple or green limb. Var. **albispàthum,** Hort., has a white spathe.

L. H. B.

ARÚNCUS (old name). *Rosàceæ*. GOAT'S-BEARD. Ornamental tall perennial herbs, cultivated chiefly for the large showy panicles of white flowers and also for the handsome much-divided foliage.

Leaves bi- to tripinnate with minute or wanting stipules: fls. dicœcious, small; calyx 5-lobed; petals 5; stamens many; pistils commonly 3: the follicles dehiscent, glabrous, usually 2-seeded, seeds minute, dull.—Two species in N. Amer., N and W. Eu., N. Asia to Japan. Formerly usually referred to Spiræa, which differs chiefly in its shrubby habit, simple, rather small lvs., and 5 pistils.

They are tall perennial herbs with large compound leaves and small white flowers in slender spikes forming large terminal panicles. The species in cultivation is hardy North; it prefers rich rather moist soil and grows well in half-shady situations. Propagation is by seeds, which germinate readily, and also by division of older plants.

sylvéster, Kostel. (*A. Aruncus*, Karsten. *Spiræa Aruncus*, Linn.). Tall (5–7 ft.), erect branchy herb: lvs. large, 2–3-pinnate; lfts. ovate to lanceolate, sharply and doubly serrate, 1–2½ in. long: fls. about ⅛in. across: follicles deflexed in fr. May–July. Rich woods, N. Amer., N. Eu. and Asia.—A desirable hardy border plant of easy cult. Var. **Kneiffii,** Zabel. Lfts. linear-lanceolate, irregularly serrate or incised, long-acuminate: fls. as in the type. M D G 1897:260.—Very graceful form with its finely cut foliage.

A. astilboides, Maxim. (Spiræa Aruncus var. astilboides, Maxim.) Similar to the preceding, but lower and smaller in every part. lfts. more deeply serrate, ¼–1½ in. long. infl. less compound, with denser oblong branchlets: follicles erect. Japan.—Apparently not in cult., the plant cult. under the name of Spiræa astilboides is Astilbe astilboides, Lem., which is a true astilbe.

ALFRED REHDER.

ARUNDINÀRIA: *Bamboo.*

ARÚNDO (an ancient Latin name for *A. Donax*). *Gramineæ*. REED. Tall reed-like grasses with broad flat blades and large plume-like terminal panicles: spikelets 3–4-fld., glumes narrow, acute; rachilla naked; lemmas long-pilose.—Species about 6, in the warmer regions of the Old World.

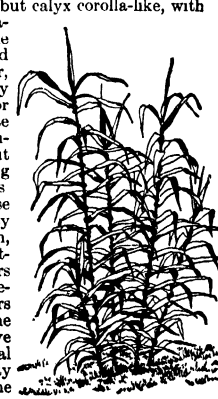
Dònax, Linn. GIANT REED. Figs. 396, 397. Tall and stout, as much as 20 ft., from large knotty rootstocks: blades numerous, cordate-clasping and hairy-tufted at base, 2–3 in. wide on main st.: panicle 1–2 ft.; spikelets 6 lines long. G. 2:419. Gn. 1, p. 391, 3, p. 493, 8, p. 199, 17, p. 407; 27, p. 307. G M 50 253. G W 2:337; 3:416; 8:613.—Cult. for ornament because of the regularly placed lvs. and the large plumes. A smaller less hardy variegated form with white-striped lvs. is cult. under the name of var **variegàta** (var *versícolor*, var *pícta*). G. 18 137. Var **macrophýlla** has large glaucous lvs.

conspícua, Forst. f. Sts. lower and more slender: blades long and narrow, 2–4 ft.: panicle 1–2 ft., silvery or yellow-white; spikelets 1–3-fld. B M 6232. F. 1874 61. G 1:344; 9:64, 19 21. Gn. 49, p. 229, 66, p. 121. G M. 55:408. G W. 15 51. Native of New Zeal.—Less hardy than *A. Donax*.

A. S. HITCHCOCK

ÁSARUM (ancient obscure name). Including *Hexastylis*. *Aristolochiàceæ*. ASARABACCA. Low, nearly stemless herbs, sometimes planted in wild borders and used as ground-cover in shady places.

Perennial: sts. creeping, with odd purplish or brown fls. on the surface of the ground (or nearly so), underneath the heart-like or kidney-like lvs. corolla wanting or merely rudimentary, but calyx corolla-like, with a regular 3-parted limb, stamens 12, with tips on the filaments projecting beyond the anthers: ovary inferior, maturing into a rather fleshy globular caps.—A dozen or more species in the temperate parts of the northern hemisphere. The asarums inhabit rich, shady woods, spreading on the ground, and the fls. are unseen except by the close observer. They are of easy culture if transplanted to rich, moist places. They make attractive carpets in borders and groves. The species described are sold by dealers in native plants. Some of the species are reported to have medicinal properties. Several species of doubtful validity have been described from the southern states.



396. Arundo Donax.

A. *Plant markedly pubescent.*

canadénse, Linn WILD GINGER. CANADA SNAKE-ROOT Lvs about 2 to a plant, thin, kidney-shaped, pointed, with a deep and open sinus, not mottled: fl. slender-stalked, with lance-acuminate calyx-lobes an inch or more across at the expanded mouth, chocolate-brown; style 6-lobed. Frequent in woods E. B.M. 2769. A.G. 13:517

Hártwegii, Wats. Tufted, loose-pubescent: lvs. large and thick, cordate, with rounded basal lobes, mostly acute at the apex, margin ciliate, glabrous and mottled above. fl. stout-stalked, the lobes often ovate and long-pointed, the ovary inferior; styles 6. Sierra Nevadas, 4,000–7,000 ft. altitude

europæ̀um, Linn. Lvs. kidney-shaped, evergreen, dark green, the petiole 3–5 in: fls greenish purple, ½in, with incurved lobes; styles 6, and grooved or 2-parted, recurved. Eu



397. Plume of Arundo Donax. (×⅙)

AA *Plant slightly or not at all pubescent*

caudàtum, Lindl WILD GINGER. Rather slender, with long rootstocks, sparingly pubescent lvs cordate-kidney-shaped, and more or less cupped or cucullate, acute or obtusish fls slender-stalked, the calyx-lobes oblong or triangular and attenuate, styles united. Pacific coast —Evergreen.

Lémmonii, Wats. Like the last, but lvs. plane or flat, rounded at apex, less pubescent, calyx-lobes short. Sierra Nevadas

virgínicum, Linn. Lvs. broad-ovate or orbicular, rounded at the top, the sinus narrow: fl. short-stalked, purple, the calyx-lobes broad and rounded, styles 6, 2-lobed; anthers not pointed Va, S in mts

arifòlium, Michx. Lvs thickish and usually mottled, orbicular to hastate, obtuse: fls stout-stalked, urn-shaped and much contracted at the throat, styles 6, 2-lobed; anthers pointed Va, S L. H B.

ASCLÈPIAS (ancient Greek and Latinized name). *Asclepiadàceæ.* MILKWEED. SILKWEED. Perennial milky-juiced herbs, sometimes used in the hardy border or wild garden

Erect, with deep thick and hard perennial roots. lvs. opposite or verticillate (rarely alternate), entire. fls. gamopetalous, the corolla segms. generally strongly reflexed; stamens 5, attached to the corolla, the anthers more or less united about the stigma; between the corolla and the stamens is a crown of 5 cornucopia-like horns or appendages; pollen cohering into a waxy mass (pollinium) which is removed bodily by insects that visit the fl: fr. 2 warty, or echinate or smooth follicles.

The pollination of an asclepias fl. is shown in Fig. 398. The pollen-masses are usually twin (as at *b*), and the handle or caudicle lies in a chink on the side of the stigma. The pollen-masses become attached to the legs or mouth parts of the insect, and are thereby transferred to another fl.—The milkweeds are common in waste places in N. Amer., and are rarely cult About 80 species are known, mostly North American, but others in Cent and S. Amer and Afr. Several species (described below) have been offered by dealers in native plants. The butterfly-weed and some others are very showy and worthy of more general attention The large-lvd kinds are desirable when heavy foliage effects are wanted. They are all perennials of the easiest cult. Prop. by division, rarely by seeds.

A. *Fls. (corolla and crown) orange.*

tuberòsa, Linn. BUTTERFLY-WEED. PLEURISY ROOT. Fig 399. Hairy, 2–3 ft high, from long, horizontal roots, with more or less alternate, lance-oblong or lance-linear lvs. umbels several, short-peduncled: pods pubescent, erect Dry banks and fields, widespread, and not infrequent. B R 76.—A handsome plant.

AA. *Fls. in shades of red or purple.*

Curassávica, Linn Plant glabrous, 2 ft or less: lvs. opposite and short-petioled, thin, oblong-lanceolate: corolla scarlet: pods glabrous, erect. Fla and La. B.R. 81.

incarnàta, Linn Glabrous or nearly so, leafy and branching, 3 ft. lvs opposite, oblong-lanceolate. corolla rose-purple to flesh-color, with oblong lobes pods glabrous, erect B R 250. Var **púlchra,** Pers Hirsute, and lvs. broader. Swamps.—Common

AAA. *Fls greenish, yellowish or white (sometimes purple-tinged, especially in A. quadrifolia).*

B. *Pods tomentose and soft-spiny.*

speciòsa, Torr. (*A. Douglasii,* Hook.) St stout and simple, 3 ft or less, fine-tomentose or becoming glabrous: lvs large and broad, ovate, transversely veined, short-petioled: fls. purplish and large, the peduncle of the umbel shorter than the lvs. Neb. W. and S B M 4413.

Cornùtii, Decne. (*A. syriaca,* Linn.) Differs from last in having obtuse and short hoods to the crown, taller, less pubescent lvs oblong or oval: fls dull purple, in large, more or less nodding umbels Mn 7 221 — The common milkweed of the eastern states.

BB. *Pods glabrous and unarmed.*

C. *Fruiting pedicels recurved or deflexed, the pods erect or ascending.*

amplexicaùlis, Michx. Plant glabrous and glaucous: st. decumbent, 1–2 ft long: lvs. numerous, cordate-ovate and clasping, obtuse, succulent: corolla green-purple. Barrens, N. C. and S.

phytolaccoìdes, Pursh (*A. nivea,* Sims). Plant glabrous and green, 3–4 ft, erect: lvs. thin, oval to lance-oval, acuminate and short-petioled: fls. greenish, in large, loose umbels. Moist ground; frequent. B.M. 1181.

Hállii, Gray. Stout, puberulent: lvs. thickish, ovate-lanceolate or oblong (3–5 in. long), short-petioled: fls. greenish white and purple, in few many-fld. umbels. Colo. G.C. III. 28·183



398. Milkweed flower showing pollination.

variegàta, Linn. Two ft. or less high: lvs. 3–7 pairs, oval, ovate or oblong, thinnish, green and glabrous above and pale beneath: fls. white and pink, in 1–3 umbels. Dry, shady places, central and southern states. B.M. 1182.

eriocárpa, Benth Densely woolly all over. lvs. alternate or in 3's, long-oblong or lanceolate, short-petioled: fls. dull white, in few or several umbels. Calif.

cc *Fruiting pedicels erect, and the pods erect.*

quadrifòlia, Linn About 2 ft., not branched, with lvs. towards the top of the st. in whorls of 4. lvs. ovate or lance-ovate, acuminate, thin, nearly or quite glabrous. fls. pink to white in 2–4 loose umbels Dry soil; frequent L B C. 13 1258

verticillàta, Linn. About 2 ft., slender, very leafy: lvs. in whorls of 3–6, very narrow-linear and revolute fls. greenish white, in many small umbels. Dry soil, frequent. L B C. 11. 1067

Var. **pûmila,** Gray A few inches high from a fascicled root: lvs. filiform, crowded. Plains, W

mexicàna, Cav. Height 5 ft. or less lvs. in whorls of 3–6, or sometimes opposite or fascicled, linear or narrow-lanceolate fls. greenish white or purplish in dense, many-fld. umbels. Ore., W. and S. L H B



399 Asclepias tuberosa. (×½)

ÁSCYRUM (Greek, *not hard* or *rough*, ancient name of some plant) *Hypericàceæ* Small plants sometimes planted in wild gardens and borders

Low herbs or subshrubs, with bright yellow fls., 2 small sepals and 2 large ones, 4 petals, and many stamens: fr. a 1-celled and 2–4-valved caps. — Two species in dry, sandy soils in eastern states (also one or two W. Indian and one Himalayan species) Of easiest cult but should be covered in winter in the N. Prop. by division; also by seeds.

hypericoides, Linn (*A. Crùx-Andreæ*, Linn.). St Andrew's Cross Fig 400. A ft. or less high, branchy: lvs. thin, oblong or obovate, narrowed to the base: petals linear-oblong; styles 2, short G.F. 5:257 (adapted in Fig. 400). Mn 3:65.

stàns, Michx. St. Peter's-wort. Taller, scarcely branched: st. 2-edged, stout: lvs. thicker, broad-oblong or oval and clasping: petals obovate; styles 3–4.

L. H. B.

ASH: *Fraxinus.*

ASÍMINA, (from *Assiminier*, a French-and-Indian name). *Annondceæ.* Papaw (the papaw of literature is Carica, which see). Small trees or shrubs, grown chiefly for their handsome large foliage and for their attractive flowers; also sometimes for their edible fruit.

Low shrubs, and 1 species a small tree: lvs. alternate, usually deciduous, entire: fls. axillary, solitary or few, nodding, short-stalked; sepals 3, smaller than petals,



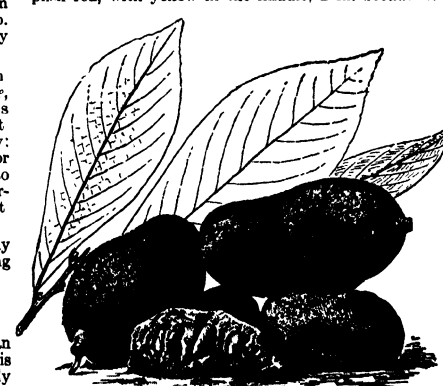
400 Ascyrum hypericoides (×½)

deciduous; petals 6, the inner ones smaller, usually upright; stamens numerous, crowded, with short filaments, pistils 3–15, separate, 1-celled with many ovules: fr. consisting of 1 or few oval to oblong berries with rather large compressed seeds in 1 or 2 ranks — Eight species in E. N. Amer. Description of all species is given in Gray, Syn. Fl. N. Amer. 1, pt. 1, pp. 62 and 464.

Asiminas are ornamental trees or shrubs with handsome large foliage, of disagreeable odor when bruised, conspicuous white or purplish flowers in early spring and large edible fruits in autumn Only two species are cultivated, of which the arborescent one is the hardier and the handsomer in foliage, while the more tender *A. grandiflora* has larger and showier flowers.

They grow best in rich and moist soil They transplant with difficulty Propagation is by seeds sown in autumn, or stratified and sown in spring, or by layers in autumn, also by root-cuttings In the North, the seeds should be sown in pots or pans

triloba, Dunal (*Annòna triloba*, Linn.) Fig 401 Small tree, 10–40 ft.: lvs. cuneate, obovate-oblong, acute, ½–1 ft. long, glabrous fls. with the lvs. from branches of the previous year, green when expanding, changing to purplish red, with yellow in the middle, 2 in. broad. fr.



401. Asimina triloba. (×½)

oblong, 2–6 in. long, dark brown. S. states, north to N. Y., west to Mich. and Kan. S S. 1:15, 16. B.M. 5854. Gn. 33, p. 321. G.F. 8:495 A G 44:713. R H. 1911, pp. 134, 135 —This is the only arborescent species of the genus. It is well worth a place in the garden, for its large foliage is very handsome and the fls, appearing in the early spring, are attractive. The large fr is edible, and may be still improved by cult and careful selection of the best varieties. Many persons do not relish the highly aromatic flavor, and the large seeds are a disadvantage. The tree has proved hardy in Mass. and Ont One or 2 named forms have been offered.

grandiflòra, Dunal. Shrub, 2–6 ft.: lvs cuneate, obovate or oblong, obtuse, 2–4 in. long, rufous-pubescent when young, at length glabrous and chartaceous fls large, appearing with the lvs, outer petals cream-colored, over 2 in. long, much larger than the inner ones: the large fr. is said to be very delicious S. Ga., Fla.

ALFRED REHDER.

ASPÁRAGUS (the Greek name) *Liliàceæ* ASPARAGUS. SMILAX (greenhouse). ASPARAGUS FERN A large genus of herbaceous perennials and tender woody shrubs and vines, grown mostly for ornamental habit and foliage, but one of them (*A officinalis*) for food

Plants provided with short underground rhizomes from which the aerial sts arise in serial order roots often tuberous, sometimes fleshy but long-cylindric as in *A officinalis* sts varying from low herbs to stout woody vines 50 ft or more long. lvs reduced to scale-like bracts usually with a basal spur, often spiny, lf-function performed by special sterile twigs, cladodes (phyllodia, cladophylls, i e, lf.-like branchlets) of determinate growth and of characteristic shape with each species (see Fig 411); fls usually axillary, or terminal, in 1–4's, sometimes umbellate, often racemose on special branches lacking the cladodes, small, perianth 6-parted, stamens 6, free, filament attached to base of perianth lobes; ovary 3-celled, stigma 3-parted (except in Section Kodastigma), ovules 2–6 in locule fr a berry 1-, 3-, 6- or more seeded; seed globose or flat on one side, testa usually black, embryo straight, surrounded by a hard endosperm —About 150 species, all native of the Old World, ranging from Siberia to Cape of Good Hope, usually from dry regions. Monogr. by Baker, Journ Linn Soc 14 (1875); account of cult species by Watson, G.C. III 23·122, 147, 178.



402. Male flower of Asparagus officinalis Typical of Euasparagus The rudimentary ovary is shown.

This large genus is remarkable for its lack of functional leaves, whose place is taken by the leaf-like cladodes which are usually considered as leaves The cladodes are usually borne in fascicles of three to forty in the axils of the leaf-scale; in *A asparagoides* the leaf-like cladode is solitary in the axils. The woody members of the genus often have the base of the leaf-scale developed into a strong spine. In some groups the cladodes are spiny tipped *A stipulaceus* and its relatives (apparently not in cult.) have the side branches developed into thorns

Most of the ornamentals of the genus will not stand frost, but some of the Asiatic forms are perfectly hardy except in the North. Members of this genus furnish the most satisfactory "green" for decorative purposes known to the trade, some of the forms rivaling the finest ferns in their delicate beauty Their ability to hold up for several days without wilting makes the cut sprays of some of the species necessary in some forms of decorative work.



403. Female flower of Asparagus officinalis, showing rudiment of stamen.

Nearly all the species are of easy culture and can be propagated readily by seed which is usually produced in abundance; also propagated by division and in some woody forms by cuttings.

INDEX.

asparagoides, 17.
Blampiedii, 6.
comorensis, 6
compactus, 6, 14
Cooperi, 7
crispus, 5
decumbens, 5
deflexus, 11
drepanophyllus, 13.
Duchesnei, 13
elongatus, 16
falcatoides, 14
falcatus, 15.
filicinus, 3
Hatcheri, 6.
lucidus, 4
madagascarensis, 10
medeoloides, 17
myrtifolius, 17.
nanus, 6
officinalis, 1
plumosus, 6
racemosus, 12
retrofractus, 9
robustus, 6.
sarmentosus, 14.
scandens, 11.
Sprengeri, 14
superbus, 6
tenuissimus, 6
tetragonus, 12.
umbellatus, 8.
variegatus, 14
verticillatus, 2.
virgatus, 16.

KEY TO THE SPECIES.

A. *Lf.-scales with a basal spur or scale. cladodes fascicled in axils of lf.-scales and, when flat, with stomata on both sides.*
  B. *Fls. dræcious fl.-buds axillary and present on young shoots, developing with the cladodes* Section **EUASPARAGUS**
    C *Cladodes filiform*
      D *Plant an erect herb: cladodes terete* . . **1. officinalis**
      DD *Plant a semi-woody vine: cladodes angled* . . . . **2 verticillatus**
    CC. *Cladodes flat, linear or linear-lanceolate*
      D *Berry black, cladodes falcate, ¼ 1½in branches with twigs and cladodes in a horizontal plane fls opening widely an erect herb* **3. filicinus**
      DD *Berry white or pink: cladodes nearly straight, 1–2 in., not in a definite plane: a vine* **4. lucidus**
  BB *Fls perfect, usually appearing after the cladodes or on special branches on the old wood*
    C. *Base of lf.-scale a spur, often a sharp spine fls, when solitary, in axils with cladodes* Section **ASPARAGOPSIS**
      D. *Position of fls axillary or terminal, with cladodes*
        E *Cladodes filiform or 3-angled*
          F. *The fls not umbelled, 4 or less*
            G *Shape of cladodes 3-angled, in 3's fls axillary an herbaceous vine, tuberous-rooted* **5 crispus**
            GG. *Shape of cladodes terete, numerous fls terminal woody vines, not tuberous-rooted branches with twigs pinnate in a horizontal plane*
              H *Lf.-scales white or whitish, spine deltoid: sts slender, smooth* **6. plumosus**
              HH. *Lf.-scales red-brown, spine terete, strong and sharp sts thick, with short pubescence.* **7. Cooperi**
          FF. *The fls in umbels*
            G *Plant a slender green-stemmed vine cladodes 3–8* **8 umbellatus**
            GG. *Plant stiff gray-stemmed shrubby climber cladodes 10–20* . . . **9 retrofractus**
        EE. *Cladodes flat*
          F. *Berry 3-lobed. cladodes lanceolate fls terminal: erect shrub, 1 ft* **10. madagascariensis**
          FF. *Berry globose cladodes linear-falcate: fls axillary: a delicate vine* **11 scandens**
      DD. *Position of fls. in racemes on old wood.*
        E. *Cladodes 3- or 4-angled, flattened* . . **12 tetragonus**

EE. *Cladodes flat, linear or linear-lanceolate.*
F. *The cladodes arranged in horizontal plane on twigs. a long vine* . . 13. **drepanophyllus**
FF. *The cladodes not in one plane.*
G. *Length of cladodes about 1 in.. st. 6 ft or less: spines small* . 14. **Sprengeri**
GG. *Length of cladodes 2–3 in. a rank-growing vine, 20–40 ft* 15. **falcatus**
CC. *Base of lf.-scale appressed, bract-like. stigma capitate fls. solitary in axils without cladodes* Section **KODIASTIGMA** 16. **virgatus**
AA. *Lf.-scales not spurred fls axillary cladodes solitary in axils, flat, lf.-like, stomata only on lower side* Section **MYRSIPHYLLUM** 17. **asparagoides**

1. **officinālis,** Linn ASPARAGUS Figs 402, 403 An erect herb from a woody crown with long fleshy roots sts smooth, much branched above, 4–12 ft. high. cladodes 3–8 in a fascicle, ¼–1 in. long, terete lf.-scale with a short soft spur at base: fls 1–4, in axils with cladodes or branches, campanulate, yellowish green: berries red, ¼–⅜in , 1–9-seeded, seed germinate in 12–14 days in warmhouse, often taking a month when planted outdoors in spring. Eu —The esculent asparagus of the garden, the fruiting sprays with the bright red berries used for decorating The young seedlings developed from a large number of seed planted in a small pot or pan make a very handsome table decoration See *Asparagus, Esculent*


404 Flower of A. plumosus. Typical of Asparagopsis.

. 2 **verticillātus,** Linn. A semi-woody climbing vine from a woody rootstock. roots long-cylindric, fleshy sts stout (½in), 10–15 ft long, edible when young branches green, angled, flexuose cladodes 3–8, ¾–2 in long, angled, filiform, not stiff: lf.-scales of main st developed below into spines: fls. funnel-shaped in 1–4's in axils of lf.-scales berries red, ¼in. diam , 1–3-seeded Persia to Siberia R B 20 154. G W. 14 648 G Z 21:505 —A hardy ornamental climber; grows readily from seed, which germinates in about 3 weeks in a warmhouse, plants slow-growing at first.


405. Asparagus plumosus var. nanus. (×⅓)

3. **filicinus,** Ham. An erect herb with densely clustered fusiform tuberous roots 2–4 in. long: sts. erect, branching: branches with twigs and cladodes in a horizontal plane like *A. plumosus:* cladodes flat, lanceolate strongly falcate, 3–5, of varying lengths, ¼–⅝in.: fls. axillary on long slender pedicels, green; stamens and pistils white; perianth-lobes wide-spreading berry black, ⅜in., 1–3-seeded. India and China. G.C. III. 44:122, 123 —Hardy herbaceous perennial, very ornamental, suggesting a delicate fern in appearance; several wild varieties.

4. **lūcidus,** Lindl Semi-woody climber, 6–10 ft , few main branches roots tuberous, 2–6 in. long cladodes 3–5, flat curved linear about 1 in long: lf -scale on main st. with a short spine: fls small, white, 1–4, in axils with cladodes: berries pink or white, ¼in. diam. China, Japan and Formosa. A.G. 13:78.—Probably hardy in most of U. S. Tubers edible.

5. **crispus,** Lam. (*A. decúmbens,* Jacq., and Hort.). Roots tuberous, short, densely clustered about crown: sts herbaceous, green, weak, climbing or drooping, 3–6 ft , much branched: branches deflexed, and zigzag lf -scale developed below into a weak spur: cladodes 3, 3-angled, reflexed, about ¼–⅜in long. fls. on slender drooping pedicels, axillary, solitary, or in pairs, white, sweet-scented, resembling the fls of *A. asparagoides:* berry white or pink, ½in , several-seeded, seeds small, black. S. Afr. A F. 16.825 —Easily grown from seed or prop. by division; a beautiful plant for hanging-baskets This species is often sold under the name of *A scandens deflexus,* Baker, which has flat cladodes and 1–3-seeded; red berries

6 **plumōsus,** Baker ASPARAGUS FERN Fig. 404. Woody, tall climbing vine: roots not tuberous, long, slightly fleshy: sts terete, green, glabrous branches with twigs and cladodes arranged in a horizontal plane, making a compound pinnate frond, triangular in outline: cladodes numerous, 8–20 in a fascicle, ¼in. or less long, slender, terete, bright green: lf -scale white or gray, on main st. developed be ow into a woody deltoid spine: fls 1–4 at ends of twigs, white, perianth-lobes spreading obovate, blooming in autumn berry 1–3-seeded, purple-black. S. Afr. F 1882 101 F R. 4:93. F S. 2413–14 G 25.110. G C. II. 13 749, III 23:146. G.Z. 25·2 A F 11 1178 —A popular decorative plant now almost superseded by some of its varieties. The cut sprays and strings of *A plumosus* and its varieties are used in large quantities by florists on account of their beauty and keeping qualities Most of the forms are prop. by seed or division but some are readily increased by means of cuttings. Var **comorénsis,** Hort (*A comorénsis,* Hort) Similar to *A. plumosus* but more robust cladodes lighter green, more open and delicate in their arrangement frond widely triangular, very regular A F 18.684 F E 14·462. F R 9:877. G C. III 23:181. Gng 10 295 I H. 42.61 S.H 1:84 V 20 101 Var **nānus,** Hort Fig. 405 The common commercial variety of the species cladodes more numerous and shorter than type, making the horizontally spreading fronds more dense: sts. often short, making a short spray rather than a vine easily reproduced by seed, which germinate in three weeks Var **tenuissimus,** Hort. (*A. tenuissimus,* Hort). Fig 406. A wiry stemmed variety with fewer cladodes longer than in type and not so much in a horizontal plane, distinctly glaucous blue-green; not a strong climber. Var. **robústus,** Hort. A ranker-growing vine with shorter cladodes than type, side branches making longer and more irregular fronds than *A. plumosus nanus,* a duller green. *A plumósus supérbus,* Hort , *A. Blámpiedii,* Hort , and *A Hátcheri,* Hort. (F.E 31:935), are all botanically closely related if not identical with *A. plumosus robustus* and with it are separated from the other forms of the species by their stronger growth and by the much less regular arrangement of the cladodes and twigs into a horizontal plane Var. **compáctus,** Hort. A dwarf form, said to be a hybrid between *A. plumosus nanus* and *A plumosus tenuissimus,* suitable for pot-plants F.E. 16:637 See *Fern, Asparagus.*

7. **Coòperi,** Baker. Roots long, cylindric, more or less fleshy: sts. large, up to ¾in diam and 60 or more ft. long, branching above; main sts and branches dark green, with a soft, very short pubescence: cladodes very dark green, ¼–½in. long, 5–12 in a cluster, much stouter than in *A. plumosus:* final branches with twigs and cladodes making beautiful pinnate fern-like sprays ½–3 ft. long. lf.-scale swollen at base, red-brown,



406 Asparagus plumosus var tenuissimus. (×⅓)

with a strong spine: fls small, white, bell-shaped, sweet-scented: berry about ¼in diam, red S Afr. G Z. 21: 568, 569.—This species is probably the largest one in the genus, its long vines covered with beautiful dark green sprays making a very desirable cover for pillars The side sprays are valuable for cut-green for florists' use and, when removed, a second crop will appear shortly on the old vines

8. **umbellàtus,** Link. A spreading climber or undershrub: sts terete, slender, scabrous, dark green, woody below, branching: branches and twigs often reflexed and pendulous cladodes 3–10, terete, ¾–1 in. long, very dark green: fls in axillary or terminal umbels; pedicels ½in. long, perianth largest of genus, ⅓–½in. spreading, white; segms. elliptic-obtuse; stamens dark yellow: berry globose, yellow to dark red. Canary Isls. and Madeira B M 7733. G C III. 28:379.—The large, sweet-scented fls produced abundantly in midsummer; a good plant for pillar decoration; grows well from seed.

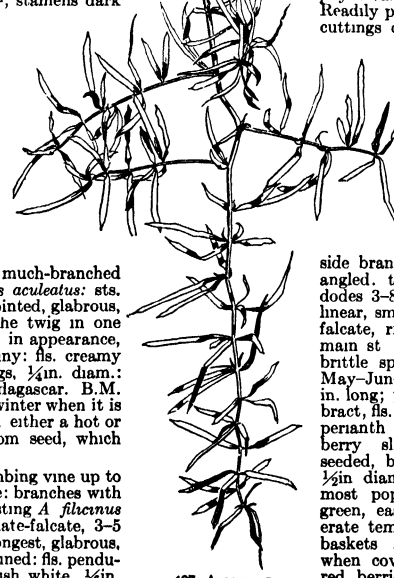
9 **retrofráctus,** Linn (*A. retrofràctus arbòreus,* Hort) Sts. slender (6 or more ft.), becoming woody and gray, scarcely climbing, zigzag, the branches wiry: cladodes in close clusters, green, filiform, about 1 in. long: lf.-scale bases spiny: fls. in umbels small, white: berry small, nearly globose, 1-seeded. S. Afr. Gn. 59:111.

10. **madagascarénsis,** Baker. Erect, much-branched shrub, 1 ft. or more, suggesting *Ruscus aculeatus:* sts. green, angled: cladodes 3, lanceolate, pointed, glabrous, dark olive-green, often arranged on the twig in one plane making a pinnately compound lf in appearance, ⅜–⅝in long: base of lf.-scale not spiny: fls. creamy white, normally in 4's at end of twigs, ¼in. diam.: berry scarlet, 3-lobed, 1–3-seeded Madagascar. B.M. 8046.—A good pot-plant, especially in winter when it is well set with scarlet berries Thrives in either a hot or temperate greenhouse, easily prop. from seed, which are freely produced.

11. **scándens,** Thunb. A slender climbing vine up to 6 ft.: sts. green, branching freely above: branches with twigs and cladodes in one plane, suggesting *A filicinus* somewhat: cladodes flat, long, lanceolate-falcate, 3–5 in.: fascicle ¼–½in. long, central one longest, glabrous, light green: lf.-scale minute, base not spined: fls. pendulous, solitary or paired in axils, greenish white, ⅛in. diam., perianth spreading, segms. elliptic-oblong: berry globose, ⅛in. diam., red, 1-seeded. S. Afr. B.M. 7675. G.C. III 33:339.—One of the weaker-growing kinds of ornamental asparagus, thriving well in an intermediate house. A good decorative plant when grown in strings for table decoration; also good as a pot-plant. Var. **defléxus.** Similar to type but with branches deflexed: cladodes stiffer and smaller: fls. smaller: seed often white. G.W. 5:446; 13:301. *A. crispus* is often sold under this name, but is easily distinguished by its 3-angled cladodes (see discussion under No. 5).

12. **tetragònus,** Bresler (*A. racemòsus tetragònus,* Baker) A climbing vine, 15–20 ft. high: roots tuberous, elliptic, 1–2 in long sts gray to brown, branching above: cladodes 3–8, usually 5, 3–4-angled, ⅓–⅝in. long, dense, more or less falcate. lf.-scale on main st. with a strong recurved basal spine up to ½in. long. fls in racemes 2–3 in long, on old wood; perianth white or pink, ¼in. diam., segms obovate-obtuse; fls. fragrant. S Afr. B.M. 8288 G.C III 23:147.

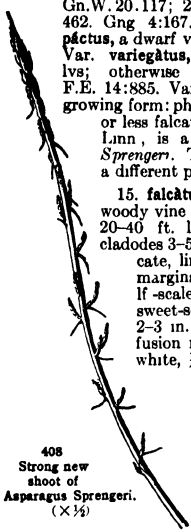
13. **drepanophýllus,** Welw. (*A. Duchésnei,* Linden). A tall climbing woody vine with tuberous roots 2–3 ft. long: sts 20–30 ft long, terete, without main branches: axillary twigs and cladodes making a compound cladophyll from upper axils twigs ½–2 ft. long, thick-set with cladodes in fascicles of 3–5: lf.-scales on twigs 5-ranked but cladodes turned into a horizontal plane: central cladode 2–3 in long, lateral 1½ in, the compound cladophyll suggesting a frond of Asplenium: lf.-base with a strong spine. fls in dense erect racemes, 3–8 in long, pedicels deflexed in fascicles of 3–8; perianth greenish, bell-shaped, not opening widely: berry rare, 3-lobed, usually 1-seeded, ½in diam., bright scarlet, ripe in 90–120 days after the bloom. Oct.–Jan. S. Cent., Afr, Congo region. G C. III 28:305. R B. 28:60. Gng 15:131 A F. 27:1139 —A highly decorative plant; the compound cladophylls valuable in florists' work. Readily prop by division or by cuttings of the twigs taken off with a heel, or piece of the main st attached and put in a sandy soil in a close case with bottom heat.



407. Asparagus Sprengeri. (×⅓)

14. **Sprèngeri,** Regel. Figs 407, 408. Roots tuberous, white, elliptic, not densely clustered. sts. numerous, scarcely climbing, 6 ft. or less: side branches numerous, small, angled. twigs 1–3 in. long: cladodes 3–8, ½–1½ in. long, flat, linear, smooth, pointed, slightly falcate, rich green: lf.-scale on main st with a slender brown brittle spine ⅜in. long: fls. in May–June, in open racemes 1–3 in. long; pedicels 1–2 from each bract, fls. whitish pink, fragrant, perianth wide-spreading, ⅛in.: berry slightly 3-lobed, 1–3-seeded, bright coral-red, up to ½in diam. Natal —One of the most popular plants for cut-green, easily grown in a moderate temp. Plants in tubs or baskets are very ornamental when covered with the bright red berries which ripen about Christmas-time Easily grown

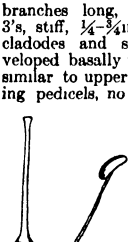
from seed, which germinates in a temperate house in about 4 weeks. The best asparagus for a house plant. A.G. 18:86, 883; 19:101. B M. 7728 (as *A. ternifolius*), 8052. F.E. 9:11. F.R 4:95. G. 21:123. Gn. 54, p. 88; 58, p. 109. G.L. 17:175. Mn. 8, p. 151. Gn.W. 20.117; 23:607. G.W. 4, p 109; 13, p 462. Gng 4:167. G.C. III. 37.10. Var. **compáctus,** a dwarf variety seldom over 18 in long. Var. **variegátus,** a form having variegated lvs; otherwise like the type. Gn. 59.145. F.E. 14:885. Var. **falcatoides,** a large strong-growing form: phylloclades solitary to 5–6 more or less falcate. *A sarmentòsus*, Hort., not Linn , is a short compact form of *A Sprengeri*. The true *A sarmentosus* is quite a different plant and not in cult



408 Strong new shoot of Asparagus Sprengeri. (×½)

15. **falcàtus,** Linn. A large spreading woody vine with stout gray or brown sts 20–40 ft. long, much branched above cladodes 3–5, or more at ends of twigs, falcate, linear-lanceolate, with undulate margins, rich dark green, 2–3 in. long. lf.-scales with stout basal spines sweet-scented fls in loose racemes 2–3 in. long, produced in great profusion in midsummer; perianth pure white, ¼in. diam., segms. lanceolate; stamens yellow fr dull brown Trop. Asia and Afr.—One of the largest and finest species of the genus; thrives under temperate conditions growing outdoors in the absence of frost. G C III. 23 123, 41 82 Ref. Bot 261. G.W. 5.334

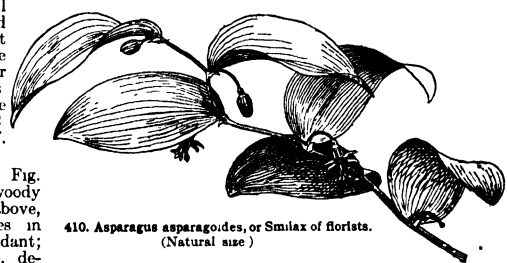
16. **virgàtus,** Baker (*A elongàtus*, Hort) Fig. 409. Roots fibrous, crown with long semi-woody rhizomes. sts. erect (3–6 ft.), much branched above, branches long, straight or drooping: cladodes in 3's, stiff, ¼–¾in. long, angled, not very abundant; cladodes and sts dark green· lf.-scale white, developed basally into an appressed bract-like extension similar to upper part: fls. solitary at nodes on drooping pedicels, no cladodes in axils with fls ; perianth greenish white, wide-spreading, ⅛in diam.; stigma capitate berry 1–2-seeded, dull orange-red, ½in. in diam. S. Afr F E 27:114.— Easily grown from seed, which germinates in 3 weeks, or from cuttings of rhizomes. Not highly ornamental, but of value in decorative work on account of its erect habit.



409. Flower of Asparagus virgatus. Typical of Kodiastigma.

17 **asparagoides,** Wight (*Myrsiphýllum asparagoides*, Willd. *A medeoloides*, Thunb.). SMILAX of florists. Fig. 410. Tall slender glabrous twiner: sts. slender, much branched cladodes single in axils of lf.-scales, ovate, about 1 in. long, usually spreading horizontally. lf.-scale small, not developed into a spur at base· fls. solitary or paired in axils on slender pedicels, greenish white; perianth-lobes spreading or recurved from beyond middle: berries dark purple, 1–3-seeded. S. Afr. B.M. 5584. R.H. 1895: 177. S.H. 1:417; 2:160. Gn. 42, p. 536. G.W. 1, p. 206.—Much grown for florists' use in decorations. Seed small, germinating in about 3 weeks (see cultural notes under *Smilax* in a succeeding volume). Var. **myrtifólius,** Hort. "BABY" SMILAX, an extremely light and elegant variety with much smaller lvs. than the type, becoming popular.

A. acutifólius, Linn. Semi-hardy, becoming a woody shrub in the S , zigzag, branching, 5 ft . cladodes short, stiff, terete, spiny-tipped in fascicles of 5–12, ½in long, fls dioecious, yellow. berry waxy olive-green —A dark green cedar-like ornamental Medit. region —*A. æthiópicus*, Linn Tropical vine: cladodes 3–5 ft., linear falcate, 1–2 in long lf.-base spiny fls. in racemes, near A. Sprengeri S. Afr.—*A. africánus*, Lam Woody semi-climber, spiny: cladodes filiform-terete, stiff, dark green, up to 20 in a cluster 1 in. long fls in umbels. S Afr —*A. álbus*, Linn (A Pastorianus, Webb & Berth). A white-stemmed branching woody shrub, semi-hardy, 3–4 ft high· cladodes densely fascicled, 1 in. long· lf.-scale with a long sharp spine fls in umbels Medit region —Very susceptible to attacks of red-spider G Z 1907 31 —*A. asiáticus*, Linn A tall branching woody vine cladodes numerous in clusters, soft-filiform, ½in. long. fls in umbels S Afr —*A. declinátus*, Linn Allied to *A plumosus* but with cladodes about ½in long: branches slender, drooping fls axillary, small, white berries 1-seeded S Afr —*A. laricínus*, Burch A woody shrub suggesting A retrofractus but with cladodes 1 in long S Afr G C III 23 122 —*A. lóngipes*, Baker A copiously branched undershrub with subterete slender green cladodes ½–1 in long in whorls of 9–12· fls. axillary, solitary or paired. S Cent Afr —*A. myriocládus*, Hort (A Greenfieldii, Hort) An erect, much-branched shrub, 6 ft., with tuberous roots· st gray· branches zigzag with dense clusters of light green filiform cladodes ¾in long, becoming dark green with age —Very ornamental fls unknown, but it is closely related in type to A. retrofractus Natal G 25.293, 33.435 Gng 12 547 F E. 16 637 The true A myriocladus, Baker, is related to A. Sprengeri and has flat cladodes and racemose fls This species is apparently not in cultivation —*A. oligoclónus*, Maxim Erect, hardy herbaceous perennial suggesting A officinalis cladodes more dense, slender and graceful 1–2 ft fls. dioecious, campanulate N Asia —*A. scoriónides*, Kunth Erect, hardy herbaceous perennial, 1–3 ft roots tuberous cladodes long, 3-angled, flat, ascending fls nearly sessile, dioecious berries red. Japan and China —*A. Siebertanus*, Hort A supposed hybrid between A crispus and A plumosus tenuissimus sts slender, rigid, with slightly curved cladodes Distinct and valuable as a market plant —*A. tenuifólius*, Lam Herbaceous perennial like A officinalis, with very slender, numerous cladodes and large bright red berries S Eu —*A. trichophýllus*, Bunge Hardy herbaceous perennial, somewhat twining, 3–6 ft cladodes like A officinalis, ¼–1 in. long fls. dioecious (long-campanulate) on drooping pedicels N Asia



410. Asparagus asparagoides, or Smilax of florists. (Natural size)

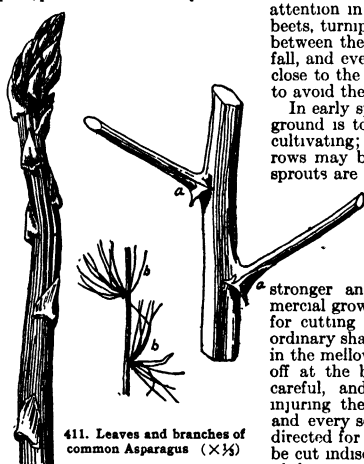
J. B. NORTON.

ASPÁRAGUS, ESCULENT (*Aspáragus officinális*, Linn). *Liliàceæ*. A perennial herb, cult for the succulent young shoots that arise from the crown in spring.

Asparagus is native to Europe. It has been cultivated 2,000 years and more It was known to the Greeks and Romans The so-called lvs. of asparagus are really leaf-like branches The lvs are the scales, which are well shown on the shoot at the left in Fig. 411. From the axils of these scales, branches may arise, *a a*. At *b b* are shown clusters of branchlets, or "leaves," issuing from the axils of scales or lvs.

Being a rugged plant, asparagus will live and in a measure thrive on almost any kind of soil, even under adverse circumstances and when entirely neglected. Occasionally one may find apparently thrifty plants in fence rows, or strong stalks pushing up through stone heaps or other rubbish piled foot-thick upon an old abandoned asparagus bed. Plants on good soil will get so large, and the immense network of roots so well anchored in the soil, that all the strength of a good team may be insufficient to pull them out, and sometimes several years' persistent efforts may be required to clear them out of a piece of ground once used as an asparagus patch. The stalks that the discriminating growers and fastidious consumers want are those an

inch in diameter and deliciously tender and succulent, and these can be grown only on good plants set far enough apart on well-drained, well-manured and well-tilled soil. To secure the choice early stalks that bring the high prices, the land selected for an asparagus patch should be a warm rich loam, preferably exposed to east or south. Manures and fertilizers, also, must be used most lavishly In this respect, many growers fail to obtain best results, such as are within their reach by greater liberality. Unless the soil is already well supplied with vegetable matter and for that reason very loose and mellow, bulky manures, such as fairly well-rotted stable manure or rich compost, are almost or quite indispensable at the start. A heavy dressing is to be plowed under, and should be well and deeply mixed with the soil by replowing and reworking the land. Afterwards concentrated manures, rich especially in nitrogen and potash, will do very well for loose soils, and may be used broadcast on top, as the crop appears to need them from year to year, at least for a while. Even then an occasional, or better, yearly, application of good stable manure or compost, placed in furrows plowed (with a one-horse plow) on each side of the rows after the cutting season or in early fall, will be of benefit or become necessary to keep the yield up to a high mark. To start a plantation in the right way, the selection of good strong one-year-old plants is of much importance. They are usually preferable to the ordinary two-year plants. To grow one's own supply for starting a plantation a year later is usually a safer plan than to depend on purchased plants. The male, or pollen-bearing, plants are often more vigorous and more productive of good stalks than the female or seed-bearing plants; but one cannot very well tell the one from the other unless they bloom, until long after they are already established in the plantation, when it would be impracticable to tear out the less desirable female plants and replace them with the male plants —The seed, obtainable from any regular seed house, is rather hard-shelled and sometimes slow to germinate It is important to give the seedling plants the longest possible period of growth so as to secure the strongest possible plants. It is advisable, therefore, to soak the seed, or give it special treatment or seed stimulation, before sowing it, and to sow it just as soon in spring as a rich mellow seed-bed can be prepared. The rows or drills may be made a foot apart, and seed sown rather thinly. Plants are to be thinned to 3 inches apart at an early age, and weeds should be carefully kept down from the very start. In short, nothing should be neglected to prevent any interference with the rapid and healthy growth of the seedlings, for the future outcome hinges, to a great measure, on a favorable early start.—When getting ready to set the plants, and after the land has been carefully and deeply plowed and harrowed, plow out furrows 4 or even 6 feet apart. It may look like a sinful waste of good land to set asparagus so far apart, but even at 6 feet the roots will fill the soil and reach across the rows, and the fat stalks obtainable by wide planting are worth more in our markets than the inferior ones usually found there. Some markets demand or prefer green stalks which are mainly grown above ground. In that case, make the furrows 5 to 9 inches deep. In other markets blanched shoots are wanted, and these are of superior flavor and tenderness, provided they are grown in mellow soil and under high and skillful culture. In that case, make the furrows a few inches deeper than for plants set for green stalks. Set the plants in the furrows about 2 feet apart, each on a little mound of soil, spreading the roots in the same way as they grew in the seed-bed. Cover with mellow soil to the depth of a few inches, and afterwards, in the course of some weeks and by means of some suitable tools (cultivators, harrows, and the like), gradually fill the furrows even with the ground-level. A still better plan when the material can be had, especially for the home-gardener, is to fill the furrows with fine old compost, wood's earth, leaf-mold, or any other loose and rich material, as the covering above the crowns of the plants cannot be made too loose. It is advisable and will insure closer attention in cultivation, to grow some hoed crop, like beets, turnips, radishes, cabbage, beets, beans or peas, between the rows of asparagus the first year. In the fall, and every fall thereafter, cut the asparagus stalks close to the ground and remove them from the patch, to avoid the scattering of the seed.



411. Leaves and branches of common Asparagus (×½)

In early spring of the second year, the surface of the ground is to be loosened by shallow plowing or deep cultivating; and when the first sprouts appear, the rows may be hilled up to some extent if any of the sprouts are to be cut for use. Under especially favorable conditions a few may be cut the second year It is better for the plantation and its future value, however, if no cutting is done that year. Plants left intact until the third year, and kept in a high state of cultivation, will grow much stronger and be more productive afterward Commercial growers use specially devised asparagus knives for cutting the stalks In the absence of such, any ordinary sharp table or kitchen knife may be used, or in the mellow soil the blanched shoots may be broken off at the base with the finger In cutting, be very careful, and try to avoid cutting later shoots or injuring the crown of the plants The third season and every season thereafter, loosen up the ground as directed for the second season. The shoots are now to be cut indiscriminately and clean, up to the beginning of the green-pea season After that, allow them to grow undisturbed, but continue cultivation, to keep the ground-surface mellow and free from weeds. For market, wash the freshly-cut stalks and tie them in neat, compact bunches of the size demanded in the particular market, using some bright-colored ribbon, or perhaps rubber bands. If to be shipped, especially for longer distances, pack the bunches in moist moss or other material that will keep the stalks fresh

The varietal differences in the asparagus plant do not appear to be very pronounced except in the color of the young shoots, and most of the variations seem to be due to differences in culture and environment rather than to those characteristic of the variety. American seedsmen offer the following as distinct varieties: Colossal (Conover's), Palmetto, Mammoth (Barr's), Columbian (Mammoth Columbian White), Argenteuil (Giant Argenteuil), Bonvallet Giant, Reading Giant.

To save the seed, strip the ripe berries off the stalks by hand, or thresh them off with a flail, put them in a sound barrel or tank, and mash them with a wooden pounder, to separate the hard, black seeds from the pulp. Clean them by washing in plenty of water, pouring off the pulp and skins; then dry and store.

To any person who has even a little land to use for a home-garden, no better advice could be given than to

plant in a corner or at one side of it 50 or 100 asparagus roots for his family, as no other use of that spot, ordinarily, may be expected to give more real benefit, enjoyment and value. The number of roots named will under average conditions give all the stalks that a large family could use, and several times the quantity that a person of ordinary means would feel able to purchase for the family table in the open market. For the market-gardener, especially one with a regular retail trade, few if any vegetables offer equal chances of profit and regular returns and a sure income at a most opportune time (spring).

Enemies —The asparagus rust (*Puccinia asparagi*) has often done considerable damage. Planting rust-resistant varieties is the best procedure. Argenteuil and Reading Giant afford the best relief. Dusting completely with flowers of sulfur when the dew is on, and after the cutting season, is the best remedy; two applications, three or four weeks intervening, are usually sufficient.

Of insect enemies, two have become well known on asparagus plants in America, namely, the common asparagus beetle (*Crioceris asparagi*) and the twelve-spotted asparagus beetle (*C 12-punctata*). The following remedies are recommended: chickens and ducks; close cutting of the young shoots in the early season, and the use of arsenate of lead or of dry arsenites dusted on the dew-wet plants after the cutting period.

The subject of asparagus and asparagus-growing is treated in the following books and bulletins: Asparagus, by F. M Hexamer, Orange Judd Company. Farmers' Bulletin No. 61 (Asparagus Culture), issued by the Department of Agriculture, Washington, D. C. Bulletin No. 151 of the Maryland Station (Fertilizers for Asparagus). Bulletin No. 34 of the Missouri Station (Asparagus and Rhubarb Culture) Bulletins Nos. 165 and 172 of the California Station (Asparagus and Asparagus Rust in California). T. GREINER.

ASPÀSIA (Greek personal name). *Orchidàceæ*. Epiphytic hothouse orchids.

Stems thickened into pseudobulbs, 1- or 2-lvd.: racemes lateral; sepals and petals nearly alike, spreading; lip with the claw adnate to the column, the blade spreading; lateral lobes distinct or confluent with the middle lobe, pollinia 2.—Species about 8, ranging from Cent Amer to Brazil.

epidendroides, Lindl. Pseudobulbs, oblong, 2-edged: lvs. linear-lanceolate: racemes of 2–4 fls.; sepals and petals whitish yellow, streaked with brown; lip white, dotted with purple. Panama. B.M. 3962.

lunàta, Lindl. Pseudobulbs, 2-edged, oblong: lvs. oblong-ligulate, up to 6 in long: fls single, or rarely 2; sepals and petals linear-lanceolate, acuminate, green or yellowish, marked with violet-purple; lip white, marked with purple. S. Brazil.

variegàta, Lindl. Pseudobulbs ovate or oblong, 2-edged: lvs. lanceolate-ligulate, up to 8 in. long: raceme of 2 or 3 fls.; sepals oblong-lanceolate, acute, greenish or yellowish, marked with interrupted longitudinal black-purple lines; petals obovate-oblong, acute, yellowish veined with purple; lip white, yellowish at the base, spotted with purple. S. Amer. B.M. 3679. B.R. 1907.
GEORGE V. NASH.

ASPEN: *Populus.*

ASPERÉLLA: *Hystrix.*

ASPÉRULA (*roughish;* referring to lvs.). *Rubiàceæ.* WOODRUFF. Mostly dwarf hardy herbs, for borders, rock gardens and shady places.

Annual or perennial: sts square: lvs. whorled (some of the lvs. are really stipules): fls. many, small, mostly 4-parted, produced freely from May to July; corolla funnelform, which distinguishes it from the closely related Galium in which the corolla is rotate.—About 80 species in Eu., Asia and Austral.

The commonest species is *A. odorata,* the Waldmeister of the Germans, which is used in their Maitrank, or May wine, and in summer drinks. The dried leaves have a hay-like fragrance, lasting for years, and are often kept with clothes. The plant occasionally escapes from gardens *A hexaphylla,* with its delicate, misty spray, is used with sweet peas and other cut-flowers that are inclined to look lumpy. Other plants for this purpose are *Gypsophila paniculata, Statice latifolia,* and several galiums, all of which have small, abundant flowers in loose panicles on long, slender stems.

In half-shaded and moist soil, asperulas grow very luxuriantly until late fall In dry and sunny places they soon become stunted, and die down before the season is over.

Propagation is by division and by seeds.

A. *Plants perennial: fls white or pink.*

B. *Corollas 4-lobed.*

odoràta, LINN SWEET WOODRUFF. Fig 412. Habit erect or ascending: height 6–8 in. lvs. usually in whorls of 8, lanceolate, finely toothed or roughish at the margin. corollas campanulate: seeds rough Eu and Orient. Eng Bot 2 775 Baxter Brit. Bot 1:46 —Increases rapidly, and is used for carpeting shady places, and for edgings.



412 Asperula odorata. (×1)

Gussònei, Boiss. (*A. suberòsa,* Guss). A glaucous, smooth, usually cespitose perennial suitable only for the rock-garden: lvs. small, in pairs, some ovate-oblong, the rest lanceolate-linear fls at the ends of the branches, the corolla smooth and pinkish, not showy. Sicily —A graceful little alpine.

hexaphýlla, All. Plant-st. glabrous: habit ascending, slender. height 1–2 ft lvs. in whorls of 6, linear, acute, rough: corollas tubular-funnel-shaped panicles very loose; fls. larger than the bracts seeds smooth. Italy, Hungary, Pyrenees on high passes and dry mountain-sides.—Well-grown specimens may be 3 ft. in diam. and nearly as high.

hírta, Ramond. A many-stemmed hairy perennial, suitable for the alpine garden: sts. 4-sided, with verticillate lvs. in 6's: lvs linear, 1-nerved. fls. small, pinkish. Rocky situations in the Pyrenees. July, Aug.

BB. *Corollas often 3-lobed.*

tinctòria, LINN DYER'S WOODRUFF Habit procumbent unless supported. height 1–2 ft , the st. purplish: lvs. linear; lower ones in 6's, middle ones in 4's, uppermost ones in 2's: bracts ovate: fls. reddish on outside: roots large, creeping widely, reddish. Dry hills and rocks of Eu.

AA. *Plants annual: fls. blue.*

orientàlis, Boiss. & Hohen. (*A. azùrea* and *A. setòsa,* Jaub. & Spach. *A. azùrea-setòsa* and *A. setòsa-azùrea,* Hort). Height 1 ft.: lvs. in whorls of 8, lanceolate, bristly: fls. longer than the bracts. Eu. and Orient.

A. cynánchica, LINN. 9–12 in , glabrous: fls corymbose on erect peduncles. lvs 4 to a whorl. Eu and Asia —*A. longiflòra,* Waldst. 6–8 in., weak, glabrous fls. white, yellowish inside lvs 4 to a whorl, linear-lanceolate. Eu.—*A taurina,* LINN 1 ft , erect, smooth: fls. in fasciculately umbelled corymbs, white: lvs 3-nerved, ciliate, 4 to a whorl. Perhaps not hardy N S Eu.
WILHELM MILLER. N TAYLOR †

ASPHODEL: *Asphodeline* and *Asphodelus.*

ASPHODELÌNE (name modified from *Asphodelus*). *Liliàceæ*. Hardy herbaceous plants, distinguished from Asphodelus by the erect and leafy stems.

Asphodelines have long racemes of yellow or white fls. in June and July. All the older species were described under Asphodelus. In 1830, Reichenbach made the new genus Asphodeline for *A. lutea* and others. The only species advertised in Amer. is *A. lutea*, but all those described below are likely to be in cult. Monogr by J. G. Baker in Journ. Linn. Soc. 15:273–278 (1877). There are some 145 species in the Medit. region and the Caucasus

The culture of *Asphodeline lutea* is simple. Any soil will suit. Partial shade is allowable, but flowers are often better in the sun. Propagated readily by division, in spring or the fall.

A. *Sts. leafy up to the raceme*

B. *Fls yellow.*

lûtea, Reichb. (*Asphódelus lùteus*, Linn.). TRUE ASPHODEL of the ancients, or KING'S SPEAR. Height 2–4 ft.: roots thick, fleshy, stoloniferous: lvs. 3–12 in. long; margins rough. racemes 6–18 in. long, 3 in. wide. bracts large, membranaceous, persistent. Italy, Muritania and Algeria to Tauria and Arabia B.M. 773. L.B.C. 12:1102 as *A. taurìcus*.—The best species. A double-fld. var. *flòre-plèno* has been advertised.

BB. *Fls. white.*

taûrica, Kunth. Height 1–2 ft.: roots slender: lvs. 3–9 in. long; margins membranaceous: racemes 6–12 in. long, 1½–2 in. wide: bracts 9–12 lines long, 1½–2 in. wide. Caucasus, Tauria, Syria, Asia Minor, Greece. G.C. III. 21:175.

AA. *Sts. leafy only a third or half the way to the raceme.*

B. *Fls. white. raceme dense.*

globìfera, J. Gay. Height 2–3 ft.: lvs numerous, subulate 5–6 in long, 1–1½ lines broad: racemes dense-fld.: caps. globose. Cappadocia.

BB. *Fls. yellow: raceme lax.*

C. *Bracts large, 6–12 lines long, long-cuspidate.*

tenûior, Ledeb. Height 1 ft.: smaller than *A. lutea*, with finer lvs. and smaller, fewer and paler fls. Caucasus, Armenia, N. Persia. B M. 2626.—Especially distinguished by the stalk being naked at the upper part, below the raceme of fls., and the bracts as short as or shorter than the peduncle.

CC. *Bracts small, 1½–3 lines long, short-cuspidate.*

libúrnica, Reichb. (*A. crética*, Vis., not Boiss.). Height 1–2 ft. lvs 3–4 in. long: racemes weak, 6–9 in. long, when expanded 2½–3 in. wide; stamens unequal. Greece, Crete, Dalmatia, Austria, Italy, not Asia Minor L.B C 10.915 (as *A. cretica*).

brevicaûlis, J. Gay (*A. crética*, Boiss., not Vis.). St. often flexuose, that of all the others here described being erect and strict. Asia Minor, Syria, Palestine, Egypt.

AAA. *Sts leafy only at the base: fls. white: racemes dense.*

B. *Racemes usually simple.*

C. *Height 8 ft.: sts. having lf.-scales.*

imperiàlis, Siehe Tallest species of the genus: fls. large, reddish white: lvs. numerous, forming a large rosette, and also clothing part of the st. Cappadocia. G.C. III. 22:397.

CC. *Height 1½–3 ft.: sts. not having lf.-scales.*

damascèna, Baker. Height 1½–2 ft.: bracts membranaceous, lanceolate, the lowest 9–12 lines long: racemes simple, rarely branched. Mt Lebanon.

Balansæ, J. Gay. Height 2 ft.: bracts scarious, 6–9 lines long. Cilicia. Gt. 46, p. 521. G.C. III. 23:111.

BB. *Racemes much panicled.*

isthmocárpa, J. Gay. Height 2 ft. Cilicia. G.C. III. 23:117. WILHELM MILLER. N. TAYLOR.†

ASPHÓDELUS (Greek name of unknown origin). *Liliàceæ*. ASPHODEL. Hardy herbaceous stemless plants, with white, lily-like fls. in long racemes, fleshy fascicled roots, and firm, linear, radical, tufted lvs.: perianth funnel-shaped; segms. 6, oblong-ligulate, obtuse, equal, with a distinct nerve on the back, and always ascending —Probably a half-dozen species in Medit. region and India.

The asphodel of the ancients, or king's spear, is *Asphodeline lutea*, which see. Homer mentions the asphodel meadows of the dead, where the shades of heroes congregated in Hades. The asphodel in Greek mythology was the peculiar flower of the dead. It has always been a common weed in Greece, and its pallid yellow flowers are associated with desert places and tombs. The word daffodil is a corruption of asphodel. The asphodel of the early English and French poets is *Narcissus Pseudo-Narcissus*. J. G. Baker, in his revision of the genus in Jour. Linn Soc. 15:268–272 (1877), refers forty species of other botanists to *A. ramosus*, the dominant type, of which he makes three subspecies. These subspecies are here kept distinct, for horticultural purposes, as good species. They are the ones first described below. *A. ramosus* and *A. albus* are among the few current trade names in America.

Culture simple; see *Asphodeline*.

A. *Plant perennial: lvs. 3-angled.*

B. *Scape long.*

C. *Racemes simple or sparingly branched.*

álbus, Mill., not Willd. BRANCHING ASPHODEL. Bracts buff-colored when young: filaments deltoid at the base· caps medium-sized, 5–6 lines long, subglobular or ellipsoid S. Eu.

cerasíferus, J. Gay. Bracts pale yellow: filaments wedge-shaped at the base, but rapidly becoming awl-shaped· caps large, 8–10 lines thick, flattish globular, umbilicate. W. Medit. region.

CC. *Racemes much branched or panicled.*

comòsus, Ford. Radical lvs. sword-shaped, 1–1½ ft. long, acutish, sharply keeled on the back: panicle branched, the terminal racemose cluster 2–3 in. diam.; petals white, ⅝–¾in. long. Himalayan region.

tenuifòlius, Cav. (*A. microcárpus*, and *A. æstìvus*, Reichb.). Bracts pale yellow at first: filaments 4-angled at the base: caps. small, 3–4 lines long; obovoid-globose. Medit., Canary Isls.

BB. *Scape short, almost wanting.*

acaûlis, Desf. Lvs. 6–20, in a dense rosette, 3–4 in. long, minutely pubescent: fls. 6–20, in a crowded corymb; segms. of perianth 2–3 lines wide. Algiers. B.M. 7004.

AA. *Plant annual: lvs. cylindrical, hollow.*

fistulòsus, Linn. Height 16–20 in.: lvs. 12–30, in a dense rosette, 6–12 in. long, striate, awl-like, glabrous: segms. of perianth 1–2 lines wide, lined with pink: buds pink: fls. pinkish. France and Portugal to Syria, Arabia and Afghanistan B.M. 984. L.B.C. 12:1124. —Needs protection under glass in winter. If removed early in autumn to a greenhouse, it may be induced to seed freely.

A. crèticus=Asphodeline liburnica.—*A. lùteus*=Asphodeline lutea.—*A. Villársii*, Verl., is a form of A. ramosus, from E. France, with long, dense racemes and dark brown bracts.

WILHELM MILLER N. TAYLOR.†



XII. Asparagus, variety Colossal.

ASPIDÍSTRA (Greek, *a small, round shield;* referring, probably, to the shape of the stigma). *Liliàceæ.* A popular florists' plant, grown for its stiff, shining, beautiful foliage, which is sometimes striped.

Leaves all radical, many, long, gradually narrowed into petiole, the rhizome thick and sometimes creeping· fls. inconspicuous and borne close to the ground, perianth wide-campanulate, 8-lobed; stamens 8, attached on the tube, the filaments very short; ovary 4-celled: fr. a globose indehiscent 1-seeded berry — Three or 4 species in Himalaya, China and Japan. The casual observer never suspects that Aspidistra is a liliaceous plant The parts of the fl. in monocotyledons are typically in 3's. The genus Aspidistra is considered abnormal, as usually having its parts in 4's. This tetramerous state (which is here considered the normal one, and described below) is pictured in B.M. 2499, but the species was first described upon a trimerous state, and pictured in B.R 628. In *A. lurida*, the trimerous state must be regarded as an exceptional reversion: in *A typica*, B.M. 7484, the trimerous state is thought to be constant.

Aspidistra is invaluable to the florist in decorative work, owing to its ability to withstand rough usage, dust, heat, cold and drought The foliage is very useful when cut for mixing with amaryllises when they are used as cut-flowers, lasting for weeks in good condition, for such purposes the aspidistra may be planted under greenhouse benches in waste places for the production of leaves alone The variegated variety is often seen, but a poor soil must be used or the variegation will speedily disappear. To increase the plants, divide in early spring when repotting, shaking out the old soil from the roots and separating the leaves, putting several in a pot of a useful size, a 6-inch being large enough to hold a number of leaves and their roots. (E. O Orpet)



413. Aspidistra lurida var. variegata.

lûrida, Ker-Gawl (*A clàtior*, Hort. *A. punctàta*, Lindl). Fig 413. Lvs 15–20 in long, stiff, evergreen, oblong-lanceolate, sharp-pointed, radical, blade narrowed into a channeled petiole a third of its length: fls lurid purple, on short 1-fld scapes, perianth segms. 8; stamens 8; stigma broadly shield-shaped, like a small mushroom China B R. 977 Var **variegàta,** Hort, has alternation of green and white stripes, no 2 lvs being exactly alike —In Fla, the aspidistra makes beautiful dense specimens in unheated plant-sheds It thrives in sunshine when growing along the edges of ditches and flowing water

A. typica, Baill Rootstock creeping· lvs elliptic-lanceolate, long-petioled, about 7-nerved fls greenish or whitish, speckled with red, purple inside, trimerous. China. L. H. B.†

ASPÍDIUM: *Dryopteris* and *Polystichum*

ASPLENÉNDRIUM: *Thamnopteris*

ASPLÈNIUM (Greek, *not the spleen;* referring to supposed medicinal properties). *Polypodiàceæ.* A large, widely distributed genus of ferns, containing some 200 species. Some of them hardy, and many others grown in the greenhouse.

Aspleniums are distinguished by the free veins, and by the elongated sori covered by an indusium, which normally is attached to one side of a vein. The species here included under Asplenium, which have some of the sori curved across the subtending veinlets and certain differences in the internal structure of the st. are placed by many botanists in a separate genus, Athyrium; in the list below, Nos. 10, 25, 26, and 27 belong in this group.

Aspleniums enjoy an abundance of moisture at the roots, but they will turn brown in the winter months in an excessively moist atmosphere. They should be kept in a very lightly shaded position. A good potting material consists of equal parts of rich soil and leaf-mold or peat. The following are some of the most useful commercial kinds. *A. Belangeri*, height 2½ feet; *A. bulbíferum* (including *A laxum*), which grows quickly into a handsome specimen about 20 inches high, and seems to stand the hot, dry American summers better than other species; *A. salicifolium;* and *A. viviparum*, which is dwarf, compact, with lace-like fronds, and easily propagated. For hanging-baskets, *A. flaccidum* is best. The foregoing species and others of like habit develop small plantlets on the surface and edge of pinnæ As soon as these are sufficiently strong, they may be detached, with a small piece of old pinnæ, and pricked into shallow pans, the older part being placed below ground to hold the young plant firmly in position until roots have formed. The best soil for this purpose is composed of equal parts of fresh garden soil, leaf-mold or fine peat, and sand. Plant very firmly, and place in a shady, moderately moist and close position, where in ten or fifteen days they will make roots. The foregoing ones do best in a temperature of 50° F *A. cristatum* is easily grown from spores, and is very useful for fern-dishes (Nichol N. Bruckner.)

INDEX.

acrostichoides, 33	ebenoides, 5	*parvulum*, 9
Adiantum-nigrum, 20	Filix-fœmina, 32	pinnatifidum, 4
affine, 19	*fœniculaceum*, 22.	platyneuron, 10.
alatum, 6	fontanum, 23,	resiliens, 9.
angustifolium, 14	formosum, 11	*rhizophyllum*, 25.
Baptisii, 18.	fragrans, 22	rutæfolium, 28
Belangeri, 29	Hemionitis, 3	salicifolium, 15
bulbiferum, 24.	*laxum*, 24	serratum, 1
caudatum, 16.	lucidum, 17	spinulosum, 34
cicutarium, 26.	myriophyllum, 25.	tenerum, 12
Colensoi, 13.	Nidus, 2.	*thelypteroides*, 33.
cristatum, 26.	nobilis, 31	Trichomanes, 8
cuneatum, 21.	*obtusilobum*, 27.	*Veitchianum*, 12.
dimorphum, 30.	oceanicum, 27.	viride, 7
ebeneum, 10.	*palmatum*, 3.	viviparum, 31.

A. *Sori linear or oblong, straight, borne on the back of the lf.* (*Nos. 1–26.*)

B. *Lf. simple, with a serrate margin.*

1. **serrâtum,** Linn. Lf. 1–3 ft long, on a very short stalk, 2–4 in. wide, gradually narrowed below: sori 1 in. or more long Fla. to Brazil.

2. **Nìdus,** Linn. (*Thamnópteris Nìdus,* Presl. *A.* and *T. Nìdus-àvis,* Hort). BIRD'S-NEST FERN. Fig. 414. Much like the preceding in size and habit of growth, but with entire margined lvs. and with the veins partly united to form a net.

BB. *Lf. lobed or pinnatifid.*

3. **Hemionìtis,** Linn. (*A. palmàtum,* Lam.). Lf. 4–6 in. each way, hastate, with a triangular terminal lobe and 2 lateral ones, and a large, rounded sinus at the base: sori often over 1 in. in length. Spain, Canary Isls. S 1:586.

4. **pinnatìfidum,** Nutt. Lvs. clustered, from a short rootstock, 3–9 in. long, with mostly rounded lobes at the base and terminating in a slender point; texture thick, herbaceous; occasionally rooting at the tip. Pa. to Ala. S. 1:628.

5. **ebenoìdes,** R R Scott. Texture thin: lvs. 5–10 in. long, with a few irregular divisions near the base, and a long, slender, much-incised apical portion, occasionally rooting at the apex. A very rare native fern —One of the very few definitely proved fern hybrids, its hybrid name being *A. platyneuron* × *Camptosorus rhizophyllus.*



414 Asplenium Nidus. (×$\frac{1}{10}$)

6. **alàtum,** HBK Lvs 1¼–2 ft long, the stalks 4–6 in. long, winged above, the blades 1–1½ ft. long, 3–4 in. broad, deeply pinnatifid, the rachis winged throughout, the lobes 1–1¼ in. long, ½–¾in. broad, herbaceous.—W. Indies and S. Amer.

BBB *Lf. once pinnate.*

C. *Pinnæ less than ¾in. long, blunt.*

D. *Rachises greenish.*

7. **vìride,** Hudson. Lvs 3–8 in long, scarcely more than ½in. wide, with numerous rather distant lfts., which are ovate and deeply crenate· sori abundant, oblique. A subalpine species of N. Eu. and N. Amer. S. 1:661.

DD. *Rachises purplish or blackish.*

8. **Trichómanes,** Linn Lvs. densely clustered, 3–8 in. long, ⅛in. wide, with densely crowded oval lfts. which are slightly crenate on the upper side and suddenly narrowed at the base. Northern hemisphere generally. A G. 13:653. S. 1:653. Gn. 59:318 (as *A. incisum*).

9 **resíliens,** Kunze (*A. pàrvulum,* Mart. & Galeotti). Lf. 5–9 in. long, with 20–30 pairs of mostly opposite lfts., which are ¼–⅜ in. long, rounded at the outer margin and squarely truncate at the base. Southern states and Mex.

CC. *Pinnæ ¾–1 in. long, with a strong auricle at the upper side of the base or deeply incised on the upper margin.*

10. **platyneûron,** Oakes (*A. ebenèum,* Ait.). Lvs. 6–15 in. long, with 30–35 pairs of lfts. which have an enlarged auricle at the upper side at the base, the lower lfts. reduced to mere triangular auricles· sori, when mature, covering the entire surface. Canada to S. Amer. A.G. 13:654. S. 1:535.

11. **formòsum,** Willd. Lvs. 12–16 in. long, with numerous alternate pinnæ which are mostly deflexed, with the upper margin deeply incised and the lower margin toothed. sori 3–5 to each lft. Trop. Amer. S. 1:576.

12. **ténerum,** Forst. (*A. Veitchiànum,* Hort.). Lvs. 1–1¼ ft. long, the stalks 4–6 in. long, gravish, the blades 8–15 in long, 3–4 in. broad, 1-pinnate with 10–20 pairs of stalked pinnæ, the pinnæ 1–1½ in long, ¼–⅜in. broad, rounded, toothed, inequilateral, usually auricled. Asia, Malaya.

13. **Colénsoi,** Col. Stalks 3–4 in. long, with small scales: lf.-blades 4–5 in long, 2 in. broad; pinnæ numerous, spreading, the lower pinnatifid auricled, on stalks ¼–½in. long. New Zeal.

CCC *Pinnæ 2–6 in. long, linear or lanceolate.*

14. **angustifòlium,** Michx. Lvs 18–24 in long on stout stalks, 4–6 in. wide, with 20–30 pairs of nearly sessile pinnæ, which are truncate at the base and extend to a tapering point, fertile pinnæ narrower and more distant. Moist woods northward. S. 1.496

15. **salicifòlium,** Linn Lvs 12–18 in long, with about 20 distinctly stalked horizontal pinnæ, which are wedge-shaped at the base, and curve upward to a long point· sori strongly oblique to the midrib, wide apart, not reaching either margin or midrib. W. Indies to Brazil.

16. **caudàtum,** Forst. Stalks 4–6 in. long, densely clothed with fine fibrillose scales. blades 12–18 in long, 4–8 in broad, with 20–30 pairs of pinnæ, the pinnæ 3–4 in long, ½–1 in broad, acuminate, deeply toothed, auriculate above Polynesia, Malaya.

17. **lùcidum,** Forst Stalks 3–6 in long, grayish, densely clothed with large gray scales, the blades 1–2 ft. long, 4–8 in. broad, oblong, or ovate-deltoid, with a terminal pinna and 15–20 pairs of lateral pinnæ, pinnæ 4–6 in. long, 1–1½ in. broad, acuminate, toothed. New Zeal.

BBBB. *Lf 2–4 pinnate.*

C. *Ultimate divisions linear or cuneate venation somewhat fan-shaped. texture thick.*

18. **Báptistii,** Moore. Lf. bipinnate, with broadly ovate pinnæ 5 in or more long, each with about 4 stipitate linear toothed pinnules; sori nearly parallel with the midvein and close to it, rachises scaly, with purplish lined scales. South Sea Isls.

19. **affìne,** Swartz Lf. 9–18 in. long, with numerous pinnæ on either side, the lower ovate deltoid, the upper lanceolate, pinnules incised: sori linear. Mauritius and Ceylon to E. Indies.

20 **Adiántum-nìgrum,** Linn. Stalks brownish, lvs. 3-pinnatifid from winged rachises, triangular, 5–9 in. long; ultimate divisions ovate, sharply incised and serrate on both sides. Old World generally. S. 1:486.

21. **cuneàtum,** Lam Lvs. 12–16 in. long, 4–6 in. wide, tripinnate below, the ultimate divisions broadly obtuse above and strongly cuneate below· sori linear, usually long for the size of the segms. Tropical regions generally.

22. **fràgrans,** Swartz (*A. fæniculàceum,* Kunth) Lvs. 2–3-pinnate; ultimate segms. lanceolate, sharp-serrate above; veins simple or the lowest forked: sori

oblong, extending from midrib to near base of the lobes: petiole brownish, rachis flattened. W. Indies. S. 1:577.

cc. *Ultimate divisions rhombic, sharply spinulose: texture herbaceous.*

23. **fontànum,** Bernh. Growing in dense clusters: lvs. 3–6 in. long, 1 in. or more wide, 2-pinnate; segms. with 2–5 spinulose teeth which are widely divergent: sori at maturity covering nearly the entire surface of the segms. England and Spain to the Himalayas. S. 1:574.



415. Asplenium myriophyllum. (×¼)

ccc. *Ultimate divisions longer, not spinulose: texture membranous or herbaceous.*

24. **bulbíferum,** Forst. (*A. láxum,* Hort). Lvs. 1–1½ ft long, 6–8 in. wide, 3-pinnatifid, pinnæ tapering to a slender toothed point: often bearing bulbs from which new plants originate while still attached to the lf. Afr and Australasia. S. 1:508. Gn. 72:156.

25 **myriophýllum,** Presl. (*A. rhizophyllum,* Kunze). Fig. 415. Growing in extensive tufts, with grayish brown stalks and rachises: lvs 6–15 in long, 3-pinnate or 4-pinnatifid, the ultimate segms. frequently deeply 2-lobed with a single sorus to each division. Fla. to S. Amer.

26 **cristàtum,** Lam (*A cicutárium,* Swartz). Lvs. 3-pinnatifid with a winged rachis, 8–18 in. long, pinnules ovate, with 5–7 narrow divisions, each bearing a single sorus; texture thin, membranous. Trop. Amer., rare in Fla

AA. *Sori linear, marginal or submarginal, on narrow, linear, ultimate divisions of the lf.* (*Darea.*)

B. *Lvs bipinnatifid, less than a foot long.*

27. **oceánicum,** C Chr (*A obtusilobum,* Hook., not Desv). Lvs 4–7 in long, 2 in. wide or less, with about 10 pinnæ, which are made up of 5–7 narrow segms bearing occasional sori in the outer margin of the segms. New Hebrides and Fiji Isls S. 1.625.

BB. *Lvs. 2-pinnate or 3-pinnatifid, over a foot long.*

C. *Pinnæ short, with close segms.*

28. **rutæfólium,** Kunze. Lvs. 13–15 in. long, with 12–20 pinnæ on each side, each with 7–11 narrow segms., 2 or 3 of the lower ones 2-fld. or rarely 3-fld. S. Afr., India and Japan.

29 **Belángeri,** Kunze. Fig. 416. Lvs. 15–18 in. long, 3 in. wide, with numerous horizontal pinnæ on each side, cut into about 12 slender linear segms. on either side, which are set nearly at right angles to the rachis; the lower basal segms. often forked. Each segm. has a single sorus, and 1 vein. This species is thought by some fern students to be merely a divided variety of *A. tenerum,* Forst. (No. 12). In general the two species are much alike. E. Indies.

30. **dimórphum,** Kunze. Stalks 6–12 in long, naked: blades 2–3 ft. long, 12–15 in. broad, ovate-deltoid, 2–3 pinnate; sterile lvs. 2-pinnate, segms. ovate 1 in. long, ½in. broad, bluntly toothed; fertile lvs. 3-pinnate, segms. linear, each with a single sorus. Norfolk Isl.

CC. *Pinnæ longer, with scattered narrowly linear segms.*

31. **vivíparum,** Presl. Lvs 15–24 in. long, 6–8 in. wide, on rather short stalks with pinnatifid pinnules and ultimate segms, which are narrowly linear and often forked: plant often bulb-bearing, like *A. bulbíferum.* Mauritius and Bourbon. Cult. under various names. S. 1:662 **A. nóbilis,** Hort., is a more vigorous variety, originally from New Guinea.

AAA. *Sori more or less curved, sometimes horseshoe-shaped: lvs ample, 2–4-pinnatifid.*

32. **Filix-fœmina,** Bernh. Lvs. 1½–3 ft, broadly ovate-oblong, bipinnate, pinnæ 4–8 in. long, lanceolate, with numerous more or less pinnately incised or serrate segms Eu. and N Amer —Very variable, especially in cult. Schneider describes 56 varieties

33. **acrostichoides,** Swartz (*A thelypteroides,* Michx.). Lvs 1–2 ft. long, on long, straw-colored stalks, 6–12 in. wide, 2-pinnatifid, with linear-lanceolate pinnæ; segms. crowded, oblong, minutely toothed. sori 10–12 to each segm. Rich soil in the E. U. S. S 1·651

34 **spinulósum,** Baker. Lvs. 9–12 in. each way, deltoid, 3–4-pinnatifid, with 9–12 pinnæ on either side, the lowest much the largest; segms short and sharply toothed. China and Japan.

Supplementary list of less common trade names: *A. aculeátum,* Hort Hab (?) —*A arbóreum* See Diplazium —*A. bifidum*= A. lineatum —*A decórum,* a sport from A bulbiferum —*A decussátum* See Callipteris —*A ellípticum,* Hort, a trade name —*A flóccidum,* Forst Coolhouse basket fern from Austral, Tasmania and New Zeal Lvs 2–3 ft long, 4–8 in broad, stipes stout, flexible, greenish, naked, pinnæ, numerous, close or distant, lanceolate, leathery, 4–8 in long, ½–¾in broad Very variable —*A. Goringianum* var *pictum,* Mett (Athyrium Goringianum var. pictum, Hort) Distinguished from all other members of the genus by the bright color of its entirely deciduous lvs, which are 10–15 in long, spear-shaped, and pendulous. Possibly the only hardy variegated fern It, however, needs glass protection for best results Stalks purple or claret-colored lvs green with a central band of gray, lfts divided into sharply toothed pinnules on which the oblong or kidney-shaped sori are arranged in 2 rows parallel to the midvein Japan —*A laceratum,* Desv Allied to A Nidus and possibly a variety of that species Lvs narrower, cut into irregular lobes, each lobe having black stripe about 3 in long Brazil — *A lánceum* See Diplazium —*A Lauréntii,* Christ. var *denticulátum* Allied to A macrophyllum but smaller Congo —*A. lineátum,* Swartz. Warmhouse species from Mauritius and Bourbon, is very variable, running into forms with lfts. again pinnate, which have either small, linear pinnules or these again twice cut. lvs 1–2 ft long, 4–6 in wide stalks erect, 6–9 in long, more or less scaly —*A. longissimum,* Blume The best of all the genus for large baskets. Lvs. 2–3 ft. long, 4–6 in. broad: stalks blackish, 3–12 in.



416. Asplenium Belangeri. (×¼)

long· lfts. sessile, auricled E Indies. S. 1·602 —*A macrophyllum,* Swartz. Coolhouse species from Polynesia, Malaya, China, and Himalayas Lvs. 6–18 in long, 6–12 in wide· stalks brownish: lfts. 6–12 pairs, stalked, 3–6 in long, 1–3 in wide, sharp-pointed, serrate.—*A. Shépherdii,* Spreng. See Diplazium.

L. M. UNDERWOOD.

ASPRÉLLA: *Hystrix.* R. C. BENEDICT.†

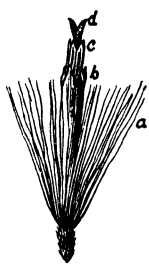
ASTÈLIA (name alluding to epiphytic character of some species). *Liliàceæ.* Greenhouse plants with racemes or panicles of small flowers.

Astelias are perennial herbs of about a dozen species in New Zeal., Austral. and the Pacific Isls., with lvs. all radical or crowded at the base of the st., belonging to the Dracæna tribe· fls. small and dioecious; perianth

6-parted, persistent, the parts spreading or reflexed; stamens 6, attached to base of corolla-parts; staminodia present in pistillate fls, the ovary sessile, 1–3-celled: fr. an indehiscent somewhat fleshy and globose berry. In New Zeal., the astelias form a prominent part of the vegetation. The species are confused. Two or 3 New Zeal. species have been sparingly intro. to cult. abroad, as: **A. Cúnninghamii,** Hook f, with 1-celled fr.: fls. numerous and small, greenish yellow or reddish yellow or maroon: a densely tufted species, epiphytic or terrestrial, with lvs. 2–5 ft. long and scape 1–3 ft. B.M. 5175. **A. Bánksii,** Cunn., with 3-celled fr.: fls. larger (about ¼in. long), many, greenish: densely tufted, large, the lvs. 2–6 ft. **A. Solándri,** Cunn., with 3-celled fr.: fls. very numerous and lemon-yellow, ½in. long: densely tufted, often making large clumps on trees and rocks, the lvs. 2–5 ft. B.M. 5503. L. H. B.

ÁSTER (*a star*). Including *Diplopappus*. *Compósitæ*. ASTER. STARWORT. MICHÆLMAS DAISY. A large temperate-zone genus of attractive but botanically-confused, mostly perennial leafy herbs, particularly abundant in North America; very useful for border planting

The genus is characterized by numerous flattish rays (white, blue, red, or purple), slender subulate or lanceolate style appendages, compressed several-nerved achenes, and an involucre with unequal bracts in few or several rows, the pappus simple, soft, and abundant (Fig. 417); leafy stemmed, mostly blooming in the autumn: lvs. always alternate. It differs from Erigeron in having 2 to several rows of involucrate bracts; in Erigeron there is only 1 series of bracts



417. Disk floret of Aster. (×3) *a*, pappus; *b*, corolla; *c*, stamens, *d*, styles.

Some of the species are annual, but those in cult are perennial (or rarely biennial). Calimeris and Linosyris, which have yellow fls, a color unknown in aster, are kept distinct in this book.

In North America, where the asters are such abundant plants in the autumn flora, the species are not much known as cultivated plants, most of the specimens seen in gardens being the wild species transplanted. In Europe, however, there are numbers of named garden kinds, some of them derived from American species that have been long cultivated there. *A. novi-belgii* has been particularly productive of garden forms. Many of the garden forms are undoubtedly confused hybrids. The Michælmas daisies are mostly from this species and perhaps also from *A. novæ-angliæ*. Many of the Latin-form garden names are very difficult to place.

The native asters are amongst the very best plants for borders and roadsides. They should be better known. *A. acuminatus* grows well in shade in ordinary soil, not necessarily moist; increases in vigor under cultivation. *A. cordifolius* prefers open or partial shade; improves much under cultivation with good soil. *A. corymbosus* prefers at least partial shade, and will grow even in very deep shade; seeds very freely; does well on dry ledges and in small crevices in rock; very tenacious of life. *A. dumosus* prefers full sunlight and dry situation. *A. ericoides* wants full sunlight and dry situation; will grow in very poor or shallow soil, but does best where roots can penetrate deep. *A. lævis* grows in either full sunlight or partial shade and good soil. *A. novæ-angliæ* will not endure much shade; prefers moist soil, but grows well in ordinary garden situations. Fall-sown seedlings of *A. novæ-angliæ* var *roseus* come practically true to varietal name, though varying in shade of color, and these seedlings bloom later than older plants and at a height of 18 inches, making the plant of value as a late bedding plant treated as an annual. *A. novi-belgii* prefers moist soil; will not endure heavy shade. *A. paniculatus* prefers moist soil, but will do well in rather dry situations; will endure more shade than either of the two above species. *A. patens* wants open or half-shaded places, and good soil; one of the weaker species, often proving short-lived. *A. puniceus* will not endure shade; prefers moist


418. Aster macrophyllus. (×½)

places, but will grow in good soil not over-moist; in dry situations it loses its vigor; spreads rapidly in favored locations. *A. spectabilis* prefers open or partly shaded places; one of the weaker species in wild state, rather short-lived *A. undulatus* wants open or half shade; late-flowering, handsome plant, forming large clumps when allowed to develop. (F. W. Barclay.)

The garden or modified asters undoubtedly deserve more attention in American collections. The beautiful low-growing, vernal alpine asters are little known at present, but are valuable for rock-garden and for bordering purposes. The earliest asters to flower are the Alpine varieties. These are well adapted for floral mass effects, and transplant well, even in an advanced state. There are many garden varieties of asters, among which are Schoene von Ronsdorf, Ultramarin, Beauty of Colwall, Beauté Parfaite, Rosalind and Boule de Neige Alpine asters can be easily raised from seed sown in spring. Seedlings do not flower until the second year. In the garden they require a light rich soil, open exposure and moderate amount of moisture. Plants retain their foliage over winter and for this reason need a more careful covering than the tall-growing classes require. Garden varieties of the latter, as a rule, do better in low and rather moist locations. Here a minimum of care is sufficient. To bring out their full beauty, however, it is necessary to plant them in well-prepared richly manured ground and properly to cultivate, stake and irrigate them. Stock of named varieties must be purchased as plants. Propagation can be effected by division of old clumps, or, if larger quantities are

desired, by cuttings. If distinctness of variety and color is no object, seeding may be employed; sow early in spring, thinly in rows; transplant seedlings in August or early in September and await their coming into flower the following season. (R. Rothe.)

INDEX.

acris, 10.
albus, 1.
alpinus, 1
Amellus, 7.
bessarabicus, 8.
caespitosus, 18
canus, 10
cordifolius, 15.
decurrens, 17.
diplostephioides, 6.
elegans, 15
eminens, 18.
ericoides, 20
Falconeri, 6.
himalaicus, 3.
himalayensis, 3.
Horveyi, 19.
laevis, 17.
macrophyllus, 13.
magnificus, 15
mesagrandiflorus=Erigeron macranthus.
nanus, 10.
novæ-angliæ, 16.
novi-belgii, 18.
Petersianus, 12.
polycephalus, 15.
pyrenæus, 5.
roseus, 16.
Shortii, 14
sibiricus, 9.
speciosus, 1.
subcæruleus, 4
superbus, 1.
tataricus, 12.
Thomsonii, 2.
trinervius, 11.

A. *Old World asters, some of them old garden plants, and somewhat modified by cult. Nos. 1–12*

B. *Sts simple and scape-like, bearing a single fl., sometimes branched in A. Thomsonii.*

C. *Rays purplish or violet.*

1. **alpinus,** Linn. Lvs. entire and spatulate, forming a cluster on the ground, those on the st. small and linear. st. 3–10 in., bearing a large violet-rayed, handsome head. B.M. 199. Gn. 76, p. 122.—In its wild state, the plant also occurs in the Rocky Mts. Valuable alpine or rockwork plant, with fls. varying to pink and white. Var. **speciósus,** Hort., is taller and stronger, with heads 3–4 in. across. Var **supérbus,** Hort. (Gn. 54 328. G. 32:591), is a large and showy form. Var. **álbus** is a beautiful pure white-fld form of the type. G.M. 50:617.

2. **Thómsonii,** Clarke. An erect, sometimes laxly branched herb, with slender, flexuous, hairy branches. lvs. 2–4 in. long, almost clasping at the base: fls. solitary, 1½–2½ in. wide, the rays reddish purple, about 20–30 in each head. Himalaya region. Gn.W. 23:27. Gn. 42, p. 295.—To be treated as an alpine near N. Y. Perhaps better referred to Calimeris.



419. Aster cordifolius. A handsome blue-flowered native aster. (×½)

CC. *Rays predominently blue or lilac.*

D. *Plants low, not over 1 ft. in height.*

3. **himalàicus,** C. B. Clarke (*A. himalayénsis,* Hort.). Similar to *A. alpinus,* but dwarfer: rays lilac-blue, slightly recurved at the tip: sts. 4–12 in., slightly villous: lvs. oblong or elliptic, nearly entire. Himalayas, 13,000–15,000 ft.—Little known in Amer.

4. **subcærùleus,** S. Moore. Erect herb from a tufted mat of foliage with sessile, nearly oblong lvs., all a little hairy: lvs. entire or sometimes slightly denticulate: fls. large, solitary on long stalks, at least 2 in. wide, the rays a beautiful pale blue, the disk yellow; involucral lvs. broadly oblong, ciliate. N. W. India. June. G. 32:449. G.C. III. 38:23. G.M. 48:411. Gn. 68, p. 11.—Needs protection N. June.

5. **pyrenæus,** DC. St. erect, simple, 10–18 in. high: lvs sessile, roughly pubescent, oblong-lanceolate and prominently 3-nerved. fls solitary or 2 or 3 together, at least 2½ in. wide, the numerous rays lilac, the disk-fls. yellow. S. Eu. Aug., Sept.

DD. *Plants 2–3 ft. high.*

6. **diplostephioides,** Benth. Two to 3 ft., soft-pubescent or hairy, the st. simple and solitary: lvs. obovate or oblanceolate, entire but ciliate: solitary head large, inclined, 2–3 in. across, blue or pale purple, very showy. Himalayas. B.M. 6718. J.H. III. 33:262. G.C. III. 48:56. G.M. 35:445.—In the American trade has been misspelled *A. Deplostaphides.* Var. **Fálconeri,** Clarke (*A. Fálconeri,* Hort.), from Cashmir, has very large sky-blue heads.

BB. *Sts. usually branched and several- to many-fld.*

7. **Amèllus,** Linn. St. simple or nearly so, few-fld. or sometimes only 1-fld: lvs. oblong-lanceolate, obtuse, somewhat serrate, more or less 3-nerved, roughish, pubescent: involucre scales oblong, obtuse or nearly so, spreading, in 4–5 rows, heads large, purple. Eu. and



420. Aster novæ-angliæ. One of the best and most showy of native asters. (×⅕)

Asia. Gn. 27, p. 202; 35:172.—Variable, and several well-marked garden forms.

8. Var. **bessarábicus,** DC. (*A. bessarábicus,* Bernh.). Lvs. oblong and attenuated at base: plant taller and larger-fld., deep purple. G. 21, p. 167. Gn. 35, p. 173; 75, p. 511.—Showy and desirable.

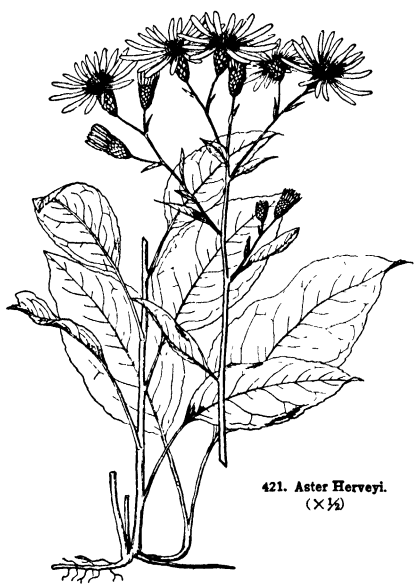
9. **sibíricus,** Linn. A foot or sometimes nearly 2 ft. high, somewhat pubescent, each branch terminating in a single head: lvs. oblong-spatulate to broad-lanceolate, serrate, almost clasping the st.: heads violet or lilac.

Arctic Eu. and Amer., and Rocky Mts.—Excellent rockwork plant.

10. **ăcris,** Linn. About 2–3 ft., slender-branched. lvs. linear, or lance-linear. heads large and blue, with long, distinct, handsome rays. S. Eu. Gn. 37:240. G.M. 34:615.—Excellent showy garden plants A dwarf form is *A. cànus*. Var. **nànus** is a very dwarf form, not exceeding 15 in.

11 **trinérvius,** Roxbg. About 3 ft., stout, corymbose at summit lvs lance-ovate, 1–4 in. long, usually rough on both sides and strongly toothed· heads large, blue or purple (a pale variety) with narrow, spreading rays. Himalayas. R.H. 1892:396.—Hardy, handsome, variable.

12 **tatáricus,** Linn. f. St. erect and striate, hispid, corymbose at the summit, often 7 ft high· lvs large (the radical 2 ft. long), lanceolate or oval lanceolate, attenuate at base, entire. involucre scales purplish at



421. Aster Herveyi. (×½)

tip; heads blue or purple, late Siberia. G.F. 4:197 — Excellent for the hardy border, particularly for its very late blooming Var **Petersiànus,** Hort., has narrower lvs and pale blue rays and yellow disk China

AA *Native Asters* These plants are one of the charms of the American autumn, and are amongst the best of all hardy border plants. They usually improve greatly in habit when transferred to cultivated grounds Any of these wild asters are likely to come into cultivation at any time The number of kinds is large The student will find them all described in Gray's **Synoptical Flora** of North America, 1, pt 2. Those of the northeastern states and adjacent Canada will be found in Britton and Brown's Illustrated Flora of the United States and Gray's Manual Those of the South are described in Small's Flora of the Southeastern States, and those of the Rocky Mountains in Nelson's Manual of Rocky Mountain Botany. The following comprises those known to be in cultivation Of these, *A novæ-angliæ* is the best known in domestication. The species are much confused.

B. *Basal and lower lvs. cordate and slender petioled.*

C *Plant glandular: rays violet.*

13 **macrophýllus,** Linn. Fig 418. Perennial about 2½ ft. tall with reddish angular st.: lvs. cordate and petioled below, on the upper part of st. sessile and acute. rays about 16, violet-lavender, the involucrate bracts prominently green-tipped E N Amer G F 4: 89 (adapted in Fig. 418).—Suitable for dry shady places.

CC. *Plants not glandular: rays blue or purple.*

14 **Shórtii,** Hook Perennial, 3–4 ft., with a rough, usually slender paniculately branched st lvs. thick, usually quite smooth, the lower cordate, the upper lanceolate and quite entire and those of the small branches bract-like heads very numerous, the 10–15 violet-blue rays showy and linear S. E U S G F. 4·473 G C III 32.269.—Cult. easy, even in dry rocky places

15 **cordifòlius,** Linn Fig 419 Perennial, much-branched herb, 3–4½ ft., with a smooth st and thin, rough, usually hairy lvs, the lower cordate, the upper ovate or lanceolate. heads very numerous, not over ½in. diam., the pale blue rays usually 10–20 in number Cent N. Amer Gn.M 3 211 —Can be grown almost anywhere. There are many varieties, the best being var. **polycéphalus** with more heads than the type Gn 40, p 337 —In cult it has varied much and is prized abroad. *A élegans* is probably a form of it. Var. **magníficus** is large with many small fls

BB. *No cordate and petioled lvs those of the st. with clasping bases*

C. *St. rough or hirsute, pubescent.*

16 **nòvæ-ángliæ,** Linn New England Aster. Fig 420 A stout-std corymbosely branched perennial, 3–5 ft. lvs oblong-lanceolate, clasping the st., hairy, 2½–4 in. long fls numerous, showy, the 40–50 violet-purple rays about ½–¾in long E N Amer A F 9·283 —The best and most widely known native aster suitable for open places but partial to moisture. Var **ròseus,** Hort., an excellent rose-colored form, is offered by some dealers Many cult forms in European collections.

CC *St. quite smooth.*

17. **lævis,** Linn. (*A decúrrens,* Hort.) Perennial, with stout often glaucous st., 2–3 ft. lvs thick, sharply toothed, often rough-margined, the upper strongly st.-clasping· heads numerous, about 1 in wide, the 15–30 blue or violet rays acutish N. E N Amer —There are several varieties, but apparently not known to the trade

18 **nòvi-bélgii,** Linn New York Aster Widely variable, slender-std perennial, 2–3 ft lvs lanceolate, or oblong-lanceolate, entire, smooth, 2½–5 in long. heads many, in a corymbose-paniculate infl., the 15–25 rays a rich violet Atlantic coast from Maine to Ga — Suitable for moist places Many garden varieties and hybrids are known, but they are mostly confined to the European trade. *A. émmens* and *A. cæspitòsus* probably belong here.

BBB *Lvs neither cordate nor st -clasping*

19 **Hérveyi,** Gray Fig 421 A rough-std perennial, 2–3 ft., with firm lvs that are rough above, hairy on the veins beneath, 2½–5 in. long, and toothed. heads numerous, about 2 in broad, with 15–25 violet rays, very showy. New England. G F. 2.473 (adapted in Fig. 421). Good for dry sandy soil.

20. **ericoìdes,** Linn. White Heath Aster. Frost-weed Aster A smooth-std. perennial with paniculately, much-branched facies, 2–3 ft lvs. slender, those of the st narrowly linear and acute, not over 2½ in. long, usually shorter· fls. very numerous, the heads not over ¾in. wide, and composed of 15–25 white rays.

Not very showy. E. N. Amer. J.H. III. 49:465. Gn. 32, p 318.—Useful for naturalizing in open dry situations.

Besides these, many other native species are from time to time found in the catalogues of dealers in native plants The most common are:

A. acuminàtus, Michx.; *A. amethýstinus*, Nutt. (G F. 5 378); *A. Andersonii*, Gray; *A. Bigelovii*, Gray (B M. 6430); *A canéscens*, Pursh; *A. carnòsus*, Gray; *A. carolinianus*, Walt; *A. Chamissònis*, Gray; *A. Chápmanii*, Torr. & Gray; *A. commutàtus*, Gray; *A. cóncolor*, Linn. (Mn. 10:161); *A. conspícuus*, Lindl.; *A corymbòsus*, Ait; *A. Cusickii*, Gray, *A. diffùsus*, Ait, and var *horizontàlis; A. Douglasii*, Lindl, *A. Drúmmondii*, Lindl; *A dumòsus*, Linn; *A. falcàtus*, Lindl., *A Féndleri*, Gray; *A foliàceus*, Lindl (*A. foliòsus*, Hort ?); *A. Frèmontii*, Gray, *A. grandiflòrus*, Linn (G.C. III. 45:36), *A Hállii*, Gray; *A. integrifòlius*, Nutt, *A linariifòlius*, Linn; *A. Lindleyànus*, Torr. & Gray (Fig 422), (G F. 2:449, adapted in Fig 422, G M. 34:615); *A. longifòlius*, Lam. (G F. 9 507); *A. Ménziesii*, Lindl; *A multiflòrus*, Ait; *A nemoràlis*, Ait; *A. oblongifòlius*, Nutt; *A. paniculàtus*, Lam, *A pàtens*, Ait, and var *Meehanii*, *A. polyphýllus*, Willd; *A. Pòrteri*, Gray; *A prenanthoides*, Muhl, *A ptarmicoides*, Torr & Gray (G F 3.153); *A. pulchéllus*, Eaton, *A puniceus*, Linn (G.M. 34:615), (Fig 423), and var *lævicaùlis* and var. *lucidulus; A. radulinus*, Gray, *A sagittifòlius*, Willd, *A. salicifòlius*, Ait, *A sericeus*, Vent (G F 5 473), *A spectábilis*, Ait (Mn 5.41), *A. surculòsus*, Michx (G F 5 521); *A tanacetifòlius*, HBK., *A. Tradescántii*, Linn. (B M. 7825), *A. turbinéllus*, Lindl (G F 6:17; Gn. 32, p. 319), *A undulàtus*, Linn; *A. versicolor*, Willd. (J.H. III. 49 309).

In the following list, those marked * are offered by dealers *A brachytrichus*, Franch Dwarf disk-fls yellow, ray-fls. blue. Yunnan, part of China R H 1900 369 —**A coccíneus nevadénsis* =(?) —**A. Dáischii*=(?) —**A hýbridus nanus*=(?) "Rosy color, only 6 in high"—**A lanceifólius californicus*=(?).—**A. dérima*, Hort, white to pink=(?).—**A delicata*, Hort, pale flesh-color=(?).—**A. gracillimus*, Hort, white changing to rosy pink =(?) —*A Ibèris*, of gardens 20 in. high, of compact even growth fls rich blue Probably a form of Amellus —**A lilacinus nevadénsis* =(?) —*A Linosýris*, Bernh =Lynosyris vulgaris, Cass, which see. —**A mésa grándе speciósa grandiflòra*, dark purplish blue=(?) B 36 117 —**A Meéhanii*, Hort, is a well-marked form of A patens, found by Joseph Meehan at Antietam —**A nóvæ-cæruleus*=(?) —**A pyramidalis*=(?) —*A Reèvesii*, Hort, is A ericoides var Reevesii, Gray, a "rigid form, comparatively stout, glabrous, except that the lvs are often hispidulous-ciliate toward the base the heads and rays as large and the latter about as numerous as in A polyphyllus" N Amer —**A rotundifólius*, Thunb =Felicia —*A sikkiménsis*, Hook Three to 4 ft, stout and erect lvs lanceolate-acuminate, spinulose-serrate heads purple, in large corymbs Himalayas B M 4557 J F 1, pl 91 —*A Stracheyi*, Hook Stemless and sarmentose, with 1-fld bracted scapes radical lvs spatulate, hairy heads lilac-blue 1 in across Pretty Himalayas B M 6912 G M 31 358 —**A terminalis*=(?) —*A Townshendii*, Hook = A Bigelovii, Gray. N. Amer

N TAYLOR.†



422. Aster Lindleyanus. (×⅓)



423 Aster puniceus. (×⅓)

ASTER, CHINA (*Callistephus hortènsis*) One of the most popular of all garden annuals, being particularly valuable for its fall blooming.

The evolution of the China aster suggests that of the chrysanthemum at almost every point, and it is, therefore, a history of remarkable variations The plant is native to China It was introduced into Europe about 1731 by R P d'Incarville, a Jesuit missionary in China, for whom the genus Incarvillea of the Bignonia family was named At that time it was a single flower, that is, the rays or ligulate florets were of only two to four rows. These rays were blue, violet or white The center of the flower (or head) was comprised of very numerous tubular, yellowish florets Philip Miller, the famous gardener-botanist of Chelsea, England, received seeds of the single white and red asters in 1731, evidently from France; and he received the single blue in 1736 In 1752 he secured seeds of the double red and blue, and in 1753 of the double white At that time there appears to have been no dwarf forms, for Miller says that the plants grew 18 inches or 2 feet high Martyn, in 1807, says that, in addition to these varieties mentioned by Miller, there had then appeared a "variegated blue and white" variety The species was well known to American gardeners at the opening of the last century In 1806 M'Mahon, of Philadelphia, mentioned the "China aster (in sorts)" as one of the desirable garden annuals.

Bridgeman, a New York seedsman, offered the China and German asters in 1837 "in numerous and splendid varieties," specifying varieties "alba, rubra, cerulea striata purpurea, etc." In 1845, Eley said that "China and German asters" "are very numerous" in New England This name German aster records the fact that the first great advances in the garden evolution of the plant were made in Germany, and the seed then used came largely from that country The first marked departure from the type appears to have been the prolongation or great development of the central florets of the head, and the production of the "quilled" flower. This type of aster was very popular fifty and sixty years ago Breck, in the first edition of his "Flower Garden," 1851, speaks of the great improvement of the aster "within a few years" "by the German florists, and others," and adds that "the full-quilled varieties are the most highly esteemed, having a hemispherical shape, either a pure white, clear blue, purple, rose, or deep red, or beautifully mottled, striped, or edged with those colors, or having a red or blue center" About sixty years ago the habit of the plant had begun to vary considerably, and the progenitors of our modern dwarf races began to attract attention The quilled, high-centered flower of a generation or more ago is too stiff to satisfy the tastes of these later days, and the many flat-rayed, loose and fluffy races are now most in demand, and their popularity is usually greater the nearer they approach the form of the uncombed chrysanthemums.

The China aster has long since varied into a wide range of colors of the cyanic series—shades of blue, red, pink and purple. The modern evolution of the plant is in the direction of habit and form of flower. There are various well-marked races or types, each of which has its full and independent range of colors. The Comet type (with very flat rays), now one of the most deserving of the China asters, illustrates these statements admirably This Comet form—the loose, open flower with long, strap-like rays—appeared on the market about 1886 or 1887, with a flower of a dull white overlaid with pink. The pink tended to fade out after the flower opened, leaving the color an unwashed white.



424. China aster, the Comet type. (×½)

The rose-colored Comet next appeared, and the blue was introduced in 1890. The first clear white was introduced in America in 1892, coming from Vilmorin, of Paris The Branching types marked a departure. The introduction of the "New White Branching" by James Vick's Sons, in 1893, gave the main impetus to the commercial development of the aster in America. It is probable that more than one-half of all the asters now grown in the United States are of the various Branching varieties The named garden forms of China aster are several hundred. As early as 1895, American seedsmen offered 250 varieties. Some of the forms are shown in Figs. 424–427 For botanical account of the China aster, see *Callistephus*.

It is impossible to construct a satisfactory classification of the China asters. It is no longer practicable to classify the varieties by color. Neither is it feasible to classify them upon habit or stature of plant, for several of the best marked types run into both tall and dwarf forms Vilmorin, however, divides the varieties into two main groups, the pyramidal growers, and the non-pyramidal growers. The most elaborate classification is that proposed by Barron, from a study of extensive tests made at Chiswick, England. Barron has 17 sections, but they are not coordinate, and they are really little more than an enumeration of the various types or classes. After consiederable study of the varieties in the field and herbarium, the following scheme seems to be serviceable:



425. China aster, the Branching type

A Flat-rayed asters, in which all, or at least more than 5 or 6 rows of rays, are more or less prominently flat and the florets open
B Incurved or ball-shaped.
BB Spreading or reflexed
AA Tubular or quilled asters, in which all, or all but the 2 or 3 outer rows of florets, have prominently tubular corollas.
B Inner florets short, outer ones longer and flat Represented by the German Quilled
BB All the florets elongated and quilled

A grower's classification (Arnold) would be approximately as follows

Upright.—All the branches erect; plants compact: e. g., Victoria, Truffaut, Giant Comet

Semi-upright —Branches few; strong, ascending from base e g, "non-lateral" type of Branching

Branching —Strong pyramidal habit Original type much branched

Spreading —More open and spreading form than Branching. e. g, Queen of the Market, Early Wonder and Early Hohenzollern

For growing in borders, one of the best types is the Comet (Fig 424), in various colors. Other excellent races are the Branching (Vick's Branching is shown in Fig. 425); Truffaut, known also as Perfection and Peony-flowered; Chrysanthemum-flowered; Washington; Victoria, Mignon, and Queen of the Market. The last is commended for earliness and graceful, open habit, and it is one of the best for cut-flowers Many other types are valuable for special purposes. The Crown or Cocardeau is odd and attractive Amongst the quilled asters, the various strains of German Quilled (Fig 426), Victoria Needle (Fig. 427), and Lilliput are excellent The very dwarf tufted asters are well represented in Dwarf Bouquet or Dwarf German, and Shakespeare. All these are easily grown in any good garden soil. For early bloom, seeds may be started under glass; but good fall bloom may be had, even in the North, by sowing seeds in the open as late as the 1st of June Asters make very showy bedding plants when grown in large masses, and are also valuable for filling up vacancies in the mixed herbaceous border, where they ought to be planted in clumps, the dwarfer kinds put in front and the taller behind. The colors of asters are not so strong or heavy as to introduce violent contrasts, and for this reason, as well as because of their simple requirements, they are useful and popular. L. H. B.

The China aster is now grown largely for cut-flowers, rather than merely for garden decoration Commercially, it is the most important of the cut-flowers that are grown out-of-doors In the garden of the amateur, it divides honors with the sweet pea The commercial value of aster seed sold by American seedsmen exceeds that of any other flower. In addition to the large amount of aster seed grown in southern California, New York now produces annually twenty hundredweight of seed, mostly in varieties used by the commercial florist The principal reasons for the popularity of the aster with florists, aside from its range of useful colors, are its excellent keeping qualities as a cut-flower, its ability to stand rough handling in shipping, and the ease with which it may be grown.



426 China aster of the Quilled type (×½)

The past ten years have been marked by a decided increase in the use of the artistic Comet type of flower. Many asters of American origin, adapted to American market conditions, have been widely disseminated "Non-lateral" strains of Branching asters, devoid of side buds, have been produced to meet a need of the florists, and as a result of careful seed-growing, the semi-double aster has nearly disappeared from field and garden The frequent accidental crossing and re-crossing of widely differing types and a natural tendency toward variation are constantly furnishing material for improvement when asters are grown in quantity and variety Recent introductions of types of asters show increased size and vigor of plant commonly attributed to a more or less remote Branching cross Some of the most valuable introductions, like the Rochester and the Crego Pink, appear to be a combination of a Branching plant and a Comet flower

The Comet aster group has not taken the place, commercially, to which its great beauty would entitle it, because its very long slender petals make it less lasting as a cut-flower than flowers with broader, shorter petals The slender stems usually correlated with this type of flower, although attractive in cut-flowers, are undesirable in the field Beautiful single asters have been introduced from Europe, but so far have made little headway against the American prejudice in favor of double flowers

Classes of asters.

The typical Branching aster is pyramidal in form, large and vigorous, with many lateral branches It blooms at the close of the season. The abundant leaves are broad and large The flower is large and deep with the long, rather broad petals irregularly arranged, giving it a soft appearance The flowers bear well the rough handling incident to ordinary shipping, and if cut before fully mature will last for two weeks The size and vigor of plant enable the amateur to get fair results with indifferent culture Modifications of the original type may now be had with flowers having petals variously folded, incurved or whorled and with plants varying to upright in growth and entirely devoid of the many branches that gave the type its name

The Comet flower is characterized by having petals that are long and narrow and strongly recurved This gives it a charming light feathery appearance Originally it was of medium size and bloomed in midseason on upright plants. Comet flowers may now be had on every sort of aster plant. The season includes the earliest and the latest, and the largest aster flowers now grown are of the Comet type.

Queen of the Market was the first of the distinctively early varieties and is still the most largely grown The plants are open and spreading and the flowers, while smaller and flatter than those of the Branching, have the same general character

Victoria and Truffaut (or Pæony-flowered Perfection) were for many years the standard varieties and are still grown to some extent The plants are upright and bloom in midseason The petals of the Victoria aster are reflexed at the ends; those of the Truffaut aster strongly incurve, making a ball-shaped flower Both varieties comprise every shade of color known in asters, and these are duplicated in Giant and Dwarf classes.

Cultivation.

Asters thrive in any soil that can be kept in a good mechanical condition The large late asters are usually the most satisfactory to the amateur They may easily be grown from seed sown as early as possible in the open ground Asters transplant readily.

If the plants are started in boxes in the house, the soil should be allowed to dry off on the surface as much as possible between waterings to prevent damping off Midseason varieties may be grown successfully in this way; but the very earliest varieties need to be started in a greenhouse or an early hotbed

For market, the extra-early kinds should be sown eight to ten weeks before the soil will permit planting out They should be kept growing thriftily with a night temperature of about 50° and afterward be thoroughly hardened off in coldframes so that they will not be injured by late frosts after planting out The soil should be quite as rich as that used for profitable crops of onions or celery, otherwise the flowers will be too short-stemmed Midseason varieties for market succeed well when started in a mild hotbed Give plenty of air and avoid overwatering The last sowing of late varieties is made in the open ground.



427. China aster, Victoria Needle type. (×½)

When growing in large quantities, the seed is sown with a garden drill in rows a foot apart A transplanting machine, drawn by horses, is used for setting the plants in the field

The most destructive diseases in the commercial cultivation of asters are various forms of stem-rot They are of fungous origin and are induced by allowing the plants to remain moist too long at a time. The infection usually takes place in the seed-row, but often no effect is noticed until the plants are nearly full-grown, when they suddenly wilt and die Covering the soil in the seed-boxes with clean sand, which can be kept dry between waterings, is an effective aid in the prevention of damping-off and stem-rot. The "yellow disease" causes the plants to have a bleached appearance and to make a spindling growth. It is a derangement of the functions of plant-growth caused, so far as known, by irregularity in the moisture-supply Thorough cultivation of the soil is the best preventive The presence of "orange rust" is shown by conspicuous orange-colored pus-

tules on the under side of the leaves The disease can be held in check by thorough spraying with a fungicide. The Pennsylvania blister beetle is so destructive to asters south of the latitude of New York that it is now commonly known as "the aster beetle." It is a large, soft-bodied, black beetle It feeds on the flower. Spraying with an arsenical poison will control the beetles in the field. Frequent hand-picking can be practised in the garden The season of this insect is short. The "tarnished plant-bug" causes extensive damage to asters, most of which is commonly attributed to other causes The inconspicuous yellowish brown insect, smaller than a house-fly, easily escapes notice. The terminal buds that are punctured by the bug, usually die Frequently the branch becomes diseased and sometimes the entire plant is dwarfed and sickened. The insects cannot be poisoned, but kerosene emulsion and whale-oil soap are effectual deterrents. Asters growing in partial shade are seldom injured by plant-bugs.

GEO. ARNOLD.

ASTEROLINOSŸRIS (name derived from *Aster* and *Linosyris*) *Compósitæ* A plant with "rosy-mauve petals, mixed yellow," reputed to be a hybrid between *Aster ácris* and *A. Linosŷris* (*Linosŷris vulgáris*). Apparently a bi-generic hybrid. *Asterolinosŷris Wullmóttiæ* is the only species offered, and apparently not by American dealers.

N. TAYLOR

ASTÍLBE (Greek, meaning *not shining*). *Saxifragáceæ* Includes *Hoteia*. Ornamental perennial herbs grown chiefly for their showy panicles of white or pink flowers

Leaves ternately 2–3-pinnate: fls perfect or dicœious; calyx 5-, rarely 4-lobed, petals as many, rarely wanting; stamens 10 or 8, rarely 5, pistils 2 or 3, distinct or partly connate: fr 2 or 3 dehiscent follicles with many minute seeds —About 14 species in Cent and E Asia, Java and E. N. Amer They look much like Aruncus (which see), and are often called Spiræa Aruncus and Spiræa are rosaceous genera, and are characterized by many stamens and usually by several to many separate pistils, whereas Astilbe has 10, 8 or 5 stamens (twice the number, or of the same number, as the petals), and a 2-3-lobed pistil (which finally separates into more or less distinct follicles). Astilbe and Aruncus are so much alike that they are often confounded by horticulturists.



428. Astilbe japonica.

The astilbes are perennial herbs, mostly rather tall with handsome compound bright green foliage and small white, pink or almost purple flowers in slender or dense spikes forming large terminal feathery panicles.

They are hardy plants of great merit. They are easily grown in any well-made border and like rich good soil and plenty of water during the growing period. They give conspicuous masses of bloom in summer.

Propagation is mostly by division; also by seeds sown early in spring in the greenhouse; they germinate after two or three weeks; the young seedlings must be pricked off several times and later planted out in frames or in the open ground. The young plants will flower the second year

Forcing of astilbe.—Few herbaceous plants force with greater ease than *Astilbe japonica*, and its var *compacta*, but three weeks longer time should be given the latter fully to develop its feathery spikes Astilbes are so easily and cheaply imported that for the commercial florist it is cheaper to buy than to divide and grow his own plants When first received, the clumps of roots should be stored, with a little earth or moss between the roots and a little soil over the crown, until the florist is ready to pot them No amount of freezing does them the slightest harm; but the boxes or flats in which they are stored are best covered with a little straw or litter, and should have the full benefit of rain or snow to keep the roots from drying From potting or bringing into the greenhouse, it requires from ten to fourteen weeks to bring them into flower, according to the earliness of the season at which they are wanted in flower The quality of soil is of no consequence, provided it is light and easily handled They need water in great abundance Temperature is also of little consequence Anything above 50° at night will do, but it is best not to flower them in a higher temperature than 60°, or they will quickly wilt when cut or used for decorations From the time the sprays begin to show white color until they are fully developed, every astilbe should stand in a saucer in which there should be constantly an inch of liquid manure When sold for window plants or for decoration, astilbes are often disappointing It is merely want of water Before the full development of the shoots and leaves, they are easily hurt by tobacco smoke, and should be covered with paper or well wetted when fumigation is necessary Aphis, spider or thrips never trouble astilbe As a border plant, astilbe is one of the best of our hardy herbaceous plants, but the feathery plume obtained in the greenhouse is much shorter, more compact, and lacks the pure whiteness of the outdoor-grown specimens. (Wm Scott.)

INDEX

Arendsii, 11
aruncoides, 6
astilboides, 6
biternata, 2
carminea, 11
chinensis, 8, 10
compacta, 4
Davidii, 10
decandra, 2
floribunda, 6
grandiflora, 4.
grandis, 3
hybrida, 9
japonica, 4
Lemoinei, 5
multiflora, 4
purpurea, 4
rivularis, 1
rosea, 9
rubella, 11
rubra, 12
rutilans, 11
Thunbergii, 7
variegata, 4

A. *Color of petals white or yellowish white (or changing to pinkish in A Thunbergii), rarely petals wanting.*

B *Petals wanting; stamens 5*

1. **rivulàris,** Ham Rhizome creeping st. 3–5 ft : lvs 2-ternate, the lfts ovate, dentate 1–3 in long, the petioles tawny-hairy like the sts at the base fls yellowish white, in large spikes, which are disposed in panicles; stamens 5, pure white Nepal, W China. Gn 48, p 355 —Attractive, border species, blooming late Probably needs protection.

BB. *Petals present at least in the staminate fls.; stamens 10.*

C. *Stamens exceeding the petals tall, 3–6 ft. high*

2 **biternàta,** Brit. (*A. decándra*, Don. *Tiarélla biternàta*, Vent). Somewhat pubescent, 3–6 ft. lvs. 2–3-ternate, the lfts. ovate and cordate or abrupt at base, sharp-serrate, 2–5 in long: fls. yellowish white, in a large (10–12 in. long) racemose panicle; petals linear, spatulate in the staminate fls., small or wanting in the perfect ones. June. Woods, Va. and S. B.B. 2.170.—Often confounded with *Aruncus sylvester*, which has numerous stamens not exceeding the broad petals.

3. grándis, Stapf. St. 4–6 ft.: lvs. ternately pinnate or 3-pinnate, lfts ovate to oblong-ovate, doubly serrate, 2–4 in. long, slightly hairy, petiole hairy panicle 2–3 ft long with spreading branches; fls crowded, petals 3 times as long as calyx, stamens longer than petals. July. Cent. China. G.C. III. 38.426. R.B. 33:232.

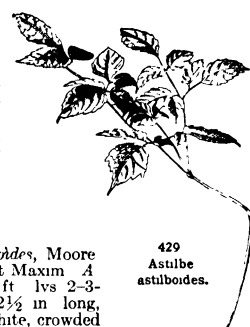
cc. Stamens shorter than petals. st. 1–4 ft.

D. Lfts. distinctly cuneate at the base petals about twice as long as calyx.

4 japónica, Gray (*Holèa japónica*, Morr & Decne. *H. barbàta*, Morr & Decne *Spirèa japónica*, Hort). Fig 428. Erect, 1–3 ft, hairy on the petioles and nodes: lvs. 3–2-ternate, petiole reddish, lfts ovate-acute, tapering to the base, serrate fls white, in a pubescent racemose panicle with somewhat recurved branches, sepals obtusish, as long or slightly longer than pistils. Japan B M 3821. Gn. 48, p 366 Mn 5 174 —Commonly known as a spring glasshouse plant in this country, but hardy in the open There are various cult forms, as var **grandiflòra,** Hort, with larger and denser panicle, var **compácta,** Hort., the panicle more compact, var **multiflòra,** Hort; var **variegàta,** Hort, with variegated lvs, var **purpùrea,** Hort, with purple-shaded foliage.

DD. Lfts. rounded at the base or occasionally broadly cuneate. petals 2½–4 times as long as calyx

5 Lemòinei, Lemoine Foliage graceful, standing 1½ ft. high, with lfts broad-oval, dentate and crimped, satiny green, hairy: fls with white petals and 10 pink stamens, very numerous, in plume-like clusters, disposed in panicles 1½ ft. long Gn 48, p 355 R H 1895, p 567 A F 11 459 —Garden plant, a hybrid of *A Thunbergii* and *A astilboides*. Hardy, and forces well



429
Astilbe
astilboides.

6 astilboides, Lemoine (*Spirèa astilboides*, Moore *Spirèa Aruncus* var *astilboides*, Hort, not Maxim *A aruncoides*, Lemoine) Fig 429 St 2–3 ft lvs 2–3-pinnate, lfts ovate to ovate-oblong, 1–2½ in long, doubly and sharply serrate, hairy. fls white, crowded in dense spikes, forming a panicle, with straight spreading branches, sepals acutish, shorter than pistils, petals linear-oblong, at least 2½ times as long as sepals Intro from Japan. G C II 14.113 —Var **floribúnda,** is supposed to be a cross of this species and *A. japonica*.

7. Thúnbergii, Miq St 1–2 ft.. lvs 2–3-pinnate, the lfts slender-stalked, ovate, 1½–3½ in long, serrate, yellowish green, hairy· fls white, on reddish stalks, often changing to pink, in clusters on rather slender spikes forming a spreading panicle, petals 2½ times as long as the calyx Japan F M 1881 457. R H. 1895, p 565.—A graceful plant Forces well

8. chinénsis, Franch & Sav. (*Holèa chinénsis*, Maxim.). Plant 1½–2 ft, graceful lvs ternately 2–3-pinnate, lfts ovate-lanceolate, doubly serrate, 2–3½ in. long, hairy: fls in a branchy, rather narrow panicle; petals linear-spatulate, white, 3 or 4 times as long as the yellowish white or pink calyx; stamens lilac; anthers blue. July. China. M D.G. 1907:547.—Possibly a form of the preceding

9. ròsea, Van Waveren & Kruijft (*A. hýbrida ròsea*, Arends). A hybrid between *A. chinensis* and *A japonica*. Similar to *A japonica* in habit, but fls. pinkish. The two best known forms are var. Peach Blossom, with lighter pink fls., R.H. 1908, p. 341, and var. Queen Alexandra, with deeper pink fls. M.D.G. 1911:53.

AA. Color of petals pink.

10. Dávidii, Henry (*A. chinénsis* var. *Dávdii*, Franch.). St 4–6 ft.. lvs. ternately pinnate or bipinnate; lfts. ovate to ovate-oblong, 1–1½ in. long, coarsely and unequally serrate: panicle about 2 ft. long, narrow, with ascending, spike-like slender branches, the lower 4–5 in. long, fls nearly sessile, crowded, fascicled, bright rose-pink; petals linear, stamens 10, shorter than petals with violet filaments and dark blue anthers. July. N. and Cent. China. B.M. 7880 G C. III 32·103 R H. 1907 : 40. Gn. 72, p. 179 M. D.G. 1907 545

11 rubélla, Lemoine A hybrid between *A. Lemoinei* and *A. Davidii* (or *A Lemoinei* × *A. chinensis* × *A Davidii*) Similar to *A. Lemoinei*, but fls rose-colored, panicle more compact than in *A Davidii* R B 34 28 —Other forms of the same parentage are var **rútilans,** Rehd (*A rútilans*, Lemoine), with rosy-carmine fls and white stamens, and var **carmínea,** Rehd (*A carmínea*, Lemoine), with violet-carmine fls, also Crepuscule, with flesh-colored fls; Lumineux, with rosy carmine fls changing to pink, plant over 3 ft high, Magenta, with carmine fls, Solferino, with violet-pink fls, and Titien, with delicate pink fls, plant over 3 ft high A series of hybrids of *A Davidii* with different species has been put into the trade under the collective name of *A Arendsii*, Arends M D G 1907 546 These comprise the following crosses *A Davidii* × *A astilboides*, with rosy-lilac fls in loose and graceful feathery panicles, stamens and petals much exceeding the sepals, here belong the varieties Juno, with purplish pink fls, plant over 3 ft high; Venus, also with purplish pink fls, Vesta, with rosy lilac fls, and Ceres, with lilac-pink fls *A Davidii* × *A. japonica*, with creamy white to pale pink or salmon fls in dense spikes, petals and the pink stamens not much exceeding the sepals; here belongs Rose Perle. *A Davidii* × *A. rosea*, similar to *A japonica* in habit, with purplish pink to salmon or nearly white fls, this cross may be classed with *A rubella* *A Davidii* × *A. Thunbergii*, taller, 4–5 ft. high with large feathery panicles, their branches nodding at the tips fls pale pink to white.

12. rùbra, Hook. & Thoms. St. simple, 4–6 ft, long-hairy· lvs 2-ternate; lfts. oblique-ovate, more or less cordate, 1–3 in. long, sharp-serrate: fls numerous, rosered, in compact, robust panicles, with the main branches erect and numerous short lateral branchlets about 1 in long; stamens 10, shorter than petals. India. B.M. 4959.—Needs protection Little known in Amer.

A crenatilobàta, Small (A decandra crenatilobata, Brit) Allied to A decandra. Lfts crenately toothed, the terminal one usually 3-lobed N C —4 *simplicifòlia*, Makino Low, not exceeding 1 ft lvs simple, ovate, deeply lobed or incised, about 3 in long panicle slender and narrow, the branches short, with star-like white fls Japan G C III 48 294, 52 101 —*A virèscens*, Hutchins Allied to A rivularis Lfts obliquely cordate-ovate, 3–4 in long, denticulate panicles much branched with small greenish white fragrant fls, petals wanting, stamens 10 China

ALFRED REHDER.†

ASTRÁGALUS (ancient Greek name of some shrub). *Legumınòsæ.* MILK VETCH. Hardy herbs or subshrubs, now and then seen in plantings.

Leaves mostly odd-pinnate, sometimes simple: fls. in spikes or racemes, yellow, purple or white; calyx tubular, its teeth nearly equal; petals clawed, the standard erect; stamens in 2 clusters, the anthers similar pods fleshy, leathery or papery, not much swollen, as they are in the membranous-legumed Phaca, the nearest relative.



430. Astragalus hypoglottis (×½)

-About 1,500 species. Many kinds are cult. in the Old World, but those described below are the only kinds commonly sold in Amer. The loco-weed of the prairies, which is said to poison cattle, is *A mollissimus.* For those below and many others, the student is referred to Britton and Brown's Illustrated Flora, Nelson's Manual of Rocky Mountain Botany, and Rydberg's Flora of Colorado The botanical characters are mostly found in the pods.

Astragaluses prefer a light, porous soil and no shade. The dwarfer kinds may be placed in the front of the border or in the rockery

PROPAGATION is chiefly by seeds, which germinate slowly, or by careful division in early spring. Many kinds are likely to die if divided or transplanted, as they are mycorrhizal plants, much dependent on a semiparasitic organism, which is better left undisturbed.

A. *Fls. yellow.*

alopecuroides, Linn St. erect, strict; height 2–5 ft.: lfts. ovate-lanceolate, pubescent· fls. in thick ovate-oblong spikes, on short, axillary peduncles. Siberia. B.M. 3193.

caroliniànus, Linn. (*A canadénsis,* Linn.). One to 3½ ft.: lfts. 15–31, glabrous or slightly pubescent, elliptic or oval, obtuse or slightly emarginate at apex: fls yellowish, ¾–1 in. long, in a dense spike· pods 2-celled, coriaceous, sessile, terete and glabrous. July, Aug. E. N. Amer. L.B C 4:372.

Drúmmondii, Douglas. Erect, 10–20 in.· lfts. 19–33, glabrous, oblong or sometimes oblanceolate, and obtuse: fls. yellowish white, the keel rarely tinged with purple, 1–1½ in. long, in a loose spike: pods 1-celled, distinctly stalked, glabrous and grooved. June, July. Plains of Cent. N. Amer Hook. Fl. Bor. Amer. 57.

AA. *Fls. not yellow.*

B. *Sts. trailing.*

monspessulànus, Linn. St. trailing: height 9 in.: fls. purple, purplish or white, in smaller and looser heads than the above. Eu. B.M. 375.

BB. *Sts. erect or merely decumbent, not trailing.*

C. *Plants not spiny.*

D. *Pods 1-celled*

flexuòsus, Hook. Four to 15 in., leafy-std and finely hairy: lfts 9–21, linear, oblong or oblanceolate, obtuse or emarginate: fls. purplish, ½–¾in. long, the peduncles exceeding the lvs.. pods 1-celled, sessile, cylindric, linear or linear-oblong June–Aug. Plains of Cent. N. Amer

alpìnus, Linn Height 6–15 in : lfts. 13–25· fls. violet, keel darker· pods 1-celled, black-pubescent. Northern and Arctic regions around the world.

DD. *Pods more than 1-celled*

hypoglóttis, Linn Fig 430 Height 3–24 in. lfts. 17–25· fls violet-purple, 6–10 lines long, in dense heads pods 4–5 lines long, 2-celled, densely villous with white hairs Eu , Asia, and from Kan west to Nev. and north to Alaska —Also a white variety excellent for pots

caryocárpus, Ker-Gawl Perennial, the whole plant tomentulose. sts decumbent, ultimately ascending· lvs alternate, distant, with 17–25 lfts : fls. pale violet-purple, the calyx about half as long as the corolla seeds several in each cell. I.a. B R 176.

adsúrgens, Pall. (*A Láxmanni,* Jacq) Fig. 431 Small, erect or mostly decumbent plant, with 15–25 lfts , which are oval to linear-oblong, obtuse and rarely emarginate. fls. purplish, ½–1 in. long, the peduncles exceeding the lvs., the spikes dense: pods 2-celled, sessile, oblong and pointed. June, July. Plains of Cent. N. Amer. Jacq. Hort. Vind. 3.37 (as *A. Laxmanni*).

CC. *Plant spiny: fls. white.*

hórrida, Boiss. A low bristly perennial with spiny lvs composed of 7–8 pairs of broad lfts.: fls. white in a dense, long-stalked spike-like cluster. Persia —Curious and rare, rather than attractive.

A racemòsus, Pursh. Zigzag, erect st. lfts. 17–21: fls. yellowish in loose racemes July Plains of Cent U S —*A Róbbinsii,* Oakes. Erect and glabrous lfts. 9–25 fls. in loose racemes, white or purple pods 1-celled, flattened Suitable for rocky places June, July N E U S —*A Shortiànus,* Nutt Silvery canescent lfts 9–15 fls blue or violet, pods sessile, 1-celled, strongly curved upward May, June Plains of Cent U. S

N. TAYLOR

ASTRÁNTIA (name in allusion to star-like appearance of umbels) *Umbellíferæ.* MASTERWORT. Perennial garden plants, grown for the odd and ornamental umbels and attractive habit.

Glabrous and erect low herbs with dark-colored aromatic roots· lvs. palmately lobed or dissected, petioled, the st.-lvs. often sessile and more simple: fls. polygamous, the sterile long-pedicelled and the fertile short-pedicelled; calyx with 5 foliaceous lobes, more or less tuberculate; petals oblong-ovate, connivent: fr. compressed — Perhaps a half-dozen species, in Eu. and W. Asia, bearing fls in leafy-involucred umbels and umbellules, the fls being white, rose-colored or blush The astrantias grow a foot or more high, making

interesting branching plants for the border, particularly in moist places. Prop. by seeds, and easily by divisions in autumn or spring.

carniòlica, Wulf. About 1 ft · radical lvs. 5–7-lobed, the lobes oblong-acuminate, serrate: fls white or blush: involucel of about 12 entire whitish parts with green red-tinged line. Eu. Attractive. June, July.

màjor, Linn The commonest species in cult · 1–3 ft · radical lvs. 5-lobed, the lobes ovate-lanceolate and more or less parted and toothed, acute. fls pinkish, or rose, or white involucel of 20 or less linear-lanceolate entire leafy parts, calyx-lobes lanceolate and spinulose, exceeding the petals Eu —Thrives by running water and in partial shade May, June

Biebersteinii, Traut. Small radical lvs 3-parted, the middle lobe oblong or obovate and more or less 3-lobed, sharp-serrate involucel parts oblong, entire or nearly so, equaling the umbel; calyx-lobes lanceolate-acute, equaling the petals. Caucasus.

A helleborifòlia, Salisb (A heterophylla, Willd , A maxima, Pall) 2 ft or less radical lvs 3-lobed, serrate fls pink: involucre of about 12 ovate-lanceolate bristly parts Caucasus —*A minor,* Linn 8–10 in · radical lvs. 7–9-lobed, toothed. fls. white: involucre white Eu

L. H. B.

ASTRAPÆA: *Dombeya.*

ASTROCÀRYUM (Greek, *astron,* star, and *karyon,* nut, referring to star-like arrangement of the fruits). *Palmàceæ,* tribe *Bactrídeæ* Spiny palms, stemless or with a short, or tall, ringed caudex

Leaves terminal, pinnately parted, segms approximate, equidistant or fasciculate, lanceolate-acuminate or attenuate to the obliquely truncate apex, plicate, whitish beneath, the terminal ones free or confluent, the spiny margins recurved at the base, petiole very short; sheath short, open, the spines of nearly all parts of the plant, in some cases, nearly a foot long. spadices short or long, the finely divided branches pendulous, thickened at the base, thence very slender, long, naked, the floriferous naked basal portion, as it were, peduncular; spathes 2, the lower one membranous, deciduous, the upper fusiform, coriaceous or woody, open on the ventral side, persistent, bracts of the female fls. broad, imbricated like the bractlets; pistillate fls with a stipitate male one on either side· fr rather large, ovoid or subglobose, beaked, smooth ,or spiny, red or orange.—Species 30. Trop. Amer.



431. Astragalus adsurgens. (×½)

Astrocaryums are elegant palms of medium height, very suitable for moderate-sized conservatories *A. Murumuru, A. mexicanum* and *A. argenteum* are the kinds most commonly met with in collections The leaves are pinnate, spiny on both sides, even in very young plants, and in small plants, at least in some of the species, the segments are narrow, four or five pairs of these alternating with two very broad ones *A. argenteum* has the under surfaces of the leaves of a much lighter color than the others

In a young state, the plants require the temperature of the stove, and after attaining the height of a few feet they may be best grown in a warmhouse, and given plenty of water, also a humid atmosphere Specimens 8 to 10 feet high fruit freely.

Propagation is by seeds, which are slow in germinating. The soil in which they are sown should be changed occasionally, to prevent it from becoming sour Be careful not to overpot, or the fleshy roots will decay G.C. II 22 522 See *Palms*

A. *Lvs. scurfy, at least beneath or on the petioles*

Mùrumuru, Mart Lvs 9–12 ft long, segms lanceolate, somewhat falcate, rich green above, silvery beneath sts 12–15 ft high, densely covered with stout, black spines 6 in long Brazil I H 22 213

argénteum, Hort Petioles and under surface of the lvs covered with silvery white scurf lvs arching, wedge-shaped, 2-lobed, distinctly plicate, bright green above; petioles with numerous dark, spreading spines 1 in. long Colombia F R 3 569 —Perhaps more correctly named *A Malybo,* Karsten

filulàre, Hort. Small, slender: lvs erect, narrowly cuneate, with 2 divergent lobes, inversely sagittate; petioles densely scurfy, rachis scurfy on both sides; spines numerous on the petioles and rachis, and on the principal nerves above, brown Country unknown.

AA *Lvs not scurfy*

Àyri, Mart Trunks 18–30 ft high, 8–12 in diam., usually cespitose lvs 15 ft long, equally pinnatisect to the apex, petiole plano-compressed, membranaceous on the margins, densely scaly and with scattered spines; lower segms. over 3 ft long, 1¾–2 in wide, 2 in apart, the upper ones 2-2½ ft long, 1 in wide, 1¼ in apart, conduplicate at the base, linear, long, attenuate, pointed, minutely and remotely spiny along the margins, white-tomentose below Brazil

mexicànum, Liebm St. 4–6 ft. high, cylindrical, thickly covered with rings of black, straight 2-edged spines: petiole 2 ft. long, 4-sided, the 2 upper sides concave, clothed (as is the rachis) with straight black spines; blade 6 ft , segms. 15–18 in long, 1 in. wide, alternate, broadly linear, acute, straight, white beneath, with deciduous black spines along the margins Mex.

A. granatènse, Hort , is an unidentified trade name

J G Smith and G W Oliver.
N Taylor †

ASYSTÀSIA (obscure name) Including *Henfrèya, Dicentranthèra* and *Mackàya Acanthàceæ* Hothouse or greenhouse evergreen herbs and shrubs

Plants erect or scandent lvs membranaceous, entire corolla-tube straight or curved, the spreading limb 5-lobed and nearly or quite regular; stamens 4, unequal, stigma blunt or minutely 2-lobed, fls white, blue or purple, in axillary or terminal clusters, often very showy —About 20 species in the Old World tropics Require the general treatment of Justicia, in intermediate or warmhouses

bélla, Benth & Hook (*Mackàya bélla,* Harv.) Glabrous, upright sub-shrub lvs ovate-oblong, acuminate, spreading, short-stalked, sinuate-toothed. fls. lilac, 2 in long, with a long tube below the flaring throat, the spreading segms. ovate-obtuse, disposed on one side of a raceme 5–8 in long S Afr B M

5797.—A beautiful plant, rarely seen, and thought to be difficult to manage; but it seems to flower readily in fall in our climate, if rested during the previous winter and brought on in the summer. Prop. by cuttings of firm wood in spring or summer. Young plants in small pots often bloom well.

A. coromandelidna, Nees (A comorensis, Bojer. A. violacea, Dalz Justicia gangetica, Linn.) Zigzag sub-shrub: lvs ovate-cordate, wavy: fls. purple, nearly sessile, in 6-10-fld raceme India B M 4248. P M 14:125 F S 2.179 —*A. scándens*, Lindl. (Henfreya scandens, Lindl). Climbing: lvs obovate to ovate, thick, entire. fls large, yellow, white and blush, in a thyrse Afr. B.M. 4449 B.R. 33:31. F.S. 3.231. L H. B.

ATÁCCIA: *Tacca.*

ATALÁNTIA (*Atalantia*, one of the Hesperides). *Rutàceæ*, tribe *Citreæ*. Woody plants, now receiving attention in America as stocks for citrus fruits, and as possible parents in breeding new forms of such fruits.



432. Leaf of Atalantia citrioides. (×⅔)

Small trees or shrubs, usually spiny, with persistent coriaceous simple lvs. having prominent netted veins and wingless or very narrowly winged petioles jointed at base of lf.: fls. usually pentamerous, with the stamens free or united into a tube, twice as numerous as the petals; ovary 3–5-celled, with 1 or 2 ovules in each cell: fr. like a small orange with a lemon-like skin. In the typical species, the pulp-vesicles fill the segms , but in some dry-fruited species they are rudimentary; these species constitute the subgenus Rissoa —Twelve or 15 species are known, ranging from India through the Malayan peninsula to Austral

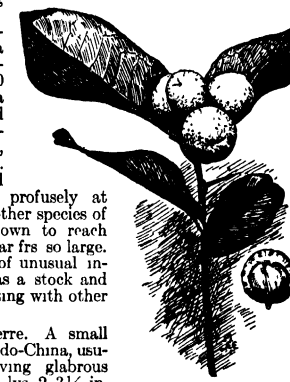
A. *Subgenus Euatalantia. Cells of fr. lined with pulp-vesicles.*

monophýlla, DC. (*Limònia monophýlla*, Roxbg., not Linn.). A large shrub or small tree, native to India, Ceylon, Burma, Siam and Indo-China, usually spiny: lvs. glabrous, or sometimes pubescent, 1–3 in. long; petioles short, slightly or not at all winged: fls borne in axillary panicles; calyx irregularly lobed, split to the base on one side; petals usually 4, stamens 8, the filaments connate and forming a completely closed tube; ovary 3–5-celled fr from ½–¾in. diam., with a skin like a lime, globose, with several cells (generally 4), each usually containing 1 seed and filled with pulp-vesicles, making the fr. much like a miniature orange. India, Ceylon, farther India. Ill. Roxbg. Pl. Corom , pl. 83. Wight, Icones, pl. 1611. Engl in Engl and Prantl. Nat. Planzenf. III. 4:191; fig. 111, C,D —This tree, still little known outside of India and Ceylon, is the type of the genus Atalantia, and one of the promising species for trial as a stock on which to graft other citrus frs., and also for use in breeding new types of citrus frs The frs. yield an oil which in India is considered a valuable application in chronic rheumatism.



433. Cross-section of ovary of Atalantia citrioides. (×1)

macrophýlla, Kurz. (*A. monophýlla* var. *macrophýlla*, Oliver). A small or medium-sized tree, native to the Andaman Isls. and Burma, having ovate-elliptical emarginate lvs. 1½–4 in. long and 1–2½ in. broad: fls. on short axillary racemes; calyx irregularly lobed, split to the base on one side as in *A. monophýlla;* stamens connate and forming a tube: fr. large, said to reach 1½–2 in. diam. Andaman Isls , Burma, Malay Peninsula, Bangka Isl.—Little known and is chiefly interesting because of the large size of its frs. Kurz, in his "Forest Flora of British Burma," says of this species, "Berries globose, the size of a wood-apple, glabrous," and gives the size of the wood-apple as 1½–2 in. diam A tree brought from the island of Bangka, east of Sumatra, and now growing at the Botanical Gardens at Buitenzorg, Java, is considered by Hochreutiner to belong to this species It is of remarkable size, being a beautiful round-topped tree 40 ft. high with a deeply furrowed trunk 6 ft. in circumference, forking at 3 ft. from the ground and branching profusely at 6½–10 ft No other species of Atalantia is known to reach this size or to bear frs so large. This species is of unusual interest for trial as a stock and also for hybridizing with other citrus frs.



434. Atalantia ceylonica. (×½)

citrioides, Pierre. A small tree native to Indo-China, usually spiny, having glabrous emarginate oval lvs. 2–3½ in. long (Fig. 432) calyx cup-shaped, not split to the base, stamens connate, forming a tube; ovary usually 3- or 4-celled. fr resembles a small orange about ¾in diam , with a roughened glandular skin; cells filled with pulp-vesicles and contain usually a single seed about ¾in long (Fig 433). Ill H. Lecomte Fl. gén de l'Indo-Chine, Vol I, pl 24, fig. C 5, 6 —This interesting species is native to Cochin China and Cambodia and has recently been intro into this country, where it will be tested as a stock and for breeding purposes Its close relationship to Citrus is shown by the fact that it grows well when grafted on grapefruit

racemòsa, Wight. A shrub or small tree, differing from *A. monophylla* chiefly in having a regular calyx not split down one side. S. India, Ceylon. Ill. Hook. J. bot. Vol. I, pl. 122: Wight, Icones, pl. 71

AA. *Subgenus, Rissoa, n subg , named for A. Risso, b Nice, 1777, d 1845, a well-known writer on citrus frs. Rissoa, Arnott, 1836 as a genus Like Eu-atalantia, but with dry frs , the cells being nearly filled with 1 or 2 large seeds; pulp-vesicles rudimentary and greatly reduced in number.*

ceylónica, Oliver (*Rissòa ceylónica*, Arn) Fig. 434. A much-branched spiny shrub or small tree native to Ceylon and India: lvs. lanceolate emarginate, 1¼–3 in. long: fls borne in crowded cymes; calyx not split on one side; stamens free, alternate ones longer, ovary usually 2-celled with 2 ovules in each cell. frs. about ½–¾in. diam , dry, having only rudimentary pulp-vesicles; containing from 2–4 very large rounded seeds. Ceylon. —This species is of interest chiefly for trial as a stock, since its large seeds would be likely to produce very vigorous seedlings. The dry fr. renders it unpromising for breeding purposes The figure is from a specimen grown at the Hope Garden, Jamaica.

Guillaumínii, Swingle. A small spiny tree, 10–13 ft. high: young branches angular and pubescent: lvs. oval, more or less pointed at both ends, 2–4 in. long: fls. unknown: frs. ¾–1 in. diam., 3-celled, 2 large seeds in each cell, pulp-vesicles rudimentary. Tonkin Ill. Notulae systematica. H. Lecomte, Vol. II, p 162, fig. 1. —A little-known species, interesting on account of its large frs Because of its large seeds, it should yield vigorous seedlings

simplicifòlia, Engl (*Ámyris simplicifòlia*, Roxbg. *Atalántia Roxburghàna*, Hook f.). A spineless shrub or small tree: lvs. very large, 4–6 in. long, 1½–2½ in. wide, elliptic, pointed at both ends. stamens free; ovary 2-celled. fr. spherical, rough-skinned, ½–1 in diam., with large seeds. Malay Peninsula. Ill. Wight, Icones, pl. 72 —An interesting species because of its unusually large lvs

Imperfectly known species: *A caudàta*, Hook f Lvs caudate-acuminate, narrowed at base ovary 2-celled India —*A pubérula*, Miq Lvs narrowly oblong-emarginate twigs, petioles, lf -bases and midrib puberulous, perhaps a form of A. monophylla

WALTER T. SWINGLE.

ATAMASCO LILY: *Zephyranthes.*

ATHANÀSIA: *Lonas.*

ATHROTÁXIS (name alludes to the crowded cone-scales) Sometimes spelled *Arthrotaxis Pinàceæ*. Evergreens, allied to Cryptomeria, Sequoia and Sciadopitys, suitable for planting South, or for use as tub specimens in coolhouses

Trees, densely branched, monœcious lvs small, either short, blunt, scale-like and appressed, or lanceolate and somewhat loosely disposed· staminate fls in imbricated spiral aments, the anthers 2-celled, pistillate fls in spirally imbricated aments, 3–6 ovules under each scale, these aments becoming small globular cones with woody scales which are contracted at base and at apex incurved or acuminate or pointed —Three species in Tasmania, by some considered to be inseparable from the genus Cunninghamia These plants are little known in cult Aside from seeds, cuttings may be used for prop

selaginoìdes, Don (*A alpìna*, Van Houtte *Cunninghámia selaginoìdes*, Zucc.) Stout, to 45 ft lvs loose, lanceolate, incurved, acute, ⅓in or less long, those of young seedlings narrower cones ½–¾in diam., the scales lanceolate-pointed Mts

cupressoìdes, Don (*A imbricàta*, Maule *Cunninghámia cupressoìdes*, Zucc.) Tree, reaching 40 ft, with ascending branches lvs broad and obtuse, less than ⅛in long, thick and keeled, closely appressed to the branches cones ½in or less diam., the scales rounded at top and bearing a short point

laxifòlia, Hook (*A Donìana*, Henk & Hochst.) Tree, 25–30 ft, closely allied to *A cupressoìdes* lvs imbricate but less appressed, acute, about ⅛in long cones larger and scales more acuminate Mts

L. H. B.

ATHŸRIUM. A generic name recognized as valid by many well-known fern students As usually delimited, it includes species of Asplenium (which see) which have some of the sori curved across the subtending veinlets There are also differences in the stem structure The species are mostly larger and more herbaceous than those of true Asplenium.

R. C. BENEDICT.

ATRÁGENE: *Clematis*

ATRAPHÁXIS (ancient Greek name) *Polygonàceæ*. Ornamental shrubs grown chiefly for the white or pinkish flowers produced during the summer

Low shrubs with spiny or unarmed branches· lvs deciduous, short-petioled, alternate or fasciculate fls small, apetalous in few-fld axillary clusters forming terminal racemes, sepals usually 5, sometimes 4, the 2 outer ones smaller and usually reflexed; stamens 8, sometimes 6; ovary superior with 2–3 styles free or connate at the base· fr a small 2- or 3-angled achene enveloped by the enlarged inner sepals. Summer —About 18 species in Cent. and W. Asia, Greece, and N. Afr.

These plants are of spreading habit, with usually small leaves, attractive with their numerous racemes of white or rose-colored flowers, which remain unchanged for a long time, owing to the persistent calyx.

They grow best in well-drained soil and sunny situations, but do not stand transplanting well when older. They are well adapted for planting in rockeries or on rocky slopes and are hardy North. The handsomest of the species is *A Muschketowii*. Propagation is by seeds sown in spring; the seedlings are liable to rot if kept too moist, or in damp air Increased also by greenwood cuttings under glass in early summer, and by layers. None of the species is in the American trade

A buxifòlia, Jaub & Spach (Polygonum crispulum, Sims) Height 1-2 ft, spineless lvs obovate, crenate, dark green, ½–1 in long racemes short Transcaucasia, Turkestan B M. 1065 —*A frutéscens*, Koch (*A lanceolata*, Meisn.) Height 1–2 ft, spineless lvs ovate-lanceolate, glaucescent, ½–1 in long racemes loose Caucasus, Turkestan, Siberia L B C 5 489 B R 3 254 —*A Muschketowii*, Krassn (*A latifolia*, Koehne Tragopyrum lanceolatum var latifolium, Regel) Erect, 2–3 ft, spineless lvs lanceolate, crenate, ¾–2 in long fls white with the anthers and ovary red, ¼in across in dense racemes Turkestan B M 7435 Gt 40 1341 —*A spinòsa*, Linn Height 1–2 ft, spiny lvs elliptic, entire, glaucescent, ¼–½in long racemes short, sepals usually 4 and stamens 6 S. Russia, Orient, Siberia

ALFRED REHDER

ÁTRIPLEX (from a Greek name of orache) *Chenopodiàceæ* Herbs with inconspicuous flowers, some of which are used for forage under the name of saltbushes, some for hedges or lawn specimens, and one as a garden vegetable, and many succulent weeds of desert regions.

Flowers dioecious or monoecious, in spicate or paniculate clusters, sometimes bunched in the axils lvs usually alternate or some opposite fr half or wholly inclosed by the persistent bractlets —About 125 widely distributed species, often weeds *A patula*, in many forms, is a common weedy plant throughout the country

Atriplex hortensis is a garden vegetable used like spinach, for culture, see *Orach A leptocarpa*, *A sembaccata* and others have been introduced as supplementary forage plants for arid regions *A Breweri* is a popular low hedge plant in southern California

A *Garden vegetable (with ornamental-lvd variety).*

horténsis, Linn ORACH SEA PURSLANE Annual st herbaceous, erect lvs hastate, cordate, or triangular-oblong, acute, 4–5 in long, 2½–3 in wide, petioles 12–18 lines long fruiting bracts 4–8 lines long, short-pediceled Var **àtro-sanguínea,** Hort, is a crimson-lvd ornamental about 4 ft high, sometimes grown with amarantus-like plants Old World See *Orach*



435 Atriplex Breweri Used for hedges in California (×⅛)

AA. *Ornamental shrubs.*

B *Shrubs 1–3 feet.*

canéscens, James A pale, densely scurvy shrub, 1–3 ft. high lvs oblanceolate, entire fruiting bractlets with 4 vertical, reticulated wings. July–Sept New Mex to S Dak. and west to Calif

Hálimus, Linn Low-spreading shrub with gray foliage, cult in Calif for hedges and for seaside planting· lvs 1–1½ in. long, petioles 3–4 lines long fls purplish fruiting bracts 1½ lines long, 2 lines wide, sessile, reniform, obtuse, entire seed compressed, yellowish Medit region and S Afr

BB. *Shrubs 4–10 feet.*

Bréweri, S Wats Fig 435. Stout woody shrub, 4–6 ft.: lvs. ovate-oblong, silvery gray, somewhat rhombic-cuneate at the base, obtuse and acute at apex, 1–3 in long: fls. dœcious, the calyx deeply 4-cleft. At home in sandy, wind-swept places S. Calif.

lentifórmis, S. Wats. (*Obione lentifórmis,* Torr). Diffusely branched, 4–10 ft., the branches terete, with rigid often spinescent branchlets lvs. oblong-rhombic, ½–1½ in. long· fl.-clusters small, golden or silvery, the calyx 5-parted. S.W.U S.—Silvery and tall, growing as the preceding but standing more cold.

N. TAYLOR.†



436. Atropa Belladonna or Deadly Nightshade. (×⅓)

ÁTROPA (after *Atropos,* that one of the three Fates who cut the thread of life). *Solanàceæ.* BELLADONNA. A genus of 2 species of Old World herbs of great economic importance Calyx with 5 ovate leafy divisions, enlarging in fr ; corolla bell-shaped or funnelform. The purple berries are poisonous The plant is used in medicine and is the source of atropine and other drugs Not in cult. in U. S except in botanic gardens.

Belladónna, Linn. Fig. 436. Plant erect, branching, leafy: lvs. ovate, entire, pointed: fls. single or in pairs, nodding on lateral peduncles; corolla blue-purple or often greenish purple. Eu. to India.

N TAYLOR.†

ATTALÈA (*attalus,* magnificent). *Palmàceæ,* tribe *Cocoíneæ.* A large genus of horticulturally little-known palms, well worth more attention.

Stems spineless, single, usually ringed, sometimes lacking: lvs. usually many in a large erect tuft, pinnate, the numerous lfts. rather regularly placed, but at right angles to the rachis, those above standing erect, those beneath falling below the rachis, young lvs. very attractive but rather stiff in their perfect erectness; petiole concave above, often very fibrous at the base. fls. monœcious or polygamo-dioecious, on a branched spadix inclosed in a rather woody spathe, at least at first, which appears among the lowest lvs.; spadix ultimately recurving, sessile, bracted, usually yellow. fr. a drupe, sometimes quite large, frequently fibrous-coated —Because of their slow growth the 20–25 species are not very favorably known to the dealers. All are natives of Trop. Amer See G.C. II 22.523.

At least two of the species are of economic importance *A Cohune* is the source of a finer oil than that of the coconut, and is also used in making an intoxicating beverage *A funifera* is the source of a fine fiber much used in the making of brooms, and in rope-making

Attaleas must be grown in a tropical greenhouse, with a night temperature not less than 60°. They will do best in a mixture of loam three parts, cow- or horse-manure, one part, and one part of sand

Propagation is by seeds, which may be placed 2 inches deep in a box to be plunged out-of-doors in summer, covered with moss and watered freely

A *Trunks becoming tall, or at least not stemless.*

B *Bases of the petiole prominently fibrous old lvs persistent in A. funifera trunks 18–30 ft*

funífera, Mart PISSABA PALM. COQUILLA. St. 18–30 ft , 8–13 in diam , smooth lvs as long as the caudex, green both sides, petioles with very long hanging fibers, segms broadly linear-acuminate, in clusters of 3–5, divaricate, very numerous. drupe 4 in. long Brazil

gomphocòcca, Mart St. 20–30 ft crowned by a magnificent cluster of large (6–9 ft) lvs lfts very numerous, linear or linear-lanceolate, bright green above, paler beneath; petiole relatively short, very fibrous at the base spathe slender and woody, the spadix reflexed, but short-stalked and half hidden by the lvs fr. fibrous-coated Costa Rica —Intro. by Reasoner Bros. in 1911.

BB. *Bases of the petiole not prominently fibrous· trunks 50–100 ft*

excélsa, Mart St 90–100 ft high in the wild, 16–20 in. diam. lvs. erect-spreading· pistillate fls solitary on the branches of the spadix. drupe oblong-cylindric, acute at both ends. Brazil —A little-known palm among the dealers, but not uncommon in fanciers' collections Stately in habit and with splendid large lvs.

Cohûne, Mart. COHUNE PALM Fig 437 St 50–60 ft.: lvs. erect, pinnate, the dark green pinnæ 30–50 and 18 in. or less long; petiole flat above and rounded below: drupe broadly ovate, nearly 3 in. long, with a very short beak. Honduras —Fruit used for soap-making, and exported from Cent. Amer. for that purpose. Used for thatching.

AA. *Without trunks.*

spectábilis, Mart. Stemless, or with a very short caudex· lvs. 18–21 ft. long, erect or spreading, the lower segms. 3–4 ft , the upper 12–16 in , ½in wide, linear-acuminate spathe erect fr about as large as a hen's egg. Brazil —Requires plenty of water, as its home is on the banks of the Amazon

amygdalîna, HBK. (*A nucifera,* Karsten) Stemless: lvs 15–18 ft long, crowded, pinnatisect; segms 90–100 on each side, ensiform, glabrous above, with hairs along the outer margins beneath, 2½–2⅔ ft. long, about 1¼ in. wide; petiole with rusty scales beneath: spadix of male fls. about 18 in. long, with a flattened stalk, inclosed by a thick woody spathe. Brazil

A Guichire is a trade name, "extremely long-leaved "—*A Máripa,* Mart (A. Mariposa, Hort). See Maximiliana

N. TAYLOR.†

AUBRIÈTIA (Claude Aubriet, French natural history painter of last century). *Cruciferæ* PURPLE ROCK-CRESS Showy perennial more or less evergreen trailers, excellent for rockwork or edgings

Allied to Alyssum and Vesicaria, distinguished chiefly by the outer sepals being saccate at base, the shorter filaments toothed, and the valves of the oblong or globose silique convex and not ribbed. lvs entire or angular-toothed fls. in shades of violet or purple, in few-fld bractless racemes: plant canescent or tomentose —About a half-dozen species, Italy to Persia The aubrietias are of simple cult Prop by seeds, layers or cuttings They make excellent mats of foliage and bloom


437. Attalea Cohune

deltoidea, DC Fig 438 Lvs oblong-spatulate, deltoid or rhomboid, with 1 or 2 teeth on either side, grayish, narrowed into a very short petiole fls in few-fld. lax clusters, the violet or purple petals twice the length of the calyx —Grows 2–12 in high. Pretty spring and summer bloomer Hardy in the N Very variable, some of the forms being named as if of specific rank Var. **Bougainvillei,** Hort Fls light violet dwarf and compact Var **Campbellii,** Hort Fls large, purple plant large Var **Eyrei,** Hort Fls large and long, deep violet Var **græca,** Hort (var *superba*). Dwarf and compact, large-fld One of the best Var **Hendersonii,** Hort, probably the same as *Campbellii* Var **Leichtlinii,** Hort Profuse bloomer, pink fls Var **olympica,** Hort Fls large, violet, like var *Eyrei* Var. **violacea,** Hort One of the largest forms Var. **Mooreana,** Hort Compact fls blue Var **Perkinsii,** Hort. Fls. deep purple with tiny white eye, the petals rounded plant strong, 10 in, making a large mat Gn 67, p. 344 Raised by F Perkins, Stratford-on-Avon Var. **Moerheimii,** Lemoine Fls large, rosy pink or mauve, blooming all summer Var **purpurea,** Hort Erect in habit. fls large, purple Var **variegata,** Hort. Lvs. variegated.

L. H. B.

AUCÙBA (Latinized for *Aokiba*, its Japanese name) *Cornàceæ* Ornamental plants grown for their large evergreen foliage, often handsomely variegated, and also for the bright scarlet fruits

Shrubs with stout forked branches: lvs opposite, remotely serrate or nearly entire fls dioecious, small, calyx minute, 4-toothed; petals 4; staminate fls with 4 stamens, filaments short, with a large disk in the middle; pistillate with an inferior 1-celled ovary, style short with an oblique stigma fr. a 1-seeded berry-like drupe.—Three species in E. Asia extending west to W. China and E Himalayas, often considered varieties of one polymorphous species.

The aucubas are evergreens with large, lustrous, and often handsomely variegated leaves, small purple flowers in terminal panicles, elongated in the staminate, short and rather dense in the pistillate plant and with bright scarlet oblong berries forming terminal clusters Hardy in the southern states about as far north as Washington, D. C., and in sheltered localities even farther north; they are well adapted for city gardens as they withstand dust and smoke to a considerable degree

In the northern states, aucubas are grown in cool-houses—those adapted to azaleas are excellent—and they are kept evergreen by keeping them in a pit during winter, or by holding them cool and partially dry in the house They will stand five or six degrees of frost in a pit From cuttings of half-ripened wood, good specimen plants may be had in two or three years Fruiting plants, with their numerous bright scarlet berries, are exceedingly attractive, but as the plant is dioecious, there must be male plants with the female ones If grown in pots and under glass, the plant must be fertilized by shaking the flowering male plant over the female, or by applying the pollen with a camel's-hair pencil. If the male plant flowers earlier, the pollen may be collected and kept dry until the female plant is in flower, it remains effective for some weeks In the open, aucuba grows well in any good, somewhat moist though well-drained soil, in a half-shaded position In pots, it will thrive in a sandy loam with sufficient drainage, and requires plenty of water during its growing period Fruiting plants should not have too large pots

They are propagated very easily by half-ripened greenwood cuttings at nearly any time of the year, under glass, and by seeds sown soon after maturity, the varieties are sometimes grafted on the common form in early spring, under glass

japónica, Thunb A stout shrub, 4–15 ft. lvs. usually ovate, 3–8 in long, remotely and coarsely dentate, obtusely acuminate, shining petals obtusely acuminate berries scarlet, rarely white or yellow, usually oblong From Himalayas to Japan B M 5512. I H 11 399 S I F 2 59 F S 16:1609 F. 1865 65.—There are a great number of garden forms in cultivation, mostly with variegated leaves, the latter are more often cult than the green forms Handsome variegated forms are Var **latimaculàta,** Kirchn (var. *aùreo-maculàta*, Dombrain) Lvs ovate-oblong with a large irregular yellow blotch in the middle and smaller yellow dots around it F M 10 527. F W 1876.353. Var **variegàta,** Dombrain, not Regel (var *maculàta*, Regel, var *picta*, Hort, var *punctàta*, Hort) GOLD DUST TREE Fig 439 Lvs with numerous yellow spots. —The most commonly cult form B M. 1197. F.M. 5.277 R H 1866 292 Var **limbàta,** Bull Lvs large, coarsely dentate, with a greenish yellow margin Var. **bicolor,** Regel. Lvs with a large yellow blotch in the middle, ovate to ovate-oblong, remotely dentate. The following forms have green lvs Var **angustifòlia,** Regel (var *salicifòlia*, Hort) Lvs narrowly oblong-lanceolate. Var **concolor,** Regel (var. *viridis*, Hort.). Lvs ovate-lanceolate or elliptic-ovate, remotely and coarsely serrate Gt 25.859. Var **dentàta,** Carr. (var. *macrodónta*, Hort) Lvs elliptic, coarsely and long-dentate Var **macrophýlla,** Bull Lvs large and broad, remotely and slightly dentate. Var. **ovàta,** Regel Lvs. ovate, coarsely sinuately dentate, dark green, lustrous. Var. **pygmæa,** Regel. Low: lvs ovate-oblong, remotely and sharply


438. Aubrietia deltoidea. (plant × ¼)

dentate, bright green, dull. Differently colored frs distinguish the following forms. Var. **luteocárpa,** Rehd. (*A. luteo-cárpa,* Dombrain) with yellow fr. F.M 1872: 12. Var. **leucocàrpa,** Matsum. & Nakai, with white fr —*A. cranifòlia,* once offered in American trade, is probably a form of *A. japonica.* To indicate whether a certain form is a staminate or a fruit-bearing plant, mascula or femina (fœmina) is often added to the varietal name

A chinénsis, Benth Lvs lanceolate to nearly obovate, entire or toward the apex sharply dentate, sharply acuminate petals finely and long-acuminate, panicle with scattered short and stiff hairs China —*A himalàica,* Hook f & Thoms (A japonica var himalaica, Dipp) Lvs usually lanceolate to ovate-lanceolate, entire or dentate, sharply and long-acuminate panicles densely hairy, petals long and finely acuminate fr orange to scarlet E Himalayas F S 12 1271 I H 6 197 ALFRED REHDER

AUDIBÉRTIA (*M. Audibert,* of Provence). *Labiàtæ* Including *Ramòna* Perennial herbs or sub-shrubs, sometimes grown for bees and in ornamental plantings

Ten species all from W. U S. mostly from Calif, related to Salvia, but differing in the calyx being more deeply cleft in front, and in being almost spathaceous lvs opposite, usually rugose, sage-like fls axillary or terminal, not unlike those of *Salvia officinalis,* corolla with upper lip spreading, 2-lobed or emarginate

grandiflòra, Benth. St villous, glandular, 1–3 ft high lvs woolly beneath; lower lvs hastate, obtuse, 3–8 in long, coarse; bracts crowded, conspicuous fls 1–1½ in long, red or crimson-purple, in dense, showy clusters. Calif — Prized for bees.

incàna, Benth St. woody, tomentose-canescent, leafy lvs spatulate or obovate, obtuse or retuse, not rugose, scarcely 1 in long; bracts obovate, ciliate, purple-tinged corolla ½in long, rarely slightly longer, pale blue Wash to Ariz. B R 1469 N TAYLOR



439 Aucuba japonica var variegata (×⅕)

AURÍCULA (*Primula Auricula,* Linn) Fig 440 A European perennial, sending up short scapes, bearing flowers of many colors It is one of the most famous of florists' flowers, but it has never received the attention in this country that it has in Europe Our summers are generally too hot for it In this country generally treated as a greenhouse plant, but it is hardy, and in the Old World is grown largely in frames See *Primula*

Auriculas grow wild in the mountainous districts of Switzerland, Austria, Syria, and the Caucasus; therefore they are generally regarded as alpine plants, but like many other alpines, they have proved to be excellent subjects for cool greenhouse culture as well as for rock- or alpine-garden culture In their native habitats, some plants are heavily powdered with a fine mealy substance called "farina," while others are perfectly destitute of it. Under cultivation, also, they show this same characteristic This has caused fanciers to divide them into two sections, those covered with farina, called show auriculas, and those destitute of it, termed alpine auriculas The show auriculas have received the most attention at the hands of fanciers Their flowers are large, and present more combinations in variety of color than the alpine section, and since rains mar their beautiful farina-covered leaves and flowers, they are by far best adapted to greenhouse culture. Like all primulas, the flowers are tubular and borne in erect trusses well above the foliage Well-grown plants will produce strong trusses with often as many as twenty "pips" or individual flowers Such a number cannot fully develop, consequently they should be thinned out and only eight or nine flowers allowed to develop on each truss The tube of the flowers of show auriculas is usually white, with a circle of maroon, violet, plum or chocolate-color above and a margin of green, gray, white, or yellow In what are called "selfs," the circle of chocolate-maroon, or violet, extends to the edges of the flowers They are usually very sweet-scented Alpine auriculas are best adapted for growing in the rock- or alpine-garden since the leaves and flowers are destitute of farina This section does not exhibit as large a variety of color in the flowers The tube of the corolla is usually yellow or cream-color with a margin of maroon or purple which shades off toward the edges The culture given below is the same for both sections except that the alpine section should be planted on the north side of the rock-garden in October, where they will flower the following spring.

Auriculas may be propagated by seed for general purposes and for the production of new varieties, but to perpetuate very choice varieties it is necessary to propagate either by offsets or division of the plants Seed should be sown in shallow pans or 1-inch pots early in March, so that the seedlings will be well developed before very warm weather sets in The soil used in the seed-pans should be very light and sandy, the surface should be made smooth, and the seeds then pressed lightly into the soil, after which a light covering of sand should be given, and the pans placed in a temperature of 60° until they have germinated, which usually takes from three to four weeks, pans should then be removed to a light position, shaded from direct sunlight, in a rather lower temperature, to induce a stocky growth. As soon as the seedlings are large enough to handle conveniently, they should be pricked off into other pans or shallow boxes containing a mixture of three parts leaf-mold and one part sifted loam and clean silver-sand Watering should be carefully attended to, and everything done to promote active growth, so that, if possible, the plants may be large enough to require a second shift into other boxes, similarly prepared, by the end of June. Auricula seedlings go through the hottest months much better in boxes than in pots, as they can be kept more evenly moist For their summer quarters, a wooden frame placed on sifted coal-ashes on the north side of a building or wall, or almost any position in which they will be sheltered from the sun and still receive plenty of light, should be given them. The frame should be provided with sash, which should be kept over the plants most of the time, giving air in abundance in favorable weather, and during the warmest weather the whole frame should be raised by placing a brick under each corner, so as to allow a good circulaton of air among the plants About the second week in September the young plants should be potted, using a compost of two parts good fibrous loam, one part leaf-mold, and one part well decayed cow- or sheep-manure, with a little sand added. The frame should be kept a little close for a few days after potting, and from this time care must be taken not to wet the foliage in watering The plants may remain in the frame until danger of freezing, when they should be transferred to a cool

greenhouse for the winter. All decaying leaves should be carefully removed, and but little water will be required during the dull winter months. Toward the end of February the plants will show signs of flowering, when they should be given a top-dressing of pulverized sheep-manure and placed in a light, airy position, in a temperature of 55°. The flowering season lasts about two months, after which the plants should receive their annual potting All diseased or decayed roots should be cut away, and most of the old soil carefully removed The propagation of very choice varieties by offsets or division is best done at this time. The pots used in potting should be well drained, and no larger than will just accommodate the plants The soil best suited is the same as before recommended. After potting, they may be placed in their summer quarters. Offsets should be inserted around the edge of 4-inch pots, using very sandy soil, and kept in a moist, shaded position until rooted By annually repotting and giving a little extra care during the summer months, a batch of show auriculas will return very satisfactory results, and may be kept in a good, healthy condition for several years.

EDWARD J. CANNING.



440 Auricula. (× ½)

AUTUMN COLORS, PHYSIOLOGY OF. When the conditions in almost any locality are favorable for the rapid growth of plants, the prevailing color of the vegetation is green The leaf-green, or chlorophyll, is a conspicuous part of vegetative organs Green is normal, so that one does not regard a green plant as "colored" It is true that in some species of plants, chlorophyll is partially or completely veiled by the presence of other pigments, and in the blossoms it may practically fail, but in the latter case the life of the brilliant structures is fleeting, and green is promptly predominant "Color" is more or less restricted to blossoms, to particular species, or to seasons The great seasonal change is here the center of interest

In the autumn the vegetation of the usual temperate landscape loses gradually its distinctive green, while striking yellows and reds are substituted With favorable conditions, the climax of this transformation is such a riot of color as is not seen at any other time. It is noteworthy that this change is an immediate forerunner of leaf-fall and death The vegetation that is suddenly cut off by severe frost seldom exhibits true autumnal colors, but instead the dry brown or blackened effects of rapid death, characteristic of any season On the other hand, autumn tints of leaves may appear in the summer, as when limbs of the hard maple or peach are ringed This suggests that the production of color is susceptible of experimental study On the whole, the layman may regard the autumn colors as a necessity to the wholesome rounding out, and a fitting terminus, of a season of usefulness Coloration is, however, an evidence of fundamental physiological changes, and it is appropriate to ask regarding the climatic or other conditions which bring this about, as well as concerning the nature of these internal changes which also make for the development of color in the autumn.

For the most part, the autumn leaf-colors fall into two groups—yellows and reds These colors are produced by two groups of pigments essentially different in chemical and physical properties; yet these pigments are frequently blended in the same leaf, yielding such gorgeous effects as may be seen in the sumach

The yellow pigment (more correctly pigments) of leaves occurs in the chlorophyll bodies of the cell. It is present in conjunction with the leaf-green in the healthy leaf, but not infrequently it seems to increase in quantity as the chlorophyll disappears It belongs to a group of substances often called xanthophylls. These are carotin-like compounds, that is, related to carotin, the orange or orange-red pigment of the carrot root. Carotin-like bodies are widely distributed in plants and are also responsible for the yellow, orange, and orange-red colors of a large number of blossoms These pigments do not occur in solution in the cell-sap, but may be present either in the healthy chlorophyll bodies (plastids) or outside of them In the latter case, they form crystals, or are in solution in droplets of fatty oils Carotin-like compounds are more permanent than chlorophyll, so that any green plant may exhibit a yellowish color upon the gradual disappearance of the chlorophyll

The red pigments of autumn leaves are cell-sap colors, substances soluble in the aqueous solution constituting plant juices They are supposed to be tannoid compounds, and are generally referred to as anthocyanin. The pigments of red beets and dark grapes are similar compounds It is significant that those plants exhibiting conspicuous red coloration in the autumn are usually those which give some indication of red during the growing season, as in the possession of red petioles or twigs; and, more especially, they are those in which red is more or less conspicuous as the buds open and the leaves unfold in the spring The attractive tints of unfolding hard maple buds are therefore an indication that the maple has the capacity to develop a coloration of the cell-sap in the autumn Some plants develop no anthocyanin under normal conditions of growth

It is then evident that the yellow colors of autumn leaves may be due to both a greater visibility of the yellow in the chlorophyll body when the chlorophyll disappears, and also to actual increased development of carotin-like compounds The reds and purples in autumn leaves are a result of the formation or increased formation of tannoid compounds. The question then is: What are the conditions which make the autumn season particularly favorable for the development of these substances?

Some careful studies have been made that bear upon this question It appears that the production of autumnal reds in many species is related to the sugar-content, and color may be induced or heightened in the shoots of many plants by growing them for a time in strong solutions Moreover, cold weather has been found to be generally favorable to the accumulation of sugar in the tissues Observation indicates that after a season favorable for growth, a cold, protracted autumn results in exquisite autumn coloration It is certain that nothing is more disastrous to brilliance of color than severe early frosts In addition to enhancing pigmentation, sugar-content seems to be most important as one factor in cold-resistance It requires a very light frost in the late summer to kill outright the leaves and young shoots of many trees, but the same shoots may be unaffected by an equal degree of cold when the conditions have been such as to bring about the normal autumn coloration

B. M. DUGGAR.

AUTUMN-GARDENING. There is wealth of material for spring-and summer-gardening; but to secure good garden effects in autumn requires mostly other material and a different intellectual conception of the problem. The common problems of the gardener in autumn grow out of two facts: First, the frost kills tender plants sooner than he desires; therefore he tries

to save vegetables and flowers as long as possible by protection and by choosing hardy kinds. Second, gardens tend to look unattractive and seedy in September, because this is nature's time for ripening fruits; therefore he desires fresh flowers The popular demand is for fresh vegetables as long as possible, color in the garden right into the teeth of winter, cut-flowers after frost, home grounds that will be attractive even after a summer's absence, and a note of welcome to the children in every school-yard Also, there are enthusiasts who wish gardens devoted exclusively to autumn beauties.

Prolonging the vegetable-garden.

The ideal way to prolong the yield of fresh vegetables in late autumn is by means of greenhouse, hotbeds and coldframes. In frames, which are the cheapest, it is



441. A good autumn landscape for color effects.

easy to have in November lettuce, spinach and radishes. The next best plan is to shelter the garden from cutting winds and frost by a windbreak, e g , wall, fence, hedge, natural wood, or group of evergreens Sheltered gardens often yield fresh vegetables two to six weeks after adjacent unsheltered gardens have been devastated by frost It is also possible to prolong the season by raising late-growing varieties and by starting the ordinary kinds later in the year.

Freshening the flower-garden.

Parks and the grounds of wealthy people often rely chiefly on tender or temporary bedding plants, e g., cannas, dahlias, scarlet sage, gladioli, geraniums and Pfitzer's torch-lily, for their largest masses of autumn color. This method gives the greatest show the first year, but is costly in the long run Moreover, these plants are killed by frost, leaving gaps too large to fill.

A grade higher is hardy bedding, which has become popular since 1900 The favorite plants are long-blooming shrubs and perennials, e g , Baby Rambler rose, garden and tree hydrangeas, Miss Lingard phlox, gaillardias, stokesia, Napoleon III pink, double ragged robin, *Veronica longifolia* var. *subsessilis*, *Conoclinium* (*Eupatorium*) *cœlestinum*

Unfortunately, the flowers of the two preceding lists do not really freshen the garden, because they are summer flowers or are being made so by the irresistible tendency to exploit earlier varieties of everything As taste improves, there is a reaction against excessive use of long-blooming plants, and a desire has arisen for "season markers." Among the finer plants of this real autumn sort are *Colchicum Parkinsonii*, *Crocus zonatus*, *C speciosus*, *C sativus*, *Crinum Powellii*, *Sternbergia lutea*, *Chrysanthemum uliginosum*, gordonia, and the rarer plants to be mentioned hereafter. They are, however, plants of the skilled amateur

For beginners, the favorite hardy autumn flowers include the following annuals or plants treated as such, —China asters, pansies (sown outdoors about May 10 in latitude of New York City), snapdragons, and cosmos; bulbs,—*Colchicum autumnale*, perennials,—sneezeweed, *Helianthus orgyalis* and *H. Maximiliani*, and pompon chrysanthemums

Another way of providing fresh color in autumn is to make a second or June sowing of favorite annual flowers, e g , sweet alyssum, candytuft, love-in-a-mist, common and pot-marigold, mignonette, nasturtium, phlox, California poppy, portulaca and zinnia These usually fail in September from the April sowing The June sowing will carry them beyond a hard frost, except nasturtium and portulaca.

Flowers after frost.

In early November, after frost had devastated the gardens in the neighborhood of Philadelphia, the following flowers were in condition at one of the largest nurseries of perennials. Only those are mentioned that gave decided masses, not mere dots or remnants of color: *Aconitum columbianum*, *A Fischeri*, alyssum, antirrhinum, *Aster grandiflorus*, *A. tataricus*, *Cimicifuga simplex*, Napoleon III dianthus, *Erigeron glabellus*, gaillardias, gladioli, *Helianthus Maximiliani*, hunnemannia, kniphofias, pansies (sown in May), Miss Lingard phlox

Nearly all the flowers in the two preceding lists are available for home decoration, although the quality may not be equal to that of early September. If long-stemmed, long-lasting flowers are needed in quantity, the most satisfactory, perhaps, are chrysanthemums, snapdragons, Miss Lingard phlox, gaillardias. To this list may be added delphiniums, Baby Rambler rose and *Catananche cærulea*.

Gardens based on the dominant color.

It is feasible to make a garden that changes its color every three or four weeks, based upon the idea that a garden may well reflect the dominant color in the landscape produced by the wild flowers of each season. Since yellow is the dominant color of autumn (witness the goldenrods, sunflowers and other composites) such gardens may be rich in sneezeweed and perennial sunflowers (especially *Helianthus Maximiliani*, *H orgyalis*, and *H. multiflorus* var. *plenus*) since these are particularly appropriate to season and country. The following yellow flowers of summer may be prolonged into autumn by seed-picking, cutting back, fertilizing, and watering. Tufted pansies, snapdragons, Golden Glow rudbeckia, gaillardia, Iceland and horned poppies, *Anthemis tinctoria* and *Lepachys columnaris*.

Gardens of perennial asters.

The English make an exceedingly showy, yet artistic, garden based upon what they call "Michælmas daisies" (asters), of which 137 species and varieties are catalogued by a single dealer. It consists of a double border devoted to the early kinds that bloom during the first three weeks of September, and a separate border for the October- and November-blooming species.

The pictorial effect is improved by a definite color scheme, planting in drifts, and an ingenious system of training on hidden branches This type of garden is of peculiar interest to Americans because the perennial asters are mostly American wild flowers, and it meets the general desire to grow a class of flowers which is too prolific for the ordinary garden Owing to the notorious difficulties of identifying species of this genus, Americans find it more practicable to import collections than to assemble species from the wild The true asters are generally supplemented by yellow flowers of other genera (e g , Chrysopsis) in order to make the early garden a pink and yellow composition, while the later garden is devoted to purple, lavender and blue.

Woody plants for autumn bloom.

In larger gardens and on home grounds it is desirable to secure flowers by using more permanent materials, as woody plants Unfortunately, the only tree that blooms in autumn (gordonia) has to be wrapped during winter in the North The list of vines also is small, being confined to left-over blooms of trumpet creeper, Hall's honeysuckle, and paniced clematis

The autumn-blooming shrubs, however, are excellent. Unluckily, the showiest of them all, *Hydrangea paniculata* var *grandiflora*, is commonly used in such ways as to bring upon American yards the reproach of gaudiness and vulgarity It looks gross and over-fed compared with the slender grace of its prototype, *H paniculata*, and its double flowers are artificial compared with the single ones True, they last longer and give more for the money than any other flower of autumn, but such plants from their irresistible appeal to beginners, are planted in every yard and tend to make home grounds look too much alike and too common. The situation is aggravated by inartistic ways of using it, e g , hedges from sidewalk to porch, great masses across the front of the house, borders of curving drives, and beds in the middle of the lawn Again, it is pruned severely to make the largest trusses, which results in loss of height and dignity, and in top-heavy masses ill-concealed by supports A better system of yard-decoration, is the use of informal shrubbery borders, since they give year-round interest and greater variety to yards

To supplement the ubiquitous double hydrangea, the following may be recommended, subject to the limitations noted *Abelia chinensis*, white, begins blooming in Georgia in June and is well covered in New England as late as September 30; *Abelia grandiflora*, pink, needs a winter covering of boughs North, *Baccharis halimifolia*, has tufts of showy pappus, like camel's-hair brushes, that look like white flowers, *Buddleia variabilis*, pink, is killed to the ground at New York but recovers and blooms freely, *Caryopteris Mastacanthus*, blue, behaves like buddleia, *Hamamelis virginiana*, yellow, not showy, but the last shrub to bloom, *Hibiscus syriacus* or althæa (only the single white variety here recommended), *Hydrangea paniculata* var. *tardiva*, which gives a fresh white after the double hydrangea has begun to assume its metallic colors; roses, hybrid teas, which are at their best on Long Island in early September; *Vitex Agnus-Castus*, lilac, hardy to New York.

A more artistic way of securing color

Although the popular interest is in flowers, there is a far more important method of securing color,—by means of trees, shrubs and vines with brilliant autumn colors in foliage and fruit This method is more artistic because more appropriate to the season, more permanent, and cheaper in the end It is also more American, because we have more native shrubs than autumn flowers; because shrubbery is the only class of material (except water-lilies) in which we enjoy a climatic advantage over England; and because autumnal colors in America are more brilliant than those in western Europe. For home decoration, cut sprays of multiflora rose, common barberry, bittersweet, and the like, are longer-stemmed and last longer than flowers Those just named remain attractive all winter, even when shriveled

Our climate naturally suggests flowers in spring, attractive foliage in summer, natural colors in autumn, and in winter the shrubs with brightly colored berries and twigs. The late season situation can be met by making 90 per cent of the planting consist of combinations of trees and shrubs with triple or quadruple attractions of flowers, foliage, autumn colors and fruit, e g., *Cornus alba* and var *sibirica*, *C Amomum*, *C florida*, and *C mas*, *Viburnum cassinoides*, *V. Lentago*, *V. prunifolium*, *V Lantana*, *V tomentosum*, and *V. americanum*, *Magnolia stellata*, *M Soulangeana*, *M glauca*, *M acuminata*, and *M tripetala*, *Berberis vulgaris* and *B Thunbergii*; Regel's privet and the best form of the Amoor River privet, Morrow's bush honeysuckle; prairie, multiflora, rugosa, and Wichuraiana roses and their sturdiest descendants, and the following vines: *Euonymus radicans* var *vegetus*, trumpet creeper, wistaria, bittersweet, and the wild and paniced clematis.



442. An autumn-blooming bulb —Colchicum autumnale.

Color harmony in autumn.

Sentimentalists aver that nature never produces discordant colors, although the famous poinciana of the tropics and the nemesias of the garden furnish a combination of magenta and scarlet in the same flower. A walk through a good arboretum in September will convince the unprejudiced observer that discords exist in flowers, fruit, and foliage. In practice, nine-tenths of the troublesome discords are produced by the magenta group of colors, including the strongest purples, crimson, lilac, and crimson-pink The artistic way to handle these colors is to isolate them in nooks surrounded by green, or to put them in deep shade, where they are purified and softened, instead of allowing them in the open garden, where full sun makes them too strong and where they conflict with all other colors, except white and green The list of "dangerous colors" includes the flowers of Japanese anemone, crimson-pink chrysanthemums and China asters (in all of which safer colors are available), the Anthony Waterer spirea, the subsessile veronica, *Lespedeza Sieboldii* and *Clerodendron fœtidum* Examples among fruits are Indian currant, callicarpa, burning-bush, strawberry-bush and several of the species of euonymus during the period when their highly colored capsules conflict with their scarlet arils. The purplish-twigged shrubs, e. g., *Cornus alba*, *C. Amomum*, *C. stolonifera*, and *C. Purpusii* (the last a species commonly but unwittingly distributed as *C. Amomum*), constitute an exception, since they are brilliant only in sunlight, and their color being dis-

sipated, instead of massed, is less liable to produce discords.

In foliage, the colors bordering on magenta are so rare that they may be ignored in planning the home-grounds, although careful designers always consider autumnal colors. When discords occur they may be resolved usually by planting between the discordant trees or shrubs some plants that retain green foliage until late autumn. Wine- or claret-colored foliage, like that of the maple-leaved arrow-wood, or crimson, like that of *Itea virginica*, occasionally makes discords with nearby foliage of yellow or scarlet, but in the case of such small plants it is usually easier to remove one of the trouble-makers The sweet-gum, however, often makes a large mass of very dark purple, which may seriously disagree with yellow-foliaged specimens, or with buildings of yellow or red, especially since it has come to be used as a street tree In practice, however, flowers make less trouble than shrubs, and shrubs than trees, and discords may generally be abolished by moving the smaller plants. The commonest and greatest color difficulty in autumn foliage comes from over-planting the following class



443 Hardy chrysanthemum, one of the best of the autumn-blooming herbaceous plants

Scarlet foliage in autumn theoretically may be no more vivid than other colors, but it is popularly regarded as the climax of all the autumn colors For example, persons who give little thought to planting for autumn effect buy the scarlet and Tartarian maples, the red variety of silver maple, and ask the nurserymen for "a sugar maple that is guaranteed to turn red" The aromatic, scarlet, smooth, and staghorn sumachs are in considerable demand And, above all, the Japanese and common barberry are planted At the entrance to public parks are often seen several hundred Japanese barberries planted in a bed for a blaze of autumn color If disproportionately large, such masses of scarlet are perhaps only one grade higher than tender foliage plants. The brilliant reds commonly conflict with brick buildings and parti-colored houses of wood

Deep red foliage in autumn is quieter, but rich enough. It is seen in the scarlet, pin, and red oaks, flowering dogwood, black choke-cherry, wild gooseberry (*Ribes Cynosbati*), and several native huckleberries and roses

Bronze foliage is seen in most of the plants that become red, for they attain to it from green through many bronzy colors But the richest bronzes generally are associated with thick, lustrous, persistent leaves The most highly esteemed, because most costly, are the broad-leaved evergreens, e g, the Hinodigiri and amœna azaleas, mahonias, leucothoes, *Pieris floribunda* and *P. japonica*, and galax. These assume their brightest colors in full sunshine and, at the northern limits of their cultivation, sometimes suffer a loss of foliage. In the higher latitudes it is often best to sacrifice color to hardiness, by sheltering the plants from winter winds and sunshine, in which case they usually retain a lively green. A cheaper list, because composed of semi-evergreen plants, comprises California privet, Hall's honeysuckle, Wichuraiana rose, sweet fern, and bayberry. These color poorly in some localities, but they are of special value in the latter half of November, when the landscape first becomes bare, except for evergreen and nearly evergreen plants.

Yellow and orange foliage in autumn is midway between the vivider and the quieter autumn colors, the former having an exciting, while the latter have a soothing, effect upon the mind. The yellow and orange group rises in vividness from pale yellow, through gold to orange, the three stages being exemplified by larch, witch-hazel, and persimmon Here belong the striped maple, yellow-wood, Kentucky coffee tree, ironwood, *Prunus pennsylvanica* and *P serotina*, cucumber tree, large-leaved magnolia, *Cratægus punctata*, yellow-root and sugar maple. The duller yellows merge with the next group.

Brown and neutral autumn foliage tones down the most brilliant colors and resolves nature's discords Examples are the American and slippery elms, and perhaps even the brighter red and chestnut oaks

Green foliage in autumn is even more valuable in harmonizing colors. It is well expressed in the evergreens and nearly evergreen plants The sudden devastation of the landscape occasioned by the fall of the leaves (whence the Americanism "fall" as a synonym of autumn) excites fresh interest in all the plants that remain green. These are of three classes (1) The *broad-leaved evergreens* constitute the most sumptuous class of hardy plants, because they often possess showy flowers or fruits in addition to broader and more lustrous leaves than the conifers Of the fifty kinds that are hardy in the latitude of New York, the following have special autumn attractions *Osmanthus Aquifolium* (flowers), mountain laurel (red twigs), American holly, climbing euonymus, fire thorn, *Cotoneaster buxifolia* and *C microphylla*, partridge berry, and winter-green In the South, the following have special attractions in autumn English holly, *Euonymus japonicus*, ardisia, and nandina, all of which have red fruits, and pernettyas having fruits of various colors Unfortunately, no plant of this class much exceeds 15 feet in height in the northeastern United States, and it is idle to hope for a 50-foot tree of this group, such as England possesses in the holm oak or ilex (2) The *narrow-leaved evergreens*, or *conifers*, may lack showy flowers but they furnish more tall hardy plants than the broad-leaved evergreens Their year-round uses are too numerous for mention here, but their autumnal functions are four,—(*a*) to harmonize discords; (*b*) to rest the eye from color; (*c*) to furnish contrast, which intensifies color; (*d*) to give greater dignity than showy colors possess This dignity is due to the year-round beauty, longer life, and costliness of white and red pine, northern and Carolina hemlock, Nordmann and concolor fir, white and Douglas spruce, red cedar and arborvitæ, as compared with cheap, showy and temporary deciduous trees like willows, poplars, silver maples, and the like Even the Vermont sugar-bush which, in October, is one of the most gorgeous spectacles, presents a finer appearance in the landscape when skirted by occasional white pines, which add greatly to the dignity and "paintable quality" without obscuring its farm value or purposeful character (3) The *nearly evergreen* or *half-evergreen plants* may be bare from one to three months, depending largely on latitude and season The plants that remain green until their leaves fall are mostly natives to western Europe, or to the warmer parts of China, Japan or Korea, and are usually associated with a moist and cloudy autumn European examples are buckthorn, common privet, sea buckthorn, *Cytisus capitatus* and *C. nigricans*, *Genista tinctoria*, *G. elata*, *G. pilosa* and *G germanica*. Far-eastern examples are California privet, matrimony vine, panicled clematis, *Akebia quinata* and *A. lobata*, *Lonicera fragrantissima* and *L. Standishii*, and *Euonymus Hamiltonianus* var *semipersistens*. American examples are few, and *Lonicera Ledebouri* comes from California (climate like Europe), but the overcup oak and *Leucothoe racemosa*

are eastern and southern plants All these species were reported as being green at the Arnold Arboretum as late as November 8 The peculiar value of this class is as a substitute for broad-leaved evergreens Unfortunately, the climate of the northeastern United States is not favorable to broad-leaved evergreens, compared with the South or Europe, and the lavish use of them requires a princely income Consequently, some of these cheaper plants, e g , California privet, Hall's honeysuckle, and Wichuraiana roses, are available even to the poor, while the whole list is of special interest to people who have summer homes.

Ornamental fruits of autumn

The extraordinary beauty of shrubs with brightly colored berries was first publicly and sufficiently demonstrated in this country by the Arnold Arboretum Compared with autumnal colors of foliage, the fruits present fewer, smaller, and more jewel-like masses Amid the bewildering variety one may discern three groups

First are the short-lived fruits, which drop soon after the killing frost, or present an unattractive appearance owing to decay Here belong the vast majority of ornamental fruits, including crab apples, dozens of hawthorns, *Viburnum Lantana, V alnifolium, V cassinoides, V Sieboldii* The chief function of this class is to suggest the fecundity and variety of nature in autumn, but attractive thorneries have been designed, and the ornamental fruits of the Rosaceæ are now used to connect the battle-scarred remnants of old orchards with modern ornamental planting, especially boundaries

The second group comprises all the fruits that remain attractive until Christmas, e g , the rugosa rose

The third and most valuable group comprises those that remain attractive all winter, like the barberries This and the second group are classified by color under *Winter Gardening* (Vol VI)

Most persons are willing to sacrifice some degree of ornament in order to attract the birds The following furnish food in autumn, when it is especially desirable to attract the migrants to the South the flowering dogwood, red osier, and alternate-leaved dogwood, choke-cherry, black and sweet elder, arrow-wood, sassafras, kinnikinnick, crab-apple, hawthorn, firethorn, cotoneaster, buffalo berry, tupelo, and mountain ash.

Landscape forestry in autumn

Private and public woodlands in the East are more beautiful than a decade ago, in spite of the destruction of magnificent chestnut trees, and this is true, although probably to a lesser extent, in other parts of the country. The sudden spread of the chestnut disease has brought certain compensations For example, the flowering dogwood, which was formerly kept down, has prospered mightily, making the woods showier both in May and September, and other vegetation changes are following

There is arising a general interest in pleasure woods, as witness the term "landscape forestry," which was unknown ten years ago We are beginning to make personal use of woods Judged by English standards, American woods are too crowded by crooked and spindling trees for comfort, and the general lack of evergreens robs them of mystery and charm Our most urgent needs, therefore, are thinning, drives, paths, and the restoration of evergreens, all of which are especially enjoyable during the autumn and nutting season Mistaken zeal has denuded many woods of undergrowth, which should quickly be restored along drives and paths To glorify the woods on dark autumnal days, it is well to use masses of witch hazel, the foliage of which furnishes one of the cheapest and quickest ways of getting great sheets of sunny color.

Unfortunately the eastern mountains have been devastated so often by fires and lumbermen that there is comparatively little variety, the chief masses of color being furnished by quick, short-lived species, like poplars, birch and balsam, which are mere weeds compared with the more enduring and valuable oaks and pines Our greatest problems are the restoration of variety and of long-lived species In such work the fashionable colonies in the Berkshires ought to take the lead, since the social season reaches its height at Lenox in September. The Arnold Arboretum presents one of the most artistic, and probably the most varied, autumn landscapes made by man.

WILHELM MILLER.

AVÈNA (the old Latin name) *Gramineæ* OATS Mostly annuals with open panicle and large spikelets Spikelets 2-6-fld ; rachilla bearded below the florets; glumes about equal, large and membranaceous, many-nerved, usually as long as the spikelet, lemmas indurated, bidentate at apex, bearing a stout twisted awn on the back (this often straight or wanting in the cultivated oat) —Species about 50, of the temperate or cooler regions of the world Scarcely grown as ornamental subjects.

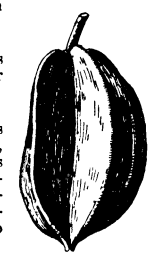
fátua, Linn WILD OATS. Resembles the cultivated oat, but differs in having long, brown hairs on the lemmas spikelets usually 3-fld , glumes 1 in long; awns of lemmas about an inch long Dept Agric , Div. of Agrost 20.94 —Intro. from Eu , especially on the Pacific coast, where it is a troublesome weed In the latter region the spontaneous growth is frequently used for hay.

sativa, Linn CULTIVATED OATS Spikelets usually 2-fld ; lemmas glabrous, awns usually straight or wanting See Cyclo Agric I

stérilis, Linn ANIMATED OATS Resembles *A fatua* but the spikelets larger, the glumes about 1½ in , awns 2-3 in —Occasionally cult as a curiosity, the florets when moistened presenting spontaneous movements due to the twisting and untwisting of the awns as they absorb or give off moisture

A elàtior=Arrhenatherum elatius

A S HITCHCOCK



444. Averrhoa Carambola. (×½)

AVERRHÒA (after Averrhoes, the Arabian physician) *Oxalidàceæ.* Tropical fruit trees, cultivated in India and China, and sometimes grown under glass for ornament

Leaves alternate, odd-pinnate, lfts alternate, ovate-acuminate, entire, stalked, sensitive fls borne on the naked sts and branches, minute, fragrant, rose-colored to reddish purple in axillary or lateral cymes which are often panicle-like. calyx red, corolla campanulate, petals 5 See N Amer. Fl 25 57 (1907).

Carambòla, Linn. CARAMBOLA Fig 444. Height 15-30 ft lfts 5-10· fls rosy purple borne in the lf-axils. fr varying in size from a hen's egg to a large orange, ovate, acutely 5-angled, yellow, fragrant, the pulp acid P M 15, p 231 Rheede, Hort. Ural 3 pl 43, 44 Cav Diss. pl 202.—Cult sparingly in S Calif , and frequent in W Indies. The half-grown fr used as pickles, the ripe fr. for preserves There are said to be two varieties, the sweet and sour, the former being eaten Said to produce 3 crops a year. Leaves responding to the touch.

4 *Bilimbi,* Linn CUCUMBER TREE BILIMBI Height 20-60 ft : lfts usually 31-45 pairs fls red, in longer clusters than the above and borne on branchlets from the hard wood fr smaller than the carambola, cucumber-shaped, smooth, green rind, and acid pulp. Extensively cult in S Amer P M 15, p 231 Rheede, Hort Mal 3, pl 45 46 Lam Encyc pl 385

N. TAYLOR.†

AVICÉNNIA (from *Avicenna*, the Latin name of an illustrious physician of the Orient, 980–1036). *Verbenàceæ* BLACK MANGROVE WHITE MANGROVE. Trees or shrubs usually growing in mangrove swamps and on the shores of tropical estuaries, remarkable for the vertical leafless breathing-stems that rise above the soil from their long spreading horizontal roots.

Leaves opposite, entire, coriaceous, persistent: fls. small and inconspicuous in axillary cymes, calyx cup-shaped, deeply 5-lobed; corolla bell-shaped, whitish, 4-lobed, stamens 4, inserted on the corolla-tube, exserted, bearing ovate, 2-celled anthers, ovary sessile, 1-celled, ovate, tapering upward into a slender 2-lobed style, and containing 4 ovules suspended from a central placenta. fr ovate, oblique, opening by the ventral suture and exposing the expanding embryo, before dropping off; embryo with broad, fleshy conduplicate cotyledons — Three species now recognized· *A nitida* which reaches S. Fla. and La., *A officinalis* of Polynesia and the E. Indies, and *A. africana* of the west coast of Afr Planted on the shores of estuaries to prevent washing by tidal currents, they collect floating debris by means of their erect breathing-sts , and by this means aid in extending the shoreline seaward.

nítida, Jacq. BLACK MANGROVE WHITE MANGROVE. HONEY MANGROVE SALT-BUSH. A tree, usually of moderate size but sometimes 60 to 70 ft high, with a short trunk, and spreading crooked branches: inner bark bright orange-red, outer bark scaly, deciduous, dark reddish brown young branches hoary-pubescent, at length glabrous and marked with interpetiolar lines and conspicuous lf.-scars· lvs. opposite, oblong or lanceolate-elliptical, gradually narrowed at the base, coriaceous, deep green and glossy above, whitish or grayish beneath, 2 or 3 in. long and about 1–1½ in broad. fls inconspicuous, fragrant, borne in few-fld spikes on angled canescent peduncles, closely invested with small bracts, corolla whitish, about ½in diam. when expanded, the lobes slightly tomentose on both surfaces, and the 4 anthers together with the style protruding from the nearly closed throat: fr oblong or elliptic 1–2 in long and about 1 in. broad Mangrove swamps and shores of estuaries, Fla , Miss , and Texas; also Trop Amer —The fls are very rich in honey, on which account bee-keepers in certain parts of Fla transport their entire apiaries to the coast, along the Indian River during the season of blooming, which occurs in June and July The honey produced is white and clear, and of excellent flavor, and always commands the highest market-price The embryo begins to germinate while the fr is still on the tree. When it drops off, the two cotyledons unfold into a miniature boat, floating on the tide, which distributes the fr. along the shores of bays and lagoons and carries it to the outlying keys Crystals of salt are often deposited on the lvs., on which account this species is sometimes called *palo de sal,* or salt-bush W. E. SAFFORD.

AVOCADO. (*Persèa gratissima,* Gaertn.). Figs. 445, 446 One of the most highly valued of tropical fruits It is commonly grown in Mexico, Central America, parts of South America, the West Indies, and Hawaii; to a limited extent in India, Madagascar, Reunion, Madeira, Samoa, Tahiti, Algeria, Queensland, and other tropical and subtropical countries In Florida and California, its cultivation is conducted commercially See *Persea*

The avocado is considered by most authorities to be indigenous to Mexico, Central America, and South America to Peru and Brazil From the Aztec *ahuacatl* has been derived the Spanish adaptation *ahuacate* or *aguacate,* the name in general use in Spanish-speaking countries. *Avocado* is an adaptation in use in the United States and other English-speaking countries; *avocat* in the French colonies *Alligator pear* is a misleading corruption that should be dropped.

Seedling avocados grow to a height of 50 or 60 feet; when budded the tree is considerably dwarfed The leaves are elliptical to oblong-lanceolate, varying from 4 to 8 inches in length, persistent, deep green, the new growth frequently wine-colored. The tree is worthy of a place in every dooryard for shade and ornament The small, greenish flowers are produced in great abundance on loose axillary racemes.

The fruit is variable in form, color, and size, as well as in quality and minor characters The form ranges from oblate or spherical to slender pyriform, including a great variety of shapes, one of the commonest being broad pyriform. The color may be light or dark green, purple, crimson, or maroon. The fruit varies from 1 to 6 inches in diameter, and in weight from a few ounces to three or four pounds The skin is sometimes soft and pliable, and no thicker than that of an apple,



445. Avocado tree.

in other forms it is coarsely granular, woody, and ⅛ inch thick,—in reality almost a shell Inclosed by it is a mass of yellowish pulp, of the consistency of firm butter, and of delicious nutty flavor The avocado is unlike most other cultivated fruits in the fact that it contains a large amount of vegetable oil, sometimes as much as 18 per cent; hence it can be considered more as a food than as a dessert It is used in numerous ways, the commonest being as a salad, with the addition of salt, pepper and an acid Sometimes it is cut in half, the seed removed, and the flesh eaten with a spoon, as muskmelons are eaten, salt or other condiment being added. The single, spherical or conical seed is frequently as large as a hen's egg. It is provided with two more or less distinct coats, which sometimes adhere to the seed, and in other instances to the flesh.

In recent years the avocado has been given systematic attention in the United States, both in regard to cultivation and varieties Previous to 1900, propagation was exclusively by seed, and as the species is variable when grown in this way, many trees produced inferior

fruit and commercial cultivation on a sound and profitable basis was not possible The choicest varieties are now propagated by budding and are grown on a large scale

The diverse climatic conditions under which the avocado is found enable varieties to be obtained which are suited to regions with cool climates as well as those which are strictly tropical. In Mexico the fruit has been grown for centuries at altitudes of 6,000 or 7,000 feet, where severe frosts are experienced each winter, varieties from such regions, as opposed to those from hot and humid lowlands, are suitable for cultivation in those parts of California and Florida in which slight frosts are the usual winter occurrence When mature, some types will stand temperatures as low as 20° F. without injury, if in proper condition at the time of the freeze, others will not withstand lower than 27° or 28° without serious damage

The subject of races or types has not been given systematic attention outside of the United States, and no attempt at classification has been made, other than brief descriptions of types found in limited areas in Mexico and Central America. In California two very distinct types are grown, commonly referred to as the Mexican and the Guatemalan; the former (*Persea drymifolia* of some botanists) is ordinarily a small fruit, four to eight ounces in weight, oval or pyriform, and thin-skinned It is one of the hardiest types in cultivation and very productive, as a rule The Guatemalan type is characterized by its thick, woody skin, frequently rough or tuberculate on the exterior, the fruits are medium-sized It is considered one of the best for commercial use, as it can be shipped without difficulty The type grown in Florida is usually referred to as the West Indian-South American. It has a skin sometimes as thick as the Guatemalan, but of softer texture, some varieties are of large size and attractive appearance, but the type is rather susceptible to frost

The avocado has been subjected to systematic cultivation for so brief a period that a large number of named varieties has not been established In Florida the Trapp is the most widely planted and is, in fact, the standard commercial variety, Pollock occupying the place of next importance Several others are grown to a limited extent, including Family, Rico, Blackman, and Wester In California some of the most promising varieties are Taft, Lyon, Meserve and Murrieta, a number of others have been disseminated Several named varieties have been established in Hawaii

For commercial cultivation, winter-fruiting varieties have been found to be the most valuable, since northern markets are almost destitute of fresh fruit during that season It is desirable, however, to have a supply, for local consumption at least, during other seasons of the year Fortunately varieties are obtainable which ripen at widely different times,—in California fruit is in the markets fully ten out of the twelve months, although the season in Florida, at the present time, is not so long A variety running uniformly about a pound in weight appears to be the most desirable, and if the fruit is round or oval, it can be more advantageously packed and shipped than if pear-shaped or "bottle-necked" The skin should be sufficiently thick and tough to withstand shipment without undue care in packing, and the seed should be as small as possible. It is also important that the seed be tight in its cavity, for in the loose-seeded varieties, the flesh is often seriously damaged by the seed shaking around while the fruit is in transit. Flavor and quality must of course be up to the standard, there being a wide difference among the varieties in these respects.

Large seedling trees of the small-fruited Mexican type sometimes produce as many as 2,000 or 3,000 fruits in a season, while a large-fruited variety may not produce more than a few dozen. Two or three hundred fruits may be considered a good crop for a tree of a medium-sized variety.

In Florida, budded trees are planted in orchard form 20 feet apart; in California the distance is increased to 24 or 25 feet Seedlings must be given more room,—30 feet at least. A well-drained, sandy loam is the soil best suited to the avocado, drainage being the most important requirement. For this reason it is best, where possible, to select a sloping piece of ground as a site for the orchard Heavy soils, such as clay and adobe, will grow the tree successfully if the drainage is good

Transplanting is best done in early spring, after danger of frost is over, but before the tree has started into new growth In climates such as those of California and Florida, the tree is in a semi-dormant state after the cool weather of winter, and can be moved with little difficulty A ball of soil should be taken with the roots, and the top pruned moderately In light soils which cannot be balled, the trees should be transferred to pots or boxes and allowed to establish themselves, after which they may be set out in the orchard without disturbing the roots When the budded trees have been grown in pots, the possibility of injuring the delicate roots is eliminated

The cultural requirements of the avocado are similar to those of the citrous fruits In dry climates the trees must be irrigated regularly and frequently, particularly during the first two or three years For bearing trees a fertilizer containing 3 per cent nitrogen, 5 per cent phosphoric acid, and 12 per cent potash has been recommended, the quantity required each season varying from three to ten pounds per tree, according to the character of the soil This should be applied in several doses during the growing season The growth of young trees is greatly encouraged by organic nitrogen. Leguminous cover-crops are very desirable, for the humus they will furnish as well as the nitrogen

Often there is a tendency, especially in seedlings, to shoot upward and not spread out, this must be checked by heading back All weak or unshapely growths should be trimmed out, and all wounds made when pruning should be covered with grafting wax or paint to prevent the entrance of any fungus into the wood It is well to keep the trees headed low to prevent damage from winds as much as possible, this also brings the fruit within easy reach for picking

In regions subject to severe frosts, the trees should be protected during the first two or three winters with a shelter of palm leaves, corn stalks, burlap, or some such material Where irrigation is practised, it is well to harden the trees by withholding water in late fall

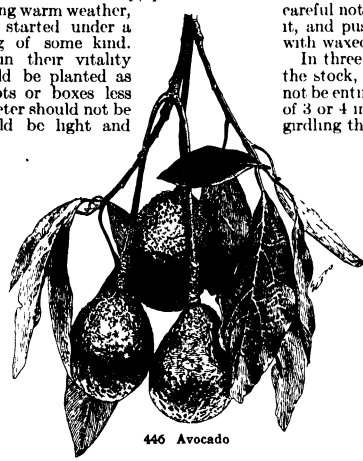
In Florida the avocado is attacked by the wither-tip fungus (*Colletotrichum gleosporioides*), which can be controlled with bordeaux mixture. Two or three scale insects have been noted on trees in California, but up to the present time they are not of serious importance, with the exception of the black scale (*Saissetia oleæ*), which sometimes requires combative measures The avocado mealy bug (*Pseudococcus nipæ*) is troublesome in Hawaii

For market purposes, the fruit should be graded according to size, color and form, and carefully packed; it is essential, if the fruit is to be shipped any distance, to select varieties having good carrying qualities Light wooden crates are used for shipping, containing one layer of fruits, and provided with good ventilation. The fruits must be separately wrapped in pieces of strong paper, and packed closely together to prevent their shaking about and becoming bruised If they are to be shipped long distances, refrigeration is essential, experiments having shown that the temperature should be 40° to 45° F Prolonged storage in temperature lower than 40° results in decomposition of the flesh

Seedlings do not usually bear as early as budded trees, and on account of the variation which they are

likely to show in productiveness, as well as in form, size and quality of fruit, they are unsuitable for commercial cultivation For the home grounds, on account of their ornamental value, they are worth planting; it is imperative, however, to select seeds from the most desirable fruits, of known quality and productiveness

The avocado is budded on seedlings of the same species For nursery purposes the seeds are usually planted singly in pots or in rows in the open ground They may also be planted in flats, and potted off as soon as they have germinated, as the roots are delicate and easily injured, however, this is not a desirable method A glasshouse is unnecessary, provided the seeds are planted during warm weather, but they are usually started under a lath or slat covering of some kind. Seeds will not retain their vitality very long, and should be planted as fresh as possible. Pots or boxes less than 4 inches in diameter should not be used The soil should be light and porous, preferably rich in humus Most avocado seeds are somewhat conical; they should be planted with the pointed end up, leaving the tip projecting above the surface of the soil The pots should then be plunged in a frame, covered with straw or litter, and kept continually moist, but not soggy Germination will take place in two or three weeks if conditions are favorable If planted in the open ground, the seeds should be placed in rows 3 or 4 feet apart, and 14 inches apart in the row, covering them with an inch or two of soil It is well to cover the ground with a mulch of straw to prevent evaporation as much as possible



446 Avocado

The avocado is a rapid grower, and young plants require frequent repotting. It is also a gross feeder, so that a rich soil should be used The plants may be budded either in pots or in the open ground; if in the former, they must be given very careful attention so as to keep them growing vigorously, and should be in 6- or 8-inch pots They may be budded when ⅜ inch in diameter, or even slightly less.

For avocados, shield budding, essentially the same as practised with the citrus fruits, is most successful and advantageous The amateur may have some trouble in performing the work successfully, but after a little experience, few difficulties will be encountered

The season at which budding is most successful naturally depends somewhat upon the locality In Florida, late autumn and winter budding is favored; in California, May and June seem to be the best, although good success is often obtained in the fall, in Hawaii winter and early spring are preferred. Probably the work can be done at any season when the bark will slip readily, but all seasons are not equally advantageous.

Selection of budwood is one of the most important matters, and one likely to give the novice most trouble. If the wood is too old or too far advanced, the buds are almost certain to drop, leaving a "blind" shield, this may happen even when good budwood is used, if the stock is not in vigorous condition. The ideal wood is of recent growth, but hardened up sufficiently so that it does not snap on bending, and having plump, well-developed buds.

It is essential that the buds be cut large,—not less than 1¼ inches in length, and thick enough so that a small quantity of wood will be taken In budding large stocks, ¾ inch in diameter, 2 inches is not too long for the bud, provided the budstick is, as it always should be, not less than ⅜ inch in diameter. The budding-knife must be as keen as a razor, and kept in as nearly that condition as possible by frequent stropping or whetting the knife after cutting each thirty or forty buds The incision in the stock may be made either in the form of a T or an inverted T, preferably the latter, which has the recommendation of the most successful avocado budders In lifting the bark be careful not to injure the delicate tissues which lie under it, and push the bud in very gently Tie it in firmly with waxed tape, leaving the eye exposed

In three to five weeks the bud will have united with the stock, and the wrap should be loosened; it should not be entirely removed until the bud has made a growth of 3 or 4 inches Force the bud into growth by partly girdling the stock 3 or 4 inches above it, or by cutting off the stock about a foot above it Lopping is difficult, as the wood is brittle and will frequently break off rather than be lopped The stock must be gone over every week and all adventitious buds rubbed off When the bud is 8 or 10 inches high, the stock may be trimmed off close above it, and the stump covered with paint or grafting-wax

Both marching and grafting are practised to a limited extent, the latter usually under glass Neither of these methods is so desirable as budding Cuttings can be grown if bottom heat is available but trees produced in this way do not seem to have the vigor of budded trees

Large, unproductive or undesirable seedlings should be worked over to a good variety This is not difficult to do by budding, grafting is also possible Cut the tree back severely in spring, leaving only the stumps of the largest branches, 3 or 4 inches in diameter, and painting the cut ends with white lead Numerous sprouts will soon make their appearance; all but three or four of these on each branch must be rubbed off, and when these have attained a diameter of ¾ inch they can be budded in the same manner as seedlings It is necessary to loosen the wraps oftener, however, as the sprouts naturally make a very rapid growth Old trees worked over in this way will often produce fruit in two years

F W POPENOE

AZÀLEA (from Greek *azaleos*, dry: Linnæus believed them to grow in dry locations). *Ericàceæ*. See *Rhododendron*

The genus Azalea seems botanically inseparable from Rhododendron; there are no characters by which the two genera can be clearly separated, though if one looks only at the American species and those generally in cultivation, the differences seem to be clear enough, but if one takes into consideration the whole genus, particularly as it is represented in Asia, where it reaches its greatest development, one finds many species that have the characters of these two groups combined in various ways and render a natural and clear separation impossible

Most of the species retain the same specific or varietal name under Rhododendron, except the following:

A álba, Sweet=Rhododendron rosmarinifolium —*A balsamiæflòra*, Carr =R indicum var rosiflorum —*A. califórnica*, Buckl = R occidentale —*A Danielsiàna* Paxt =R. indicum var macranthum —*A ledifòlia*, Hook =R rosmarinifolium —*A liliiflòra*, Poir =R rosmarinifolium —*A lùtea*, Linn.=R calendulaceum — *A móllis*, Blume=R sinense —*A. móllis*, Miq =R japonicum — *A mucronàta*, Blume=R. rosmarinifolium.—*A. póntica*, Linn.= R. luteum —*A. procúmbens*, Linn.=Loiseleuria procumbens.— *A. punícea*, Sweet=R. rosmarinifolium.—*A. reticulàta*, Koch=

R. rhombicum.—*A Röllisonn*, Hort =R indicum var. rosiflorum. —*A. Siebôldii*, Miq =R indicum —*A speciôsa*, Willd =R calendulaceum —*A squamâta*, Lindl =R Farreræ

ALFRED REHDER.

AZÀRA (I. N. Azara, a Spanish promoter of science, especially of botany). *Flacourtiàceæ.* Ornamental shrubs or small trees grown for their handsome evergreen foliage and also for their fragrant flowers.

Leaves evergreen, alternate, short-petioled, entire or serrate, with usually one of the stipules enlarged and lf -like fls small, in axillary peduncled racemes or clusters, apetalous, sepals 4–5, with glands between the stamens and the sepals opposite the latter, stamens numerous, rarely 5, ovary superior, 1-celled, with numerous ovules, style simple, elongated fr a many-seeded berry.—About 20 species in S Amer , especially in Chile

They are handsome evergreen shrubs, with small or medium-sized foliage, inconspicuous but fragrant flowers, and therefore called "aromo" in Chile

They can be grown only in warmer temperate regions; the hardiest species is *A microphylla*. They are sometimes cultivated as greenhouse plants and potted in a sandy compost of loam and leaf soil. Propagation is by seeds or by cuttings of mature wood in autumn under glass with slight bottom heat

microphýlla, Hook f From 3–12 ft lvs. obovate, serrate, or nearly entire, ½–¾in long, shining, glabrous, the stipules similar, but half the size fls greenish in few-fld clusters, stamens 5 berries orange Feb , March. Chile G C II 1 81 Gn 18, p 403 Gt 23, p 340 F 1874, p 221 —Graceful evergreen shrub, regularly pinnately branched, excellent for covering walls; the hardiest of all the cult species, hardy as far north as Washington, D. C

Gilliesii, Hook. & Arn Height 10–15 ft · lvs. 2½–3 in. long, broad-ovate, with coarse, spiny teeth, glabrous; stipules orbicular, much smaller fls in dense, elliptic, nodding heads, yellow. Feb , March Chile B M 5178 F S 23 2145 G.C. II. 15.401.—The handsomest of all azaras.

A crassifôlia, Hort =A Gilliesii —*A dentâta*, Ruiz Height 12 ft lvs obovate or elliptic, crenate-serrate fls yellow, in small corymbs Chile B R 1788 -4 *integrifôlia*, Ruiz Height 10–20 ft lvs entire fls yellow, in oblong heads Chile Has a variegated form

ALFRED REHDER

AZÓLLA (Greek, *to destroy by drying*) *Salvinidceæ* A small genus of floating aquatics with small, pinnately branched sts and minute fleshy 2-lobed lvs , producing 2 sorts of spores in globular sporocarps The plants multiply rapidly by self-division, and will grow readily in water containing a little nutriment The species are distinguishable only by microscopic examination In natural conditions, the plants grow so closely together and multiply so rapidly as to cover very completely any quiet water surface For this reason, they have been found useful in preventing the propagation of mosquitos in Germany and Panama

caroliniàna, Willd Plant ¼–1 in. long anchor-like processes of spores with septa N Y. to the Gulf of Mex

filiculoides, Lam Plants 1–2 in. long anchor-like processes without septa. Calif. to Chile.

L. M. UNDERWOOD.
R. C. BENEDICT.†

B

BABIÀNA (said to come from Dutch for *baboon*, because those animals eat the bulbs) *Iridàceæ*. About fifty cormous plants of South Africa (and one Socotran), sometimes grown for spring bloom under glass, or in the open in the South

Usually less than 1 ft. tall: fls showy, red or purplish, in a short spike-like cluster or raceme, tubular at the base, the segms. with claws or narrow bases, and the limb erect-spreading, in marked colors and shades, often fragrant, ovary 3-loculed. lvs. narrow, hairy, plaited, standing edgewise to the st

Low plants, of easy culture if treated like freesias or hyacinths Three or four corms placed in a 4-inch pot, in autumn, give attractive bloom in March or later. Grown only indoors or under frames in the North. Outdoors in mild climates they may remain continuously in the ground, although it is better to take up and replant every year or two Propagation is by cormels and seeds They are showy and useful plants. Monograph by Baker in Handbook of the Irideæ, 1892.



447 Babiana stricta. (×⅓)

A. *Perianth-limb regular or nearly so, and wide-spreading.*

stricta, Ker (*B villòsa* and *B purpùrea*, Ker) Fig 447. Plant 1 ft or less high lvs broad, oblong-lanceolate or sword-shaped, barely reaching the spikes: fls scattered, showy, usually red or purple, with a prominent tube, the segms. oblong-lanceolate B M. 583, 621 —Babianas are not sold under species-names in this country, but as mixed varieties. These varieties are chiefly, if not wholly, of this species There are many forms and colors Var **angustifòlia**, Sweet. Lvs. linear fls blue, pinkish inside B.M 637. Var. **rùbrocyànea**, Ker Limb lilac, throat red. B.M. 410 (as lxia). Var **sulphùrea**, Ker. Yellow or whitish B.M. 1053. Two other long-cult. types are described below.

AA *Perianth-limb distinctly ringent or gaping.*

plicàta, Ker Low· lvs lanceolate, hairy, usually overtopping the spikes. fls lilac or red, long-tubed, the segms. oblong and unequal, odor pink-like. B.M. 576.

dísticha, Ker Differs from the last in having the perianth-tube distinctly exserted from the spathe; odor hyacinth-like. B.M 626.

B flabelliflòlia, Harv Fls 2–5, in erect spike, long-tubed, lower lobes blotched lvs ¾in broad, toothed at apex —*B ringens*, Ker. 6-10 in fls gaping and ringent, scarlet lvs narrow and pointed.— *B sambúcina*, Ker 6-10 in fls purplish, with spreading divisions, elder-scented B M 1019 —*B socotràna*, Hook f 3-4 in fl. single, the tube very slender, pale blue, 2-lipped lvs. narrow-lanceolate Isl of Socotra B M 6585 L H B.

BABY'S BREATH: *Gypsophila;* also *Galium* and *Androstephium.*

BACCAÙREA (Greek, *bacca*, berry, and *aureus*, golden, from the yellow fruit). *Euphorbiàceæ*. Trees, rarely cult., some with edible fr : lvs large, alternate, simple: infl. racemose; calyx imbricate; petals absent; 2 ovules in each of the 2–5 cells —About 50 species in the Old World tropics. related to Antidesma. **B. bracteàta,** Muell. Arg. (*Pierárdia dúlcis*, Wall), is mentioned as once intro. to England. Malaya. Seed of **B. Motleyàna,** Muell. Arg , of Malaya where the fr. is used, has been intro by the U. S. Dept Agric

J. B. S NORTON.

BÁCCHARIS (*bakkharis*, an ancient Greek name for different shrubs). *Compósitæ*. GROUNDSEL TREE Ornamental plants, chiefly grown for the showy white pappus of the fruit; some species also for their evergreen foliage.

Shrubby or suffruticose: lvs. alternate, usually serrate, glabrous, deciduous or evergreen heads of fls. small, white or yellowish, dœcious, in panicles or corymbs, involucre with many imbricate scales, receptacle flat, naked, pistillate fls with filiform corolla achenes compressed, ribbed, with pappus —More than 250 species in Amer , chiefly in S Amer

Baccharis halimifolia and *B. salicina* are hardy North, while the evergreen species are more tender They grow in almost any well-drained soil in a sunny position, and are well adapted for dry and rocky slopes, and valuable for seashore planting Propagation is by seeds, or by cuttings under glass

halimifòlia, Linn Shrub, 3–12 ft branches angular· lvs cuneate, oblong or obovate, coarsely toothed, the uppermost entire, glabrous, 1–2 in. long. fls in large panicles· pappus white, about ½in long Sept Seacoast, from New England southward Gng 7 113 — The hardiest species, in fr resembling a shrub with abundant snow-white fls.

B glomeruliflòra, Pers Allied to B halimifolia heads axillary, solitary or clustered, sessile or nearly so pappus somewhat shorter N C to Fla —*B patagònica*, Hook & Arn Low evergreen shrub lvs ¼–½in long heads mostly axillary Patagonia —*B pilulàris*, DC. Height 6 ft , evergreen lvs 1 in long heads in racemose panicles Pacific coast —*B salicina*, Torr & Gray (*B salicifolia*, Nutt). Allied to B halimifolia Lvs narrow-oblong, or linear-lanceolate Colo to W Texas.

ALFRED REHDER

BACHELOR'S BUTTONS: *Centaurea Cyanus, Gomphrena globosa, Ranunculus acris* and *Ageratum conyzoides*

BACKHOÙSIA (James Backhouse, botanical traveler) *Myrtàceæ*. Evergreen greenhouse plants, blooming in spring.

Shrubs or trees, with opposite lvs. and blossoms in cymes or umbels: calyx-tube turbinate, or broadly campanulate, adhering to base of ovary, with 4 persistent segms.; petals 4, short; stamens many, ovary 2-celled, bearing a filiform style fr. a caps., more or less inclosed in calyx, indehiscent or separating into 2 parts. —Five species in Austral. Requires the general treatment of myrtaceous coolhouse plants. Prop. by hardening cuttings under glass.

myrtifòlia, Hook. & Harv. Large slender-branched shrub, or small tree: lvs. ovate-acuminate, stiff, pellucid-punctate. fls. white, in pedunculate corymbs, the younger ones partly concealed by the petaloid bracts; petals small, round-ovate, concave, acute; calyx hairy Queensland and New S. Wales. B.M. 4133.

L. H. B.

BÁCTRIS (Greek, *baktron*, cane; the young stems used for walking-sticks). *Palmàceæ*, tribe *Bactrideæ*. Usually low palms, very rarely entirely spineless.

Stems solitary or fasciculate ringed, spiny or smooth, sprouting from the roots lvs terminal or scattering,

equally or unequally pinnatisect, glabrous or pubescent, segms. sparse or aggregated, or more or less imperfectly connate, forming a bifid blade, acute or rarely obtuse at the apex, the ciliate margins recurved at the base, petiole short or long, sheath long, spiny: spadices sessile or pedunculate, perforating the lf.-sheaths; spathes 2, the lower short, open at the apex, the upper coriaceous or woody, exceeding the spadix, or fusiform, ventrally dehiscent, smooth, bristly or spiny, bracts persistent: fls. small or medium, pale yellow or greenish: fr. small, green, ovoid or globose.—Species 90. Trop. Amer. G C II. 22:595.

These are ornamental palms, but little grown on account of the spines The fruits of *B. major* are used extensively in South America for food

The cultivation of bactris is easy if it is grown in a warmhouse, with a range of temperature from 60° to 80°, and given plenty of water. Frequent syringing is advisable It thrives best in a mixture of loam, two parts, leaf-mold, one part, well-rotted cow-manure, one part The young plants are very decorative, but in age most of the species become spindly

Propagation is by suckers which grow freely; rarely by seeds, which are hard to get

A *Spines yellow, tipped black.*

pallidispìna, Mart (*B flavispìna*, Hort). St 10–18 ft high, 1–2 in. diam , the internodes spiny lvs showy, 5–9 ft. long, equally interruptedly pinnatisect, petiole 4–6 ft , brown-scaly, thickly covered with very long (¾–2¼ in), black-tipped yellow spines, either solitary or in groups of 2–4, segms linear-lanceolate, caudate-acuminate, prickly on the margins, the basal ones 2–8 in long, 1½ in wide, the upper, 12 x 1¼ in fr 3–4 times exceeding the persistent calyx, about 1½ in. long. Brazil

AA. *Spines black.*

B. *Lf.-segms acute at both ends.*

màjor, Jacq Beach Palm St. 9–15 ft high, 1–1½ in. diam , armed with rows of black spines 2 in. long: petiole armed with very long black, terete spines; lvs. 4–6 ft. long, equally pinnatisect nearly to the rachis; sheath and rachis spiny and white or brown tomentose; segms. linear, acute at both ends, 25–35 on each side, 1-nerved, 8–12 in. long, ⅓–½in wide, glabrous on both sides, densely setose, with black hairs along the margin. frs about the size of an apricot, edible. Brazil.

minor, Jacq Fig 448 A tall, slender-stemmed palm, often 40 ft in height, armed with many dark-colored spines. lvs roundish in outline, about 3 ft. long and composed of numerous narrow, sharp-pointed lfts that are spiny on the veins beneath spathe axillary, solitary, spreading, very spiny; corolla in both sexes gamopetalous. fr rotund, purplish black.—A rare but showy palm grown sometimes in tropics.

BB *Lf.-segms. acute at tip.*

Gasipàes, HBK (*Guilielma speciosa*, Mart). St. about 60 ft high, single or cespitose, with rings of subulate-compressed black spines, 1 in. long, the rings about as far apart as the diam. of the st.. lvs. 6 ft. long, curving; segms dark green above, pale green below, very numerous, approximate, 1½ ft. long, 1¼ in. wide, linear-lanceolate, long-acuminate, bristly or minutely prickly along the margins. fr. orange or reddish, nearly 2 in. long, ovoid. Lower Amazon.

hórrida, Oerst. Cespitose sts 6–8 ft. high, 8–9 in. diam., very spiny, sheathed for most of its length with bases of dead lvs ; spines 3–4 in. long, 4-sided, whitish tomentose, at length glabrous: lvs. 2½–3 ft. long; sheath 8 in., brown-tomentose; petiole 1½ ft , densely spiny, subtetragonal, densely brown-tomentose beneath, segms 7 in long, ½in. wide, lanceolate, rigid, glaucous Unlike all the above in having a hairy but not spiny spathe. Nicaragua

B. aurantiaca, Hort , is a "pinnate palm from Mex , dwarf and spiny but beautiful " The name is unknown in botanical literature —*B caryotæfolia*, Mart , from Brazil, with wedge-shaped 3-lobed pinnæ, has been catalogued, also *B utilis*, Benth & Hook (Guilielma utilis, (Erst), from Costa Rica, with spiny petioles and young lvs. N. Taylor.†

BACULÀRIA (Latin, *baculum*, a small walking-stick). *Palmàceæ*, tribe *Arèceæ*. Two or three small palms, completely spineless By some, included in *Linospadix*

Stems very thin, either solitary or in bunches, which are prominently ringed lvs usually numerous, terminal, unequally pinnate, and with relatively short petioles; lfts coriaceous, usually alternate, from 4–6 pairs, strap-shaped, and with incised or much-laciniated apices, attached by a broad, almost decurrent base, nerves prominent, numerous on older lfts , on small ones solitary spathes in pairs; spadix consisting of a long spike-like cluster, as long as or longer than the lvs ; fls. in 3's, a female with 2 males in each cluster on the green spadix· fr. small, obovate or ovoid, green, from ¼–¾ in



448. Bactris minor.

long The genus is confined to temperate and tropical Austral G.C. II 22 595.

For general culture, see *Areca*, to which they are allied. The only species known in cultivation seem to do better in a temperate rather than a tropical house, but shifting will probably be found advantageous. One of the smallest palms in cultivation, *B. monostachya* is very popular, particularly in England.

monostàchya, F Muell. (*Arèca monostàchya*, Mart. *Kèntia monostàchya*, F. Muell.) Walking-stick Palm Trunk 6–12 ft high, scarcely 1 in thick: lvs. 1½–4 ft long; the sheath broad, coriaceous, about 6 in long, produced into 2 stipular lobes, segms very irregular, acuminate, very variable in breadth and distance, adnate to the rachis, or tapering at the base, the longest about 1 ft long· infl very long, often exceeding the lvs , stamens usually 10: fr ovoid, about ½in. thick. Queensland, New S. Wales. B M. 6644.

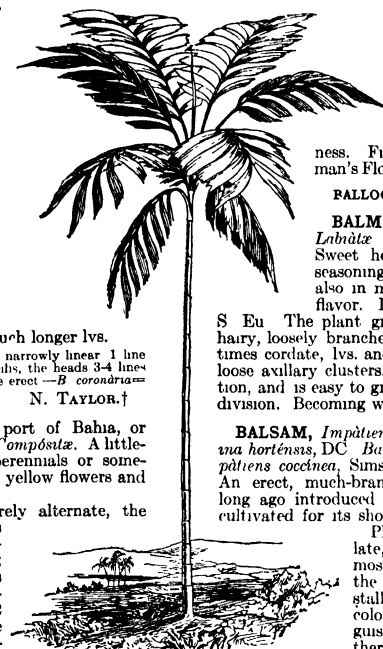
minor, F. Muell. Sts several from the same rhizome, 2–5 ft high, about ½in thick: lvs about 3½ ft long, with from 12–14 lfts spadix about as long as the lvs. or a little shorter, scarcely ¼in. thick; stamens 12; seed about ½in diam Queensland —A delicate palm, not so well known as the preceding, but attractive.

N Taylor.†

BAÈRIA (after the Russian zoologist, Karl Ernst von Baer). *Compósitæ.* Small plants, one of which is sometimes grown as a garden annual.

Heads usually many-fid, radiate, the rays 5–15; bracts of the involucre as many as rays, pappus often wanting.—Twenty species of Californian annuals (or one or two perennial species), with numerous showy, inch-wide yellow fls. in early summer

grácilis, Gray (*Burrièlia grácilis,* DC.) Easily distinguished from *Actinolepsis coronaria* by its hairy sts and foliage and undivided lvs.; plant much branched; height 4–12 in.: lvs. opposite, connate, linear-lanceolate; fls. solitary, on slender terminal peduncles, involucre leafier than in *Actinolepsis coronaria,* the scales longer, downy, in 2 series, rays 8–12. B.M. 3758.—This is likely to be cult as *Lasthenia californica,* which, however, is not hairy and has much longer lvs.



449. Balaka Seemannii

B chrysóstoma, Fisch. & Mey. Lvs narrowly linear 1 line or less wide; fls larger than in B. gracilis, the heads 3–4 lines high, ligules 3–4 lines long; habit more erect.—*B. coronária*=Actinolepsis coronaria.

N. TAYLOR.†

BAHÌA (probably from the port of Bahia, or San Salvador, South America). *Compósitæ.* A little-known group of herbaceous perennials or sometimes subshrubs grown for their yellow flowers or canescent leaves

Leaves mostly opposite, rarely alternate, the rather small pedunculate heads terminating the branches, involucre hemispheric or obovate; receptacle mostly flat. achenes narrow, 4-sided, pappus of several scarious scales.—There are 12 species, all American. They thrive on borders of light and well-drained soil, and may be increased by seeds or by division in spring

lanàta, DC. One to 2 ft high, slender: lvs pinnately cleft or divided into 3–7 linear or linear-lanceolate lobes: rays mostly 8–9, oblong, showy achenes glabrous or minutely hairy. Calif. B.R. 1167 (as *Eriophyllum*).—Perhaps not hardy in the N.E. Summer. N. TAYLOR

BAIKIÆA (Wm. B. Baikie, African traveler). *Leguminòsæ* Great-flowered Trop. African trees of 2 species, one of which has been cult. in Eu. Trees unarmed: lvs. abruptly pinnate, coriaceous: fls few in each raceme, not papilionaceous; petals 5, much exceeding the turbinate calyx, broadly oblanceolate or obovate, long-clawed; stamens 10. *B. insignis,* Benth., is an erect evergreen, to 40 ft., with short-lined fls. 10 in. across, snow-white with lower petal or lip lemon-yellow. Upper Guinea.—Said to be the largest flower in the Leguminosæ.



450. Pod of garden balsam.

BALÀKA (the Fijian vernacular name) *Palmàceæ,* tribe *Arèceæ.* Palms, differing, if at all, from Ptychosperma, to which they are with equal propriety referred, in having the seed not sulcate, and in the half-rhomboid segms. of the lvs; and from Drymophlœus in the form of the lf. and the caducous spathes. —Species 2. Fiji Isls.

Seèmannii, Becc. (*Ptychospérma Seèmannii,* H. Wendl.). BALAKA. Fig. 449. Caudex slender, 8–12 ft. high, straight, ringed, about 1 in. diam.: lvs. pinnatisect, 4 ft. long, segms. erose-dentate at the apex, alternate, 9 on each side, semi-rhomboid, obliquely truncate, the upper margin longer, cuspidate at the apex, the terminal one deeply bifid. Growing as underwood in dense forests. Fiji.—Sts. used for spears by natives, because of their strength and straightness. Fig. 449 is adapted from Seeman's Flora Vitiensis. N. TAYLOR.†

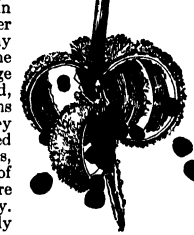
BALLOON VINE: *Cardiospermum*

BALM (*Melissa officinàlis,* Linn.). *Labiàtæ* LEMON BALM and BEE BALM. Sweet herb, the lvs being used for seasoning, particularly in liquors, and also in medicine. It has a lemon-like flavor. It is a hardy perennial from S. Eu. The plant grows 1–2 ft. high, somewhat hairy, loosely branched, with ovate-petioled, sometimes cordate, lvs. and yellowish or whitish fls. in loose axillary clusters. Thrives in any warm position, and is easy to grow. Prop. by seeds, also by division. Becoming wild in E. U. S.

BALSAM, *Impàtiens Balsámina,* Linn. (*Balsámina hortènsis,* DC. *Balsámina Impàtiens, Impàtiens coccínea,* Sims, B.M. 1256). *Balsaminàceæ* An erect, much-branched, half-succulent annual, long ago introduced from India, and now widely cultivated for its showy flowers.

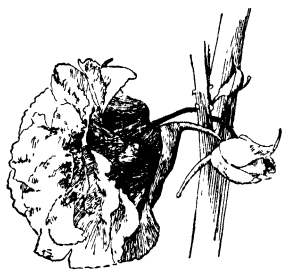
Plant 1½–2½ ft.: lvs. lanceolate, toothed, the lower ones being mostly in pairs. fls. clustered in the axils of the lvs., on very short stalks, sepals and petals similarly colored and not easily distinguished, one of the sepals (of which there seem to be 3) long-spurred; petals apparently 3, but 2 of them probably represent 2 united petals, thus making 5; stamens 5. The pod, shown in Figs. 450 and 451, is explosive. It has 5 carpels and very thin partitions, and seeds borne on axile placentæ. When the caps. are ripe, a pinch or concussion will cause the valves to separate and contract, the seeds being thrown with considerable force. The balsam has varied immensely in the doubling, size and color of its fls. and in the stature of the plant. It was known to Gerarde in 1596. The balsam is sometimes called "lady slipper," although this name is properly confined to Cypripedium, and used for Calceolaria.

Practically all the garden balsams are now double or semi-double. The full-double forms are known as the camellia-flowered varieties. Fig. 452. In well-selected stock, the greater part of the flowers from any batch of seedlings should come very double. The colors range from white to dark blood-red, yellowish and spotted. Balsams are of very easy culture. They are tender, and should be started in thumb-pots or boxes indoors, or in the open when danger of frost is past. The seeds are large, and germinate quickly. The plants prefer a rich, sandy loam, and must not suffer for moisture. Transplanting, and



451. Explosion of balsam pod.

pinching-in the strong shoots, tend to make the plants dwarf and compact, two or three transplantings are often made. It is well to remove the first flower-buds, especially if the plants are not thoroughly established. Better results are secured when only a few main branches are allowed to grow, all the secondary and weak ones being pinched out. Sometimes they are pruned to a single stem, and if much room is given very large blooms are secured. The lower leaves may be removed if they obscure the flowers



452 Camellia-flowered balsam. (×1)

Well-grown bushy plants should stand 2 feet apart each way, and the tall kinds will reach a height of 2 to 2½ feet. Good bloom is impossible if plants are crowded. For this reason, balsams do well in rows on the border of a garden where they may have room. Seed of the finest double strains is expensive, but inferior or common seed gives little satisfaction. Plants started early in May should give flowers in July, and should bloom until frost. A full-grown plant is shown in Fig. 453. At present, balsams are grown chiefly as flower-garden plants, but some years ago the flowers were largely used as "groundwork" in florists' designs, particularly the double white varieties. The flowers were wired to toothpicks, and were then thrust into the moss that formed the body of the design. L. H. B.

BALSAMOCÍTRUS (Latin, *balsamum*, balsam, and *citrus*). *Rutàceæ*, tribe *Citreæ*. Trees; usually spiny, suggested as stocks for citrous fruits, as yet scarcely known in this country.

Fruits hard-shelled and persistent; lvs. trifoliolate, or rarely simple; fls. 4–5-parted, stamens 10–20, ovary 8–9-celled, ovules numerous in each cell, seeds large, smooth, hypocotyl very short, the cotyledons remaining near or just above the surface of the ground. The first

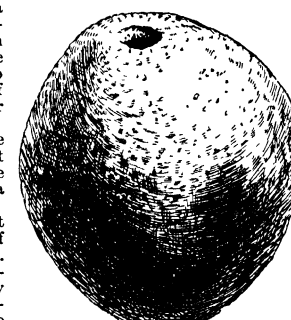


453. The garden balsam.

foliage lvs. are opposite, lanceolate or ovate.—Three species are known, all occurring in Trop. Afr. *B. Dawei* is the type species.

The subgenus Afrægle (Latin, *Africa* and *Ægle*) differs from Balsamocitrus proper in having more than twice as many (usually 4 times as many) stamens as petals and in having a larger, more deeply lobed disk. *B. paniculata* is the type of this subgenus.

Dáwei, Stapf. Fig. 454. A large tree, 50–60 ft. or more in height: first few foliage lvs. on young plants simple but next succeeding ones 3-foliolate, lateral lfts. three-fifths to three-fourths as long as the terminal lft., having a cylindrical petiolule ⅜–½in. long, terminal lft. with a much shorter petiolule, ⅛–¼in. long, but usually borne on a section of the rachis ½–1½ in. long, jointed both at the insertion of the lateral lfts. and also where the petiolule of the terminal lft. is inserted (such imperfectly pinnate lvs. are not uncommon in some pinnate-lvd. plants but are rare in trifoliolate species). fls. 5-merous with 10 free stamens (twice as many as the petals). frs. globose or oval, 4–6 in. diam., with a very thick, hard woody rind and 8 oval cells surrounded by the more or less fibrous mesocarp tissue, cells contain numerous seeds imbedded in amber-colored, fragrant gum. The ripe frs. drop off the pedicel, leaving a hole through the shell where they were attached. The seeds are large, ½–¾ x ⅜–⅝in., smooth, and germinate with a very short hypocotyl, often bringing the cotyledons to the surface of the ground or just above it. Occurring in the Budongo forest east of Lake Albert Nyanza in Uganda, E. Cent. Afr., at an altitude of 2,000–3,000 ft.—The seedlings grow very rapidly. Experiments indicate that this is a very promising stock on which to graft the bael fruit (*Ægle Marmelos*), which it is difficult to grow on its own roots. Ill. Journ. Linn. Soc. Bot. 37, pl. 22.



454. Fruit of Balsamocitrus Dawei (×½)

paniculàta, Swingle (*Citrus paniculàta*, Schum. *Ægle Bártéri*, Hook. f. *Limònia Warnéckii*, Engler). Fig. 455. A handsome tree, 20–45 ft. high and much branched. lvs. on old trees trifoliolate, the lateral lfts. about two-thirds as long as the terminal one and narrowed into a slender petiolule ⅛–⅜in. long; terminal lft. has a long slender petiolule ½–¾in. long but there seems to be no articulation where it joins the lamina as in case of *B. Dawei*, spines are said to be solitary, from 1–4 in. long but are wanting on fruiting branches. fls. usually 4-merous, sometimes 5-merous, stamens 13–20, normally 4 times as many as the petals; ovary 8- or 9-celled, disk large, lobed. frs. spherical or obovoid, 3–5 in. diam., with a thick woody rind, green until maturity, then taking on a gray color; cells of fr. contain numerous smooth seeds; germination unknown.—Commonly planted in the villages of Nigeria and the Gold Coast in Trop. W. Afr. This species has not yet been introduced into cult., but it is to be hoped that seeds will be secured from Afr. to permit its being tested as a stock for citrous frs. Ill. Hooker, Ic. 37, pl. 2285. Bull. Soc. Bot. Fr. v. 58, Mem. 8d, pl. 1–2.

gabonénsis, Swingle. A little-known tree or shrub: lvs. narrowly lanceolate, simple, with short petioles: vigorous young trees, when they have reached a height of 8 or 10 ft., begin to show trifoliolate lvs. with relatively small lateral lfts. from one-third to one-half as long as the terminal lft. and like it acute at both ends; terminal lft. sessile: fls. unknown. fr. nearly globular, slightly pear-shaped, with a thick woody rind.—The natives remove the contents through an opening at the stem end and use

the empty fr as a powder-flask. Native to the M'fan or Pahouin country in N. French Congo and S. Kamerun where the fr. is known to the French residents as "poire à poudre" (powder-flask). This species grows very rapidly under greenhouse conditions It has been grafted successfully on the tabog (*Chætospermum glutinosa*), a related tree native to the Philippines, and may prove of value as a stock for citrous fruits on account of its vigor and healthiness Ill. Bull Soc. Bot. Fr. v. 58, Mém 8d, pl. 3, and Fig B, p 235

WALTER T. SWINGLE.

BALSAMORRHÌZA (Greek, *balsam root*) *Compósitæ.* Low perennials with thick, deep, resinous, frequently tuberous roots, tufts of radical lvs, and large yellow fls: lvs usually long-petiolate, when cauline usually opposite, mostly radical· scapes few-lvd. or naked; fls usually solitary The root was an aboriginal food, when the rind was peeled —About 10 species, mostly from Cent. and W. N. Amer

Hoòkeri, Nutt. Canescent· height 4–12 in: lvs. lanceolate, 1–2-pinnately parted fls solitary, on naked scapes —Intro. 1881 by E Gillett, but scarcely known to horticulturists. Useful in dry situations

N TAYLOR.



455. Balsamocitrus paniculata (×⅓)

BAMBOO. Various perennial ornamental grasses embracing the genera and species of the tribe *Bambuseæ*, order *Gramineæ*, cultivated for the surpassing beauty of their foliage and habit; some of them are hardy even in parts of the northern states, but they are warm-country plants.

Usually large, sometimes tree-like, woody, rarely herbaceous or climbing plants, of wide geographical range. The species are irregularly distributed throughout the tropical zone, a few occurring in subtropical and temperate zones, attaining their maximum development in the monsoon regions of Asia —About twenty-three genera, only two being common to both hemispheres Something more than 200 species are recognized, of which upwards of 160 occur in Asia, about seventy in America, and five in Africa. They extend from sea-level to altitudes of more than 10,000 feet in the Himalayas and 15,000 feet in the Andes, and under the most favorable conditions some species may attain a height of 100 to 120 feet, with a diameter of culm of 8 to 12 inches

An attempt to enumerate the numerous and varied economic uses of the giant-grasses would greatly overreach the field of this article; but as objects of grace and beauty in the garden, conservatory, and under special conditions of landscape, bamboos are matchless. Not only are they adapted to sections favored with a gentle climate, but it is possible to grow certain species where the cold of winter may reach zero Fahrenheit, or even occasional depressions of greater severity

Bamboos delight in a deep, rich loam, and generously respond to good treatment A warm, slightly shady nook, protected from the prevailing cold winds of winter, and in which moist but well-drained soil is plentiful, is an ideal location A top-dressing of manure and leaves is not only beneficial in winter, by preventing the frost from penetrating the ground too deeply, but it also preserves the moisture that is so essential to the welfare of the plants during the growing season Some species produce rampant subterranean stems, and spread rapidly when once established These should not be planted for ornamental purposes, but only those forming tufts or clumps It is best to plant each group of but a single species, and to restrict the wide-spreading sorts to isolated positions The most effective results to be obtained by planting bamboos are secured on gentle banks above clear water, and against a background of the deepest green In such situations the graceful stems and dainty branches, bending with their wealth of soft green leaves, and the careless lines of symmetry of each individual, lend a bold contrast of the richest beauty Ordinarily it will require two or three years thoroughly to establish a clump of bamboos in the open air, and, until this is accomplished, the vigor, hardiness and beauty that characterize some noble kinds will be lacking During the first few years, a new plantation should receive generous protection in localities in which the winters are trying, and even with this precaution it is likely the plants will suffer to some extent in cold weather Planted out in conservatories or confined in tubs or large pots, the bamboos present many admirable qualities, and, as decorative plants, several species offer many inducements to their cultivation, especially as they may be grown and used out-of-doors in the summer and cheaply wintered in a coolhouse

Propagation is best effected by careful division of the clumps before the annual growth has started The difficulty of procuring seeds in some instances is very great, indeed, the fruiting of a number of species has never been observed Some species flower annually, but the majority reach this stage only at intervals of indefinite and frequently widely separated periods In some species the flowers appear on leafy branches, in others the leaves fall from the culms before the flowers appear, or the inflorescence is produced on leafless, radical stems Fructification does not exhaust the vitality of some species, but others, on the other hand, perish even to the portions underground, leaving their places to be filled by their seedling offspring Owing largely to the difficulty in obtaining flowering specimens, the systematic arrangement or nomenclature of the bamboos is in a sad plight As it is sometimes even impossible to determine accurately the genus without flowers, the correct positions of some forms are not known.

Four sub-tribes of Bambuseæ are accepted by Hackel, namely: *Arundinarieæ* —Stamens 3· palea 2-keeled: fr. with the seed grown fast to the seed-wall. To this belong Arundinaria and Phyllostachys *Eubambuseæ* — Stamens 6· fr with the seed fused to a delicate seed-wall. Bambusa is the only garden genus *Dendrocalameæ* —Stamens 6 (rarely more)· palea 2-keeled. fr a nut or berry Here belongs Dendrocalamus *Melocanneæ.*—Characters of the last, but palea not keeled Melocanna is an example, an extra-tropical genus, probably not in cult in the U. S.

The genera Arundinaria, Phyllostachys, Bambusa and Dendrocalamus contain the most important species in cultivation. Roughly, the species of Arundinaria may be separated from Phyllostachys by the persistent sheaths and cylindrical stems In Phyllostachys the sheaths are early deciduous, and the internodes, at

least those above the base, are flattened on one side Generally, Arundinaria and Bambusa cannot be separated by horticultural characters, and Dendrocalamus is hardly separable except by its great size. It is probable that many of the forms now classed as species of Bambusa will eventually be found to belong to other genera, especially to Arundinaria Extended information regarding the Bambuseæ may be found in the following publications Munro's Monograph, in Transactions of the Linnæan Society, Vol XXVI (1868); Hackel, in Die Naturlichen Pflanzenfamilien, Vol II, part 2, p 89 (1887), English Translation by Lamson-Scribner & Southworth, as The True Grasses, New York, 1890, papers by Bean in Gardeners' Chronicle III, 15 167, et seq (1894), Freeman-Mitford, The Bamboo Garden, 1896, New York, The Macmillan Company, pp 224, A & C Rivière, Les Bambous, Paris, 1879, Gamble, The Bambuseæ of British India, Calcutta and London, 1896, Houzeau, Le Bambou, Mons, 1906, Fairchild, Japanese Bamboos, 1903, Franceschi, Bamboos in California, Santa Barbara, 1908 Among the hardiest of the bamboos are the following *Phyllostachys Henonis, P nigra, P viridi-glaucescens, Arundinaria macrosperma, A japonica, A. nitida, Bambusa palmata, B tessellata* and *B pygmæa*

The list of descriptions contains the important kinds of bamboos in cultivation in America, and following the classified descriptions will be found a list of species, showing those that are more or less rare in gardens, but procurable from time to time through horticultural catalogues or prominent growers An attempt has been made to separate the hardier forms of bamboos from the tenderer kinds by the character of the venation of the leaves, a distinction that has been enthusiastically entertained by Freeman-Mitford in his most estimable work, a book that has done much to create a popular appreciation of bamboos, and also to clear up the complete confusion into which the trade names have fallen

Bamboos have slowly but persistently increased in popular esteem, especially in the southern and Pacific states, where they have proved their great beauty and usefulness as garden ornamentals A new impetus has been given the cultivation of these plants by the dissemination of suitable species and varieties, and by the introduction of new and desirable kinds by commercial horticulturists and the U S Department of Agriculture.

In the following taxonomy, A = Arundinaria, B = Bambusa, D = Dendrocalamus, P = Phyllostachys, T = Thamnocalamus, which is here considered a subgenus of Arundinaria No Japanese native names are indicated, although bamboos are sometimes offered under such names The prevailing tendency is to discard vernacular names, when unassociated with the Latin binomials, as they breed hopeless confusion.

INDEX.

B angustifolia, 19
B arundinacea, 40
A aurea, 17
B aurea, 24
P aurea, 24
B aureo variegata, 36.
A auricoma, 18
P bambusoides, 29
B Castillonis, 23
P Castillonis, 23
A chrysantha, 20
B chrysantha, 20
A debilis, 32
A decidua, 11
B disticha, 4
B erecta, 14
A falcata, 34
B falcata, 34
A Falconeri, 33
T Falconeri, 33
B fastuosa, 9
A Fortunei, 7, 17, 18.
B Fortunei, 17, 18
B gracilis, 33
D Hamiltonii, 37
B Henonis, 27
P Henonis, 27
A Hindsii, 14
A Hookeriana, 35
A humilis, 7
A japonica, 12
P Kumasaca, 30
D latiflorus, 38
A macrosperma, 10, 11
A marmorea, 16
B marmorea, 16
B Maximowiczii, 13.
B Mazelii, 26
D membranaceus, 39
B Metake, 12.
B mitis, 25.
P mitis, 25.
B nana, 4
A Narihira, 13
B Narihira, 13
B nigra, 21
P nigra, 21
A. nitida, 8
A nobilis, 31
B palmata, 2
B plicata, 13
A pumila, 6
B pumila, 6.
P punctata, 21.
B pygmæa, 5
B quadrangularis, 15.
B Quilioi, 26.
P Quilioi, 26
B Ragamowskii, 3.
B ruscifolia, 30.
P ruscifolia, 30.
A Simonii, 13
B Simonii, 13.
D strictus, 41.
A tecta, 11
B tessellata, 3.
A Veitchii, 1
B Veitchii, 1
B Vilmoriana, 19.
B vimmalis, 30
B violescens, 22
P violescens, 22
B. viridi-glaucescens, 28
P viridi-glaucescens, 28
B viridi-striata, 13.
A viridis, 17.
B vulgaris, 36.

SECTION I.—*Venation conspicuously tessellate, i.e, the veins crossing one another like the meshes of a net, visible to the naked eye by holding a lf up to the light, or more clearly seen by the use of a lens. (Embraces the hardier types of bamboos, 1–30.)*

A. *Internodes not flattened· sheaths persistent.*

B. *Lvs. relatively very broad, usually 2 in wide, or more.*

1 **A. Veitchii,** N E Br (*Bambùsa Veitchii*, Carr.). Fig 487 Height usually 3 ft or less. sts purple, white-waxy below the nodes lvs 5–8 in long, about 2 in. wide, bright green above, below pale and minutely pubescent, serrate. Japan M 77 but not G C III 15·169, or R B 23, p 270, which are pictures of *B palmata*, as explained in G C III 15 209 —This is also liable to confusion with *B tessellata*, but may be separated by lf characters Quite hardy, but the edges of the lvs wither in late autumn, giving a variegated but injured appearance

2 **B. palmàta,** Burbidge Fig 488 Height 2–5 ft : lvs 10–15 in. long, 2–3½ in wide, bright green, serrate, smooth and shining above, below pale and minutely pubescent; longitudinal veins very prominent Japan M 79 Gn 49, p 59, shows a clump 36 ft in circum —A beautiful, broad-lvd. ornamental



456 **Bambusa tessellata.** (×$\frac{1}{10}$)

3 **B. tessellàta,** Munro (*B Ragamówskii*, Hort). Fig 456 Height 3–4 ft lvs 12–18 in long, 2–4 in wide, smooth and shining above, whitened beneath, sharply serrate; midrib prominent and bearing a tomentose line on one side China and Japan G C III. 15 167, 18 189 R.B 23, p 269 —Produces the largest lvs of any of the hardy bamboos in cult, which is especially remarkable on account of its dwarf habit. Much confused in gardens, but unnecessarily, with *A Veitchii*, as the tomentose line on one side of the midrib is unique in *B tessellata* The lvs are used by the Chinese for wrapping tea.

BB *Lvs distinctly narrower.*

C. *Foliage green*

D. *Plants low, usually 1–3 ft in height.*

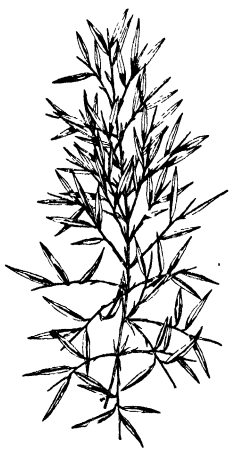
E. *Arrangement of lvs. distichous.*

4. **B. dísticha,** Mitford (*B nàna*, Hort , not Roxbg.). Height 2–3 ft . sts zigzag, slender, green or tinged with purple branches borne singly lvs 2–2½ in long, ½in wide, or less, green, serrate on both edges, produced in 2 vertical ranks Origin uncertain —An interesting and beautiful species, the distichous arrangement of the lvs. lending a distinct and unusual character.

EE *Arrangement of lvs. not distichous.*

5 **B. pygmæa,** Miq Height ½–1 ft : sts. very slender, purple, much branched; nodes prominent, with a waxy glaucous band lvs 3–4 in long, about ½in. wide, serrate, pubescent, bright green above, glaucous beneath Japan —The smallest of the bamboos, and remarkably hardy. It is especially valuable as an undergrowth, quickly making a carpet in wild places, but its rampant growth will quickly outgrow close quarters.

6. **A. pùmila,** Mitford (*B. pùmila,* Hort) Height 1–2 ft.: sts very slender, purplish, white-waxy below the nodes lvs. 4–5 in long, ¾in. or less wide, minutely pubescent, bright green —Much rarer than *B. Veitchii,* dwarfer, the sts. merely purplish, the lvs shorter and narrower The lvs. are a darker green than in *A. humilis,* shorter, narrower, and taper less gradually, nodes less well defined, but having a waxy bloom, internodes about 2½in long.



457 **Arundinaria nitida.** (×⅓)

7. **A. hùmilis,** Mitford (*A Fórtunei* var. *víridis,* Hort). Height 2–3 ft.. branches in 2's and 3's, long in proportion to the sts lvs. 4–6 in long, the largest about ⅞in wide, pale green internodes 2–5 in long Japan —A rare and pretty plant, liable to confusion with *A pumila,* but the sts lack the waxy bloom of that species

DD *Plants taller than in* D, *usually in excess of 3 ft.*

E. *Sts hollow, cylindrical, or nearly so.*

F *Culms purple, or purplish*

8 **A. nítida,** Mitford Fig 457 Height 6–10 ft sts slender, seldom exceeding a lead-pencil in thickness, black-purple in color lvs 2–3 in long, ½in wide, shining green above, pale beneath, sheaths purplish, the ligule without hairs China M 73 G C III 18 179, 24 211. Gn 49, p 388 —One of the daintiest and most attractive of the arundinarias, and exceptionally hardy. Some shade is desirable, as the lvs are often injured by strong sun Easily distinguished from *A Veitchii* and *A. pumila* by the deeper color of the sts , which are almost black.

9 **B. fastuòsa,** Latour-Marliac Height 15–20 ft . culms marked with purple-brown the internodes with an unusually large cavity branches numerous, erect, giving a columnar outline to each st sheaths shaded with purple lvs 5–7 in long, an inch or less wide, bright green above, glaucous beneath Japan

FF *Culms green or golden*

G *Species native.*

10. **A. macrospérma,** Michx LARGE CANE Height 15–25 ft , with numerous, short, divergent branches· lvs 4–8 in or more long, ¾–1½ in broad, smoothish or pubescent, sheaths very persistent sts erect, rigid, simple or sparingly branched the first year, becoming dense and leafy the second, afterwards fruiting at indefinite periods, and soon after decaying Chiefly along river banks, Va and Ky southward —Forming canebrakes, sometimes of great size and density This and the next are the only bamboos native to the U. S. Sometimes cult as an ornamental

11. **A. técta,** Muhl (*A. macrospérma* var *suffruticòsa,* Munro) SMALL CANE SWITCH CANE SCOTCH CANE. Height 2–12 ft sts slender lvs 3–6 in long, 4–12 lines wide, roughish, sheath bearded at the throat. Swamps and moist soil, Md and S Ind southward — A form, perhaps specifically distinct, which may be known as var **decídua,** common in W N C , has the peculiarity of dropping its lvs every autumn, and passing the winter in a leafless state The foliage of this deciduous cane turns yellow in autumn, drops, and in early spring the culms resume their verdure.

GG. *Species not native to the U. S.*

H. *Branches borne singly in the axils.*

12. **A. japónica,** Sieb. & Zucc (*B. Metáke,* Sieb.) Fig. 458 Height 5–10 ft lvs 4–8 in or more in length, 1–2 in wide, smooth and shining on the upper surface, below whitened and finely pubescent, sheaths conspicuous Japan M 1 G.C III 15 239, 18.185 —The commonest of the hardy bamboos, and readily distinguished from other tall-growing kinds of arundinarias by the large, broad lvs and by the broad, persistent sheaths which almost permanently enwrap the canes From *A Simonii* it differs by the bud being a simple flattish scale, instead of a complex scaly one, and also by the less amount of waxy bloom on the sts Particularly recommended for cities.

HH *Branches borne in dense, semi-verticillate clusters*

13 **A. Simonii,** A & C Rivière (*B Simonii,* Carr *B víridi-striàta,* Hort *A* and *B Naishùra,* Hort) Height 10–20 ft . lvs 6–10 in or more in length, usually less than an inch wide, sometimes striped with white, tapering to a long, fine point, mid-vein glaucous on one side toward the apex, green on the other Himalayas, China and Japan G C III 15 301, 18 181 —A silver-variegated form is sometimes known as *B Maximowiczii,* Hort , and *B plùcata,* Hort B M 7146 — One of the tallest of the arundinarias Very late in starting into growth It flowers quite frequently, and does not die down entirely after blooming, as some kinds do Resistent to drought, hardy and ultimately very vigorous and handsome

14. **A. Hindsii,** Munro (*B erécta,* Hort) Height 6–10 ft . culms straight, the branches appearing as if whorled lvs. upright at first, varying in length up to 9 in , and about ⅝in wide, the veins conspicuously tessellated internodes 3–7 in long, waxy-white, sheaths with a few hairs, long persistent Japan —The erect habit of



458. **Arundinaria japonica.** (×⅓)

growth is very pronounced, and it spreads with marked rapidity.

EE. *Sts either solid or quadrangular.*

15. **B. quadrangulàris,** Fenzi Sts square, especially in older plants, 20–30 ft. tall lvs. deep green, serrate, 6–7 in. long, about 1 in. wide, the tessellation minute. China and Japan —A wide-spreading species, when established, and one possessing considerable hardiness. New growth is produced mostly in late summer and autumn.

16 **A. marmòrea,** Franceschi (*B marmòrea,* Mitford) Height 3–5 ft. sts. slender, cylindrical, without a cavity. sheaths purple, marbled with gray· nodes unusually prominent, purple, with the under side bright green. internodes short, usually 1–2 in long lvs 3–5 in. long, about ½in wide, abruptly and sharply pointed at the apex Japan —In cult for several years in Calif

CC *Foliage variegated.*

D. *Plants low, usually 1–3 ft. in height.*

17 **A. Fórtunei,** A & C Rivière (*B Fórtunei,* Van Houtte, and var *variegàta,* Hort) Fig 459. Height 1–3 ft . lvs 4–5 in long, ½–¾in. wide, beautifully striped with white Japan F S. 15:1535 —Sometimes loses its lvs in severe winters, but quickly recovers in spring The internodes are rarely more than an inch long Var *áurea,* Hort , with yellow variegation, is *A auricoma* Var *viridis,* Hort =*A. humilis* An old favorite Rhizomes very active, requiring considerable space

18 **A. aurícoma,** Mitford (*A* and *B Fórtunei* var. *áurea,* Hort) Height 2–3 ft lvs. 4–6 in long, about an inch wide, brilliantly variegated with yellow, velvety pubescent on the lower surface, serrate, with the teeth more pronounced on one side sts purple nodes 3–5 in apart Japan —An exceedingly beautiful and meritorious ornamental of striking character

19 **B. angustifòlia,** Mitford (*B Vilmorinii,* Hort). Height about 1 ft · sts slender, purplish or light green, with prominent nodes lvs 2–4 in long, about ¼in. wide, serrate, frequently variegated with white Japan. —A dainty species, soon forming attractive clumps.

DD *Plants taller than in* D, *usually in excess of 3 ft. (See also under No 13 for A Simonii)*

20 **A. chrysántha,** Mitford (*B chrysántha,* Hort.). Height 3–5 ft lvs 5–7 in long, 1 in or less wide, nearly smooth, more or less variegated with yellow. Japan —Not so brilliantly colored as *A auricoma,* from which it may be readily distinguished by the prominent ribs and absence of the soft velvety pubescence from the lower surface of the lvs.

AA. *Internodes flattened on one side: sheaths early deciduous.*

B. *Sts. black or brown.*

21 **P. nigra,** Munro (*B nigra,* Lodd). Black Bamboo Height 10–20 ft . sts green at first, but changing to black the second year nodes conspicuous, the upper rim nearly black, the lower edged with white. lvs. very thin, 2–6 in long, 6–10 lines broad China and Japan M. 142, and frontispiece G.C III 15:369; 18 185. R B 23, p 268. B M 7994 —One of the most popular of the bamboos, markedly hardy and distinct. Var. **punctàta,** Hort , has yellowish sts. spotted with brownish black.

22 **P. violéscens,** A. & C Rivière (*B. violéscens,* Carr) Height 10–20 ft · sts violet, almost black the first few months, changing the second year to a dingy yellow or brown lvs variable in size, 2–6 in. long, ½–1½ in. wide, the larger lvs. borne on young shoots or lower branches; they are sharply serrate, and have a well-defined purplish petiole. China and Japan

BB. *Sts. striped with yellow and green.*

23. **P. Castillònis,** Hort. (*B Castillònis,* Hort.). Height 10–20 ft. or more· sts. zigzag, striped golden yellow and green, the colors alternating at the nodes: lvs sparingly striped with yellowish white, variable in size, usually 3–6 in. long, ¾–1½ in wide, serrate, the teeth being especially prominent on one edge: lf -sheaths topped by a whorl of dark brown or purple hairs. Japan. —Both beautiful and uncommon.

BBB. *Sts. green, yellow, or yellowish.*

C. *Plants tall, i e., more than 5 ft. high.*

D. *The internodes very short at the base of the culms.*

24. **P. aùrea,** A. & C Rivière (*B áurea,* Hort). Height 10–15 ft.· sts. yellowish, often brilliant in color, the internodes at the base remarkably short· lvs narrowed from near the base to the apex, minutely and regularly serrate on only one border, usually 2–4 in long and ¾in wide, but variable, light green, glaucous beneath; sheaths deciduous, marked with purple China and Japan. Gn. 8:206. A.F. 5:41.—Easily recognized by the very short nodes at the base of the culms

DD. *The internodes at the base of the culms not congested.*

E. *Outline of sts. not conspicuously zigzag*

25. **P. mitis,** A & C. Rivière (*B. mìtis,* Hort , not Poir.). Height 20 or more ft., and said to attain 60 ft in its native soil sts deep green at first, eventually yellow internodes at the base not conspicuously short lvs variable, usually 2–4 in long and ¾in wide, light green, serrate on only one border, sheaths deciduous, marked with purple China and Japan Gn 17.44 — Readily distinguished from *P aurea* by the long internodes at the base of the culms



459. Arundinaria Fortunei. (×⅛)

26. **P. Quílioi,** A & C. Rivière (*B Quílioi,* Hort *B. Mazélii,* Hort) Height 20 or more ft , and under favorable conditions up to 70 ft : sts arched, green or yellowish, bearing unusually long branches: lvs remarkably large and broad, the largest 8 in. long, 1¾ in wide, conspicuously serrate on one edge, dark green, often spotted with brown, very glaucous beneath· lf.-sheaths pinkish brown, deeply mottled with purple spots China and Japan — Rare and unusually attractive

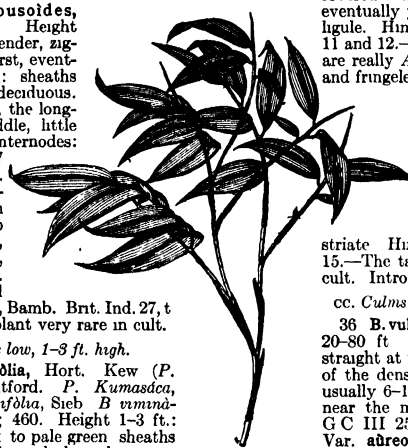
27 **P. Henònis,** Mitford (*B Henònis,* Hort). Height 10–15 ft sts arched, bright green, eventually yellowish, the surface slightly roughened sheaths yellow-brown, early deciduous lvs 2–3 in long, a little under ½in broad, narrowed below the middle to the base, long-attenuate at the apex, bright green; lf -sheaths often purplish, the ligule fringed with purple hairs. internodes 5–6 in. long near the base and middle of the culm, grooved with a double furrow Japan.— Wonderfully graceful and eminently hardy.

EE. *Outline of sts. conspicuously zigzag.*

28 **P. víridi-glaucéscens,** A & C. Rivière (*B víridi-glaucéscens,* Carr.) Height 20 or more ft., and under favorable conditions up to 60 ft : sts zigzag, arched,

bright green at first, fading as they ripen to a dingy yellow. sheaths early deciduous, the ligule extended into fringed auricles: lvs. 3–4 in. long, about ½in. wide or a little more, bright green above, whitened below. China and Japan. Gn. 7:279. G.C. III. 15:433; 18:183.—Frequent in cult. and very hardy.

29 **P. bambusoides,** Sieb. & Zucc. Height 6–10 ft : sts. slender, zigzag, green at first, eventually yellowish: sheaths purplish, early deciduous. branches in 3's, the longest in the middle, little longer than the internodes: lvs. variable, 5–7 in long, 1 in. or less wide, serrate, the teeth especially sharp on one edge, bright green, pale beneath. China and Japan Gamble, Bamb. Brit. Ind. 27, t 27.—The true plant very rare in cult.



460 Phyllostachys ruscifolia. (×1/8)

cc *Plants low, 1–3 ft. high.*

30 **P. ruscifòlia,** Hort. Kew (*P. Kumasdca,* Mitford. *P. Kumasdca,* Munro *B. ruscifòlia,* Sieb *B vimindlis,* Hort) Fig 460. Height 1–3 ft.: sts. zigzag, dark to pale green sheaths purple, much fringed. branches very short, not more than 1 or 2 in. long, in 3's and 4's· lvs 2–3 in long, about 1 in wide, ovate in outline Japan. G C III 15:369; 18·189 —The sts are almost solid, the tube being exceedingly small Dwarfest species of Phyllostachys.

SECTION II *Venation essentially striate, i e , the veins running in parallel lines from the base to the apex, cross veins obsolete or obscure, but usually with a number of interposed pellucid dots. (Embraces the less hardy types of bamboos, 31–41.)*

A. *Sts. hollow, not spiny.*

B. *Lvs. averaging not more than 3 in. long.*

31. **A. nòbilis,** Mitford Height 15–25 ft : lvs. 2–3 in. long, usually less than ½in wide, bright green, borne on short, purple petioles, striate-veined. sts. yellow-green, with purple-brown nodes. Probably a native of China —A large and graceful species intro. into Calif. by Franceschi in 1896. One of the hardiest of the arundinarias with striated lvs.

32 **A. débilis,** Thwaites Height probably 5–10 ft.: sts. clustered, much branched, the nodes 2–6 in apart, yellowish. lvs 1–3 in long, ⅛in. or less wide, striate-veined. High mts of Ceylon and the Philippines. Gamble, Bamb Brit Ind 7, t 6.—Intro in Calif and offered in 1910 by the Montarioso Nursery. The character of the venation would seem to imply only moderate hardiness.

BB. *Lvs. averaging not more than 6 in. long.*

33. **A. Fálconeri,** Benth. (*T. Fálconeri,* Hook. f. *B. gracilis,* Hort , not Wall) Height 10–15 ft.. sts. slender, bright green when young, yellow when old, the internodes sometimes white-waxy. lvs. thin, 3–4 in. long, about ½in. wide, striate-veined. Himalayas. Gamble, Bamb. Brit. Ind 20, t 18 B M 7947.—Not very hardy. The lf -sheaths are smooth, cut short at the top, without a fringe, and with an elongated ligule; while *A. falcata* has very downy lf -sheaths, fringed with long hairs at the intersection with the lf. The serrations of the lf.-edges are more pronounced in *A. Falconeri,* especially on one side.

34. **A. falcàta,** Nees (*B. falcàta,* Hort). Height 10–20 ft.: lvs. 4–6 in. long, about ⅛in. wide, light green, striate-veined: sts. slender, not exceeding ½in. diam., covered with a bluish white-waxy coating when young, eventually yellow-green. sheaths downy, ciliate at the ligule. Himalayas. Gamble, Bamb. Brit Ind. 12, t. 11 and 12.—A great many plants cult. under this name are really *A. Falconeri,* a species with smooth sheaths and fringeless ligules. Requires a mild climate.

BBB. *Lvs. averaging more than 6 in. long.*

C. *Culms 15–25 ft tall, reddish brown at maturity.*

35 **A. Hookeriàna,** Munro. Height 15–25 ft . culms glaucous green when young, turning reddish brown with age: nodes prominent, with a bluish ring· lvs. 6–10 in long, ½–1½ in wide, the venation striate Himalayas Gamble, Bamb. Brit Ind 17, t. 15.—The tallest and largest species of arundinaria in cult. Intro. in Calif by Franceschi. Not very hardy.

CC. *Culms taller, giant species sts green or yellowish.*

36 **B. vulgàris,** Schrad FEATHERY BAMBOO Height 20–80 ft sts bright green, 4 in diam , or more, straight at first, eventually much arched by the weight of the dense foliage branches numerous, striate· lvs usually 6–10 in long, 8–15 lines wide, rough on and near the margins and on the lower surface India. G C III 25·390 Gamble, Bamb Brit Ind. 44, t. 49. Var. **aùreo-variegàta,** Hort , GOLDEN BAMBOO, has canes of a rich golden yellow color, penciled with green. —Will stand but slight frost

37 **D. Hámiltonii,** Nees & Arn Height up to 80 ft · sts 4–7 in diam , much branched above, pubescent with white hairs when young internodes 12–20 in. long lvs variable, sometimes 15 in long, 2½ in wide, finely serrate; midrib narrow, with 6–17 nerves on either side, the nervules chiefly of pellucid glands. Himalayas. Gamble, Bamb Brit Ind 85, t 74 — The lower branches usually seated on woody knobs. Promises to become an important member of the tall bamboos in S. Calif.

38 **D. latifló-rus,** Munro. Height 60–70 ft · sts. erect and remarkably straight, 4–5 in diam., with a large cavity: lvs. 7–10 in. long, 1–2 in broad, long-acuminate, deep green, borne on short petioles; midrib prominent, with about 9 nerves on either side, the transverse nervules lacking or obscure. Formosa, Burma, Cochin China. Gamble, Bamb. Brit. Ind. 131, t. 117. Munro, Trans. Linn. Soc. 26:152, t. 6.—Considered one of the best of the giant bamboos in S. Calif



461. Bambusa arundinacea. (×⅛)

39. **D. membranà-ceus,** Munro. Height 60–70 ft.: sts. white-

powdery when young, smooth and bright green when older, 1–5 in. diam.: nodes prominent: internodes 9–20 in. long: sheaths with waved, hairy auricles. lvs. 5–10 in. long, ½–¾in. wide, deep green above, pale beneath, slightly hispid. Burma, India. Gamble, Bamb. Brit. Ind. 81, t. 71.—Requires a warm, protected situation to attain full development. Intro. into Calif. in 1895 by Franceschi.

AA. *Sts. either solid or spiny.*

40. **B. arundinàcea,** Retz. Fig. 461. A majestic species, often attaining a height of more than 40–60 ft.: sts. produced in dense clumps, at first green and shining, zigzag in outline, eventually straight and golden in color: branches, especially the lower, more or less spiny: lvs. 4–8 in. long, ½in. or a little more wide, nearly glabrous; sheaths persistent: fls. produced at long intervals, and after perfecting seeds, the plants die. India. Gamble, Bamb. Brit. Ind. 51, t. 48.

41. **D. stríctus,** Nees. Called MALE BAMBOO, on account of the solid character of the culms. Height 20–50 ft.: sts. 1–3 in. diam., solid or nearly so, glaucous green when young, yellowish when mature: nodes swollen: internodes 10–15 in.: branches long and slender, leafy: lvs. 4–10 in. long, up to 1¼ in. wide, soft-hairy, at least when young, narrowed from near the base to the tip, the apex usually twisted; midrib prominent, with 3–6 nerves on either side, the nervules chiefly of interposed pellucid glands. India, Burma. Gamble, Bamb. Brit. Ind. 78, t. 68 and 69.

B. agréstis, Poir. India, Cochin China. Adv. by Yokohama Nurs. Co.—*B. Alphonse Kurri,* Hort. A variegated form of B. nana, Roxbg. Young sts. striped with white and pink, older sts. yellow with broad green stripes. Tender.—*A. ánceps,* Mitford. Similar to A. nitida, but mature sts. yellow-green or brown, and lf.-sheaths fringed with white hairs. Native of the Himalayas, at elevations between 9,000–10,000 ft.—"*B. argéntea.* Grows 25–35 ft. high, the dense masses of beautiful green foliage, glaucous underneath, and the hundreds of slender culms growing close together, the exterior ones bending over to all sides, combine to make this bamboo indescribably beautiful." H. Nehrling, Fla.—"*B. argéntea* var. *vittàta,* the variegated bamboo or the blue bamboo of gardens, the taiho-chiku of the Japanese, who have grown this from time immemorial in pots, is one of the most satisfactory in Fla., it attains the size of B. argentea, but its lvs. are still more blue on the under side and altogether smaller and more delicate, they are striped and edged with white." Nehrling.—*A. aristata,* Gamble. Sts. 5 ft., purplish brown: lvs. 4 in. long, ⅓in. or less wide, narrowed to an acute apex, venation tessellate. Himalayas, where it thrives at elevations of 11,000 ft.—*B. aureo-striata,* Regel. Japan.—*P. Boryàna,* Hort. By some authorities considered to be a form of P. nigra, but the culms are of a dull yellow color when mature, splashed here and there with purple-brown blotches, and the branches are much longer in proportion to the culms. China and Japan.—*P. flexuòsa,* A. & C. Rivière. Culms 6–10 ft., dull greenish yellow when mature: lvs. similar to those of P. viridi-glaucescens: ligules of the culm-sheaths without auricles. A comparatively small and compact ornamental. China.—*A. fòliis-variegatis,* Hort., is presumably A. Fortunei, the commonest low-growing, variegated arundinaria.—"*B. grácilis.* This most beautiful small species used to be grown in gardens under the name of A. falcata: the lvs. are very small, arranged in a distichous way on both sides of the twigs, they have a fine emerald-green color: sts. thin and slender, the whole plant not growing taller than 10–12 ft." Nehrling.—*P. heterocycla,* Carr. A curious plant, the lower internodes of which are obliquely and alternately arranged like the scales of a tortoise, and for this reason called the "tortoise-shell bamboo." At about 1–3 ft. from the ground the nodes lose this peculiar character, and assume a regularity as in other species. In other respects this interesting bamboo does not differ much from P. mitis, or P. aurea. Japan.—*A. Khasiàna,* Munro. A Himalayan species with black sts., allied to A. falcata. The name, however, has been misapplied to A. nitida and A. nobilis, and the true species is probably not in cult. in the U. S.—*B. Laydékeri,* Hort. Height 3–8 ft.: sts. green with a tinge of purple, verticillately branched above, the branches relatively long: lvs. 4–6 in. long, ½in. or less wide, dark green, somewhat mottled in appearance. China and Japan.—"*B. macrocúlmis.* Received about 15 years ago directly from Japan under the name of taisan-chiku. It is a veritable giant, growing 50–75 ft. high with large dark green lvs. and thick culms, first green, then black, old culms have a gray color: in stature this is one of the noblest of all the bamboos, and it is perfectly hardy, the sts. spring straight out of the soil like spears and when they have fully developed they bend over to all sides at their tops, so that the entire plant from a distance looks like a gigantic sheaf." Nehrling.—*P. marliàcea,* Mitford. Wrinkled Bamboo. Similar to P. Quilioi, but the internodes at the base are very close together, not more than 1–2 in. apart, much wrinkled. Japan.—*P. nigro-punctàta,* Hort. Probably a variety of P. nigra, under which it appears in the classified descriptions above.—"*B. nùtans.* A most exquisite bamboo grown for many years under the name of Dendrocalamus strictus, which is a very different plant, grows 35–40 ft. high with a very dense growth of small green lvs., the green having a shade of blue in it, the sts. hang over to all sides, forming beautiful arches, tender, a most exquisite plant to grow on lawns or on the edge of lakes, or in the foreground of deep green magnolias." Nehrling.—*B. orientàlis,* Nees. Adv. by Franceschi, Santa Barbara, Calif., who regards it as a form of B. arundinacea, with lvs. larger and velvety to the touch. It forms clumps quickly. E. India.—*A. racemòsa,* Munro. A native of the Himalayas, growing at high altitudes: height up to 15 ft., the culms brown, very thick in proportion to height, the long and narrow lvs. are conspicuously tessellated.—"*B. scriptòria.* A small species not growing over 6–8 ft. high, forming fine dense clumps: lvs. small, green, underneath glaucous, particularly valuable for small gardens." Nehrling.—*A. spathiflòra,* Trin. Height 10–20 ft., the culms yellowish or nearly brown, slender and much branched: lvs. tessellated, 2–3 in. long, about ¼in. wide, acutely pointed, thin in texture. Himalayas, at altitudes of 7,000–10,000 ft.—*B. striàta,* Lodd. Height 4–5 ft.: sts. striped yellow and green, as thick as the thumb, internodes 4–6 in. long: lvs. 6–8 in. long, ¾–1 in. broad. China. B.M. 6079, which shows a flowering specimen with conspicuous anthers, red-purple at first, and fading to lilac. Not described by Mitford. Formerly sold by Yokohoma Nurs. Co.—*B. striatifòlia* var. *aurea,* Hort., an abandoned trade name never recognized by botanists.—*B. stricta,* Hort., an old trade name probably not B. stricta, Roxbg.—*P. sulphurea,* A. & C. Rivière. Height 10–15 ft., seemingly intermediate between P. mitis and P. aurea. It is less tall than the former, and the sts. are more brightly colored than in the latter species. Japan.—*B. Thouársii,* Kunth. A doubtful species, considered by some botanists to be only a form of the widespread B. vulgaris, but, according to Franceschi, at least horticulturally distinct. Height 50–60 ft., with a diam. of culm of 4–5 in. Intermediate in outline between the erect-growing D. latiflorus, and the spreading or horizontally inclined B. vulgaris. Intro. into Calif. some 25 years ago, and in recent years reintro. by the U. S. Dept. of Agric. from S. France, where it had come from Algiers 40–45 years ago.—*B. Tulda,* Roxbg. Height up to 70 ft., the culms 4–5 in. diam., and of a remarkable gray-green color: lvs. very glaucous on the lower surface. Recently intro. by the U. S. Dept. of Agric. Bengal and Burma. Gamble, Bamb. Brit. Ind. 30, t. 29.—*B. variegata,* Sieb.=A. Fortunei.—*B. verticillata,* Hort., Franceschi. Height 15–20 ft.: sts. orange-yellow: lvs. in whorls, striped white.

Among the recent introductions of bamboos by the United States Department of Agriculture, representing two genera of much interest and rarity to the United States, are the following:

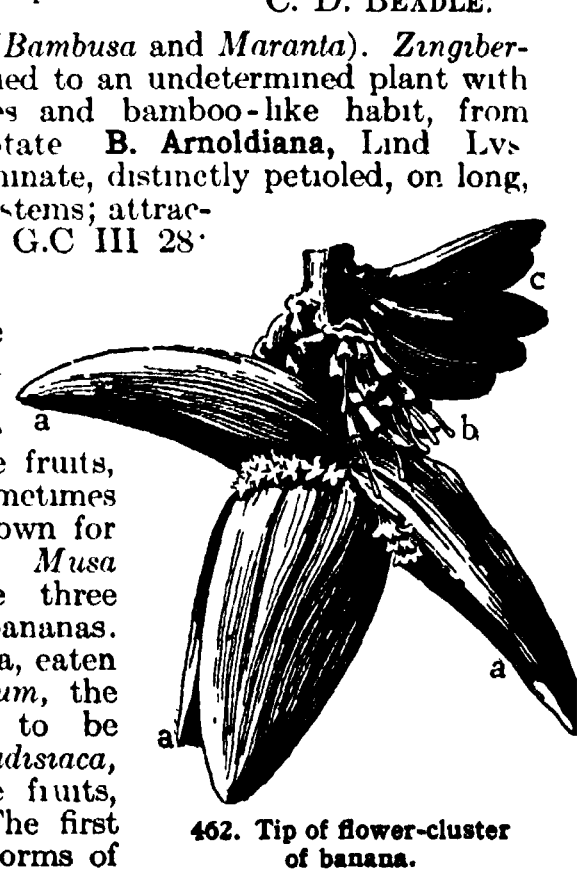
CHUSQUÈA. A genus belonging to the subtribe Arundinarieæ, of tall, shrubby or climbing plants with the flowering branches in clusters at the joints, and comparatively small lvs. and spikelets. W. Indies and S. Amer., chiefly in the Andes.—*C. bambusoìdes,* Hack. A large species with small panicles exceeded by the crowded blades, 1 in. wide and about 6 in. long. Native of Brazil.—*C. quila,* Kunth. A freely branching arborescent species with numerous open panicles and distant lvs. scarcely ⅓in. wide. Native of Chile.—*C. valdiviensis,* Desv., of Chile, is a slender climbing species with naked sts. and numerous fascicled leafy flowering branches, the lvs. 3–4 in. long.—*C. abietifòlia,* Griseb. A climbing species with dense tufts of short branches with lvs. less than 2 in. long and about ⅛in. wide. Native of the W. Indies.

OXYTENANTHÈRA. A genus of the subtribe Eubambuseæ, of tall, shrubby plants from the E. Indies and Afr., characterized by long, cylindrical or conical spikelets in compact fascicles, the anthers ending in a bristle.—*O. abyssínica,* Munro (*Bambusa abyssínica,* Rich.). Infl. capitate, large and spiny: lvs. about 6 in. long, 6–8 lines broad. Native of Trop. Afr.

C. D. BEADLE.

BAMBURÁNTA (*Bambusa* and *Maranta*). *Zingiberàceæ.* A name applied to an undetermined plant with maranta-like leaves and bamboo-like habit, from the Congo Free State. **B. Arnoldiana,** Lind. Lvs. broadly ovate, acuminate, distinctly petioled, on long, spreading, graceful stems; attractive as a pot-plant. G.C. III. 28: 313 (1900).

BANANA, a name applied to certain species of Musa, particularly to those that produce edible fruits, although it is sometimes used for species grown for ornament, as for *Musa Ensete.* There are three groups of edible bananas: the common banana, eaten raw, *Musa sapientum,* the plantain, fruits to be cooked, *M. paradisiaca,* dwarf, with edible fruits, *M. Cavendishii.* The first two are probably forms of



462. Tip of flower-cluster of banana.

one species, and the botanical nomenclature is confused Some species produce fiber. Consult *Abaca* and *Musa*.

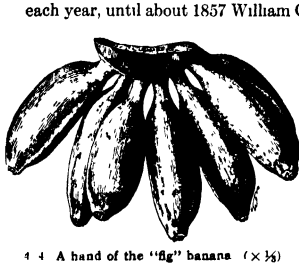
The banana plant is a great perennial herb. It grows 10 to even 30 feet tall, and produces a bunch of fruit, and the stalk then dies or becomes weak; in the meantime, suckers have arisen from the rootstock to take its place The peculiar flower-bearing of the banana is shown in Fig. 462, which illustrates the tip of a flower-cluster This cluster may be likened to a giant elongating bud, with large, tightly overlapping scales or bracts Three of these bracts are shown at *a a a*, in different stages of the flowering. As they rise or open, the flowers below them expand The bracts soon fall The flowers soon shed their envelopes, but the styles, *b*, persist for a time. The ovaries soon swell into bananas, *c* The bracts are royal purple and showy.



463. Plantain banana. (×⅛)

The banana has come to be one of the most popular fruits in North America, due to the cheapness of its cultivation and transportation, ease of handling, long-keeping qualities, and adaptability to many uses The source of supply is mostly Jamaica, Costa Rica, Cuba, Honduras, and latterly the northern shores of Colombia In the tropics, the ordinary bananas are cooked and used as a vegetable rather more than as a fruit to be eaten from the hand The plantains, which are coarser and harder fruits and thicker, are always cooked. A form of cooking banana used in parts of tropical America is shown in Fig 463 Of the banana itself there are many varieties. The common large fruit in northern markets is the Martinique, Jamaica, Gros Michel or Bluefields. A red variety, the Baraçoa or Red Jamaica, is sometimes seen. In the tropics, various very small forms are grown for local consumption These are fragile and do not keep long, and are rarely seen in the markets North One of them, known as the "fig" in Trinidad, is shown in Fig 464, the fruits are about 3 inches long. The dwarf or Cavendish banana is grown extensively in the Canary Islands, and apparently also in Bermuda; and it is not uncommon as an ornamental plant in conservatories

It is said that the banana was first imported into the United States in 1804 by Captain John N. Chester of the schooner Reynard, the lot consisting of thirty bunches The first full cargo is said to have been 1,500 bunches brought to New York in 1830 on the schooner Harriet Smith, chartered by John Pearsall of the firm of J. & T Pearsall. Two or three cargoes would appear each year, until about 1857 William C Bliss entered the banana-importing business, securing his supply from Baraçoa, Cuba, and taking the trade to Boston. In 1869, he secured a small cargo from Jamaica. In recent years, the Jamaica-United States banana trade has assumed very large proportions.



464 A hand of the "fig" banana (×⅛)

In the United States, there is little commercial cultivation of bananas, since the frostless zone is narrow and the fruit can be grown so much more cheaply in Central America and the West Indies. Small banana plantations are common in southern Florida, however, and even as far north as Jacksonville. They are also grown in extreme southern Louisiana, and southwestward to the Pacific coast. The plants will endure a slight frost without injury. A frost of five or six degrees will kill the leaves, but if the plants are nearly full grown at the time, new foliage may appear and fruit may form If the entire top is killed, new suckers will spring up and bear fruit the following year A stalk, or trunk, bears but once; but the new sprouts which arise from the roots of the same plant continue the fruit-bearing. A strong sprout should bear when twelve to eighteen months old (from two to three years in hothouses).



465 A bearing banana plant.

The plantation will, therefore, continue to bear for many years. A bearing stalk, as grown in southern California, is shown in Fig. 465.

The species mostly in demand for fruiting seldom or never produce seeds, and naturally increase by suckers The suckers are most readily separated from the parent rootstock by a spade. This is a slow process of increase, but the suckers so produced make large and vigorous plants. A quicker method of propagation is to cut the entire rootstock into small, wedge-shaped pieces, leaving the outer surface of the root about 1 by 2 inches in size, planting in light, moist soil, with the point of the wedge down and the outer surface but slightly covered. The best material for covering these small pieces is fine peat, old leaf-mold, mixed moss and sand, or other light material that is easily kept moist The beds so planted should be in full open sunshine if in a tropical climate, or given bottom heat and plenty of light if in the plant-house The small plants from root-cuttings should not be allowed to remain in the original bed longer than is necessary to mature one or two leaves, as that treatment would stunt them.

The textile and ornamental species, also, may be increased by the above process, but as these species usually produce seeds freely, seedlings can be more quickly grown, and with less trouble. The seeds of bananas should be sown as fresh as possible, treating them the same as recommended for root-cuttings As soon as the seedlings show their first leaves, they should be transplanted into well-prepared beds of rich, moist soil, or potted off and plunged into slight bottom heat, as the needs of the grower or his location may demand Both seedlings and root-cuttings should have proper transplanting, sufficient room and rich soil, as a rapid, unchecked growth gives the best and quickest results.

In the West Indies, Central America and Mexico, bananas are raised for export to the United States and Canada The site chosen is usually a level plain in the lowlands, near the coast, or in valleys among the hills, where the rainfall or artificial moisture is sufficient. For distant shipping, bunches of fruit are cut with "machetes" or knives, after they reach their full size and are almost mature, but quite green in color. Ripening is effected during shipment in warm weather, and by storing in dark, artificially heated rooms during cold weather Banana flour is a valuable product of ripe bananas prepared among the plantations in the tropics It is nutritious, and has an increasing demand and use as human food A recently invented process of drying ripe bananas has been found very successful, and the industry promises to be of vast importance as the marketable article finds ready sale Further details of the growing of the commercial crop in the tropics may be found in Cyclo Amer Agric, Vol II, p 199

E. N REASONER
L H B

BANEBERRY *Actæa*

BANKS. The means of holding and planting banks and steep surfaces is one of the perplexities of the horticulturist and landscape designer. The banks to be considered may be defined as very steep earth slopes with a bare, shifting surface, requiring protection and planting, or a surface covered with natural vegetation Figs 466–469

Low banks, either curved or rigidly formal, usually enter into symmetrical designs of the elaborately finished surroundings of a fine home Usually they are



466. A bank before planting

placed to outline or to inclose parts of a design, or to decrease or increase the apparent height of a building or other structure, or of a garden compartment.

Protection.

One problem to be solved is the protection of sea, lake, river, and small stream banks and bluffs against the sliding of the soil, due to waves or along-shore currents in sea or lakes and to running water, especially floods, in stream beds. Such water-action, cutting under the base of a bank, causes the soil above to slide down. On lake and sea shores, jetties built from the bluff-base into the water will check an eroding marginal current, make it drop its load of silt, and extend the shore In many positions willows, planted close together in a wide band on the beach or at the bluff-base, will accumulate and fill with roots the soil that



467. Same bank after planting.

is washed down and blown in, and thus create a water-resisting barrier Along salt water, plantations of the sea-beach grass, *Ammophila arenaria*, and the shrubby *Baccharis halimifolia and Iva frutescens* are serviceable: and far South, the mangrove may be planted on outermost sea-edges

Another bank trouble is soil-seepage water coming to the surface part way up the slope and making mud patches that slide down and cause the soil above to cave away Usually this sloughing is at an impervious soil layer at some feet below the surface, to which the water passes, then finds its way out to the bank-face If this water is at fixed spring-like points, a tile drain laid in porous material about 3 or 4 feet deep and directly down the bank to a concrete anchor at the outlet opening will usually take off the water that causes sliding. If the seepage is all along the face of the bank, it may be necessary to carry a drain some feet back from and parallel to the edge of the bluff-top down to and a little into the impervious soil, with tile outlets down the bank.

The surface of banks is often gullied by water running from the top down the face at frequent intervals This may be prevented by forming a ridge or barrier at the edge of the bluff to carry the water along sodded channels to paved or piped outlets down the slope

Sand-bluff surfaces that drift with the wind need thick plantations of plants that will grow well in sand, with a mulching of hay, leaves or litter to keep the sand in place until vegetation is established.

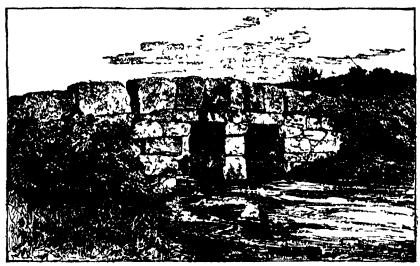
The erosion of large streams at the base of bluffs is often beyond the means of individuals to control, although persistent willow-planting along shore and planting on the slope, will often suffice In bad banks, a riprap of stone with plants having matted roots between the stones will hold On smaller streams, ripraps of stones or stumps, while unattractive until covered with vines, will hold banks at critical places A continuous stone wall is not a good barrier unless it is high enough on both sides to include flood-water, and the cost of such walls is too high for most individuals

On sliding slopes there is usually an overhanging upper edge with a short perpendicular edge just under it to be graded back The material thus secured may be used at the foot of the bluff. When more ideal conditions are desired, the grading may be extended to give angular raw banks the graceful contours that nature's gradual rounding-down of angles will give

Planting.

On low banks and terraces, where soil may be thoroughly prepared and well cared for, turf or any vigorous plant can be established. In elaborate garden designs, such planting is often trimmed or trained to a uniform surface or arranged to make a part of a formal pattern.

On high banks, landscape beauty of distinction may be created by the selection, arrangement and manage-



468. Banks held by moderate planting, the scenic features not being obscured

ment of artificial plantations or the natural growth High banks uniformly drained and graded to prevent slipping, such as railroad and reservoir slopes, may be turfed Such treatment is not recommended in large operations in which an interesting and varied surface-cover, or a low maintenance cost, is desired When large bluffs require many thousand plants and limitations of cost require that they be planted with little soil preparation, varieties must be selected that will grow well in the soil presented They must be plants that can be procured in large quantities at low cost, for the bulk of the planting, and it is desirable that they have such special characteristics as underground or surface stolons or trailing stems that root strongly at frequent intervals, or stems that root at the tips There are also varieties with very densely matted fibrous roots that hold soil well

The following plants meet these requirements for the soils indicated·

Low evergreen plants for the sandy or gravelly soil of the North Bearberry (*Arctostaphylos Uva-Ursi*) an ideal evergreen trailing ground-cover for sand or gravel, of which collected plants must be used that are not easily transplanted. Trailing juniper (*Juniperus communis*). Savin juniper (*Juniperus Sabina*) These three species are not procurable in large quantities at low cost, and collected plants do not transplant readily.

Low evergreen plants for good soil in shade Evergreen spurge (*Pachysandra terminalis*), excellent for shade and hardy over a wide territory. Myrtle or large periwinkle (*Vinca major*), from Virginia south. Periwinkle (*Vinca minor*), from Pennsylvania north The last three plants are offered by nurseries in large quantities, the latter at low cost by collectors, and collected plants transplant well. Japanese evergreen honeysuckle (*Lonicera japonica*) This climber and trailer is one of the best bank-covers in states south of New York, and it can be obtained in nurseries or from collectors in large quantities. Spring planting should be done very early

For low deciduous trailers or medium high shrubs for nearly all soils, the tip-rooting species of blackberry, such as *Rubus canadensis*, *R dumetorum*, *R occidentalis*, and the species with underground stolons, such as the cultivated high-bush blackberries, and red raspberries, are serviceable and can be obtained in large quantities at low cost Plants having a similar habit may also be thus secured, as the matrimony vine, the Indian currant, the weeping golden bell (*Forsythia suspensa*), the wild roses, (*Rosa lucida* or *R nitida*), the staghorn sumac (*Rhus typhina*) Of low-cost trees, the common locust, soft maple, box elder, and Russian mulberry, are all suitable

Of matted-root plants, the Japanese barberry, the hop-tree (*Ptelea trifoliata*), the European euonymus, the common buckthorn, can usually be readily procured.

Of small trees for shade, the flowering dogwood and red-bud are especially suitable and attractive from Massachusetts and New York south

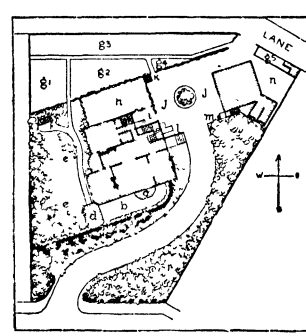
Of tall evergreen trees, the white pine is more serviceable for light soils and more easily procured; the arborvitæ and red cedar are the most available medium-height trees for average soils

In California, the mesembryanthemums are largely used for bank-covers

It is very desirable to establish a ground-cover of low shrubs and especially herbs under trees on banks as soon as practicable. By using hay containing wild asters, thoroughworts, blazing star, goldenrod, perennial sunflowers, and the like, for mulching young plantations, many of these plants will be introduced from seed, especially when seeds are mature. These will gradually be superseded by such shade-loving plants as ferns, violets, woodland asters, and goldenrods, especially if colonies of these plants are introduced as soon as the plantations are high enough to give shade.

Arrangement

If it is important to retain an extended open view from the top of high banks, then high trees must be confined to the lower edge, medium-sized trees and large shrubs to the central zone, and trailing plants or low shrubs to the upper zone If the bank is a low one, then low trees or large shrubs must be substituted for the large trees at the bottom of the bank It is often more interesting, however, to allow the bank to be covered with tall trees and then open vistas and views through these trees by cutting branches and thinning out as they develop. Banks offer rather an unusual opportunity for the development of interesting detail in the development of the planting, because of varying conditions of moisture and soil Such interesting details should be made accessible by trails following along the slope on easy grades that can be made at the time the bank is first graded or at later periods as the growth develops



469. Flat plan of a bank treatment on the right of the plan; and good planting against the residence, and up a bank at the rear.

WARREN H. MANNING.

BÁNKSIA (Sir Joseph Banks, 1743–1820, famous English scientist) *Proteàceæ* Australian evergreen shrubs or trees with handsome foliage, but not widely known in cultivation here.

Leaves variable, often deeply incised, usually dark green above, white or brown downy beneath. fls showy, sessile, usually in pairs, spicate; spike terminal or axillary, mostly crowded within the bracts and floral lvs.,

the pistillate ones ultimately forming thick woody strobiles.—Species 46, more than 23 of which have been more or less cult. in England, but only 2 or 3 so far known here.

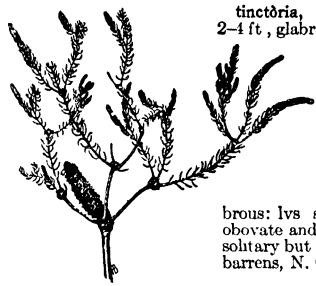
Propagation is difficult, and by seeds is usually an unsatisfactory method, although *B. serrata* has been grown satisfactorily from seeds. Cuttings under a bell-jar, without too much heat, root fairly well.

The following have been recently catalogued in North America; none of them has "gained a permanent foothold" in California. Several species are known in American botanic gardens.

integrifòlia, Linn. Ten to 12 ft.. lvs 6 in long, 1–1½ in. wide, entire, or rarely a little dentate, the upper side dark green, silvery white beneath, scattered or sometimes irregularly verticillate, spikes 3–6 in long; perianth about 1 in long, greenish yellow. Cav. Ic. 546. B M 2770. Lam. Encyc. 54.

serràta, Linn Tree, 10–20 ft, the young branches tomentose. lvs oblong-lanceolate, 3–6 in long, coriaceous and deeply and regularly serrate. fls similar to the preceding, but red B R 1316 (*as B undulata*) Cav Ic 539, 540 —Almost perfectly hardy in Cent Fla

ericifòlia, Linn Fig 470 Shrub or small tree, 12-14 ft lvs scarcely longer than ¾in, heath-like spikes 6–10 in long, the yellow perianth about ¾in long B M 738. Andr. Bot Rep, pl. 156 Cav Ic 538



470. Banksia ericifolia. (×⅛)

B latifòlia, R Br Stout shrub lvs irregularly almost spiny serrate, 4–8 in long, 1½–3 in wide. spikes 3–5 in long, perianth slender, scarcely 1 in long, greenish B M 2406 —*B. prionòtes,* Lindl Tree, 15–25 ft lvs 8–11 in long, ½–1 in wide, pinnatifid spikes 3–5 in long, perianth scarcely an inch long, villous, style rigid, incurved at the base. N. TAYLOR.

BANUCALAG: *Aleurites trisperma.*

BANYAN TREE: *Ficus indica,* and other species.

BAOBAB: *Adansonia.*

BÁPHIA (name meaning *dye*). *Leguminòsæ.* CAMWOOD BARWOOD. Shrubs or small trees, sparingly planted far south

Erect or climbing· lvs 1-foliolate, exstipellate, the stipules small fls white or yellow, papilionaceous, fascicled or racemose, calyx short-toothed but becoming slit as the fl opens, standard orbicular, and wings oblong or obovate, keel obtuse and slightly incurved; stamens not united pod linear-lanceolate, acuminate, flattened —A dozen species in Trop Afr and Madagascar Sometimes grown in hothouses. Prop by cuttings bearing lvs.

racemòsa, Hochst Erect, 8 ft, branches glabrous: lvs leathery, 3 in long, oblong or nearly so, acute fls. large in a leafy panicle, corolla much exceeding the calyx, white with purple veins on the standard pod 2 in long, about 2-seeded. S Cent Afr. and Natal. —Offered in S. Fla. L. H. B.

BAPTÍSIA (Greek, *to dye,* alluding to the coloring matter in some species). *Leguminòsæ.* FALSE INDIGO. About twenty-five erect perennial herbs of eastern North America, sometimes planted in borders and collections

Branching herbs lvs alternate, mostly 3-foliolate: corolla papilionaceous, the standard not larger than the wings calyx campanulate, the 5 teeth separate and equal or the 2 upper ones united stamens 10, distinct· pod stalked in the calyx.—Plants usually turn black in drying.

Baptisias thrive in any ordinary soil and under common treatment, preferring free exposure to sun. Propagation is by division or seeds.

A. *Lf -blades simple· fls. yellow.*

simplicifòlia, Croom. Branchy, 2–3 ft.: lvs. 2–4 in. long, sessile, broadly ovate and obtuse: fls in numerous terminal racemes. Fla., in dry pine- or oak-lands — Intro 1891.

perfoliàta, R. Br, with small axillary fls and broad perfoliate lvs, is occasionally planted, and is hardy as far north as Washington, but is evidently not in the trade. S. C. and Ga, on sand-hills B.M. 3121.

AA. *Lf -blades compound, 3-foliolate.*

B *Fls yellow*

tinctòria, R Br WILD INDIGO. Bushy-branched, 2–4 ft, glabrous lvs stalked, the lfts. small, obovate or oblanceolate, and nearly or quite sessile and entire fls ½in. long, bright yellow, in numerous few-fld racemes Common in eastern states and to La B.M. 1099. Mn. 5 81 —A kind of indigo may be extracted from this plant, and it has been used by dyers The root and sometimes the herb are employed medicinally

lanceolàta, Ell About 2 ft, pubescent when young, but becoming nearly glabrous: lvs short-stalked, the lfts. thick, lanceolate to obovate and obtuse fls large, dull yellow, axillary and solitary but close together near ends of branches. Pine barrens, N. C to Fla

BB *Fls blue.*

australìs, R Br (*B carùlea,* Eaton & Wright. *B. exaltàta,* Sweet) Stout, 4–6 ft, glabrous: lvs. short-stalked, lfts oblanceolate to oval, entire, obtuse· fls lupine-like, indigo-blue, nearly or quite an inch long, in loose-fld, long terminal racemes. Pa, W. and S. J.H III 29·64; 34:511 —Handsome. Probably the best species for cult

BBB. *Fls. white or whitish.*

álba, R. Br. Wide-branching, 1–3 ft, smooth: lvs. stalked; lfts oblong or lanceolate, obtuse, thin, drying green: fls. white, ½in long, in long-peduncled, elongated lateral racemes N. C, W and S, and extending northward B M. 1177

leucántha, Torr. & Gray Branching, more or less succulent, 2–4 ft., glabrous. lvs stalked; lfts. obovate to oblanceolate to cuneate, very obtuse, drying black. fls white, nearly an inch long, in loose-fld., lateral racemes. Ont to Texas

leucophæa, Nutt St stout and angled, but low and wide-branched, 1–2½ ft, hairy or nearly glabrous. lvs. short petioled, lfts oblanceolate to obovate, stiff, drying black fls large and cream-colored, on slender erect pedicels, borne in 1-sided declined racemes Mich. to Texas B M 5900. Mn. 3·177. F.S. 23:2449. L. H. B.

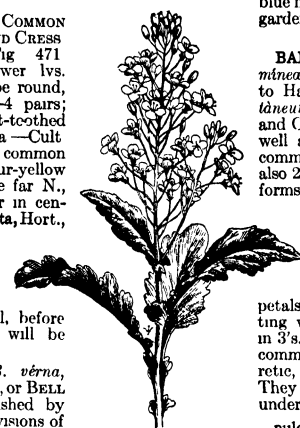
BARBACÊNIA (Barbacena, a Brazilian governor). *Amaryllidàceæ* About 30 Brazilian plants, with scape bearing a single purple fl Grown mostly in baskets, after the manner of many orchids. **B. purpùrea,** Hook, is occasionally seen in fine collections, but does not appear to be in the American trade. Grown in a warm, moist house It has many scapes which are much longer than the long, grass-like, toothed, prominently keeled lvs; 1½ ft Summer B M 2777 —The genus is anomalous. It has been placed in the *Hæmodoraceæ* as well as in *Amaryllidaceæ,* and Engler & Prantl place it in the small family *Velloziaceæ*

BARBADOS LILY: *Hippeastrum.*

BARBARÈA (from the old name, Herb of Saint Barbara). *Cruciferæ*. Hardy biennials, with yellow flowers, sometimes cultivated; allied to water-cress and horse-radish.

Branching leafy herbs: fls. small, yellow, clustered: fr. a linear cylindrical and 4-angled pod, the valves keeled.

vulgàris, R. Br COMMON WINTER CRESS. UPLAND CRESS YELLOW ROCKET Fig 471 Height 10–18 in : lower lvs. lyrate, the terminal lobe round, the lateral usually 1–4 pairs; upper lvs. obovate, cut-toothed at the base. Eu. Asia —Cult for salad, and also a common weed, making fields sulfur-yellow in early spring. Native far N., but apparently a settler in central states. Var. **variegàta,** Hort., lvs. splashed and mottled with yellow, is cult as a border plant, and grows freely in rich soil. If the fls. are picked off, st. and all, before they open, the plant will be practically perennial.



471 Barbarea vulgaris.

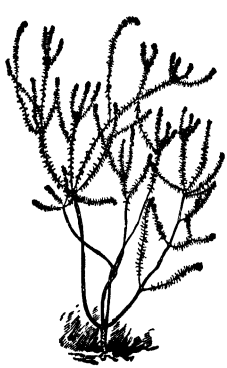
præcox, R. Br. (*B. vérna,* Asch). EARLY WINTER, or BELL ISLE CRESS Distinguished by the more numerous divisions of the lvs. (4–8 pairs) and thickened pedicels Slightly cult as a winter salad, and known S. as scurvy grass. Naturalized from Eu. L. H. B.†

BARBE DE CAPUCIN: *Chicory.*

BARBERRY: *Berberis.*

BARBIÈRIA (after J. B. G Barbier, French physician). *Leguminòsæ* Hothouse evergreen; 1 species, from Trop. Amer. Its nearest allies familiar to the horticulturist are Indigofera and Petalostemon It is distinguished from these allied genera by the calyx- and corolla-tubes, which are much longer than in either of them Tender evergreen shrubs, with odd-pinnate lvs , numerous entire lfts , and awl-shaped stipules fls large racemose, red Prop by seed and by cuttings of half-ripened wood under a bell-jar, with bottom heat

pinnàta, Baill. (*B. polyphýlla,* DC. *Galáctia pinnàta,* Pers. *Clitòria polyphýlla,* Poir). Lfts 9–11 pairs, elliptic-oblong, mucronate, pubescent with age: racemes few-fld , shorter than the lvs ; fls 2 in. long. Trop. Amer —*B. glabélla,* Hort , is probably a variety. N TAYLOR.†



472. Barosma pulchella.

BARKÈRIA: *Epidendrum*

BARLÈRIA (J Barrelier, died 1673, French botanist). *Acanthàceæ.* Hothouse evergreen shrubs

Fls axillary or terminal, the calyx with 4 sepals, the 2 outer larger than the inner, corolla-tube long, its limb of 5 rounded, ovate lobes —A genus of 150 species of tropical shrubs, mostly African, sometimes seen in fine collections of stove plants, but not offered in the American trade Prop. by cuttings of young wood, under a bell-jar with bottom heat. **B. cristàta,** Linn., with purplish blue fls , or rarely white, in dense spikes, is sometimes used as a bedding plant **B. strigòsa,** Willd , with subcoriaceous lvs , somewhat strigose, and large blue fls. in terminal spikes, is not uncommon in botanic garden collections.—Worthy of greater notice

N. TAYLOR.

BARLEY. Various kinds of *Hórdeum* of the *Gramíneæ.* Common barley is *H. sativum,* Jess. According to Hackel, it "undoubtedly originated from *H spontàneum,* C. Koch, which grows wild from Asia Minor and Caucasian countries to Persia and Beloochistan, as well as in Syria, Palestine, and Arabia Petræa " The common barley has a 4-rowed ear or head There are also 2-rowed and 6-rowed races, and other well-marked forms. They are probably all domestic forms of one parent stock. For fuller treatment, see Cyclo. Amer. Agric , Vol. II, p. 202

BARÓSMA (*heavy scent*). *Rutàceæ* A group of 15 species of S African heath-like shrubs Fls. on axillary twigs, calyx 5-cleft or 5-parted, petals 5, oblong, usually subsessile; stamens 5, alternating with 5 staminoidea lvs mostly opposite, rarely in 3's. Some of the species furnish the buchu lvs of commerce, which are used in medicine for their diuretic, diaphoretic, stimulant, and tonic properties They are evergreens, and in the N must be grown under glass. Prop by mature-wood cuttings

pulchélla, Bartl & Wendl Fig 472 Shrubby, 3–4 ft lvs scattered, ovate, with a revolute margin fls. axillary, solitary or in pairs longer than the lf., petals 3 times longer than the calyx B.M 1357 (as Diosma) —Sold by some dealers, but rare in this country.

B fœtidíssima, Bartl & Wendl (Agathosma fœtidissima, Hort) A low shrub, 2–3 ft lvs ternate, a little longer than the internodes fls umbellate at the ends of the branches, the petals one-half to one-third longer than the calyx, white or pinkish white —Attractive little shrub, grown in the temperate house, but evil-smelling It often scents a whole greenhouse N TAYLOR.

BARRINGTÒNIA (Daines Barrington, English naturalist and antiquary, died 1800) Including *Stravidium Myrtàceæ,* placed in *Lecythidàceæ* by those who keep this group as a distinct family. Evergreen broad-leaved trees, some of which are planted in the tropics for the striking foliage and flowers.

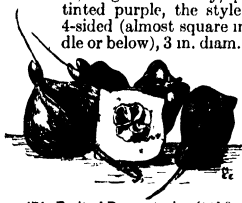
Leaves mostly large and crowded at the ends of the branches, entire or somewhat crenate fls large in the cult species and striking because of the numerous long and protruding stamens which are united in a ring; calyx-tube ovoid or turbinate, lobed; petals 4 or 5; ovary inferior, 2–4-celled· fr a fibrous berry-like or box-like structure, crowned by the calyx-limb, 1-seeded by abortion of other ovules.—About 30 species in tropical parts of Asia, Afr., and Polynesia, bearing the white or reddish fls. in spikes or racemes.



473. Barringtonia speciosa (×⅓)

speciòsa, Forst (Figs. 473, 474), is apparently most planted in parts of the American tropics tree wide-spread-

ing, large-boled, to 50 ft in height· lvs. entire, obovate, sessile, shining, 12–15 in long. fls. few in the raceme, large and showy, petals white and stamens tinted purple, the style long and prominent fr 4-sided (almost square in cross-section at the middle or below), 3 in. diam. at base, box-like in looks, with a single large seed and crowned by calyx-lobes and style India, near the sea. L H B.



474. Fruit of Barringtonia. (×¼)

BARTÒNIA of Sims is *Mentzelia*, this is in cult. Bartonia of Muhlenberg is one of the Gentianaceæ, but is not cult

BASÉLLA (native Malabar name) *Basellàceæ* MALABAR NIGHTSHADE Annual or biennial herbs, cult. in the tropics as a pot-herb, like spinach They have bisexual, white, red or violet fls Rarely cult N as an ornamental warmhouse climber It may also be started indoors, and set out in May for use as a garden vegetable, to follow spinach Prop by seeds Only 1 species, which is, however, remarkably variable

rùbra, Linn Lvs succulent, alternate, rarely opposite, almost entire, of various forms· fls. not pedicelled, in simple spikes or racemes; spikes short or long, lax, few-fld Lam Ill , pl. 215, fig 1. Rheede, Hort. Mal 7, pl 24 —The following species are now considered only forms of the above. *B álba,* a white-fld. form rarely cult as a trailer from roofs of warmhouses, or as a basket plant, *B cannafòlia, B cordifòlia,* with heart-shaped lvs 4–5 in long and 2–2½ in wide, *B. crassifòlia, B japónica, B. lùcida,* from India, *B nìgra,* a Chinese form; *B ramòsa* and *B. volùbilis* Under the name of sweet malabar vine, a form with tiny yellow and red fls , and lvs variegated with white, pink, and green has been advertised It is said that "with age it assumes a drooping habit When cut, keeps fresh for weeks "

BASIL. Species of *Ocimum* (sometimes, but incorrectly written *Ocymum*), of the *Labiàtæ* They are Indian annuals, and are cult as pot-herbs, the clove-flavored foliage being used as seasoning in soups, meats and salads They are of easiest cult , the seed being sown in the open as soon as the weather is settled Common basil is *Ocimum basilicum,* Linn , a foot high, branching, with ovate toothed lvs , and white, bluish white, or purplish fls in leafy terminal racemes or spikes *O minimum,* Linn , the dwarf basil, is lower, and smaller in all its parts, rarely seen and perhaps only a mere form of *O basilicum,* Linn When basil is in bloom, it can be cut and dried for winter use.

BASILÌMA. *Sorbaria*

BASKET PLANTS. Under this term are included all those plants which, from their habit of growth and blooming and adaptabilities as to cultivation, have been found especially suitable for use in hanging-baskets. Figs 475, 476

Most of the basket plants are dwarfish subjects of indeterminate growth, of gracefully drooping or vine-like habit, and are valued either for their grace, or for freedom and daintiness of bloom Some of the plants used in baskets are of upright habit These are either plants of naturally small stature, or are practically such for a season from a slow habit of growth The suitability of these erect-growing plants for the purpose is determined, aside from their stature, by their freedom of bloom, beauty of foliage, striking form, or grace of habit Such plants are used principally for filling the central part of the basket, whereas, plants of trailing habit are inserted near the sides—some to droop, others to twine upward on the cords or handle by which the basket is suspended. In addition to the long drooping or climbing plants, there are a number of half-erect habit, like the lobelia, sweet alyssum and russelia. These may droop somewhat, but are not of a truly vine-like habit Some plants are more suitable than others for shady places, the selaginellas, are examples. Others thrive only with several hours of direct sunshine each day

The following list of common trade names embraces a number of the most important basket plants, arranged according to habit of growth and blooming The list is, of course, not complete Any list would need amending from year to year to suit individual taste and experience Plants that withstand considerable shade are marked with an asterisk (*); those that will bear much shade are marked with two asterisks (**):

1. *Plants of vine-like habit*

a LONG-DROOPING.

**English Ivy, *Kenilworth Ivy, *Vinca major, *V. Harrisonii, Saxifraga sarmentosa, *Cissus discolor, *Moneywort Ivy, Tropæolums (Nasturtiums), Lonicera Halliana, L aurea var reticulata, Nepeta Glechoma, Ampelopsis quinquefolia, A Veitchii The ampelopsis is deciduous, and not suitable for winter baskets.

b CLIMBING

Maurandia, **Lygodium scandens, *Senecio scandens, Thunbergia, Cobæa scandens, Japanese Variegated Hop, Manettia bicolor, Lonicera Halliana, L aurea var reticulata, Clematis coccinea, Tropæolum peregrinum, forms of Convolvulus

c SHORT-DROOPING, OR HALF-ERECT

*Lobelia Erinus, *Othonna crassifolia, *Sweet Alyssum, *Tradescantia, Petunias, Oxalis floribunda, *Russelia juncea (also bears sun well), *Fittonia, *Fuchsia procumbens, Ice Plant, Verbena, *Ivy Geranium, **Selaginellas, *Begonia glaucophylla var scandens, *Sedum Sieboldii, *S carneum var variegatum, *Asparagus Sprengeri, *Passifloras, *Panicum variegatum, Gazania splendens, Abutilon megapotamicum and var variegatum, Lantana delicatissima, Solanum jasminoides, S Seaforthianum, Convolvulus mauritanicus

2. *Plants of upright habit*

a LOW-GROWING

(1) *Flowering Plants* —*Torenia, *Pansy, Cuphea platycentra, C hyssopifolia, *Primula obconica, Dwarf Alyssum, Bellis perennis, Linum or Reinwardtia trigyna, Phlox Drummondii, Dutch bulbs

(2) *Foliage Plants* —*Peperomia, *Begonia Rex, *Farfugium grande Alternanthera, **Maidenhair Fern, Geraniums (especially Mme Salleron), *Isolepis gracilis (droops with age)

b TALLER-GROWING

(1) *Flowering* —Geraniums —Pelargoniums, *Fuchsias, Petunias, *Begonias, Browallia, *Stevia serrata var hana, Madagascar Periwinkle, *Nierembergia, Lantana, *Impatiens Sultana, Cuphea Llavea, Swainsona, Chrysanthemum frutescens, Salvias

(2) *Foliage* —*Dusty Miller, *Crotons, *Palms, **Ferns, *Fancy Caladums, Coleus, Achyranthes, **Aspidistra, *Cyperus alternifolius, *Dracæna indivisa, *D terminalis, Coccoloba platycladas



475 A hanging-basket.

Some of the above plants make large subjects when growing in the open ground. Of such, only young or smaller plants are available for use in hanging-baskets Ordinarily, several different sorts of plants are used for filling a basket. In some cases, however, a satisfactory basket is made by using but one kind of plant. A hanging-basket filled with sword fern (nephrolepis), for example, makes a handsome object.

The soil used in hanging-baskets is simply good, common, florists' potting soil This usually contains about 25 per cent of humus, and a small amount of sharp sand to make it porous. Prior to filling, wire baskets must be lined with moss This is merely common woodland moss from rotting logs, or rich, damp

soil. In filling baskets, a few drooping or climbing plants are disposed around the sides; then one or more upright-growing or half-erect plants, according to the size of the plants and basket, are planted in the center. Immediate effects require plants which have already made considerable growth. Florists usually carry a stock of suitable plants. In case seedlings or cuttings are grown for the purpose, it is usually best to start them in seed-pans or cutting-boxes, and transfer them later to the basket. Seeds may be sown or the cuttings started in the basket, but it is so long before they fill the basket that there is no advantage in it

A common mistake in arranging baskets is crowding, or filling them too full. Fewer plants will appear more graceful, growth will be more vigorous, and the basket will retain its grace and beauty for a longer time. Exercise vigilance and care in watering After the roots have well filled the basket, watering is best done by dipping the basket in a tub or barrel of water, and allowing it to remain until it is well saturated. Dipping the basket in weak liquid manure once or twice a month will greatly promote vigor when the plants have been long in the basket These remarks also apply in a general way to vases and rustic stands

Baskets of many patterns are obtainable from florists and other dealers. The baskets most extensively used, are made of strong wire, woven into hemispherical or other forms These are sometimes plain, and again of ornamental character. The better form has a flat bottom, or a stand, formed of wire, to support the basket in an upright position when it is not pendent Another style is formed of rustic work Here the vessel or plant basin is covered about the sides with rough bark or knotted roots. For this purpose the roots of the laurel are much used Above the basket there is an arch or handle by which it is suspended. Again, earthenware vessels, to be suspended by wires, are offered for sale in a variety of shapes. Some of these are molded and painted in imitation of logs, and are known as "stick baskets" and "log baskets." Such baskets are often without provision for drainage When this is the case, holes should be drilled at the lowest point in the bottom. A special form of basket is much used for orchids. It is made of square cedar slats in raft- or log-fashion Fern-fiber and broken bits of brick, flower-pots or charcoal, are used for filling them. See also the article *Vases*.

ERNEST WALKER.



476. Rustic basket (with Convolvulus).

BASSWOOD: *Tilia*

BATÀTAS: *Ipomœa*

BATEMÁNNIA, (James Bateman, a distinguished collector and cultivator, and author of important orchid works). *Orchidàceæ* Epiphytic; greenhouse.

Stems thickened into pseudobulbs, 1–3-lvd.: lvs. plicate-veined racemes arising from base of pseudobulbs; sepals and petals similar in shape; lip articulated to the foot of the column, the lateral lobes inclosing the column, the middle lobe short, entire; pollinia 2 —A single species, native of Guiana, rarely seen in cult.

Cólleyi, Lindl Pseudobulbs 2–3 in. long lvs. up to 10 in. long: raceme pendulous, with 4 or more distant fls. about 3 in diam.; sepals and petals vinous, purple, the lateral sepals green-margined; lip white, red-dish stained at the base of middle lobe. B.R. 1714. B.M. 3818.

GEORGE V. NASH.

BATODÊNDRON: *Vaccinium.*

BAUÈRA (H. Gottfr. and Franz Bauer, German professor and painter, respectively). *Saxifragàceæ.* Choice little evergreen shrubs grown in greenhouses.

Leaves 3-parted and opposite, looking like a whorl of 6. fls white to purple, axillary and solitary, but sometimes aggregated at top of the st , calyx 4–10-divided; petals as many as the calyx-divisions, stamens few to many, borne on a disk fr a 2-valved caps , the valves again splitting —Three species in Austral. and Tasmania, one of which is in cult

These small shrubs make handsome specimen plants for the cool greenhouse, and flower most of the year, especially during the winter and spring months Baueras are easily propagated from cuttings of half-ripened wood in spring, cut into lengths of about 2 inches, insert in equal parts of finely sifted peat and sharp sand in 3-inch pots, pricking them round the rim of the pot, and cover with a bell-glass in a greenhouse with a temperature from 55° to 60° Give them a thorough watering at the time of insertion, and they will frequently root without further watering When the cuttings begin to show signs of growing, they should be potted singly in 2-inch pots in the same mixture as above, and should be kept in a tight case for a few days After they have gripped the soil, they should be cut back to about an inch above the pot, which will encourage them to branch Baueras should never be allowed to become pot-bound until the desired size of plant is reached The plants at all times should be kept in good shape by cutting back the strong shoots In summer, baueras do better when plunged in a bed of coal-ashes out-of-doors, and strict attention given to watering A cool greenhouse with a night temperature of 40° to 45° will be ideal all winter Water occasionally with soft-coal soot mixed in water, a handful to an ordinary watering-pot; water with clean water three times and the soot-water once. (Geo. F Stewart)

rubioides, Andr Erect or prostrate, usually 1–2 ft. in cult , but becoming 6 ft or more lfts. oblong or lanceolate, somewhat acute, ¼–½in. long, serrate: fls. pink or white, slender-pedicelled, the very obtuse petals exceeding the spreading or reflexed acute-toothed calyx-divisions Inhabits swampy places B.M. 715. L.B.C. 14:1313 (as *B. rubæfolia*) —An old favorite, blooming in spring

L. H. B.

BAUHÍNIA (after John and Caspar Bauhin, sixteenth century herbalists, the twin leaflets suggesting two brothers). *Leguminòsæ* MOUNTAIN EBONY. ORCHID TREE. Tropical trees and shrubs, sometimes climbing, planted in southern Florida and southern California to some extent for the flowers, odd foliage, and general attractive appearance, distinguished by the usually bifid or binate leaves; allied to Cercis

Trees, shrubs, or vines, with showy fls ranging from white to purple and yellow. lvs. broad, entire or 2-lobed, in some cases the lfts. being entirely free; petiole prolonged into a short but characteristic awn between the lfts.: fls. in simple or panicled terminal or axillary

racemes; petals 5, somewhat unequal, usually narrowed into a claw; stamens 10, but sometimes reduced even to 3 and perhaps bearing sterile filaments; ovary stalked, stigma in some species peltate and in others oblique: fr. a long flat pod, dehiscent or indehiscent — About 150 species in tropics of both hemispheres The number and fertility of the stamens are important characters in determining the subgenera The purplish fls. of some species suggest those of some kinds of pelargonium The bauhinias are not papilionaceous Some of the arboreal species (as *B variegata*) produce ebony wood Others are gigantic climbers, sometimes mounting the highest trees

Bauhinias are frequent in plantings in many parts of the tropics. They are planted to some extent in southern Florida and southern California. Numbers of species are likely to be introduced from time to time because of their gorgeous appearance in the tropics In the experience of Old World gardeners, the most reliable species under glass are *B variegata*, *B corymbosa*, and *B. natalensis*. These can be planted outside in southern Florida in summer, and kept over winter as oleanders are *B. variegata* and *B. purpurea* are two of the commonest and showiest small trees of India, and, although frequently introduced into northern greenhouses, have rarely succeeded permanently *B variegata* is much cultivated in India The astringent bark is used in tanning and dyeing, and the leaves and flower-buds as a vegetable, the latter being pickled Bauhinias thrive in a variety of soils on our southernmost borders They delight in high well-drained land, but will grow on lower lands in southern Florida if it is fairly well drained or if set on slight mounds, all of them are very tender and easily affected by low temperatures, but are easily saved by banking *B purpurea* and *B. variegata* (*B alba*) have withstood a temperature of 26° F. in Florida No particular care in tillage or fertilizing is necessary, but better bloom is secured if some attention is given to these details From seeds in Florida bauhinias grow readily and bloom freely in three or four years Cuttings root with difficulty, but some kinds propagate readily from suckers Bauhinias are little known as greenhouse subjects; but in the tropics they make showy and very attractive shrubs or small trees or profuse vines (E N Reasoner)

INDEX.

acuminata, 4	Galpinii, 3	purpurea, 11
alba, 12	grandiflora, 5	tomentosa, 9
candida, 12	Kappleri, 10	*triandra*, 11
corymbosa, 2	*Krugii*, 10	variegata, 12
forficata, 8	natalensis, 6	yunnanensis, 1
furfuracea, 8	picta, 7	

A *Plant climbing, or at least of climbing habit or tendencies*

1 **yunnanénsis,** Franch Vigorous, glabrous and glaucous throughout lvs coriaceous, bipartite, segms. obliquely elliptic, 3–4-nerved, rounded, 1½ in. fls in many-fld pendulous racemes, rosy white striped with purple Yunnan, China B M 7814.

2 **corymbósa,** Roxbg. Woody climber, branching from the ground: branches grooved tendrils opposite, revolute lvs 1½–2 in long, outer edges slightly rounded, inner edges straight and parallel, lfts nearly free from each other, nerves 2–4 fls numerous, corymbose, 1 in across, rosy, with fluted petals, and characteristic venation; stamens bright red, 3 very long, the rest abortive. China B M 6621. G C II 16 204

3. **Gálpinii,** N. E. Br. Half-climbing shrub, 5–10 ft: lvs 1–3 in long, 2-lobed from one-fifth to one-half their length, 7-nerved; petiole about ¼in long. racemes 6–10-fld; fls. borne continuously from spring to late autumn; petals 5, all alike, 1–1½ in long; claw as long as the limb; limb orbicular, cuspidate, brick-red; fertile stamens 3· pod 3–5 in. long, seeds dark brown S and Trop Afr. B M. 7494 —Discovered 1891

AA. *Plant upright, a bush or tree.*

B. *Fls white*

4. **acuminàta,** Linn Height 5–6 ft: lfts. ovate, acuminate, parallel, 4-nerved, closing at night fls 2–3 in. across, fertile stamen long and nearly free, the other 9 short, connected, and sterile India, Malaya, China B M. 7866. J.H III. 44. 343 —One of the most satisfactory of all, either for open ground or greenhouse culture, as it will bloom the first summer, when but a few months old and but a foot or two high, and in succeeding summers blooms continuously from May to Sept.

5. **grandiflòra,** Juss Tree, to 20 ft · lvs. oval or subcordate, tomentose beneath, not deeply divided. the lobes ovate-obtuse and 3–4-nerved, stipules spiny: fls. very large, pure white, opening at night, 1–3 on axillary peduncles, petals obovate, acute at apex, clawed. S. Amer. R H 1897, p 393.

6 **natalénsis,** Oliver Small shrub lvs. numerous; lfts each 1 in long, with a midrib and a few nerves, dark green, petioles ¼–½in long, lfts entirely free. fls. single or in 2's, 1½ in across, white, the midvein of the 3 upper petals reddish; petals erect or spreading, the 2 lower ones larger; stamens 10, 5 long and 5 short pod 3 in long S Afr B M 6086 —Not advertised at present



477 Bauhinia Kappleri. (×⅓)

7 **pícta,** DC Unarmed lvs. roundish elliptic, membranous, glabrous, lfts semi-ovate, acutish, 5-nerved fls in solitary terminal racemes, white, calyx ferrugineous-tomentose; petals oblong Colombia.

BB *Fls colored (cream-color, yellow, or shades of red or purple)*

8 **forficàta,** Link (*B furfuràcea*, Hort.) Thorny shrub. lvs cordate at base, glabrous, cleft to middle fls cream-color in summer, rather bell-shaped, the petals narrow Brazil. B M. 3741 Gt 10 333

9 **tomentòsa,** Linn St Thomas Tree Erect shrub or small tree, branches downy lvs broader than long, 1–2 in long, coriaceous, the lobes obtuse, 7-nerved: fls mostly in axillary pairs (sometimes 1 or 3) on pedicels bearing a pair of bractlets, yellow with red blotch on the upper petal, the petals 2 in or less long, obovate, much exceeding calyx (which is entire) pod stalked, 4–5 in long India B M 5560

10 **Káppleri,** Sagot (*B Krùgii*, Urban) Fig. 477. Strong tree, to 50 ft · lvs 2½ in or less long, long-petioled, longer than broad, truncate or somewhat cordate at base, divided about one-third of the length into obtuse lobes that are about 5-nerved: fls in short racemes opposite the lvs, whitish rose with darker and purple markings, the petals spatulate and clawed; lower stamens fertile pod 6–10 in., narrow and curved. Probably French Guiana; cult and partly spontaneous in W Indies —Attractive

11 **purpùrea,** Linn (*B triándra*, Roxbg). Small to middle-sized tree. lvs coriaceous, glabrous, somewhat cordate, cleft one-third to one-half their depth, 9–11-nerved, lobes obtuse or somewhat acute· fls in few-fld axillary and terminal corymbs, fragrant; petals red, one streaked with white on the claw, oblanceolate, acute; fertile stamens 3–4, very long, the rest sterile or abortive pod 1 ft. long. India, Burma, China.—One of the finest flowering small trees in S Fla Fls are borne in the greatest profusion, 3–5 in. across, varying in color from almost white to a shade of rich purple, and marked and shaded with many tones The plant is

robust and hardy, growing to a height of 15 ft in less than 2 years, and blooms all winter and spring What is known as *B trandra* to Fla cultivators is described as a very tender species but succeeding admirably there; growth like that of *B purpurea* but with longer willowy branches that bear at the tips great clusters of pink fls. in late autumn or early winter, delicately scented.

12 **variegàta,** Linn Much like *B purpurea* in habit: tree, 6–20 ft : lvs. 3–4 in. across, somewhat broader than long, divided one-fourth to one-third the depth, 9–11-nerved, lobes rounded; petiole 1–2 in long fls about 7, in a short raceme or corymb, 4 in across; calyx spathe-like, petals 5, clawed, obovate-oblong, veined, rose-colored and variegated with red and yellow, the lowest one larger, broader above the middle, strongly marked with crimson. pod 1–2 ft long India B.M. 6818.—The coloring of the fls. varies Var. **cándida,** Roxbg (*B. álba,* Buch-Ham). Height 12 ft.: fls white, beautifully veined with green fls. Feb – May. B.M. 7312

Numbers of bauhinias may be expected to appear in plantings along the southern borders . The following names have already occurred. *B. cándicans,* Benth Closely related to B forficata Spiny branchlets and racemes whitish tomento-e lvs pubescent below, 9-nerved petals nearly 3 in long Uruguay, Argentina — *B Hookeri,* F. Muell Large tree lfts distinct, broad, very obtuse, 5–7-nerved: fls white, edged with crimson, in few-fld terminal racemes, petals clawed, the blade about 1½ in. long Austral.—*B Richardsonii,* said to be from Mauritius, unidentified.

L. H B.†

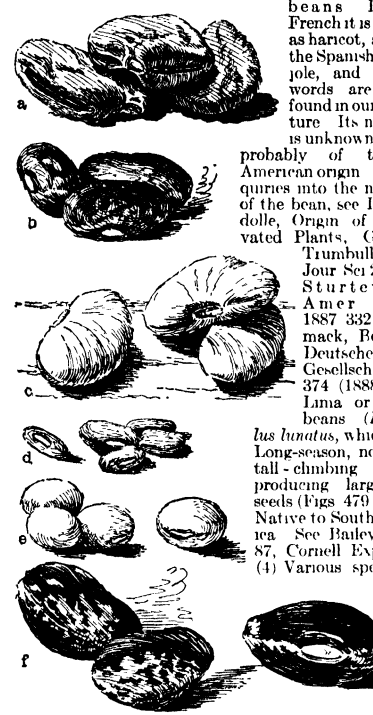
BAY TREE: *Laurus.*

BEAN. A name applied to various plants of the *Leguminòsæ.* The word is commonly used for herbaceous plants of the Phaseolus tribe, but it is sometimes employed for seeds of leguminous trees and shrubs. The species of true beans (Phaseolus and closely allied genera) are yet imperfectly understood The bean differs from the pea, among other things, in being epigeal in germination (cotyledons appearing above ground). Some of the plants to which the name is applied are really peas

The beans chiefly known to horticulture are of five types. (1) The Broad bean (*Vicia Faba*), or the bean of history, an erect-growing plant, producing very large and usually flat, orbicular or angular seeds Probably native to southwest Asia (Figs 478, 479 *a*). See *Vicia.* These types of beans are extensively grown in Europe, mostly for feeding animals. They are either grown to full maturity and a meal made from the bean, or the plant is cut when nearly full grown and used as forage or made into silage. The Broad bean needs a cool climate and long season In the United States, the summers are too hot and dry for its successful cultivation on a large scale, and the plant is practically unknown here. In Canada, the plant has been used with corn to make silage; and this combination has been called the "Robertson mixture" (2) Kidney bean (*Phaseolus vulgaris;* Figs 479*b*, 480) This is the plant which is everywhere known as bean in North America, comprising all the common field, garden, snap and string beans By the French it is known as haricot, and by the Spanish as frijole, and these words are often found in our literature Its nativity is unknown, but is probably of tropical American origin For inquiries into the nativity of the bean, see DeCandolle, Origin of Cultivated Plants, Gray & Trumbull, Amer Jour Sci 26 130, Sturtevant, Amer Nat. 1887 332, Wittmack, Ber der Deutschen Bot Gesellschaft, 6 374 (1888) (3) Lima or Sugar beans (*Phaseolus lunatus,* which see) Long-season, normally tall-climbing plants, producing large, flat seeds (Figs 479*c*, 481) Native to South America See Bailey, Bull 87, Cornell Exp Sta (4) Various species of Dolichos (as *D sesquipedalis* of gardens), or closely related things. Vines which produce very long, slender pods and small, narrow beans (Figs 479*d*, 482) Native to tropical America (5) Soy, or Soja, bean (*Glycine hispida*). A bushy, erect, hairy plant producing small pods in clusters, and pea-like seeds (Figs 479*e*, 483). In this country used mostly for forage Native to China and Japan, where it is much grown



478. Broad bean—Vicia Faba (×⅛)



479 Types of beans (Natural size)

a Vicia Faba *b* Phaseolus vulgaris *c.* Phaseolus lunatus *d* Dolichos sesquipedalis (properly a Vigna) *e* Glycine hispida *f* Phaseolus multiflorus

Aside from these types, there are others of less economic importance The Scarlet Runner type is a perennial phaseolus (*P. multiflorus*), grown in this country mostly for ornament (Figs. 479*f*, 484). The Tepary bean, now gaining prominence in the Southwest, is a form of *Phaseolus acutifolius,* a native species Various other species of Phaseolus are also cultivated in various parts of the world under the name of beans *P. radiatus* is prized in Japan, and has been introduced into the United States as Adzuki Bean (see Georgeson, Bull 32 Kan Exp Sta) *Vigna sinensis,* known in North America as cowpea (which see), is sometimes called a bean. The Velvet bean of the South is a Mucuna (which see), recently, however, referred to Stizolobium. The Jack bean is a Canavalia (Fig. 485). Recent American studies on varieties and types of beans are Irish, Rep Mo. Bot. Gard 1901, 81–165;

Jarvis, American Varieties of Beans, Cornell Bull. 260 (1908); Freeman, Ariz Bull. 68 (1912).

The sea beans of the Florida coast are seeds of various tropical leguminous plants, and are transported by ocean currents (see Coe, in G F 7·503).

For botanical treatment, see *Dolichos, Glycine, Phaseolus, Vicia, Vigna.* L. H. B.

Culture of the bean.

For the purposes of the practical gardener, the various types and numerous varieties of the bean may be classified in two groups, in two different ways, namely, either as "field beans" and "garden beans," or as "bush beans" and "pole beans" Field beans are grown on a large commercial scale for the dry-shelled seeds, either as a farm crop in regular rotation, as corn and potatoes are grown, or at times as a subsidiary or chance crop, or side line, in young orchards, and so on, but are not usually found in the home- or market-garden, where highly manured soil would tend to stimulate growth of foliage at the expense of seed-production Field beans belong mostly or entirely in the class of bush beans The garden beans are more commonly grown for their succulent pods and immature seeds, and include both bush and pole or "running" sorts The latter come almost exclusively under the head of "garden" beans



480. Common or Kidney bean.—Phaseolus vulgaris

The great economic value of the bean is generally recognized, not alone in respect to its high place as a farm and garden crop, but also as the most suitable material, next to animal products, in compounding a balanced ration for man, and to some extent for beast, and as a substitute for lean meats

Beans are easily forced under glass, in a temperature suitable for tomatoes They may be grown either in pots or beds The bush varieties, as Sion House, are preferred Keep them growing, and look out for red spider

Field beans

Ordinary field beans like a fairly good warm farm soil, such as will suit corn or potatoes They do not draw very heavily on the fertility of the land Belonging to the legumes, they are able to make use to a large extent of atmospheric nitrogen, and if given a good start will not only look out for their own needs in that respect, but may leave the land better supplied with nitrogen than it was found at planting-time They will not thrive on wet or badly drained land; otherwise good strong loams, or soils resting on limestone, are considered most desirable, with sandy loams and gravelly loams next in order They should have a fair but not excessive amount of humus A few loads of fine old stable manure spread evenly on the surface after plowing, if possible supplemented with fifty or a hundred pounds of muriate of potash and a few hundred pounds of dissolved rock (acid phosphate) or other phosphatic manure may be expected to give good returns. Or, in the absence of these chemicals, 200 pounds or so of a commercial fertilizer such as is usually applied for grain crops, and which analyzes about 2 or 3 per cent of nitrogen, 8 of phosphoric acid and 3 or 4 of potash, may be applied broadcast after plowing Although the planting should not be done until after the soil has become warm, in the northern states not before June, the customary planting-time in the great bean-producing sections extends from June 1 to June 25, it is, nevertheless, of great importance to plow the land early and keep it worked with disk or other harrows until planting-time, this for the purpose of preserving moisture and getting ahead of the weeds Important also is the use of good hand-picked seed beans, not over one year old, and free from weevils and disease infection. The rows are to be made 28 to 36 inches apart, and for small areas, planting by hand or with a corn-planter will do For planting on a larger scale, a regular bean-planter or a grain-drill with part of the tubes stopped up so as to bring the rows the correct distance apart should be used If fertilizer is to be applied with the drill at the same time, it may be allowed to run from the hoe or tube on each side of each tube that discharges the seed beans

Among the varieties generally grown in field culture are the Pea or Navy, the Medium, Red and White Kidney The Pea bean is small but early and prolific, and considered to be about as profitable as any other under ordinary circumstances It is particularly recommended for the small or home grower

The harvesting comes when the pods have ripened and the leaves have dropped off, and is to be done with a bean-puller or harvester, taking two rows at a time, or in a small way by hand-pulling The vines are put in small heaps, allowed to cure, and promptly stored out of the way of moisture, afterwards threshed with a bean thresher, or in a small way with the flail, cleaned, sorted by hand (in a large commercial way with the help of a bean-sorting device), and marketed

Garden beans

The warm and fertile soil of the average home- or market-garden suits the requirements of the "garden" beans, as they are mostly grown for their tender and succulent pods and not for their seeds, or, as in the case of the lima and several others, for their seeds in an immature or half-developed state The pods of all these garden beans should be picked promptly and clean in order to prolong the bearing period as much as possible If the beans are allowed to ripen on the vines, the latter will soon give out Only when these garden beans are grown for seed purposes is early and even ripening desirable, and in that case the pods, perhaps with the exception of the first setting if light, must all be left on A good string bean has a thick, meaty pod which snaps off clean when broken, leaving no string along the back



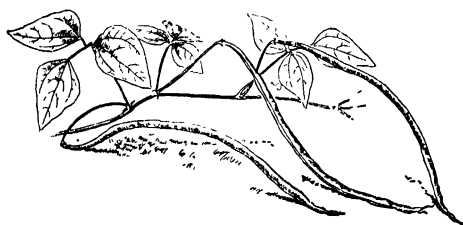
481. Large White Lima bean (×⅓)

Many varieties which answer this description are offered in the various seedsmen's lists, both green-podded and yellow-podded Early Valentine, with its many strains (Red, Black Earliest Improved, and so on), is still in favor with growers for a green-podded variety A newer good one is Stringless Green-Pod Quite numerous are the yellow-podded sorts Among them are Black Wax,

Golden Wax, Davis Kidney Wax, Wardwell Wax, Hodson, and others.

Pole beans.

Pole or running varieties of beans require especially fertile soil; and for that king of table beans, the lima of all forms, too much can hardly be done in the way of enriching the ground. Warm soil is one of the first essentials of success in growing pole beans. When poles are to be used for support, they should be set not less than 4 feet apart each way, before the beans are planted. Four or five beans are to be placed around each pole, 1 to 1½ inches deep While it is a safe rule to put the seed eye downward, it is not a necessary condition of prompt and uniform germination In case of absence or scarcity of poles, a serviceable, cheap and ornamental trellis may be constructed by setting posts firmly at proper distances along the row, connecting them with two wires, one a few inches and the other 5 or 6 feet from the ground, and finally winding cheap twine zigzag fashion around the two wires. Cultivate and hoe frequently. A top-dressing of good fertilizer, or of old poultry- or sheep-manure, hoed in around the plants, may be of great help in keeping up the productiveness of the plants to the end of the season. To have a continuous supply during the entire season, the pods, when large enough, must be gathered frequently and clean. Among the varieties used both for string and shell beans, are the Green-podded Creaseback,



482. Yard-long Bean. A species of Vigna.

several wax varieties, Golden Cluster, and the popular Horticultural or Speckled Cranberry bean, besides any number of others A very fine bean is the Dutch Runner (Fig 484), which approaches the lima in quality and resembles it in habit of growth The seed is of the largest size and clear white in color. Highly ornamental is the closely related Scarlet Runner, with its abundance of showy scarlet blossoms This latter bean is grown in Europe for eating, but is rarely used for that purpose here.

Lima beans.

Of all pole beans, the limas have undoubtedly the greatest economic value. They enjoy a deserved popularity, and are usually grown with profit by the market-gardener. The varieties might be classed in three types, —that of the Large Lima, the Dreer Lima, and the Small Lima or Sieva Each of them has a number of sub-varieties or strains, and appears in both pole and bush form. The old Large Lima (Fig 481) is a very large, flat bean, and yet largely grown for main crop. To the same type belong Extra-Early Jersey, King-of-the-Garden, and others The pods of these are very large, and the beans in them somewhat flattened.

There are dwarf forms of both sieva and the regular lima. The Burpee Bush Lima is a form of the large lima type. The Dreer Lima of both forms is appreciated especially for its high quality. The seeds are more roundish and crowded close together in the pods, the latter being much smaller than those of the Large Lima. The seeds of these two types are light-colored, with a greenish tinge, but the Large Lima is also represented by red and speckled (red-and-white) sports. The Small Lima or Sieva, with its dwarf form, Henderson Bush Lima, seems to be hardier and earlier than the two larger types, but pod and bean are quite small. The color of this bean is nearly clear white, but there is also a speckled sub-variety of it. Wherever there is a place for the Sieva, its bush form will be appreciated. The bush forms of the two larger types, however, are not uniformly productive enough to take the place of the pole forms entirely. The latter will often be preferable when a season of continuous bearing is desired.

Lima beans require a long season, and therefore are not much grown along the northern borders and in Canada They must be given warm and "quick" soil and kept constantly growing.

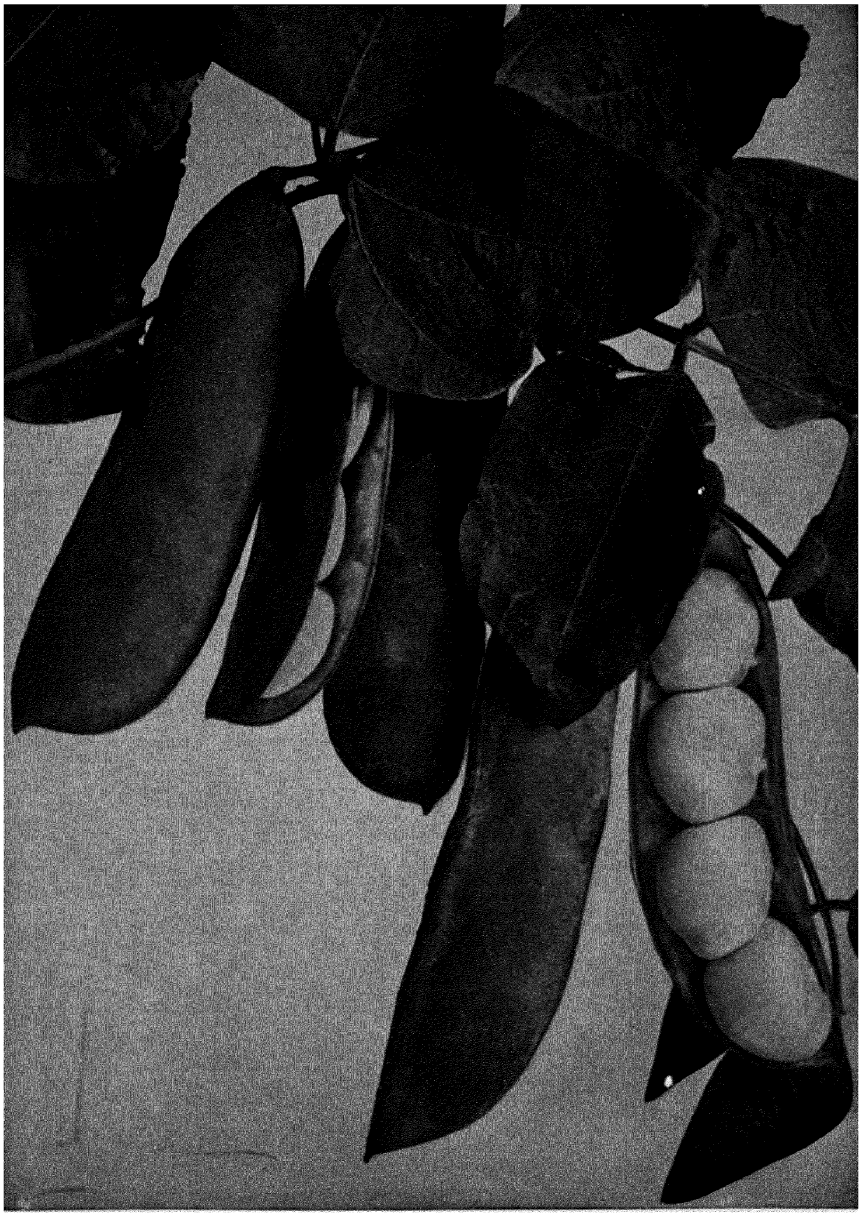
Other beans.

Three other members of the bean tribe might be mentioned in this connection; namely, the Black bean or cowpea of the South, the Japanese Soy bean, and the English or Broad bean The cowpea takes, in some measure, the same place in the southern states that red clover takes at the North, being used both as stock food and as a green-manure crop. There are many varieties of it, early and late, some of strictly bush habit and some producing long runners. See *Cowpea* Of greater value for the same purposes, north of New Jersey, seems to be the Japanese Soy bean, which is early enough to come to maturity almost anywhere in the United States. Its foliage is rather thin or open, however, which impairs its value for green-manuring The dry bean constitutes one of the richest vegetable foods known, and its flavor seems unobjectionable to all kinds of stock Sow one bushel to the acre. Similar to this in value is the English Broad bean, several varieties of which, as the Broad Windsor, the Horse bean, and others, are grown and are popular in England and in some parts of the European continent In most parts of the United States they are scarcely known, and in none generally cultivated Only a few of our seedsmen list them in their otherwise complete catalogues Yet they are a decidedly interesting group of plants, and worthy of greater attention in the cooler parts of the country Being about as hardy as peas, they may be planted much earlier than would be safe for ordinary beans The Windsor is used in England in much the same way as lima beans are used in America, but the latter are so much better that in the United States there is no need of planting the former as a table vegetable The varieties with smallish seeds are sometimes grown and used in parts of Europe for feeding pigeons and chickens, and under certain conditions might have some value here for the same purpose on account of the high protein content.

Insects and diseases.

The foliage of the various beans is rarely attacked by insects. A somewhat serious pest, however, which attacks the seeds both in the pod and dry, after being shelled, is the bean-weevil, a smaller brother of the pea-weevil, and having nearly the same general habits of development If only beans free from live weevils are used for seed in a given locality, the product will be free from them also. For that reason, all beans to be used for seed, or for food, if suspected of being weevil-infested, should be subjected to the carbon-bisulfid treatment in the fall It is simple, but care should be taken to keep the highly inflammable drug away from an open fire or light Place the beans in a tight receptacle. Pour a quantity (half pint to barrel) of the bisulfid into a saucer or other flat dish, which place on top of the beans, and cover the receptacle tightly, leaving it thus for twenty-four hours or more.

Difficult to control is the bean blight, a disease which frequently affects field, garden and lima beans. Seed



XIII. Bean.—The Bush Lima

from an affected field should not be used, nor should beans be planted again on a field for several years after having been affected. For bean anthracnose, also called bean rust (erroneously) and pod-spot, which is easily recognized by the dark or brownish spots on the pods and occurs both on field and garden beans, there is one sure preventive. Plant clean seed and grow a practically clean crop. It is advisable for the grower to select his own seed beans, carefully rejecting every pod that shows the least sign of the disease. The true bean rust is not so often met with, therefore not so serious.

T. GREINER.

Lima beans in California.

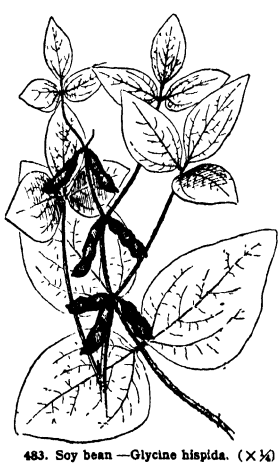
Lima beans are grown in California very extensively as a field crop, supplying the markets of the country with the bulk of the dry shelled product. The figures for the lima bean crop of 1910 in California are as follows:

	Sacks
Ventura County	800 000
Orange County	150,000
Santa Barbara County	75,000
Los Angeles County.	75,000
San Diego County	60,000
Total	1,160,000

The above represents a total of about 82,850 acres devoted to this crop

Lima beans delight in warm, summer weather, but if the relative humidity is low, they suffer in consequence Along the California coast, which is the heaviest producing section, the fogs are remarkably constant in the night and early morning, and when for a week or ten days these fogs are lacking, the bean crop suffers markedly The small pods that are just forming dry up and fall off without making seed. The heavy fogs which roll in may add a little moisture to the surface soil for a time, but not enough to reach the roots and aid the plants directly The great benefit of the fog is in lessening evaporation and tempering the atmosphere, less water passing from the plant into moist atmosphere than would pass into dry atmosphere

The profitable production of lima beans is limited to some extent by soil, though not so much as by climate They are grown on soil ranging all the way from sandy to adobe The lima bean plant does not grow well on an acid soil, neither does it thrive on an alkali soil California soils, being mostly arid or semi-arid, are not badly leached, and therefore lime is usually abundant, insuring freedom from acidity. But the same aridity and consequent lack of leaching is responsible for the accumulation in some lands of considerable amounts of alkali salts, enough to limit the area and the production in the counties where the bulk of the limas is grown The amount of alkali which this bean can endure and still produce paying crops has not been definitely determined, but it is not high. However, experience has shown that the lima will bear more alkali than the Blackeye, Lady Washington, or other beans of the common kidney type.



483. Soy bean —Glycine hispida. (×¼)

The difference in time of maturity is very great between sandy and clayey soils, and still greater between dry and moist soils. A difference of a week may be observed in the same field, due to physical variations in the soil, and much more than this difference in time has been frequently observed within the distance of a few miles It seems that the water-supply of the soil more than the texture is responsible for this difference in time of ripening, as irrigation on light soils causes the same lateness in maturity. Thus, a tendency is found toward the perennial habit which the plant maintains under the humid conditions of the tropics



484. Phaseolus multiflorus. (×¼)

Soils with much nitrogen tend to produce late maturity, hence the limas ripen later on land which has been recently manured On the other hand, the mineral elements tend toward early maturity Limas require a richer soil than do the white kidney beans, the pole varieties require a richer soil than the bush varieties

The standard preparation of land for a bean crop is practised Growers have learned by experience that good preparation pays, in fact, very much more cultivation is given the soil before seeding than after

Planting is from May 1 to May 25, at the rate of forty-five to sixty-five pounds per acre, according to the moisture condition and fertility of the soil The beans are planted in rows 30 to 36 inches apart, 8 to 12 inches apart in the row, a single seed being dropped in a place On the heavier and more moist soils, where the growth of vines is rank, the wider distances are given between rows Two inches in the moist soil is considered the best depth of planting

The beans are tilled while young, one, two or three times, the average number of cultivations being two or a little more. The fields are ordinarily kept free from weeds from the time of working in the winter till the vines cover the ground Cultivation must cease when the vines get large, as, not being provided with supports, they spread across the row and would be badly injured by the passage of the cultivator After the vines have made such a growth as practically to cover the ground, the mulch is not so much needed to prevent evaporation.

Irrigation in California.

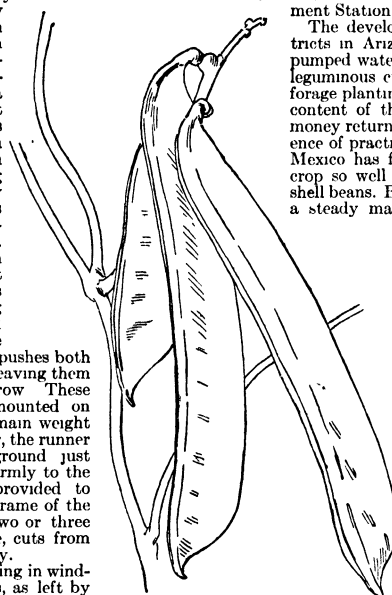
As there is normally no rain on the bean crop in California from planting till harvest, the ground, of course, becomes very dry. Hence irrigation has been found profitable, the production in many fields being doubled by the use of water. The most common method of irrigation is by the row system Furrows are made between all the rows with an implement carrying four broad shovels, furrowing between four rows at a time. Water is run in these furrows for the desired time, after which the land is leveled by a shallow cultivation. This prevents excessive evaporation which would take place if the furrows were allowed to bake in the sun. Usually only one irrigation is given, and that about July 1st, just before cultivation ceases Two and

one half to 3 acre-inches per acre are applied at this time

Harvesting, and caring for the product.

In the sections of light and unirrigated land, the beans ripen from August 20 to September 10. In the irrigated parts and on heavier land, they ripen from September 10 to September 25 or October 1. These dates indicate the time the beans are harvested. Before the earliest date for each section there will be some dry pods in all the fields and at the latest date of harvest there are always green pods

The beans are harvested by a seed-cutter with two runners 12 to 15 inches high On the inner side of each a knife is set diagonally backward and toward the middle of the sled A few inches above each knife is a bar of iron or wood set in a similar position The sled-runners are such a distance apart that two rows of beans will pass between them. Hence each knife is drawn along the line of the row cutting the plants just below the surface of the ground. The diagonal position of the knife causes it to cut the plants clean without pulling up by the roots, and together with the diagonal bar above, pushes both rows to the middle, leaving them together in a windrow These cutters are often mounted on wheels to bear the main weight of the sled and driver, the runner cutting into the ground just enough to hold it firmly to the row Levers are provided to raise and lower the frame of the sled A man with two or three horses, usually three, cuts from 8 to 12½ acres a day.



485. The Chickasaw Lima, or Jack bean.—Canavalia ensiformis. (×⅓)

The vines, after lying in windrows for a few hours, as left by the cutter, are piled by hand with pitchforks Three windrows are commonly placed together in one row of piles Piles are 4 or 5 feet in diameter on the ground and 3 feet high. They remain in these piles till very dry, which is a length of time varying with the weather and the maturity of the beans, but usually from two to three weeks A man is expected to pile about 5 acres a day, but frequently does not pile more than 2 or 3 acres. It requires from two to three men to handle the beans cut with one sled.

Threshing is done by itinerant machines, using for power either steam or gasolene engines The machines thresh from 1,000 to 2,500 sacks per day, 1,500 being a fair day's work In a few instances about 3,000 sacks have been threshed in a day. The charge is usually 25 cents a hundred pounds, equal to 20 cents a sack. The beans are stored in large warehouses until marketed, and are generally recleaned by a mechanical recleaner which is very satisfactory.

Yield and value of crop.

The average yield is about fourteen sacks, eighty pounds per sack, or about 1,120 pounds per acre. Some fields produce nearly three times this amount, but in the best section an average of twenty-five sacks or 2,000 pounds per acre is considered to be satisfactory

Another factor which is of importance, and which has only recently come to be appreciated, is the value of the bean straw as rough feed It is generally regarded that the straw is worth about $1 per ton in the field, loose.

GEORGE W. SHAW.

Tepary beans.

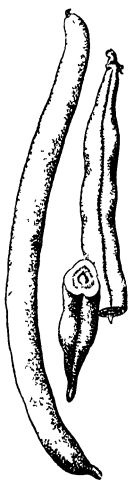
The tepary is a small white bean native to the southwestern region of the United States (*Phaseolus acutifolius* var *latifolius*), long grown by the Indians and now receiving attention from general cultivators The first full acount is in Bulletin 68, Arizona Experiment Station (1912)

The development of artesian and dry-farming districts in Arizona, together with the increased use of pumped water for irrigation, have created a need for a leguminous crop which, used in rotation with grain or forage planting, will maintain the nitrogen and humous content of the soil and at the same time provide a money return which is sure and profitable The experience of practical farmers throughout Arizona and New Mexico has for years demonstrated the fact that no crop so well fills this demand as the growing of dry shell beans. Being a countrywide food staple, they have a steady market which is little influenced by local conditions other than transportation charges As corn in Illinois, cotton in Texas or wheat in Kansas represent to their producers products of staple value, so may the dry-farmers of the Southwest, and those irrigating with artesian and pumped waters, look to the bean as a money-crop which at all times may be surely and readily turned into cash

Varieties of beans originated in the humid sections of the East are of but little value when grown in Arizona They do not withstand satisfactorily the extreme aridity and heat of the air during the summer months Out of a large number of varieties tested at Yuma, only those of southwestern origin were at all successful

Among these southwestern varieties of beans, first tested at Yuma in 1909, certain ones were noted which gave yields far in excess of all others, including even the much-prized pink bean, or frijole Subsequent investigations developed the fact that this group of varieties (known as teparies) was distinct from either the common kidney or snap bean They were found to constitute a new species, hitherto unrecognized as a cultivated plant in botanical or horticultural literature It has been described by the writer as a new variety of *Phaseolus acutifolius* In its wild state, *Phaseolus acutifolius* is peculiar to the southwestern desert region It may be found on the mountain-sides and in narrow valleys from the Pecos river westward across New Mexico and Arizona and southward into the adjoining states of Mexico. Domesticated from the neighboring cañons and cultivated in small patches, attended at best by a crude husbandry and dependent upon the precarious summer rains and uncertain floods from the mountain washes for irrigation, the tepary has lost none of its native hardiness It has been cultivated by the Papago and Pima Indians from prehistoric times and in all probability formed one of the principal food-crops of that ancient and unknown agricultural race, the ruins of whose cities and irrigating canals are now the only witnesses of their former presence and prosperity.

While growing, the tepary may easily be distinguished from the common garden bean by its more slender vines and smaller leaves The leaves are also thinner, smoother, narrower and more pointed at the apex than those of the bean The pods are smaller than those of the bean, averaging about 3 inches long and $\frac{5}{8}$ inch wide. Being somewhat flattened and having thin, rather tough walls, the pods might resemble rather closely a small variety of the lima Teparies, however, differ markedly from either the bean or the lima in the length of the stems bearing the first pair of aerial leaves. For teparies these measure only about $\frac{1}{8}$ inch, whereas for beans and limas they will average an inch or more The seeds of the tepary are smaller than those of the other sorts mentioned and there are a number of minor differences which suffice to give them a distinctive appearance at least to those who are familiar with the group The seeds of the white variety are very similar to those of the navy bean, with which they would in all probability be classed on the general market A convenient test for shelled tepary beans is to immerse them in water They will wrinkle in five to ten minutes, while other cultivated species commonly require forty-five minutes to one hour.



486 Typical Snap, or String beans. (×½)

The tepary as a food

There is considerable difference of opinion as to the relative palatability of beans and teparies Among the Indians and Mexicans, the commercial pink bean is preferred to the tepary, as they say it has a better flavor These people, however, make the same difference between the pink bean and the white navy which is shipped in from the East Teparies should be soaked twelve hours before cooking, during which time they swell to at least twice their original volume and more than double in weight In this respect they markedly surpass other beans Well-cooked teparies are light and mealy and have a rich bean-like aroma Boiled and baked with bacon or mashed and added to soups, they form most acceptable dishes To such as are fond of the onion, a small amount of this vegetable finely chopped and stirred in during boiling makes a pleasing addition.

Yields and culture.

The superiority of the tepary over other beans for planting in the Southwest is exhibited in its greater productivity when grown under similar conditions. This statement is not only true in irrigated sections, but even more marked in regions devoted to dry-farming In nine experiments in Arizona covering almost every condition of soil, culture and water-supply, and extending over three years, the average yield of the teparies has been slightly more than four times the average for varieties of the kidney bean. These greater yields are due to the ability of the tepary to germinate quickly in the presence of a low moisture-content of the soil, with the resulting better stands on dry lands The tepary is also able to withstand protracted seasons of drought without permanent injury, returning to full vigor immediately when the rains come Other beans do not possess this ability to a marked degree The tepary is also inured to the greatest extremes of summer temperatures and will bloom and set seed any month from May to November On the other hand, when the blooming period of common beans happens to fall within a season of extreme heat, the buds will for the most part drop without setting pods For these reasons the tepary is a more sure and dependable crop, often giving fair returns when beans are a total failure With an ample supply of water, good soil and other conditions favorable, teparies should yield 700 to 1,200 pounds per acre However, 1,500 pounds per acre have been reported from the Colorado Valley near Yuma. Under dry-farm conditions, yields of 150 to 700 pounds have been reported On irrigated lands, teparies may be planted in southern Arizona any time from the early spring when danger of frost is past until August 10. The best crops however, are secured by early planting, March 20 to April 1, or by midsummer planting, July 12 to 25 In dry-farming, they are planted any time from the 10th to the 15th or 20th of July



487. Bedding —Arundinaria Veitchii.

GEO. F. FREEMAN.

BEARBERRY. *Arctostaphylos*

BEAR'S BREECH: *Acanthus.*

BEAUCÁRNEA: *Nolina.*

BEAUFÒRTIA (Duchess of Beaufort, patron of botany) *Myrtàceæ* Greenhouse red-flowered shrubs, blooming in spring

Stiff, more or less heath-like shrubs. lvs commonly opposite, small and rigid, often only 1-nerved. fls in heads or short spikes, sessile, calyx 5-lobed, petals 5, spreading, stamens many, longer than the petals, in bundles opposite each of the petals, ovary 3-celled. fr. a loculicidal caps borne in the hardened calyx-tube — Twelve or 13 species in W Austral Requires the treatment of coolhouse Australian things, with peaty soil. Prop by maturing shoots under glass

purpùrea, Lindl Small free-flowering shrub, with virgate branches lvs ovate-lanceolate or narrower, becoming linear on the small branches fls small, purplish red, the petals shorter than the erect subulate calyx-lobes

L H. B.

BEAUMÓNTIA (after Mrs Beaumont, of Bretton Hall, Yorkshire, England). *Apocynàceæ* Hothouse white-flowered twiner

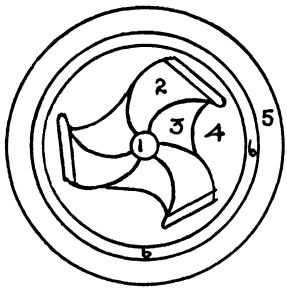
Corolla funnelform, short-tubed, without scales in the throat, with 5 broad lobes, stamens 5, included, attached to corolla, disk 5-lobed or of 5 scales. The genus is more nearly allied to the familiar greenhouse shrub *Trachelospermum jasminoides* than to the splendid tropical climbers in Allamanda and Dipladenia.— Four or 5 Indian or Javanese trees or tall climbers, with very large, white, fragrant, bell-shaped fls. in terminal cymes

B grandiflora has been neglected of late, presumably because it needs so much room. It should be planted out in strong, fibrous, loamy soil of a warm-house, as it rarely succeeds in pots It is best trained to the roof, as full light is necessary for flowering, if not for growth The shoots may be thinned if the large leaves cast too much shade on the plants beneath The wood should be well ripened to produce an abundance of winter bloom. The flowers are produced on the



488 Bedding.—Bambusa palmata.

growth of the previous season. After flowering, the plant should be severely pruned to produce lateral shoots for the next season's bloom. In its native country, this vine climbs over very tall trees.



489 Oriental pattern.

1 White geranium 2 Chlendula officinalis, "Orange King" 3 Coleus, green 4 Verbena hybrida Purple Mammoth, or Lemoine's heliotrope 5 Alyssum variegatum 6 Outline of black-red coleus bounding all parts

grandiflòra, Wall. A tall-growing, woody vine: lvs obovate, cuspidate, wavy margined: sepals 5, large, ovate, wavy, pink-tipped; corolla-tube veined with green, the limb 5-cleft. B. M. 3213. Gn. 45, p. 138; 49, p. 314. J H. III. 28 : 243. Var. **supérba,** having larger whiter fls. than the type, is known.

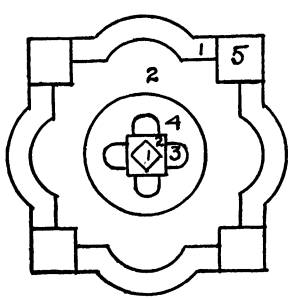
B. frágrans, Pierre. Evergreen shrub with white, fragrant, shallow bell-shaped fls. Cochin China. G C III. 49: 306.—*B. Jerdoniàna,* Wight. Similar to the above but with smaller parts, and with follicles 10 in. long. Cult. only in rare collections. Wight Ic., pl. 1314.

N. TAYLOR †

BEDDING, or BEDDING-OUT. The temporary use out-of-doors of plants that are massed for showy and striking effects. There are four main types: spring, summer, subtropical and carpet-bedding.

Spring bedding.

The most temporary of all forms of bedding is that designed only for spring effects. It is usually followed by summer bedding in the same area. It is the only kind that largely employs hardy plants, as crocuses, narcissi, daffodils, tulips, hyacinths, and other Dutch bulbs. All four types of bedding are commonly seen in public parks, but spring bedding is the most appropriate for amateur and home use, as the bulbs flower at a dreary time of the year, when their brave colors are most cheering, and also because they are much more familiar than the subtropical and foliage plants of summer. Moreover, hardy bulbs are more easily cultivated than any other class of plants, and they are cheap. The main principle is to plant them early enough to secure a strong root development. Therefore, they should be ordered early, and planted in the latter part of October or first of November. The colors may be massed or mixed according to taste, the terms massed and mixed bedding referring to unity or variety of effect, and being applicable in each of the four main types mentioned above.



490. French pattern.

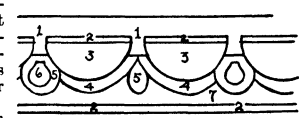
1 Calendula officinalis, "Sulphur Queen" 2. Ageratum nanum, "Blue Perfection" 3 White geranium 4 Scarlet geranium. 5. Pink geranium. Palm at center for accent. Whole design outlined with green alternanthera

Opposed to this style of bedding is the naturalizing of bulbs in the lawn. Crocuses and squills are particularly charming when they appear singly, or in twos or threes, at unexpected places in the lawn. Daffodils are frequently naturalized in large masses in spots where the grass is not mowed.

Pansies are the only other plants that are used extensively for spring bedding. English double daisies and catchflies are largely used for edgings. Pansies are set out between April 1 and 15. In large operations, pansy seed is sown in August of the preceding year, and the young plants are transplanted once and wintered in a coldframe. After flowering, the plants are thrown away. The other method is to sow the seed in a greenhouse in January. The August-sown pansies give larger and earlier blooms, but the January-sown pansies will last longer, and in partially shaded places will give scattering bloom all summer, especially if protected from drought.

Summer bedding

Bedding for summer effects often follows spring bedding in the same space of ground, and employs chiefly geraniums, coleus, begonias, ageratum, salvia, vinca, alyssum, petunia, verbena, heliotrope, grasses, cacti, and aquatic plants, the culture and varieties of which may be sought elsewhere in this work. As to tenderness, these fall into two groups, the first of which may be set out about May 15 in New York, and the second about June 1. Geraniums are the most important of the first group, and coleus is an example of the tenderest material, which is set out simultaneously with subtropical plants when all danger of frost is past.



491. French border pattern.

1 Marguerite, "Queen Alexandra" 2 Coleus, "Golden Bedder" 3 Scarlet geranium 4 Cineraria maritima 5 Calendula officinalis, "Sulphur Queen" 6 Ageratum nanum, "Blue Perfection" 7 White geranium.

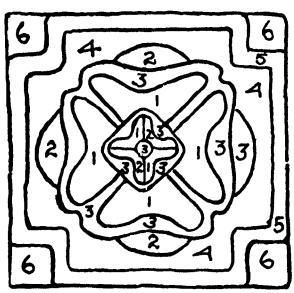
As to fondness for sunlight, there are again two groups, but the only bedding plants of importance that prefer shade are tuberous begonias and fuchsias. The popularity lately achieved by tuberous begonias in Europe will probably never be duplicated in America. The secret of their culture is shade, shelter, and moisture at the roots. Therefore, a clay bottom is desirable for a bed of tuberous begonias, as being more retentive of moisture than a sandy or porous soil. They enjoy cool air and as much indirect light as possible, but not the direct rays of the sun. The north side of a building is better for them than a station under trees, as the trees usually give too dense a shade, and their roots interfere. On the other hand, coleus is more highly colored in full sunlight than in shade.

The only fibrous-rooted begonias largely used for bedding are varieties of the semperflorens type, of which Vernon and Erfordii are popular varieties at present. In the manipulation of tender perennials, there are often two methods of propagation, either of which may be better, according to the ideal in view. As a matter of general tendency, propagation by cuttings gives bloom that is earlier but not so continuous or profuse as by seeds. Salvias and verbenas are pronounced examples. On the contrary, cuttings must be depended on, as a rule, to keep the choicest varieties true to type, as a function of seeds in nature seems to be to produce more variation than can be attained by non-sexual methods of propagation, as by bulbs or cuttings. Salvias are also an example of plants that are particularly effective when seen at a great distance, and also of plants that are generally massed for unity of effect, and not mixed with others. Verbenas are commonly grown by them-

selves, but this is because they demand much room by reason of their trailing habit.

Subtropical bedding.

Summer bedding for subtropical effects employs chiefly cannas, musas, castor-oil plants, crotons, palms, ferns of coarser habit, screw-pines, dracenas, araucarias, elephant-ear caladiums, and, to a lesser extent, abutilon, acalypha, achyranthes, anthericum, *Carica Papaya*, sanchezia, and others Cannas are by far the most popular at the present time, especially for mass-work. Sometimes the tall, purple-leaved old-fashioned, small-flowered types are used in the center or at the back of the bed, and the dwarf, modern, large-flowered types around the edges or in front Frequently, massing with a single variety of canna is practised. Next to cannas in popularity probably come the crotons or codieums,—the broad-leaved types, as Queen Victoria, being better for this purpose than the narrower-leaved or simply curious kinds, as *Codiæum interruptum* and *C volutum*, which belong to fanciers' collections For carpeting the ground in a croton bed, two variegated trailers can be used with good effect, the wandering Jew or tradescantia and *Oplismenus Burmanni*, which is familiar to gardeners as *Panicum variegatum* The large leaves of bananas give a very rich tropical effect, especially if they can be so sheltered that the wind will not split them One of the very best plants for encircling a public fountain is the huge-leaved elephant-ear caladium For interesting points concerning its culture, see *Colocasia* Among the first half-dozen favorites for sub-tropical bedding is the castor-oil plant, or ricinus Its marvelous growth from seed in a single season makes it one of the very best of all plants for rapidly filling up large areas temporarily Grasses furnish an exception to the general rule that bedding plants are tender There are some kinds of bamboos that are more or less hardy in the northern states, and these are bound to increase in popularity. Figs. 487, 488. A favorite combination of grasses for bedding is *Arundo Donax*, the giant reed, surrounded by eulalias Grasses and their kind are particularly effective in aquatic groups

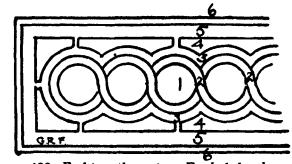


492 Tudor rose pattern

1 Scarlet begonia 1 Lobelia erinus, white 3 Echeveria secunda glauca 4. Scarlet geranium 5 Cineraria maritima 6 Alternanthera paronychioides

No well-kept large establishment is complete without a pond or body of water in which aquatic plants are naturalized For a more extended account of this attractive subject, see the article *Aquatics*

There is a large class of tender material—as palms, screw-pines, the coarser ferns, dracenas, araucarias—a class of foliage plants that really does better outdoors during summer in a shady and sheltered position than indoors all the year round. In the more formal styles of ornamental gardening, such plants often form the nucleus of a subtropical bed, the large tubs of the palms being hidden by lower-growing plants, as begonias, or whatever may be left over from the spring operations. In less formal gardening, the tubs may be hidden by plunging them half-way into the ground and grading the sod, which has been previously broken, in such a manner as to conceal the tubs entirely. The plants are arranged in a freer and more natural manner, and the outer fringe of begonias and the like may be dispensed with The chief dangers to such plants are from the sun and wind. Palms once scorched or wind-whipped are ruined. Hence, a sheltered position on the north side of a building, or under the shade of trees, is usually the best spot for their summer vacation.



493. Eighteenth century English border pattern

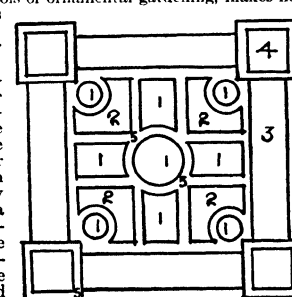
1 Lobelia erinus, blue 2 Begonia, "Fairy Queen" 3 Cineraria maritima 4 Calendula officinalis, "Sulphur Queen" 5. Lobelia erinus, white 6 Alternanthera paronychioides Alternative Use pansies alone

Carpet-bedding

What is known as carpet- or design-bedding is the most formal and most expensive of all kinds of bedding, and employs plants that stand pinching and shearing, as coleus, achyranthes, alternanthera, lobelia, one of the dusty millers (*Centaurea gymnocarpa*,—*C candidissima* will not bear the shears), and certain succulents of the hen-and-chickens type (as echeverias), and many others The plants are started indoors, mostly by cuttings, and from very carefully selected stock The terms "geometrical bedding" and "fancy bedding" are somewhat synonymous. Here belong the imitations of buildings and animals, the portraits of men, the lettered greetings to conventions, the calendars, floral clocks, and similar ingenuities

The designs of carpet-beds are very numerous, but there are certain recognized standards The diagrams (Figs 489 to 494) give forms and planting material for a half-dozen unlike and regulated patterns, with harmonious color combinations Forms of pattern-beds on the lawn are shown in Figs 495, 496 A proper setting for pattern beds is indicated in Fig 497 For designs and for extended cultural information, the reader is referred to the numerous German books on the subject, to Mottet's La Mosaiculture, and to a book published by Geo A Solly & Son, Springfield, Mass This style of bedding requires the highest degree of technical skill, and is especially enjoyed by the Germans, whose gardeners excel in it

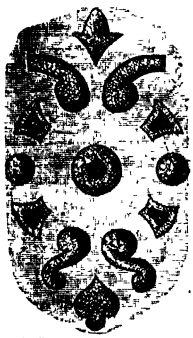
The position of a bed is far more important than the style of bedding or the kinds of plants that are used The natural school of landscape gardening, as opposed to the various schools of ornamental gardening, makes no objection to beds in themselves, but dislikes their usual position They are commonly given the most conspicuous places, where they must be seen, whether people like them or not They should be in a place by themselves where they do not interfere with the quieter and larger pictures of the whole place Sunken areas, as in Fairmount Park, Philadel-



494 An Italian pattern.

1 Calendula officinalis, "Orange King." 2 Ageratum nanum, "Blue Perfection." 3 White geranium 4 Scarlet geranium 5 Alternanthera paronychioides as an outline separating parts of the design

phia, are particularly commendable; a flower-bed should not be in the middle of a large lawn, because it distracts the attention from the larger picture, and because the lawn is the canvas upon which the landscape gardener makes his picture. The chief merit of beds is their attractiveness and brightness, which accounts for their presence in parks and public places On the other hand, they are expensive, and they are at their best only two or three months in the year, while a mud-hole in a lawn for nine months of the year is an unsightly object Formal beds, especially of foliage plants, with their gaudy colors and unchanging monotony, are considered by some the most unnatural and the least artistic style of gardening Nevertheless, they require a high degree of technical skill, which deserves appreciation.



495. Lawn bedding pattern.

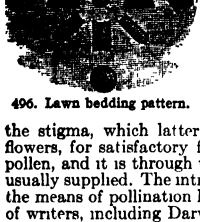
General instructions.

A few practical suggestions may be given for making any bed The soil should be rich and full of vegetable matter. If a foot or 18 inches of the surface soil is so poor that it must be removed, it may be replaced by two parts of fibrous loam and one of well-rotted manure, with some upturned broken sods in the bottom for drainage. The fall is the proper time to apply manure, and if the bed be thoroughly spaded over and left rough during the winter, the alternate freezing and thawing will fine both the soil and the fiber of the manure Beginners nearly always fail to supply perfect conditions for watering A midsummer mulch of half-rotted manure enables the plants to take all the moisture they need during the drought and to keep it The soil should be in ideal condition before the plants are set into it,—mellow, rich, full of fiber, and of firm and uniform texture. Begin in the middle and work toward the edges. When the bed is finished, give it one thorough soaking, to settle the soil at the roots.

ROBERT SHORE.

BEECH: *Fagus.*

BEES IN HORTICULTURE. Bees pollinate the greatest number of flowers of any insects To them, therefore, horticulturists are indebted for a service that is inestimable, but it is usually disregarded. The progressive horticulturist, however, today is awake to the situation and ready to utilize the honey-bee in an effort better to meet competition.



496. Lawn bedding pattern.

The bee's service to the horticulturist in pollinating the flowers of fruits and vegetables, is the result of its effort to secure nectar or pollen, the male element of the flower; this is transplanted from the anther to the stigma, which latter is the female organ Many flowers, for satisfactory fertilization, require a foreign pollen, and it is through the agency of bees that this is usually supplied. The intricacies of the mechanisms and the means of pollination have been described by a host of writers, including Darwin and Muller.

There are two kinds of bees, solitary and colonial (social). Solitary bees live isolated and singly, seldom becoming numerous. Among the colonial bees are the bumblebee and honey-bee. While the honey-bee may be classed as wild when colonies escape from apiaries, wild bees may be considered to include all bees other than the honey-bee.

While wild bees are sometimes numerous and may be observed at work on the apple, raspberry and many other flowers, the honey-bee, in most localities, probably outnumbers them. If it were possible to calculate the value derived from pollination by the honey-bee alone, these returns would without doubt far exceed the total income of beekeepers through their honey and wax In the bee, therefore, there is a source of double income.

Among the cultivated plants in northern latitudes that are pollinated by honey-bees, are the apple, pear, plum, quince, peach, raspberry, blackberry and strawberry (to some extent), mulberry, pea, bean, currant, grape, squash, melon, cucumber and the cranberry. The value of the honey-bee in the cultivation of the cranberry was but recently recognized and is mentioned on next page.

While growers of fruits and vegetables have usually recognized that bees play an important part in their croppage, they have largely depended on the wild bees or bees in neighboring apiaries for service. There is,



497. Pattern beds in a formal setting.

however, some risk in this, because the seasons vary and the prevalence of insect- and bee-life varies from year to year.

It is well known that the prevalence of all wild life, plant or animal, is subject to fluctuations due to favorable and unfavorable environmental conditions Some years in a locality there is a pest of mosquitos or houseflies In succeeding years they may be few. It is so with the game birds and the fish of the sea; they are plenty or scarce from time to time Bees also have their periods of ups and downs When favored, they rise to the crest of prosperity and prevalence. It may be that disease enters a locality and reduces their numbers. Hard winters may also depreciate them so that in a year when they are needed for their service as pollen-bearers, they are at a low ebb Fig 498 illustrates the hypothetical curve of this fluctuation.

When the horticulturist realizes that he is depending on this fluctuating service of wild bees, he asks what he can do to overcome the unreliability and assure himself of a maximum crop or a more even crop The recommendation would be to establish an apiary in proportion to the size of the orchard or garden. This eliminates any dependency upon wild bees or honey-bees from neighboring apiaries Yet their additional service will do no harm. It is far better to over-supply an orchard with bees during the blooming period than to have a scarcity. Furthermore, the cost of the small apiary is infinitesimal as compared with the possible benefits and returns.

It should also be remembered that during fruit-bloom particularly, weather conditions often prohibit free flight of bees Hence they should be near at hand to perform their service Numerous observations are on record in which orchards were successfully fertilized when the bees had less than a quarter of a mile to fly, while more distant orchards bore no crops. Thus the apiary in or adjacent to an orchard will safeguard failure.

A specific instance of the importance of bees to the practical orchardist, is shown in an observation on two orchards of about equal acreage in a western "pocket" in the foothills of an admirable fruit land, well drained and protected from frost One grower secured large crops, while his neighbor secured none, although his fruit trees were of the same age and blossomed heavily each spring The owner, in despair of financial ruin, called for assistance upon the State Experiment Station A specialist, who was a pomologist and entomologist, investigated the two entirely comparable orchards, but was about to return without solving the problem when the question of bees arose Upon inquiry it was asserted that no bees had been maintained for either orchard. Going over the ground more carefully, however, the specialist found in a neglected corner of the fruiting orchard, a fallen log partially sunken in the damp land This sheltered a very large colony of bees, to it is attributed the success of the orchard The following season bees were provided in the orchard which had previously failed, with the result that the owner netted $3,800 on his crop.

Special services of bees

Various fruits —The honey-bee has been known to work the strawberry although it does not always frequent it There is, however, a particular affinity in the raspberry for bees One of the sources of the finest honey is the wild raspberry The blackberry is less frequently visited Plums benefit materially

Cranberry —Recently investigations have shown the bees to be of prime importance in the setting of cranberries In cranberry-growing in Massachusetts, owners are maintaining their own apiaries It may be desirable to have one colony for every two acres. The growers of melons use colonies of bees on their plantations with most marked success Similarly, cucumber-growers for pickling-houses and squash-growers regularly maintain bees General market-gardeners also believe in the benefits derived

Apple and peach orchards —Apple and pear crops as well as peach and plum are, without doubt, more even, larger and more constant when bees are kept In Vermont it has recently been noticed that the largest apple crops occur in the vicinity of the commercial apiaries It is fast becoming the custom among commercial growers to maintain their own apiaries adjacent to or in their orchards. Some advocate a colony of bees for every fifty trees.

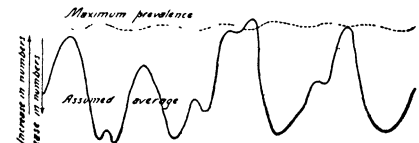
In greenhouses —For the fertilization of vegetables and fruits in greenhouses, bees are of material service, having largely done away with the use of the camel's-hair brush, impossible for commercial growers. For example, in Massachusetts, one grower of greenhouse cucumbers uses upwards of eighty colonies a year The total number used annually in the state by greenhouse cucumber-growers exceeds 2,000 colonies It is believed by some that tomatoes in the greenhouse benefit to some extent by the service of bees.

The alleged injury to fruit by bees.

Occasionally it is alleged that bees damage an orchard. It might be concluded when bees are seen upon peaches, grapes or pears, sucking at the flesh, that the bee is injurious. On the other hand if this act could have been traced, it would have been found that something other than a bee had first pierced the skin of the fruit Investigation shows that wasps and birds do this, or that a fungus may disintegrate the skin In some such break in the skin the honey-bee can make a start; but to the satisfaction of all beekeepers and most orchardists, it has been proved by experiments and demonstrations that the honey-bee is physically incapable of puncturing a sound fruit. Thus, the injury by bees to fruit is a misconception; the news should be spread by successful orchardists.

Securing of bees

Bees are available to horticulturists in several ways A small number of colonies is sometimes hired for a period of a few weeks, during the blossoming period of the crop Growers occasionally induce beekeepers to establish an apiary in their orchards by granting them privileges Bee-keepers sometimes approach orchardists for the location of the apiary The more thoughtful grower, however, considers it advisable to own his bees. These he maintains himself or hires kept by a practical apiarist The practice is growing in favor, especially among moderate-sized orchardists or cranberry-growers, of hiring a practical apiarist to maintain the colonies on several adjacent farms This cooperative plan insures a maximum efficiency of the colonies at a minimum cost and without burdening the horticulturist with additional detail Those who use bees in



498 Hypothetical curve illustrating the fluctuation of wild-bee life, their periods of "ups" and "downs" Dotted line illustrates high efficiency secured by maintaining an apiary

greenhouses will find it advantageous to maintain colonies rather than to purchase annually

In buying bees it is particularly essential to secure disease-free stock Bees are subject to at least two prevalent diseases, known as "American foul brood" and "European foul brood," to which they succumb rapidly The inexperienced, therefore, should secure information and ascertain that the bees have been inspected for disease, when this is possible Should disease set in, a considerable loss, both in bees and to the orchard, might result in a short time Information concerning diseases can usually be had through the experiment stations or agricultural colleges as well as the United States Department of Agriculture.

Manipulation of bees.

There are numerous books and bulletins upon the manipulation of colonies A few fundamental features are Always keep the colonies strong, secure an amiable race so that the bees may be handled agreeably; keep the colonies in hives from which the combs may be removed, eliminate swarming, give adequate protection in winter; feed when necessary

If the inexperienced grower is to manipulate his own bees, it is advised that he begin with a small number of colonies, say not more than five

If the bee-moth becomes prevalent in the hive, it is a sign that something is radically wrong with the colony An experienced apiary inspector always suspects the presence of disease when moths are found.

BURTON N GATES.

BEET. A set of garden vegetables, grown for the fleshy roots and a few sorts for the thickened midribs; and some kinds in the ornamental garden for the highly colored foliage

There are 4 or 5 species of the genus Beta, which are

sometimes cultivated under the name of beet, but *Beta vulgaris*, Linn., is the only one of practical importance. From it all our common garden varieties are derived According to DeCandolle, the aboriginal slender-rooted species is found in sandy soil, and especially near the sea, throughout southern Europe, and on nearly all the coasts of the Mediterranean. It also occurs as far eastward as the Caspian Sea and Persia "Everything shows that its cultivation does not date from more than two or three centuries before the Christian era." It is now highly improved, principally in the one direction of large and succulent roots, and is much esteemed in all civilized countries. See *Beta*.



499. Bassano beet.

The beet grows at a low temperature and thrives best, therefore, in the cooler parts of the country. It is also an important winter crop at the South and an early spring crop at the North. The young plants will stand light frosts and after two weeks will stand fairly heavy frosts.

With the extension of glasshouse gardening, beets have come to be one of the important greenhouse crops. They are not usually made a main crop, however, but are grown between other crops, such as lettuce, beans, or even tomatoes They are sown very thick and when the young plants begin to crowd, they are thinned out and the thinning sold for greens As beets thrive best at relatively low temperatures, they may first be grown in a lettuce-house or other greenhouse having a temperature of 60° to 70°, rather than in a house piped for tomatoes or cucumbers.

The beet is grown exclusively from seed Most table-beet seed for use in the United States is produced in Europe It is possible, of course, for any gardener to grow his own seed, but in order to do this the roots must be taken up before the crown is exposed to severe frost, and carried through the winter in cool and moist but frost-proof storage, and planted in the garden the second year. Seed stems run up to the height of 4 feet. When the seeds are ripe the tops are cut and put in a warm storage house to dry When fully dry the seed is winnowed out. Seed is usually sown where the crop is to grow, although the plants are easily transplanted The transplanting is sometimes undertaken, especially when beets are to be grown as a catch-crop or intercrop in greenhouses.

Varieties and types.

Some of the most popular varietal types of the garden beet are: *Bassano* (Fig 499).—Flesh white and light red mixed; an old-time early variety, now less grown than formerly *Crosby*.—Slightly oblate, red flesh, excellent for general purposes, including forcing *Early Blood Turnip*.—Rich, deep blood-red, flattened turnip-shape, an old and well-known sort *Edmand*.—Moderate size; handsome, rounded, smooth, deep red, good grain and flavor, not quite first-early *Eclipse*.—Uniformly globular, bright red, fine-grained and sweet, one of the best quick-growing early beets. *Egyptian Turnip*.—Tops quite small, roots fair size, rich, deep red, a standard early variety.

For field culture of culinary beets, the long-rooted varieties are chiefly used These are sown in the field as soon as the weather is settled, in rows far enough apart to allow of tillage by horse. Most of them require the entire season in which to mature. They are grown mostly for storing for winter use They were once grown for stock, but the mangel-wurzels give much greater yields The various types of Long and Half-long Blood beet (Fig. 500) are chiefly used for field culture.

Favorite varieties of mangel-wurzels are Golden Tankard, Golden Yellow Mammoth, Mammoth Long Red. Several sorts of sugar beets, mostly imported from Germany, are being grown in divers places in America. Of chard, there are few selected varieties offered in America.

The varieties of *Beta vulgaris* may be conveniently divided into five cultural sections, though the distinctions are somewhat arbitrary and of no fundamental importance. These sections are as follows.

1. Garden Beets Varieties with comparatively small tops. roots of medium size, smooth, regular and fine-grained. mostly red, but sometimes whitish or yellowish.

2. Mangel-wurzels, or Mangels. Large, coarse-growing varieties, with large tops and often very large roots, the latter frequently rising some distance out of the ground, rather coarse-grained Extensively grown for stock-feeding. See Cyclo. Amer. Agric Vol II, p 539 (Root Crops).

3 Sugar-Beets Sometimes said to belong to another species, but doubtless to be classified here. Rather small-growing varieties, with medium tops: roots small to medium, usually fusiform, smooth, nearly always yellowish or whitish. See Cyclo Amer Agric Vol. II, p. 588

4. Chard, or Swiss Chard Varieties with comparatively large tops, broad leaf-blades and very large, succulent leaf-stems, which are cooked and eaten somewhat like asparagus. The thrifty, tender young leaves make a very excellent pot-herb. Chard has sometimes been referred to a separate species, *Beta Cicla*, but should be included with *B. vulgaris*. See *Chard*

5. Foliage Beets. A race which has been developed to produce luxuriant foliage of many colors and varied markings. Of such varieties are the Brazilian, Chilian, Victoria, and Dracæna-leaved The ribs of the leaves are usually beautifully colored. Where the leaf-blight fungus is not serious, these foliage beets make excellent borders when strong and heavy effects are desired, and they are excellent for bedding. Raised from seeds, as other beets are; roots may be kept over winter.

Cultivation.

Young beets constitute one of the most important early crops in truck-gardening. Many acres of them are grown near all the city markets, and as they bear transportation well, they are often grown at comparatively remote places Large quantities are shipped early from



500. Half-long Blood beet.

Norfolk, Va., and from other southern points to northern markets. Like all root crops, the beet needs a loose, light, fresh, clean, rich soil, which must be in the best condition of tillage. No fermenting manure should be used, but instead fully rotted barn manure, with some good potash fertilizer. Light applications of nitrate of soda often produce marked beneficial effects. The seed for the first crop is sown early in spring, as soon as the soil can be well worked When intensive garden-

ing is practised, the drills may be as close as 1 foot apart, in which case the young beets are thinned to 6 inches apart in the row. But in ordinary gardening, it will be found most convenient to run the rows 2 to 3 feet apart, allowing cultivation with the horse. The plants in such rows can be left 4 inches apart at thinning time The thinning is done when the young plants are large enough to be pulled for "greens," for which purpose they find a ready market Beets are also grown in quantities as a fall crop, and are stored for winter use. When this is to be done, the seed is sown in June, and the plantation is managed in all respects like the spring sowing When the young roots are ready for the early market, they are pulled and tied in bunches of five or six The fall crop is pulled soon after the first frost, the tops are removed, and the roots stored in pits or root cellars.

Marketing.

Greenhouse beets and early beets are usually bunched for market, three to six together, according to size They are bunched together tightly with a string about the tops All beets should be thoroughly washed before marketing Considerable quantities of late beets and field-grown stock are sold in bulk, like potatoes In this case the tops are cut off Late-grown beets may be stored over winter in the same manner as potatoes. They are often buried in the fields in pits, but may be kept in a good cellar or storage house The yield of mature beets varies from 200 to 500 bushels to an acre, 300 being an average yield

Insects and diseases

There are many species of insects that feed upon beets, but flea beetles are about the only ones of importance These may be poisoned by spraying with paris green or arsenate of lead, and they are driven away in many cases by the use of bordeaux mixture which is also the most important preventive of leaf-spot This leaf-spot is perhaps the worst disease which attacks beets, but this is more common upon the sugar-beets in the field than upon the more common varieties. The potato scab, very common on potatoes, is found also on beets, and as this disease lives in the soil from year to year, it is a bad practice to grow beets after a crop of potatoes. F A Waugh

BEGÒNIA (named after Michel Begon, superintendent at St Domingo, 1638–1710, a French promoter of botany) *Begoniàceæ* Begonia Elephant's Ear Beefsteak Geranium A various group, ranging from hothouse to conservatory and window-garden subjects, many of them grown primarily for foliage, others for the showy bloom, treated mostly as single pot-specimens, but some kinds used for bedding

More or less sappy or succulent herbs or undershrubs, having the st in some cases reduced to a thick rhizome, in others to a distinct small tuber, while a few others possess a semi-tuber in which there are a number of closely set scales or suppressed lvs , resembling bulbs: lvs variable, alternate, more or less unequal-sided, entire, or lobed, or toothed, ovate-acuminate, orbicular or peltate. fls. monœcious (bisexual variations are known. Dümmer, Annals Bot xxvi 1123), asymmetrical, usually in axillary cymes, the males usually with 4 parts, of which 2 are mostly small, the females with 5 (rarely 2), pink, white, rose, scarlet, yellow, and all shades of these, being represented; stamens numerous; filaments free or united at the base; styles 2 or 4, free, sometimes connate; stigmas branched or twisted like a corkscrew, ovary inferior: fr usually a 1–3-winged caps , which is often colored; seed numerous, very minute —The genus Begonia, with 400–500 species in warm countries around the globe, gives the name and definition to the Begoniaceæ. Only three other genera are recognized: Hillebrandia, with 1 species in Hawaii, Symbegonia, 1 little-known species in New Guinea; Begoniella, 3 species in Colombia The begonias are exceedingly variable, the genus running into about 60 well-marked sections, but the intergradations are so many and the essential floral characters so constant that it is impracticable to break up the great group into separate genera

The begonia is one of the great groups of cultivated ornamental plants Very many species have been introduced, and there are numberless hybrids and variations The most popular single begonia is now probably the wonderfully floriferous Gloire de Lorraine (Fig 505) The foliage begonias are of many original kinds, and the numerous hybrids and variations have given great choice to the cultivator *B Rex* is the chief basis of the foliage races Many cultivators are unaware of the possibilities of the Rex derivatives, because they grow them in pots (for commerce) on benches, whereas the singular and characteristic results are secured by growing them in the earth against greenhouse walls or in rock pockets below the benches (Plate XIV).

Because of the great numbers of interesting forms, begonias have appealed strongly to collectors and fanciers In recent years, however, the collections have been passing out in the large private places, and most dealers now carry only a few standard kinds (mostly modified cultivated forms), in addition to the florists' bedding and garden sorts and a general mixed stock of tuberous kinds. The following botanical account, therefore, does not accurately represent the present state of the begonia trade It is to be regretted that the fanciers' collections are not kept, and it is partly in the hope that the desire for collections will return that this rather full treatment is given of the main species and stem-groups now in cultivation

The foliage begonias of the Rex type are subject to an insidious disorder, affecting the leaves and eventually the entire plant. The remedy seems to be to discard all suspected stock and to propagate from wholly healthy plants, or to grow them out of it by planting them in a shaded airy greenhouse bench for a summer and potting again in fall

The interest in begonias centers in their use as ornamental subjects. It is said that the stalks of some of the species are used as the leaf-stalks of rhubarb are used The rhizomes of many species, particularly those from South America, are bitter and astringent and are employed locally for certain fevers and for syphilis. Some species contain purgative principles. The sour sap of one of the Asiatic species is said to be used for the cleaning of weapons

The first begonia was introduced into England in 1777, *B. nitida*. Since then, about 200 have proved of value to the horticulturist Few other plants have been improved or varied so rapidly, there being thousands of variations now in cultivation, displaying the most gorgeous colors in their flowers and beautiful coloring in their leaves The development of the modern race of hybrid tuberous begonias followed the introduction of *B. Veitchii, B roseiflora, B. Davisii, B. boliviensis, B Pearcei* and others after 1860. The geographical distribution of begonias is very disjunctive and localized They are indigenous to Mexico, Central and South America, Asia, and South Africa. They seem to have no genetic relationship with other plants now living For literature, see Dryander, The Genus Begonia, Trans of the Linn. Soc , Vol I, 1791, Klotzsch, Begoniaceen-Gattungen und Arten, 12 plates, 1855 (Abh. Ak Berlin); DeCandolle's Prodromus, 15, 1, 1864; and floras of regions in which begonias are native.

L. H B.

General culture and propagation.

For horticultural purposes, the begonias may be arranged in four groups· The socotrana or semi-tuberous set; the tuberous-rooted; the foliage kinds, mostly

rhizomatous; and the fibrous-rooted. The bedding begonias are mostly of the fibrous-rooted section, particularly in the Semperflorens group, although the improved tuberous kinds may be used for this purpose in special places.



501. Young plants starting from the incisions on a begonia leaf.

(1) The semi-tuberous or bulbous group comprises such begonias as *B socotrana* and Gloire de Sceaux. They require much care and should be grown in a soil with more leaf-mold than the fibrous-rooted, and a temperature of 65° to 70° in the daytime and 60° at night Of Gloire de Sceaux and some others, plants two years old will be found best for decorative purposes For special notes on *B. socotrana*, see the treatment of that species, page 473.

(2) The tuberous begonias are grown in pots, boxes or baskets, under glass, or as bedding plants in a shaded border. If the plants are intended for pot-culture in the greenhouse, it is best to use the tubers. For early flowering, start the tubers in February or March, either in small pots or shallow boxes. The soil may be composed of loam, sharp sand and leaf-mold, and the temperature about 60° to 65°. When the plants are ready for repotting, well-rotted manure may be added, and when the roots have taken a fresh hold a cooler temperature may be maintained. For bedding purposes, seedling plants, as well as tubers, may be used, providing they are of a first-class strain. Tubers are preferred if early-flowering plants are desired. For further cultural notes, see the discussion on page 471

(3) The Rex begonias are grown entirely for the beauty of their foliage They may be propagated by means of either shoot- or leaf-cuttings, the latter being the better when plants have to be raised in quantity. Large and well-matured, but still healthy and vigorous leaves may have the principal nerves cut on the under side. The leaf is then pegged or weighted down on the surface of a well-drained propagating bed. If carefully shaded, roots will be formed at every cut, a tiny leaf will follow (Fig. 501), and the little plants may be inserted singly in small pots Another method is to cut the large leaves into triangular parts, with a bit of the main petiole at the tip of each, and insert the pieces about 1 inch, with the lower or thickest end of the rib downward (Figs 502, 503). Still another method is to cut the leaf in two, across the veins, and stand it edgewise in the propagating bed. The young plants may be potted-up into small pots, using a light, porous, sifted soil. Keep shaded in a low house with a moist atmosphere. The soil may be gradually made coarser with each potting until in the final shift, an unsifted compost of two parts loam, one part leaf-mold, one part well-rotted manure, and one part sand, is used, adding a sprinkling of lime. While watering, avoid wetting the leaves as much as possible, and keep large, well-developed plants in a shaded house, with plenty of ventilation day and night during the summer.



502. Triangular leaf-cutting of begonia.

(4) The fibrous-rooted begonias comprise such species as *B. nitida, B. semperflorens* var. *gigantea, B albopicta, B. Haageana,* and *B. Duchartrei.* Of these, cuttings taken from clean, healthy stems in spring will strike readily in an ordinary propagating-box or bench, and if potted-on, as they require root-room, will make fine plants for late winter and spring flowering. As soon as one neglects good treatment, especially in regard to light, fresh air and fresh soil, the red spider, a physiological disease appearing like rust, and the dreaded nematodes, will soon attack them and give them a sickly and stunted appearance. They require a temperature of 55° to 60° at night and 65° to 70° in the daytime. The plants should be kept close to the glass in the early stages of growth, on account of the tendency of many of the varieties to send out rather long shoots A good compost is three parts loam, one part well-rotted manure, and one part sand

While begonias in general are injured by too strong sunshine during summer, they are benefited by all the sunshine they can get during the winter and early spring months. Strong sunshine, however, pouring through imperfect glass upon wet foliage, is liable to blister the leaves of any begonia Such species as *B Dregei* and *B weltoniensis,* which produce at their base a thickened, fleshy stem like a potato, may be propagated either by division or by cuttings. Many kinds of the fibrous-rooted and rhizomatous sections can be grown by amateurs, and make excellent house-plants, especially *B manicata, B. coccinea, B speculata, B argyrostigma* var *picta, B. ricinifolia, B heracleifolia, B. incarnata.*

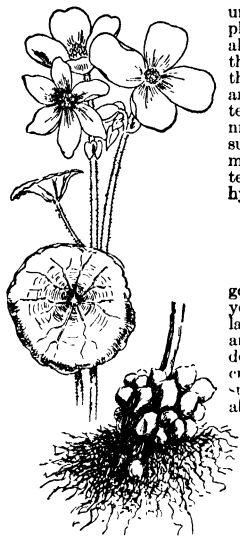
ROBERT SHORE

Begonia Gloire de Lorraine.

Begonia Gloire de Lorraine (Fig. 505) was raised by Lemoine by crossing *B Dregei* and *B socotrana,* and is one of the most useful and beautiful decorative plants introduced If large specimen plants in 10- or 12-inch pans are desired, propagating should be begun about November or December of the year previous, as these plants are generally at their best about Christmas time The best plants are obtained from leaf-cuttings. Select medium-sized, well-ripened leaves, cut off with a sharp knife, insert in a bed of sharp sand in a temperature of 70° and space them far enough apart, so that they do not touch one another The propagating-bed should be at least 2 inches deep, but the stems should not be buried so deeply that the leaf lies on the top of the bed These precautions prevent damping off A further preventive against damping off is to dust powdered charcoal over the bed after the cuttings have been thoroughly watered The leaf-cuttings of Gloire de Lorraine are far superior to shoots that start from the base of a cut back plant, the leaf-cutting having greater vigor and breaking more shoots from the base of the plant. The leaf-cuttings will root in three weeks in the temperature recommended above, but they should be left in the sand until they begin to throw up shoots from the callus formed at the end of the leaf-stem, after which they should be immediately potted in 2-inch pots, in equal parts of fibrous loam and leaf-mold, with about a fourth part of charcoal Never allow the plants to become pot-bound until they have attained the desired size, and for all future pottings use equal parts of the fiber of loam, half-decayed flaky leaves, well-rotted cow-manure or horse-droppings, and a fourth part of charcoal Use this compost as rough as can be conveniently worked around the plant while potting. During the summer, they should be grown in a rather humid atmosphere near the glass, always lightly shaded from the sun until they begin to flower. Pinch the shoots two or three times during the season as this encourages breaks from the base of the plant When well rooted in the final shift, waterings with manure-water will be beneficial When the plants begin to flower, they should be neatly staked with thin twigs,



503 Plant arising from the base (or tip) of a triangular leaf-cutting.



504. Begonia socotrana (×⅔) No 1

unless desired for hanging plants, when they may be allowed to droop around the pan When in flower they should be in a light airy greenhouse with a temperature of 45° by night. These plants are subject to mealy-bug and may be fumigated at intervals of two weeks with hydrocyanic gas.

GEO. F. STEWART.

Tuberous begonias.

The tuberous-rooted begonias, which are every year becoming more popular, both as pot-plants, and for bedding out-of-doors, are the result of crossing several different species differing considerably in habit, and are easily cultivated They are raised almost wholly from seed, and good strains in different colors may be obtained from any reputable seed firm However, if one wishes to increase these plants by cuttings it can be done Shallow boxes or seed-pans may be used in which to sow the seed about the beginning of February They should be well drained and filled with a compost made up of equal parts of peat, leaf-mold and about a fourth of charcoal. As soon as the plants are large enough to handle, prick them out about 2 inches apart in the same soil as above, place them close to the glass, but always shaded from the bright sun, and in a moist atmosphere When they have grown close together, transfer them to 3½-inch pots, the best soil to use from now on being a spent mushroom bed, adding about a fifth part of charcoal A 6-inch pot is generally large enough for the first season, and when they are well established in these pots should be kept as cool as possible A house facing north is the best place for them during the summer, and all the air possible may be admitted night and day On no account allow these plants to suffer for lack of water until fall, when they will begin to show signs of ripening off. During their growing period, they may be stimulated by frequent applications of cow-manure water, and soot diluted in water, an ordinary handful to two and a half gallons of water; water three times with clean water, and alternately with the other two When signs of ripening begin to show, gradually withhold water until the growths decay, and then place the pots on their sides under a bench in a greenhouse where the temperature keeps around 40°. Be sure they are in a position where water does not reach them. The tubers will be good for several years, but the best plants are in their second year. The plants may be started at intervals, having an earlier and a later lot For bedding out in partial shade, these plants have no equals. Start the tubers in flats about the end of April, have the bed heavily manured and the soil level with the surface of the ground, as the roots run near the top of the ground, and consequently they have to be watered frequently. The top of the bed should be always moist, a mulching of well-rotted manure being of great assistance in retaining the moisture. Plant about a foot apart, all of one color, unless great care is exercised in blending the brilliant colors so that they do not clash

GEO F. STEWART.

INDEX.

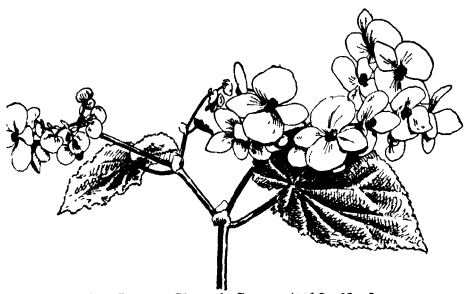
acuminata, 74.
alba, 18
albo-coccinea, 56.
albo-picta, 75
Alleryi, 92
angularis, 99
annulata, 16
argenteo-guttata, 112
argyrostigma, 113
ascotensis, 71
atropurpurea, 60
aucubæfolia, 70
Augustinei, 37
aureo-maculata, 57
Baumanni, 20
Bertini, 11
bicolor, 16
Binoti, 44
Bismarckii, 106.
boliviensis, 11
Bowringiana, 95.
Brunnii, 62
Buncha, 52.
caffra, 17.
Caledonia, 2
carminata, 107.
carolinæfolia, 83.
Carrierei, 62
Cathayana, 95
cinnabarina, 22, 67
Clarkei, 14
coccinea, 109
Comte de Lamminghe, 31
conchæfolia, 54.
coralina, 113
Corbeille de Feu, 66
coronata, 116
Countess L. Erdoedy, 33
Credneri, 91
crinita, 23
crispa, 57
cyclophylla, 24
cyprea, 93
dædalea, 38
Davisii, 6
decora, 40
dichroa, 96.
diadema, 81
dichroa, 115
digitata, 82
Digswelliana, 69.
discolor, 15
diversifolia, 16
Dr Nachtigal, 104
Dregei, 17
Duchartrei, 90
echinosepala, 87.
elegantissima, 113
elliptica, 32
Engleri, 86.
Engleriana, 86.
Erfordii, 63
erythrophylla, 88.
Evansiana, 15
Feastii, 52
foliosa, 72.
Fræbelii, 8.
fuchsioides, 67.
fulgens, 19.
Gottlibii, 43
geranifolia, 25.
geranioides, 26.
gigantea, 46, 61.
glaucophylla, 31
Gloire de Chatelaine, 60
Gloire de Lorraine, 2
Gloire de Sceaux, 3
Glory of Cincinnati, 2
goegensis, 45
gracilis, 10
Grahamiana, 56
grandiflora, 10, 70.
grandis, 15, 85
Griffithii, 35
gunneræfolia, 81.
Haageana, 91
Hasskarlii, 77
Humblyana, 80
heracleifolia, 47
heracleicotyle, 50.
hydrodotylifolia, 51.
impercalis, 41.
incarnata, 70
incomparabilis, 5.
Ingramii, 68.
insignis, 70.
jatrophæfolia, 47.
kewensis, 103.



505. Begonia Gloire de Lorraine. No 2.

INDEX, CONTINUED.

knowsleyana, 73.
lacinıata, 97.
Lazuli, 34.
leprosa, 58.
Limminghei, 31.
longipes, 101.
longipila, 47.
Lubbersii, 55.
lucerna, 119.
Lucianæ, 65.
lucida, 32.
luxurians, 79
Lyncheana, 64.
maculata, 41, 109, 113.
Mad de Lesseps, 110.
magnifica, 59.
.nanicata, 57
Margaritæ, 94
Martiana, 16.
metallica, 93
miniata, 67.
minor, 104.
modica, 42.
modicæ, 3, 11.
natalensis, 27, 108.
nelumbiifolia, 53
nigricans, 47
nitida, 104.
obliqua, 104.
octopetala, 10.
odorata, 104.
olbia, 111.
palmata, 82.
parvifolia, 17.
Pearcei, 13.
peltata, 77
phyllomaniaca, 117.
picta, 35.
pictaviensis, 91.
pictifolia, 34.
platanifolia, 81.
polyantha, 108.
polypetala, 28
Pres. Carnot, 118.
punctata, 47.
Rajah, 36.
reniformis, 17, 85.
Rex, 33
ricinifolia, 46.
Roezlii, 64
rosæflora, 7.
rosea, 76
Rothschildi, 2.
rubella, 48
rubra, 109
rubricaulis, 29.
Sandersonii, 69.
sanguinea, 98.
scandens, 32
Scharffiana, 89.
Scharffii, 91.
Schmidtiana, 76.
Schmidtii, 76.
Sellowii, 60.
semperflorens, 60.
smaragdina, 41.
Smithii, 62.
socotrana, 1.
speciosa, 104.
speculata, 39.
stipulosa, 38.
Sunderbruchii, 47.
Sutherlandii, 12.
tenera, 30.
Teucheri, 105.
Thurstonii, 114.
Thwaitesii, 30.
Triomphe Lemoine, 4.
Triomphe de Lorraine, 60
Triomphe de Nancy, 4.
tuberhybrida, 21.
tuberosa, 21
Turnford Hall, 2.
ulmifolia, 100
undulata, 102
variegata, 93.
Veitchii, 9
velutina, 93.
venosa, 78
vernalis, 8.
Vernon, 62.
Verschaffeltiana, 49
Verschaffeltii, 49
vitifolia, 85
Washingtoniana, 81.
weltoniensis, 18.
Worthiana, 11.
Wrightii, 113.
xanthina, 34.
zebrina, 99.



506. Begonia Gloire de Sceaux (×½). No. 3.

HORTICULTURAL ARRANGEMENT OF SPECIES.

This arrangement often throws together species of no close botanical relationship, but it will aid the cultivator to understand the genus.

I. SPECIES BULBOUS OR ESSENTIALLY SO.
socotrana

II. SPECIES TUBEROUS.
A. *Plant stemless, lvs. springing directly from the crown or tuber (Davisii, rosæflora, Froebelii, Veitchii, octopetala)*
AA. *Plant with sts., more or less branching.*
B. *Lvs. narrow (lanceolate to ovate-lanceolate) (bolivvensis, Sutherlandii).*
BB. *Lvs. broad (ovate to cordate-ovate) (Pearcei, Clarkei, Evansiana, gracilis, Dregei, weltoniensis, fulgens)*
BBB. *Lvs. orbicular (Baumannii).*
BBBB. *Lvs various, mostly broad-ovate at base, acuminate (tuberhybrida).*

III. SPECIES RHIZOMATOUS
A. *Plant creeping, trailing, or climbing (glaucophylla, scandens).*
AA. *Plant upright, often diffuse.*
B. *The picture-lvd. species, grown for the foliage, which is large and prominent and blotched, strongly colored, blistered, or otherwise illustrated The Rex set, and others*
C. *Lvs. oblique, lobed at the base, not peltate (or only slightly so) (Rex, xanthina, Griffithii, Rajah, Augustinei, dædalea, speculata, decora, imperialis).*

CC. *Lvs. markedly peltate (modica, Gentilii, Binoti, goegoensis).*
BB. *The essentially plain-lvd rhizomatous kinds, although some of them are grown chiefly for foliage.*
C. *Lvs. prominently lobed, or parted or even divided (ricinifolia, heracleifolia, Sunderbruchii, rubella, Verschaffeltiana, heracleocotyle).*
CC. *Lvs. lanceolate to ovate or cordate-ovate to orbicular, not deeply lobed, often entire, and sometimes peltate.*
D. *Foliage small, the lvs. less than 2 in. wide (hydrocotylifolia).*
DD. *Foliage of usual or large size*
E. *The lvs peltate (Feastii, nelumbiifolia, conchæfolia, Lubbersii, albo-coccinea).*
EE. *The lvs. not peltate (maculata, leprosa, magnifica).*

IV. SPECIES FIBROUS-ROOTED (*Rhizomes small or 0.*)
A. *The herbaceous kinds—the plant small, succulent, never becoming very tall or woody (semperflorens, gigantea rosea, Carrierei, Erfordii, Lyncheana, Lucianæ Corbeille de Feu)*
AA. *The woody or shrubby kinds, usually much branched when mature, and often tall*
B. *Kinds slender, upright, small-leaved, mostly smooth, green or nearly so lvs many and usually not more than 1 in across*
C. *Fls pink or red (fuchsioides, Ingrami, Digswelliana, incarnata, nasutensis)*
CC *Fls white, or tinted white (foliosa, knowsleyana, acuminata, albo-picta)*
BB. *Kinds low-growing, diffuse (Schmidtiana)*
BBB *Kinds stiff, succulent white-scurfy (peltata, venosa)*
BBBB. *Kinds mostly tall and erect, some of them becoming 8 ft high, distinctly shrubby and bushy*
C. *Lvs compound, or divided (luxurians, Hemsleyana, platanifolia, digitata, carolinæfolia, diadema)*
CC. *Lvs not compound, although sometimes strongly notched or even lobed)*
D *Whole plant hairy, or at least so much so as to give it the appearance of being a rough or pubescent species.*
E. *Foliage light green and plant pubescent (vitifolia, Engleri)*
EE. *Foliage markedly colored above or beneath, or both*
F *Fls white (echinosepala, erythrophylla, Scharffiana, Duchartrei).*
FF. *Fls colored (Haageana, Credneri, Alleyn, Margaritæ, metallica, cathayana, deliciosa, lacinıata)*
DD. *Whole plant smooth or becoming so (a few hairs perhaps remaining on the lvs), or so much so as to give it the appearance of being a glabrous species.*
E. *Lvs. medium to large, very broad, fleshy or thick, entire, often peltate (sanguinea)*
EE. *Lvs. medium size, stiff, green and shining, often elongated, mostly undulate or notched.*
F. *Fls white (angularis, ulmifolia, longipes, undulata, kewensis).*
FF. *Fls. colored (nitida, Teuscheri, Bismarckii, carminata, polyantha, coccinea).*
EEE. *Lvs medium to large, the margins strongly toothed, incised or lobed.*
F. *Fls white (Madame de Lesseps, olbia).*
FF. *Fls. colored, varying to tinted white (argenteo-guttata, maculata, Thurstonii, dichroa, coronata, phyllomaniaca, President Carnot, lucerna)*

I. BULBOUS BEGONIAS, AND SEMI-BULBOUS OR SEMI-TUBEROUS DERIVATIVES.

1. **socotrāna**, Hook. Fig. 504. A winter-flowering species: st. annual, stout and succulent, forming at the base a number of closely set scales or suppressed lvs. resembling bulbs: lvs. dark green, orbicular, peltate, 4–7 in. across, center depressed, margin recurved,

crenate: fls. all male except the terminal one of each branch of the cyme, in terminal few-fld cymes, bright rose G.C II. 15:8. B M. 6555. Gn 21:163; 49·426 (as *B Gloire de Lorraine*). J H. III. 51·317. R.H. 1906, p 130; 1909, p. 426. A F. 13:587, 588.—Bulbs or semi-tubers were brought from the hot sandy island of Socotra by I. B Balfour, and grown at Kew in 1880. The species was first described in Gardeners' Chronicle in 1881, and in the same year in Botanical Magazine See also Balfour, Botany of Socotra, p. 102, 1888 (Vol 31, Roy. Soc, Edinburgh) An early study of the nature of the bulbs by Duchartre will be found in Bull. Soc Bot. de France, 12 (1885) —This excellent plant requires to be grown in a light position in a stove to develop at its best. The bulbs should be shaken out of the old soil in Sept. or Oct and potted up in a light soil, rich in humus, and placed in heat and moisture, and, when well established, should be liberally supplied with manure-water The fls. appear during the winter months, after which the plant dies down, forming a number of large resting buds or bulbs, the pots should then be placed in an intermediate temp and be kept nearly dry until the following growing period comes round. On account of its habit of producing fls in winter, this species has been largely used by the hybridist in the production of a race of winter-flowering begonias, of which there are many named varieties



507 Begonia Davisii (×⅓). No 6

Following are leading Socotrana derivatives:

2 **Gloire de Lorraine** (*B socotrana* × *B Dregei*) Fig 505 One of the finest hybrid begonias ever raised lvs small, nearly regular, pure green fls almost exclusively male, 4-petaled, large, borne in broad panicles, covering the whole superior part of the plant, rose-colored, not deciduous Gt 42, p 111 A F. 12 842 G F 5 247 — Although *B socotrana* is semi-bulbous and *B Dregei* has a thickened rhizome, the hybrid forms show neither, but the base of the st throws out many shoots, which can be separated and insure the multiplication of the plant Intro by Lemoine in 1892 —There are several forms of this plant now in cult *Rothschildii* variety has larger and darker colored fls than the type *Turnford Hall* is a form with white fls *Caledonia* also has white fls but is far inferior as a garden plant to that of *Turnford Hall Glory of Cincinnati*, a form with very lasting large satiny pink fls, is a seedling from B socotrana × a sport of Gloire de Lorraine, it bloomed first in Dec, 1908, and was intro to trade in 1910 (J. A. Peterson)

3 **Gloire de Sceaux** (*B. socotrana* × *B. subpeltata*). Fig 506. Plant stout, half shrubby, erect, vigorous, compact, will form a plant as much as 8 ft. high in a year with good cult and produce quantities of its large rose-colored fls over a period of several months lvs dark metallic green, thick, large, red beneath, veins red above, suborbicular, slightly oblique· fls profuse, beautiful rose-pink, shiny, females the last fl on the cyme Fls from Dec till May R.H. 1884 516 G F. 7 185 —Intro in 1885

4 **Triomphe de Lemoine** (*B socotrana* × *B Roezlii*) St herbaceous, spreading, then erect and branching into numerous flowering branches lvs large, coriaceous, orbicular, somewhat oblique, margins slightly cenerous, 6 in diam.· fls in dichotomous cymes from axils of lvs, rose-carmine, female fls exceedingly rare, males very profuse, plant resembling a large bouquet when in full bloom G F 2 557 —Intro by Lemoine in 1887 Retains its fls after they are withered, a rare occurrence in begonias Another hybrid from the same parent is *Triomphe de Nancy*, with fls rich yellow in the center, double, and the outer petals of a paler hue —Intro. 1888.

5. **incomparábilis,** Hort. (*B. socotrana* × a garden tuberous form). Lvs. large, with the showy, well-formed orange-red fls. standing well above them R.B. 33.60

II. TUBEROUS BEGONIAS, *the plant passing the winter as a dormant tuber Nos. 6–30.*

A. *Plant stemless· lvs springing directly from the crown or tuber.*

6. **Dàvisii,** Veitch Fig 507. Lvs. ovate-cordate, dull green, thinly hairy, above and below, upper side lighter veined and under side red, petiole short. peduncles, pedicels and fls bright red Peru B M. 6252. F.M. 1876·231. G C II 15·669 —A favorite with hybridists, because of its rich coloring and its free flowering It has given rise to numerous dwarf, erect-habited garden forms, with small but brightly colored fls

7 **rosæflòra,** Hook Stout petioles, scapes, bracts, and stipules bright red. lvs green, 2–4 in. wide, on stout, hairy petioles, 2–6 in. long, orbicular, reniform, concave, margins lobed, red, toothed: fls 2 in across, rose-red. Andes of Peru, 12,000 ft, Intro. in 1867. B M. 5680 —Light-colored seedlings of this species gave rise to Queen of Whites, put into commerce in 1878, and apparently an important factor in subsequent garden forms of the same color. The species itself is probably not now in cult

8 **Froëbelii,** A DC. More or less hairy: lvs numerous, cordate, acuminate, green, covered with fleshy, purplish hairs: fls. in tall, lax, drooping, branching cymes, brilliant scarlet, large. Late autumn and winter. Ecuador J H III 32, p 33 Journ Roy. Hort Soc 19, p. exci Gn 12, p. 376 Intro. about 1872–3 by Otto Froebel of Zurich —A beautiful flowering plant, useful for conservatory work in winter Var **vernàlis,** Hort, hybrid (*B Froebelii*×*B Dregei*), similar to type, intro by Deleuil in 1880. Var **nàna,** Hort. Very dwarf· fls dark scarlet

9. **Vèitchii,** Hook Loosely hairy· st very short or practically none, thick, fleshy, green· lvs orbiculate, cordate, lobed and incised, margins ciliate, green, principal veins radiating from a bright carmine spot near the center, under side pale green, petiole thick, terete pilose. fls. 2¼ in diam, cinnabar-red caps. smooth, unequal wings Peru, 12,000 ft B M 5663. F S 22 2326 —One of the progenitors of the tuberous race. Intro. 1867 Probably not now in cult, but a beautiful species.

10 **octopétala,** L'Her. (*B grandiflòra*, Knowl & West). Lvs on long, succulent downy petioles 1½ ft. long, cordate, deeply lobed and serrated, bright green: fls seldom produced in cult, greenish white, in corymbs, males with 8 or 9 petals 2 in across, females smaller and generally fewer Intro to Glasgow from Lima, Peru, in 1835 B.M 3559. F. S 20·2056–7. A F 4 225 (var *Lemoinei*). This species is of little or no horticultural value.



508. Begonia boliviensis (×⅓). No. 11.

AA. *Plant with st (not scapes) evident and more or less upright, usually branching.*

B. *Lvs narrow, lanceolate to ovate-lanceolate*

11. **boliviénsis,** A. DC. Fig. 508. Plant sparsely

hairy: st. erect at first, but drooping and becoming slender with age, 2–3 ft. high, branching: lvs. lanceolate to ovate-lanceolate, acuminate, serrate, 3–5 in. long: fls. in drooping panicles, cinnabar-scarlet, long and fuchsia-like; males twice as long as females Bolivia. B M. 5657.—Intro. into England in 1864. It is a very useful basket-plant. This species has recently been crossed with some of the double and single garden forms of the tuberous race (of which this species was one of the ancestors), and has given rise to a pretty and distinct type with long pendulous sts. and drooping fls. which render them most useful as subjects for baskets. **B. Bertínii,** Hort, is closely allied, and perhaps a form of *B. boliviensis* Fls light scarlet, numerous and large, not so pendent. Gt 51, p 550, desc. R H. 1894, p 247. There is a dwarf form (var. *nàna*) of this. **B. Worthiàna,** Hort., said to be a seedling of *B. boliviensis*, with larger and shorter lvs. and more numerous and less pendent fls. **B. bolidàvis,** Hort, is a hybrid of *B Davisii* and *B. boliviensis*.

12. **Sûtherlandii,** Hook. Slender and graceful, 1–2 ft high, bright vinous red, from small tubers: lvs. 4–6 in. long, lanceolate, lobed and serrated, green, with red veins and margin; petioles slender, red. fls numerous, coppery or salmon-red Natal B M 5689 —Intro. by Backhouse in 1867. Of little decorative value.

BB. *Lvs broad-ovate to cordate-ovate.*

13. **Pèarcei,** Hook. Pubescent, branching, 1 ft. high: lvs oblique-ovate, cordate, acuminate, toothed, glabrous and velvety green above, tomentose beneath, pale red on under surface· fls. in loose, axillary panicles, large, bright yellow Bolivia; intro. from La Paz, being sent by Mr Pearce, collector for Messrs. Veitch. B M. 5545 —A variable plant, both in habit, size, color of the fls and in the degree of the venation of the strongly nerved lvs It is the only yellow-fld tuberous begonia in cult. It has been the chief factor in the production of the hundreds of yellow, buff and orange-colored garden forms Intro in 1865.

14 **Clárkei,** Hook Stout and erect, 2 ft, puberulent, the st. purplish, fleshy: lvs. obliquely cordate-ovate, serrate: fls. in pendulous racemes, abundant,



509. Begonia Dregei (×⅓). No. 17.

large, bright red. Bolivia, 9,000–10,000 ft. B.M. 5663 (as *B. Veitchii*), 5675.—Resembles *B. Veitchii*. It was the seed parent of Vesuvius and Emperor, two important and useful varieties for bedding out. Probably not now in cult.



510. Begonia tuberhybrida. Single-flowered (×⅓). No 21

15. **Evansiàna,** Andr. (*B. discolor*, R. Br. *B grándis*, Dry.) Smooth. st deciduous, branching, 2 ft high lvs ovate-acute, subcordate, lobed, margins denticulate, green above, under side and petioles red, peduncles branching, axillary. fls numerous, flesh-colored, large. Java, China, Japan B M. 1473 —A handsome and almost hardy species. Intro in 1804 to Kew. Little cult now. It makes a pretty and free-flowering plant for the cool greenhouse in summer Readily prop by bulblets, which are produced in quantities in the axils of the lvs. after flowering, and which will give flowering plants the following year. Stands some frost.

16. **grâcilis,** HBK (*B bicolor*, Wats *B diversifòlia*, R Grah.) Smooth and shining, tall and st erect, seldom branched, succulent lvs thinly scattered along sts, almost heart-shaped, slightly hairy, lobed, denticulate, ciliate fls on short, axillary peduncles, pink. Mex B M 2966 —In axils of lvs between stipules a cluster of bulblets is borne These may be gathered and sown as seeds Along with its varieties, **annulàta, diversifòlia, Martiàna,** and others, it makes a very beautiful summer-flowering greenhouse begonia —Intro by P. Neill, of Cannonmills, Edinburgh, in 1829. This species should be treated in exactly the same way as the garden race of tuberous begonias as to cult The variety *Martiana* is a large-fld form with rose-colored fls and frequently reaches 5 ft in height It is a pretty and desirable greenhouse plant, producing a succession of fls for 2–3 months during the summer

17. **Drègei,** Otto & Dietr (*B. cáffra*, Meisn *B. parvifòlia*, Grah *B. reniformis*, Hort.). Glabrous sts. succulent, annual, 1–3 ft. high from a rootstalk a fleshy irregular tuber· lvs thin, small, oblique-ovate, green, deeply serrated, reddish on the under side. fls. white, small, profuse Cape of Good Hope. B M 3720. —Received at Botanic Gardens, Edinburgh in 1836 from Berlin. A useful free-flowering greenhouse plant.

18. **weltoniénsis,** Hort. (*B Sûtherlandii* × *B Drègei*). St. reddish, 1–3 ft. high: lvs light green, smooth, ovate-acuminate, lobed, dentate, 1½–2 in. across; petiole red, 1–1½ in. long: fls. pink, profuse, on short peduncles.—Frequently met with in cottagers' windows in England; of very easy cult. Intro. by Major Clark, of Welton Park, England. Var. **álba,** Hort., has white fls.

19. **fúlgens,** Lemoine. Stout: st. short: lvs. large-reniform to cordate-ovate, more or less oblique, irregularly sinuate-toothed, sparsely hairy above and beneath. dull dark green above and reddish on the under side.

fls. large (2 in. across) in many long-peduncled clusters, bright rich rose-red, fragrant. Bolivia.—A handsome plant, published by Lemoine in catalogue of 1893.

BBB. *Lvs. orbicular.*

20. **Baûmannii,** Lemoine. Loose-hairy or nearly glabrous, the sts. often very short and the plant appearing acaulescent, but becoming 1–1½ ft. high: lvs large, orbicular, with short, thick petioles: peduncles 18 in. high, bearing panicles of 4–6 fls., which are rose-red, 4-petaled, from 3–4 in. across, and fragrant as roses. Bolivia, 8,000–9,000 ft. B.M. 7540 Gt. 40.1348; 42, p 25. A F. 7:561. G F. 5·77 —It is described as plentiful in the moist valleys of the Cordilleras, where it is eaten by cattle. Distributed by Lemoine in 1890. Tubers as large as ostrich eggs. Habit of *B. socotrana.*

BBBB. *Lvs. various, mostly broad-ovate at base, acuminate, oblique.*

21. **tuberhýbrida,** Voss (*B tuberòsa,* Hort.). Figs. 510, 511, 512 The garden race of tuberous begonias, combined of many species and derived from many sources, very variable and yet for the most part agreeing in general lf. form. There are many named garden varieties.



512. **Begonia tuberhybrida. Double-flowered form.** No 21.

OTHER TUBEROUS-ROOTED SPECIES.

22 **cinnabarina,** Hook Puberulent sts short, green, zigzag, slightly downy lvs on short petioles, obliquely ovate, lobed and serrated peduncles 9–12 in long, red, fls cinnabar-red, 2 in across. Bolivia B M 4483 P M 16 225 —Intro 1849, not in cult

23 **crinita,** Oliver Slender, sparsely hairy sts red, hairy, 1 ft high lvs ovate-cordate, irregularly toothed, tinged with red on the under side peduncles erect, red, producing 3 pale rose-colored fls. Bolivia B M 5897 —Intro by Veitch in 1866

24 **cyclophýlla,** Hook Slightly hairy, slender, stemless lf solitary, orbicular, 6 in across, green, with fimbriated margin peduncles erect, 6 in long, fls rose-colored, with the fragrance of roses China B M 6926 —Intro to Kew in 1885

25 **geraniifòlia,** Hook Glabrous st 1 ft high, erect, greenish· lvs cordate, lobed, incised and serrated, green, margins red fls 2 or 3 on terminal peduncles, outer petals orbicular, red, the two inner obovate, white Lima B M 3387 —Intro 1833

26 **geranioides,** Hook Small, 10–14 in , stemless, rootstock fleshy lvs radical, reniform, 6 in across, lobed and toothed, green, hairy, petioles 8 in long peduncles erect, 6–12 in long, reddish, hairy, bearing a lax panicle of fls , each 1¼ in across, pure white, with a button-like cluster of yellow anthers Natal B M 5583.—Planted in a border in a sunny greenhouse, this is a fine begonia,



511. **Begonia tuberhybrida. Double-flowered.** No 21.

flowering profusely during Oct and Nov Intro to Kew in 1866. Probably not now in cult Allied to *B Dregei*

27 **natalénsis,** Hook Glabrous sts fleshy, 1–2 ft high lvs. obliquely cordate, lobed, sinuate, 2–3 in long, green, sometimes mottled with gray, veins reddish fls yellowish white, tinged with rose, 1 in across Natal B M 4841 —Intro to Kew in 1854

28 **polypétala,** A DC St short, fleshy lvs ovate-cordate, toothed, hairy, with raised veins, 10 x 8 in fls with 9 or 10 ovate-oblong petals an inch long, red, ovary hairy, with 1 long wing Peru Gn 14, p 531 —Intro by Froebel in 1878

29 **rubricaûlis,** Hook Pubescent, stemless, scapes red lvs 4–6 in long, ovate, wavy, ciliate along the margins, deep green fls large, males 1¼ in across, 5-petaled, females smaller, 6-petaled, reddish Country unknown B M 4131 —Intro to Birmingham Botanic Garden in or about 1844

30 **ténera,** Dry (*B Thwaitesii,* Hook) Pubescent, stemless: lvs radical, cordate, 5 in long, coppery green, mixed with purple and blotched with gray, under surface very red fls white, tinged pink Ceylon B M 4692 —Chiefly interesting as a variegated plant. Intro to Kew about 1852

III. SPECIES RHIZOMATOUS *the rhizomes mostly shaggy and lying on top the ground or very nearly so (Fig 516), plant making no proper upright stem or trunk. Nos 31–59*

A *Plant creeping, trailing, or climbing.*

31. **glaucophýlla,** Hook. (*B. glaucophýlla splèndens,* Hort. *B glaucophýlla scándens,* Hort *B Comte de Lamminghe,* Hort *B Limminghei,* Hort) Glabrous: sts long, drooping or creeping, lending themselves to training on rafters. lvs. ovate, wavy, 3 in long, glaucous green, reddish and variegated in bud, purple beneath and white-spotted above, the margin cartilaginous: fls. brick-red, males 1 in across, with petals, females of equal petals Brazil. B M 7219 Gn 59, p. 336 —A good basket plant, flowering freely all winter. Excellent for a permanent position in a greenhouse; reaches 6–8 ft. or more high.

32 **scándens,** Swartz (*B lùcida,* Otto & Dietr. *B ellíptica,* HBK). Glabrous: sts climbing or trailing clinging by means of short aerial roots lvs ovate or broader, acuminate, notched at base, dentate, glossy green, 4 in. long: fls. small, white, hanging in ball-like clusters. W. Indies and S.—An excellent basket or climbing plant.

AA. *Plant upright, often diffuse.*

B. *The picture-lvd. sets plants low and tending to be compact, the mature lvs usually hanging nearly vertical, often variously colored and marked.*

C *Lvs. oblique, lobed at the base, not peltate (or only slightly so).*

33. **Rex,** Putz. Fig 513 Very hairy: st a short, fleshy rhizome, from which spring the long-stalked large ovate wavy lvs , which are hairy and colored a rich metallic green, with a zone of silvery gray: peduncles erect, fls. large, rose-tinted, males 2 in. across, with 4 unequal petals, females smaller, with 5 nearly equal



513. Begonia Rex, in its original form. No. 33

petals; ovary 3-angled, with 2 short and 1 long wing. Assam. F S 12 1255-1258 B M 5101 —This noble species is the principal parent in the production of the numerous ornamental-foliaged begonias It has been crossed with a few species in the first place, and then hybrid seedlings have been raised again and again from the progeny Fig 513 is a copy of a part of the original figure in Flore des Serres (1857), and is given here for the purpose of showing what this species was like when first known to horticulturists There are very many named forms, but most of the listed kinds tend soon to pass out One of them that has persisted, because of the odd curl to the lf is *Countess Louise Erdoedy* (B Alexander von Humboldt × *B argentea-cupreata*). Fig 514 Lvs obliquely cordate, ovate-acute, the smaller of the 2 lobes twisted in a spiral manner, with as many as 4 coils; upper surface silvery, with veins deep green, under surface reddish, pilose I H 31:516 C.C. II. 22.205 Intro by F. Nemeczek, gardener to Count Erdody, a Hungarian nobleman, in 1884 —Other Rex varieties of unknown or uncertain origin: *Louise Closson* Lvs ovate-acuminate. lobed, veins deep purple, surface blotched with deep purple bronze, metallic luster very bright *Lucy Closson* is very similar, but more vigorous, with the blotches more numerous and better distributed *Marquis de Percita* Lvs. small, margins hairy, numerous silvery spots on surface Compact, dense grower *Duchesse de Brabant* Lvs. large, purple, margins and surface hairy, otherwise like *B. Rex* *Louise Chretien* Lvs green, with a zone of glossy silver towards the center, covered with very small white spots *Count Erdoedy.* Silver-white, green-striped along the veins, hairy, lobes twisted into a spiral, hairy

34. **xanthina,** Hook Similar to *B Rex:* lvs. large, fleshy, cordate-ovate, acuminate, sinuate-ciliated, dark glossy green above, purplish beneath. fls. large, almost golden yellow, tinged on the back with red. caps with one large wing India B M 4683 Var **pictifolia,** Hook. Lvs with rows and spots of silvery white: fls. yellowish white. B.M 5102 Var **Lazulii,** Hook. Lvs. not spotted, tinted with bluish purple. B.M. 5107. This species is probably not now in cult.

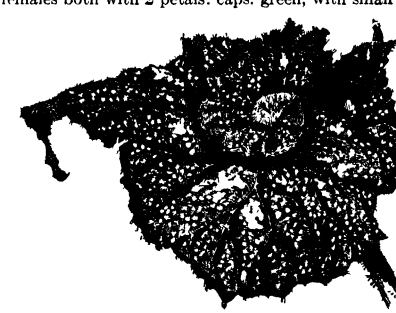
35. **Griffithii,** Hook. (*B picta,* Hort.). St.-lvs. and habit as in *B Rex:* lvs olive-green, with a broad zone of gray inside a purple margin, tinged with red on the under side, the basal lobes overlapping. fls. large, fleshy, pink; ovary curiously crinkled along the angles. Assam. B.M. 4984 —Intro by Henderson, England, in 1856 Probably not now in cult.

36. **Rajah,** Ridley. Fig 515 Lvs. from the rootstock, angular-orbicular, papery, the petioles and under veins setose, upper surface smooth and richly mottled from the green ribs and the brown or brown-red intermediate spaces, the margins serrate and setose: fls. small, pink, on hispid peduncles that stand about as high as the lvs. Malaya. G.C. III 16:213 —A distinct and beautiful hothouse species, deserving of popularity Said erroneously to be a garden hybrid

37 **Augustinei,** Hemsl A dwarf, compact species, allied to *B Rex* but devoid of color in the lvs as in that species: sts. branching freely, short-jointed. lvs. erect or spreading, elliptic or ovate, 3-6 in long, reddish green above and below, covered on both sides with red hairs, petiole red, terete, provided with dense white hispid hairs whole plant presenting a mixture of white or red hairs infl erect, few-fld ; fls pink. China — Differs from *B xanthina* in its rough rugose hairy lvs and rose-pink fls.

38. **dædalea,** Lem (*B. strigillosa,* Dietr). Hairy, Rex-like st a short, thick rootstock lvs large, green, ovate-acuminate, cordate, margins slightly serrate and beset with long reddish hairs, surface covered with a peculiar network of russet-brown peduncles spotted and slightly hairy, fls white, tinged with pink Mex I H 8 269 —A handsome foliage plant, not very widely known

39 **speculata,** Hort Probably a hybrid st a short, thick rhizome lvs broadly ovate, acuminate, cordate, lobed half way down the blade, on long, hairy petioles, dull green, rough, speckled with gray, hairy, reddish on the under side, veins very prominent, light green fls on long, hairy peduncles, pink-white, males and females both with 2 petals: caps. green, with small red



514. Begonia Countess Louise Erdoedy (×⅓) No 33

spots —Origin uncertain, although apparently common in cult. in this country. A hardy and useful begonia for conservatory and window-garden.

40. **decora,** Stapf. A small species of compact habit, allied to *B Rex.* rhizome short, reddish green: lvs. 3-4 in long, ovate, rich reddish brown with prominent yellow-green veins whole plant covered with thick-set papillæ and short hairs: fls pink, comparatively large for so small a plant. Perak.—This plant thrives best in a stove It is readily crossed with many other species, notably with *B. Rex,* and the offspring are amongst the finest ornamental foliage plants.

41. **imperiàlis,** Lem. Very hairy, low· st. short, herbaceous, green: lvs. 4–6 in wide, brownish green, with irregular bands of bright green along the nerves, making a striking contrast. fls. insignificant, white. Mex I.H. 8:274. Var **maculàta,** Hort, has brown lvs with green blotches. Var. **smarágdina,** Hort., has wholly bright green lvs. I H. 7.262.—These plants require a hothouse treatment in winter.

cc *Lvs. markedly peltate.*

42 **módica,** Stapf. A spreading, dwarf plant with sts. green, slender: lvs peltate, orbicular or broadly ovate, 2–4 in. long, pale green in color, margins pink, undulate, margins and veins ciliate; petioles greenish red, hairy, 3–5 in long infl few-fld, males small, 2-petaled, orange-yellow, with red blotch at base of petals, females same as males in color; ovary 4-celled, ½in long, winged, hairy W Trop Afr B M. 8258.—A recent species, requiring stove conditions

43 **Géntilis,** De Wild A near ally of *B modica*· sts creeping, red hairy lvs peltate, erect, ovate, acute, margins finely serrate, slightly reflexed, green suffused with light red, young lvs red, petiole terete, red, hairy, 6–12 in long, blades 3–4 in. long infl few-fld; fls orange-yellow suffused with red, ovary 4-celled, winged Congo

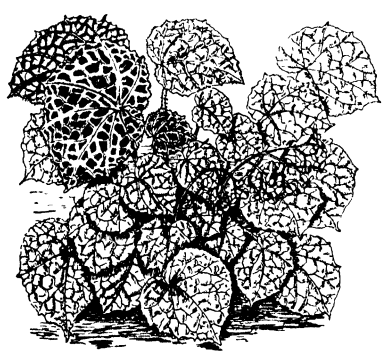
44 **Binótii,** Hort Plant rough hairy like *B Rex.* lvs elliptic-orbicular, markedly peltate, green above and red-hairy beneath, blistered or bullate —Very recently offered, and yet little known

45 **goegoénsis,** N E Bi Fire King Compact but large plant st a short, thick, greenish red rootstock: lvs handsome, erect, peltate, ovate-orbicular, 6–9 in. long, surface blistered or puckered green, with dark bronzy blotches, prominently veined, dull red on the under side fls small, rose-pink, in a lax cluster 6 in. high. Goego, Sumatra —A distinct and ornamental-lvd. plant, requiring stove conditions, deserves the attention of amateurs.

BB *The essentially plain-lvd rhizomatous kinds, although some of them are grown almost wholly for the foliage (Some of this group are bold and striking)*

c *Lvs prominently lobed, or parted or even divided*

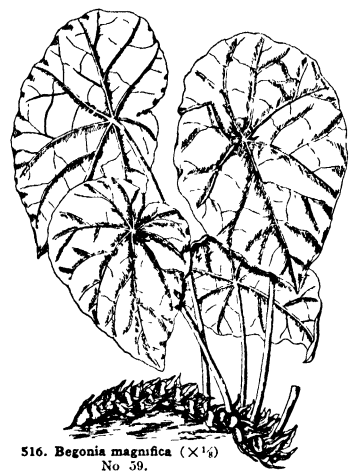
46 **ricinifòlia,** Hort (*B heracleifòlia* × *B. peponifòlia*) St a short, thick rootstock lvs large, bronzy



515. Begonia Rajah (×⅓). No. 36.

green, lobed, resembling castor-oil plant: fls. numerous, on long, erect peduncles, rose-pink.—A useful free-flowering plant for the greenhouse, producing its fls in winter and early spring. Var **gigantèa odoràta,** Hort, is a double hybrid (*B. ricinifòlia* and *B fulgens* × *B. Scharffiana*) of German origin. Lvs. large, round-cordate, the lobes extending one-third or less deep and notched. fls. on long scapes, standing above the lvs., delicate rose-color and with tea-rose odor. Gt. 54, p 42.

47 **heracleifòlia,** Cham & Schlecht (*B jatrophæfòlia,* Hort) Hairy st a short, thick rhizome lvs 6–12 in across, with 5–9 deep and narrow notched and toothed



516. Begonia magnifica (×⅛) No 59.

lobes, rich green: peduncles 2–4 ft, long, straight. fls. white or rose-tinted, small, with 2 prominent rounded parts. Mex. B M. 3444. B R 1668 J H III 56 309. Var **nigricans,** Hook, has the margins of the lvs bordered with dark (almost black) green B M. 4983 Var. **longipila,** Hort has long, fleshy hairs on the lf-stalks and peduncles **B. Sünderbruchii,** Hort, is an American form of this var.: lvs. bronze-green, silver bands along the nerves, purple underneath. Var **punctàta,** Hort, has green lvs., reddish near the margin: fls. rose-colored, with deep red spots on the outside.

48. **rubélla,** Haml. Smooth st a short, thick rhizome· lvs. handsome, large, cordate, acuminate, deeply lobed, spotted with irregularly shaped dark brown marks· fls. pale pink, on long peduncles, decorative Nepal.

49. **Verschaffeltiàna,** Regel (*B. Verschaffèltii,* Hort. *B manicàta* × *B carolinæfòlia*) Hairy st a thick rhizome. lvs large, ovate, acuminate, lobed: fls. rose-colored, pendent on long peduncles I H. 2·68 —Tall, coarse and unsightly as an old specimen, but when well grown from year to year from cuttings makes an excellent plant and produces quantities of its small rose-colored fls. in early spring, which last for several months and have a considerable decorative value

50 **heracleicótyle,** Veitch (*B heracleifòlia* × *B hydrocotylifòlia*). A small, essentially smooth plant, with lvs close to the rhizomes: lvs thick, obliquely cordate-ovate, many-lobed and toothed, margins slightly ciliate, shining metallic green above and reddish beneath: fls pink, small, freely produced on about 8 free-branching peduncles in early spring. Veitch, 1895 —A useful and decorative greenhouse plant.

cc. *Lvs. lanceolate to ovate or cordate-ovate to orbicular, not deeply lobed, often entire, and sometimes peltate.*

D. *Foliage small, the lvs. less than 2 in. wide.*

51. **hydrocotylifòlia,** Otto. Whole plant hairy: st. succulent, creeping· lvs. rotundate-cordate, repand bu-

entire, small, on short petioles and therefore clustered near the ground: peduncles 1–1½ ft. high, pilose; fls. dipetalous, rose-colored, small and numerous, showy. Mex. B.M. 3968.

DD. *Foliage of usual or large size.*

E. *The lvs. peltate.*

52. **Fèastii,** Hort. (*B. manicàta* × *B. hydrocotylifòlia*). Shaggy-hairy on petioles and lf.-edges. st. a short, thick rootstock: lvs. suborbicular, thick, red beneath,



517. Begonia semperflorens A recently struck cutting. To show the precocity of bloom. No 60.

entire with long white hairs on margins; petioles short, irregularly marked fls light pink, on long peduncles. A.G. 23:335.—Intro. by John Feast, of Baltimore, before 1880. A common pot and house plant **B. Búnchii,** Hort, is a form with edges of lvs. crested and frilled. Originated with Lloyd C. Bunch, Fredonia, Kan.

53 **nelumbiifòlia,** Cham. & Schlecht. Hairy: st. a short, thick rhizome: lvs. large, 12–18 in. long, 8–12 in. wide, peltate, hairy on the under side, on long upstanding petioles: fls many and small, white or rose-colored, in a dense erect much-branched cluster. Mex.—The foliage is bold and handsome, and distinct in general effect from any other cult species

54. **conchæfòlia,** A. Dietr. Lvs. nearly peltate or semi-peltate, thick, cordate-ovate and the basal lobes or ears overlapping, margins entire or repand, becoming smooth above, shining green above and reddish beneath: fls. pink. Cent. Amer

55. **Lúbbersii,** E Morr. Semi-shrubby, the short rhizome occasionally ascending and becoming gouty at the base: lvs. large, peltate, obliquely lanceolate, entire, green with many silvery blotches above, claret-colored beneath. fls. white, on long peduncles. Brazil. G.C. III. 3.301. R H. 1888, p. 225.—Named in compliment to M. Lubbers, curator Brussels Bot. Gard. Has spots like *B. maculata* —Of little horticultural value.

56. **álbo-coccínea,** Hook (*B. Grahamiàna,* Wight). Smooth and shining. rootstock creeping: lvs. peltate, ovate, leathery, 6 in. long: peduncles 1 ft. long, coral-red, springing from the crown; male fls. 1 in. across, with 4 petals; female fls. also of 4 petals, white above, coral-red beneath. Flowers in winter. India. B.R. 32:39. B.M. 4172.—A beautiful species, apparently little cult. now.

EE. *The lvs. not peltate.*

57. **manicàta,** Cels. Essentially smooth except the hairy lf.-edges, short-stemmed, succulent: lvs. ovate, obliquely cordate, thick, fleshy, smooth, shiny green, 6–8 in. long, petioles covered with fleshy scale-like hairs: peduncles a foot or more long, bearing loose panicles of pink dipetalous fls Mex. Var **aûreo-maculàta,** Hort, has large blotches of yellowish white on the lvs. F E 8.1159 F R. 2.435. A G 23·337.—Flowers profusely in spring, having a light elegant and feathery effect supported on long erect and free-branching peduncles. Var. **crispa,** Hort, has foliage with crispate margins; there is also a yellow-spotted form of it

58. **leprósa,** Hance A dwarf, compact species, with short, free-branching rhizomes and erect, ovate, pale green lvs. with biserrate margins and reaching to a height of 6–9 in.. infl few-fld , fls. large for so small a plant, rose-pink, male with 4 petals and female with 6 petals partially deciduous during the winter months. China —Thrives best in a greenhouse

59 **magnífica,** Lind. Fig 516 Sub-frutescent, smooth and shining, the sts. creeping lvs large and bold, sometimes rising 2 ft, obliquely ovate-cordate, entire or obscurely lobed, serrate, slightly peltate, bright green, the margins ciliate fls. long and fuchsia-like, numerous, the sts , bracts, fls and hairs of the clusters all scarlet-red, showy Colombia R H 1870. 270 —One of the best of the rhizomatous begonias. Lf -blades often 2 ft across.

IV. Species Fibrous-rooted (*rootstock, if any, small*) Nos. 60–119

A. *The small succulent herbaceous kinds, never becoming very tall or woody*

60 **semperflórens,** Link & Otto (*B. Séllowii,* Klotzsch). Fig 517 Erect, smooth plants with st. herbaceous, green or reddish, 6–18 in high lvs ovate, rotundate, obtuse at the base, toothed and ciliate along the margin, pale glossy green, tinged with red on the midrib and petiole peduncles axillary, few-fld ; fls white or rose-colored; males with 4 petals, females with 5 petals caps green, wings tinged with red Brazil L.B C. 15·1439 R H. 1897, p 46 B M. 2920 —This is an exceedingly variable species An endless number of garden forms has been produced from it. A very popular bedding begonia, and a persistent bloomer Var **Vernon** (*atropurpùrea compácta,* Gt 44, p 570) is one of the best forms **Triomphe de Lorraine** (Fig. 518) is one of the good bedding kinds. Fls cherry-red, the stamens golden yellow. **Gloire de Châtelaine** is a form of dwarf habit and deep rose fls ; one of the best in England for bedding and pots, and a continuous bloomer.



518. Begonia, Triomphe de Lorraine (×⅓). No. 60.

61. Var. **gigantèa rósea** (*B. semperflórens* × *B. Lynchedna*). Very distinct· rootstock woody: sts. succulent, about 3 ft. high. lvs. on short petioles, ovate or reniform, obtuse, toothed at



XIV. Foliage begonias well grown in banks, with ferns and similar plants.

the margins, about 7 in across, bright green, with a red spot at base of sinus. peduncles axillary stout, 4–8 in. long, bearing large panicles of large rosy red fls., of which the males have 2 ovate petals, the females 2–4 smaller petals. A.F 13:586. A G. 16:41. —One of the best begonias for winter decoration in the cool greenhouse. Intro by Lemoine in 1888.

62 **Carriérei,** Hort (*B semperflòrens* × *B. Schmídtii. B. Bruántii,* Hort. *B Smíthii,* Hort) Dewdrop. Compact, about 1 ft high. lvs like *B semperflorens.* fls. nearly as large as in *B. semperflorens,* abundant, pure white G 6.557. J H III. 53.249 —Excellent bedding begonia, also a good late winter bloomer. Intro. by Bruant in 1883.

63 **Érfordii,** Hort (*B. Schmídtii* × *B semperflòrens Vernon*). Very dwarf and bushy, 1½ ft high· fls abundant, rose-carmine.—Excellent for bedding Intro by Haage & Schmidt in 1894.



519 Begonia Corbeille de Feu ("Basket of Fire") (×⅓) No 66

64. **Lyncheàna,** Hook (*B Roèzlii,* Hort, not Regel) Glabrous: rootstock stout, somewhat tuberous st erect, tall, succulent, smooth lvs green, smooth, ovate-cordate sinus red: fls in axillary, drooping cymes, deep reddish crimson Mex B M 6758 — Very like *B semperflorens gigantea rosea,* but not so strong a grower Perhaps not now in cult.

65 **Luciànæ,** Hort (*B Lyncheana*×*B Bruántii*) Fls. large, in the axils of the lvs, rose —Intro. by Bruant in 1889

66 **Corbeille de Feu** (*B semperflòrens*×*B fuchsioides*). Fig 519 Intermediate in habit between its parents fls bright coral-red, produced in quantity nearly all the year round —The plant branches freely from the base and makes an excellent bedding plant, the fls are rich-colored and withstand the sun well. Intro by Lemoine, 1891.

AA *The kinds becoming woody or shrubby, mostly tall and much branched*

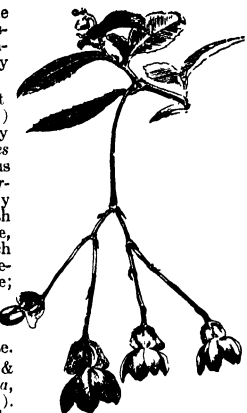
B *Plants slender, upright, small-leaved.*

C *Fls pink or red.*

67 **fuchsioìdes,** Hook. Fig 520 Smooth rootstock woody, not prominent sts. slender and erect, 2–3 ft., succulent. lvs many and small, ovate, 1½ in long, tinged with red when young fls drooping like a fuchsia, rich scarlet, males with 4 petals, females with 5 petals. Mex —Requires the conditions of a warm airy greenhouse If kept in a moist close atmosphere it is apt to damp off badly, and if kept too warm it makes a lot of growth and produces very few fls. It rapidly forms a large specimen if kept growing, and is a most attractive plant for greenhouse decoration during winter and spring months B M 4281. Var **miniàta,** Lind (*B. cinnabarina,* Hort), differs only in having flesh-colored fls and smaller lvs R.H 1855:221. F S 8 787.

68. **Íngramii,** Hort (*B nítida* × *B fuchsioìdes*). Fig. 521. Combines the characters of the two species: very free-flowering and makes a most desirable bedding plant, and also blooms well in winter. fls. rose, large: foliage tinted with red when exposed to the sun. The horizontal blooming side branches are characteristic of this plant as a greenhouse subject —Intro. by Ingram in 1849.

69. **Digswelliàna,** Hort (*B. Sándersonii,* Hort) A useful hybrid probably between *B. fuchsioides* and one of the numerous varieties of *B semperflorens* sts. erect or nearly so, green suffused with red· lvs elliptic, serrate, 2–4 in long, dark rich green in color. infl medium in length and size; fls rosy scarlet, pendulous —A useful bedding plant or may be used for a cool greenhouse.



520 Begonia fuchsioides (×¼) No. 67

70 **incarnàta,** Link & Otto (*B aucubæfòlia,* Hort *B insignis,* Grah). Smooth st. erect, subherbaceous, 2–3 ft high lvs very unequally cordate, ovate-lanceolate, toothed· fls rose-colored, abundant, males 1½ in across, with 2 ovate and 2 narrow petals, females smaller, with 5 equal petals B M 2900 A G 16 97 A F 12 724–5, 13 588; 17 857 R H. 1870, p 266, 1875 151 Var **grandifìora,** Hort, is a much improved variety, very useful for cut-fls or decoration in winter

71 **ascotiénsis,** Weber Of hybrid origin, probably obtained from *B fuchsioides* and one of the forms of *B. semperflorens.* lvs ovate, 2 in long, smooth, brown, margin green, dentate fls on peduncles 4 in long, bright red —An excellent bedding begonia.

CC *Fls. white, or tinted white*

72 **foliòsa,** HBK Small, smooth, shrubby· sts. herbaceous, slender, branching lvs very many, frond-like, very small, somewhat 3-lobed, glossy green, distichous: fls white, tinged with rose Blooms early summer. Colombia —An elegant little basket and ornamental plant

73 **knowsleyàna,** Hort Much like *B incarnata,* but lf smaller, entire or nearly so. fls nearly white Named for Knowsley, seat of the Earl of Derby Origin not known, probably a seedling of *B acuminata* A good winter bloomer, particularly in 6-in. pots. J.H. III. 49, p 177.

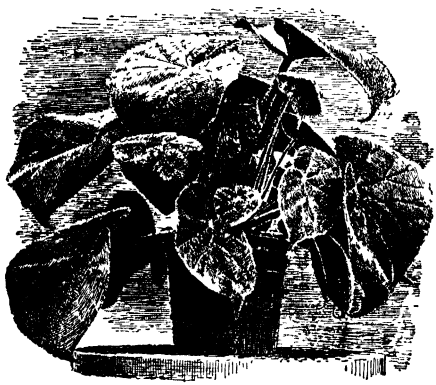


521. Begonia Ingramii (×⅓). No. 68.

74. **acuminàta,** Dry. Slender, 3–4 ft.: sts. nearly or quite smooth lvs. 2–3 in. long, oblique-ovate, tapering to the point, toothed and serrate, the margin and veins underneath hairy: fls. white, 3–5 on a peduncle, nearly 1 in. across, spring and summer. Jamaica.—A

useful plant for growing in baskets, thriving and flowering freely in a sunny position in a cool airy greenhouse. Intro. to Kew in 1790. B.M. 4025. B.R 364.

75. **álbo-pícta,** Hort Shrubby, compact growth, freely branched: lvs. elliptical, lanceolate, covered with



522 **Begonia Scharffiana.** No 89

numerous small silvery white spots fls greenish white, males with 2 broad and 2 narrow petals, females of 5 subequal petals Brazil —An elegant foliage plant, especially in the young state Intro by Bull in 1885.

BB *Plants low-growing, diffuse.*

76. **Schmidtiàna,** Regel (*B Schmidtii,* Hort). Herbaceous or half-shrubby, slender-branched, 1 ft or less in height, the branches red-tinged· lvs. lobed, toothed, hairy, about 2 in long, reddish beneath· fls white, tinted with rose. Brazil. R H. 1883, pp 56–7. Gn. 17, pp 268–9 —A very useful plant for summer bedding Named for Mr Schmidt, of the firm of Haage & Schmidt, Erfurt. Var. **rósea,** Hort , has rose-red fls

BBB. *Plants stiff, succulent, white-scurfy.*

77. **peltàta,** Hassk (*B Hásskarlii,* Zoll). Upright: st perennial· lvs. peltate, ovate-acuminate, very thick and succulent, covered with a whitish tomentum, 6–9 in. long· fls small, white, on long peduncles Brazil —It is the only begonia in cult with thick, felted, peltate, silvery lvs.

78 **venósa,** Skan. A tall, stout, erect species with white-frosted very fleshy foliage, and marked by very large inflated conspicuously veined stipules· lvs reniform or ear-shaped, repand-entire, joined at the middle (not peltate) with the thick flattened petiole. fls. many, white, crowded on a reddish peduncle. Brazil. B.M. 7657.—Very distinct, and a striking plant when well grown. Requires a warm sunny position in the greenhouse, and to be kept rather on the dry side at the roots during winter.

BBBB. *Plants mostly tall and erect, distinctly shrubby.*

C. *Lvs. compound or nearly so.*

79. **luxúrians,** Scheidw. Sts and lf -stalks hairy, the lf.-stalks reddish· pointed membraneous stipules at the younger nodes. lvs. peltately compound, the 7–17 lfts. lanceolate (3–6 in long and 1 in. broad), serrate, under surface glabrous and green, upper surface with stiff short hairs and red: fls. small, cream-color, in a compound long-stalked cluster. S. Amer. G.C. III. 51:28.—Thrives in an intermediate temp.

80. **Hemsleyàna,** Hook. Slightly hairy: habit dense, free-branching· sts. erect, red, hairy: lvs. digitate 6–12-parted, the parts or lfts. lanceolate or elliptic, slightly curved, serrate undulate, rich shining green above, dull greenish red beneath; petiole long, red: sts. and petioles covered with soft-tomentose hairs. infl. slender, few-fld.; fls. pink, large, 1–1½ in diam Yunnan, S. China. B.M. 7685.—One of the hardiest species.

81. **platanifólia,** Hort. (Schott?). St. shrubby, smooth, 5–6 ft. high, erect, robust, smooth, green, joints annulated: lvs. 8–10 in. across, reniform, lobed half way down, hispid on both sides, dark green, lobes acute, toothed, ciliated: fls. in axillary dichotomous cymes, large, white, tinted rose Brazil. B.M. 3591.—**B. gunneræfólia,** Lind. (*B. Washingtoniàna,* Hort.), is very similar to this, but its lvs. are not so deeply lobed and the fls. are very insignificant I.H 22 212. Runs into many forms. See *B. Faureana* in supplementary list, p 484.

82 **digitàta,** Raddi (*B. palmàta,* Hort.). St short, gouty· lvs. palmate, 10–12-parted, somewhat pubescent, green above, brownish beneath: fls white, in dense clusters. Brazil.—A species of little decorative value.

83. **caroliniæfólia,** Regel St erect, thick, fleshy lvs. palmately divided into 6–8 long ovate segms . fls small, pink, on long peduncles Mex. Gt. 1 258 — Named for its lvs resembling those of the Carolinea (Pachira). The lfts. are ovate, rather than narrow as in most begonias with divided or compound lvs , and in this regard peculiar.

84. **diadèma,** Lind Sts. short and fleshy, 2 ft high lvs. many, maple-like, deeply parted, bright green blotched with white, dentate fls. insignificant, pink Borneo. I.H. 29:446.—Attractive for its conspicuously marked foliage.

CC. *Lvs not compound*

D. *Whole plant hairy.*

E. *Foliage light green, and plant pubescent.*

85. **vitifólia,** Schott, not Lindl. (*B. grándis,* Otto. *B reniformis,* Hook) Tall, strong species, 3–4 ft high lvs large and grape-like (*Vitis vinifera*), orbicular or reniform, lobed and serrate, soft-pubescent, green above and rusty veined beneath, the petiole flat or canaliculate on top fls small, white, slightly downy, winter Brazil B M. 3225.

86. **Éngleri,** Gilg (*B. Engleriàna,* Hort). Striking species with mostly a single st conspicuously red-strigose-hairy and scaly, becoming 5 ft. tall· lvs large and showy, thin, oblique and ovate-oblong, deeply and evenly serrate, hairy, red-ribbed: fls. on long pendulous peduncles, numerous, pink. E. Trop. Afr.—Distinct, and worthy of attention on account of its handsome hairy lvs.



523. **Begonia Haageana. Showing a very small cluster** (×½) No 91

EE. *Foliage colored above or beneath, or both.*

F. *Fls. white.*

87. **echinosèpala,** Regel. St. green, succulent, erect and branching freely: lvs. obliquely oblong, finely serrate, rather small: fls. on axillary peduncles, white, with curiously papillose sepals. Brazil —A useful species for warm greenhouse, of very easy cult and very free-flowering. One of the best for decoration



524. Begonia cathayana (×⅛) No 95

88 **erythrophýlla,** Neum Soft-hairy, the st fleshy, strong lvs thick, reniform, long-stalked, dark green and lustrous above and red beneath, almost entire, strigillose fls small, white —Probably of garden origin.

89 **Scharffiàna,** Regel Fig 522. A robust herbaceous perennial, 1–3 ft high lvs large, thick, fleshy, hairy, olive-green above, crimson below stipules very large and prominent fls waxy white with red hairs on under surface of petals, large Brazil Gt 1888, p 661 —This begonia requires warmth and care to succeed well. When well grown, it is an excellent bracket-plant

90. **Duchártrei,** Hort (*B echinosèpala* × *B Scharffiàna*) St 2–3 ft high, branched profusely, hairy, purple-lvs ovate-lanceolate, acuminate, green above, hairy, red below fls large, waxy white, a few red hairs on the under surface of petals. R H. 1892, p 29.— Intro by Bruant in 1892.

FF *Fls colored.*

91. **Haageàna,** Wats (*B Schárffi,* Hook). Fig 523. Tall-shrubby, whole plant hairy. lvs ovate-cordate, acuminate, wavy, red-nerved above. fls rose-pink, with a cyme 8–12 in diam, males with 2 round and 2 narrow petals, females with 5 equal petals. Brazil. G C. III. 16.633. B.M. 7028, (as *B Scharffi*) —One of the most beautiful plants of the genus, and now one of the best known of the big tall red-hairy begonias; the hanging trusses of fls (imperfectly represented in Fig. 523) are very conspicuous. Named for one of the firm of Haage & Schmidt. *B Crédneri,* Hort (*B Scharffiàna* × *B metállica*). Intro by Haage & Schmidt, 1890 There is another plant named *B Crednerı,* which was raised by Lemoine in 1891 from the same parents Bruant also used these two parents in 1891, and called his plant *B. pictaviensis* All three plants can be distinguished from *B. Haageana* only by their smaller fls and the peduncles standing erect and not gracefully bending over, as in *B. Haageana.*

92. **Alléryi,** Hort. (*B. metállica* × *B. gigantèa*). Of the *B. Haageana* type hairy, lvs. bronzy, red-veined beneath, toothed· plant becoming very tall (even 4–6 ft. in a single year), producing many large pendulous clusters of rose-colored fls —A very fine warm greenhouse or stove variety, free-flowering, of easy cult Shown in 1905 before Société National d'Horticulture de France by M. Allery Aubert of Tours.

93 **metállica,** G. Smith. Hairy: sts. perennial, succulent, 4 ft. high, branched lvs. obliquely cordate, lobed and serrated, 3–6 in long, upper surface green, shaded with a dark metallic color· fls. blush-white, under side of petals clothed with red bristly hairs. There are a number of varieties, e. g, var **variegàta,** var. **velùtina,** var. **cýprea,** but they do not differ much from the original Bahia. R H 1844·218 (as *B velutina*). G.C. II. 5.397.—A very attractive plant.

94. **Margaritæ,** Hort. (*B. metállica* × *B echinosépala*). Plant 1–2 ft. high: sts. purple, hairy. lvs. ovate-acuminate, sinuously dentate, green and purplish above, red beneath fls. in cymes, large, rose-colored; sepals with long hairs at the base —Intro. 1884.

95. **cathayàna,** Hemsl (*B. Bowringiàna,* Hort, not Champ). Fig 524 A beautiful ornamental-lvd. species, named in 1908 sts. fleshy and crimson-hairy, 18 in. high· lvs hanging much like the Rex varieties, large, obliquely cordate, long-pointed, toothed and serrate, green with crimson nerves above and bright mottled crimson beneath, very showy: fls large for the group, vermilion Sept China B.M. 8202 —It propagates readily from cuttings of both sts. and lvs. It has been hybridized with *B Rex,* producing very richly colored foliage. *B Bowringiana,* Champ B M 5182, is distinct from *B cathayana,* and apparently is not in cult; but the *B Bowringiana* of gardens, as figured in G.C. Apr. 18, 1903 suppl., is the plant here described.

96. **deliciòsa,** Lind Plant the size of *B Rex,* but smooth or nearly so lvs large, obliquely cordate-ovate, many triangular-toothed or -lobed, marked above with many gray blotches, reddish beneath fls in dense clusters, pink, produced in winter Ceylon

97. **lacinìata,** Roxbg Erect, 1–2 ft, becoming straggling, the sts. green lvs roundly ovate, sharply lobed, pubescent, black-purple, with a broad zone of green, reddish on the under side fls as in *B Rex* India, S China. B M. 5021 G C III 34.368 —Odd.

DD. *Whole plant smooth.*

E. *Lvs. thick, broad and entire, often peltate.*

98 **sanguínea,** Raddi. Fig 525 Very smooth and shining. sts perennial, woody at the base, red lvs. 4–6 in long, subpeltate, obliquely cordate, abruptly pointed, thick, fleshy, bright green above. blood-crimson below fls small, white Brazil B M 3520.— A handsome ever-green-foliaged begonia, notable for its brilliant red-lined thick-edged lvs.



525. Begonia sanguinea (×⅛). No. 98.

EE *Lvs medium, stiff, green and shining.*

F. *Fls. white.*

99 **angulàris,** Raddi (*B. zebrìna,* Hort). Smooth, shrubby, very tall (to 8 ft), much branched, the branches spreading or drooping: lvs elongate, ovate-acuminate, shiny dark green, veins white, pale green and reddish tinged beneath, the margins undulate and crenate-serrate: fls small (⅔in. across) and many in large cluster, white. Brazil B.M. 7842.—A striking plant.

100. **ulmifòlia,** HBK. (*Donàldia ulmifòlia*, Klotzsch). Tall, green, the st. 4-angled and grooved, shedding its hairy scurf. lvs. small and elm-like (whence the name), thinly hairy, green on both sides: fls. white, small. Colombia. Gt. 1854:93.—Very free-flowering when grown large, the fls. appearing in winter and early spring.



526. Begonia nitida (×⅓)
No 104

101 **lóngipes,** Hook. Tall and stout (3 ft. or more), the st furrowed and more or less glandular but otherwise the plant green, smooth and shining lvs. ample, reniform or nearly orbicular, oblique or lop-sided, glossy, serrate fls small, white, numerous in a long-stalked cluster, winter-blooming Trop Amer B M 3001.—In some forms, the peduncles are excessively long.

102. **undulàta,** Schott. Plant green and shining, although somewhat hairy when young lvs 2-ranged, oblong, very short-stalked, acuminate, wavy or undulate on the margins. fls. rather small, white, in short axillary clusters, the pistillate ones long Brazil. B.M. 2723

103 **kewénsis,** Hort. Like *B. undulata* slender, with spreading or drooping leafy branches lvs. ovate to cordate-ovate about 6 in. long, smooth and shining, green. fls many, in large clusters, small, white or slightly cream-colored, ½in. across Of garden origin — There is a hybrid between this and *B. coccinea*. A good basket plant.

FF. *Fls. colored.*

104. **nítida,** Dry. (*B. mànor*, Jacq *B. speciósa*, Hort. *B. obliqua*, L'Her.) Fig 526. Smooth: st 3–4 ft high, perennial, fleshy, woody at the base when old· lvs. obliquely ovate, wavy, 4–6 in across, glossy dark green: fls. on long, axillary peduncles, pale pink, with a silvery blush; males 1½ in. across, with 2 broad and 2 narrow petals; females smaller, with 5 equal petals. Jamaica. B.M. 4046. A.G 24.575 Gt. 2:192.—A very useful plant in the greenhouse, flowering all winter. Also interesting on account of being probably the first begonia intro. to cult in Eu (1777, at Kew, by Wm. Brown). Var. **odoràta álba** is a very handsome variety of this species, which has smaller fls. of the purest white and sweet-scented. **Dr. Nachtigal** (*B. nítida* var *odoràta álba* × *B Lyncheàna*), is similar in general form to the latter, but has fls of a delicate rose-pink, especially on the inner surface of petals.

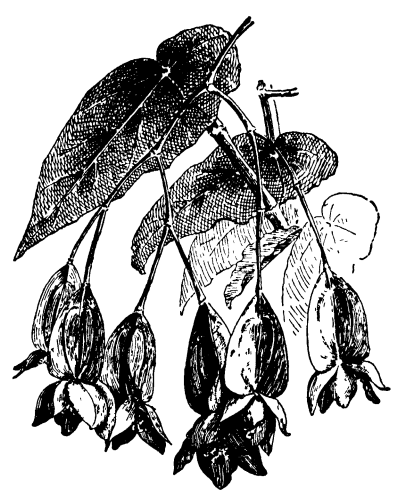
105. **Teùscheri,** Lind. Stout: st. 2–6 ft. high, erect, strong grower. lvs. large, oblique, fleshy, acutely lobed, ovate-lanceolate, margins serrate, bright green above, with large grayish blotches or in one form with dots, red and strongly veined beneath: fls. in axillary clusters, bright red, large. Malaya. I.H. 26.358.

106. **Bismarckii,** Veitch. Lvs. large and lobed, oblique, acuminate-pointed, 6 in. long: fls in drooping clusters, satiny rose, males insignificant, females 1½ in. across and making a gorgeous display.—Very similar to *B. Teuscheri*.

107. **carminàta,** Veitch. A handsome hybrid, the result of a cross between *B. coccinea* and *B. Dregei*: plant erect or nearly so, branching freely st green, shining lvs obliquely ovate-acuminate, deeply toothed, light green fls. rosy scarlet in large pendulous cymes — The male fls do not remain on the plant long, the main feature being the large bright rosy scarlet female fls and their brightly colored ovaries which remain on the plant for a considerable period In this respect it greatly resembles its parent, *B. coccinea* It is a very fine greenhouse plant and should be in every collection.

108 **polyántha,** Hort Sts green, red at the nodes, erect, free-branching lvs elliptic, rich green, glabrous or nearly so; petioles reddish green, 2–3 in long infl. numerous, 10–20-fld ; fls pink, ¾–1 in diam Mex — A strong-growing species of quick growth and producing a mass of charming fls all over the plant in winter and early spring One of the finest and best of the winter-flowering begonias The plants often supplied as *B natalensis* are said to be this species.

109 **coccínea,** Hook (*B rùbra*, Hort *B maculàta* var *corallìna*, Hort.) Fig 527 Smooth sts tall, succulent lvs on short petioles, obliquely oblong, angular, with wavy red margins, 4–6 in long fls deep coral-red; males ½in across, with 4 unequal petals, females more attractive, owing to the length and rich color of the



527. Begonia coccinea (×½). No. 109.

ovary, which has 3 small subequal wings. Brazil. B.M. 3990.—The fls. are very persistent and exceedingly ornamental, especially when planted out. Thrives well in a warm airy greenhouse One of the most attractive and best-known members of the genus. It has been largely used by the hybridist, the well-known

President Carnot being one of its offspring. Intro. from the Organ Mts. of Brazil by William Lobb in 1841.

EEE. *Lvs. medium to large, the margins strongly toothed, incised or lobed.*

F. *Fls. white.*

110. **Madame de Lesseps.** Fig 528. Showy, strong, erect grower: lvs acutely lobed, large, margins serrate, green above, red and strongly veined below. fls. large, white, in axillary clusters, males small. Garden origin.



528. Begonia Madame de Lesseps (×½) No 110

111. **ólbia,** Kerchove. Erect, the st 2–3 ft high lvs lobed, hairy and olive-green above, smooth and red beneath, margins reddish, petioles grooved, smooth, veins prominent as dark lines· fls concealed by lvs., in small clusters directly on the st without peduncles, large, white, male and female in same cluster. Brazil.

FF. *Fls. colored, varying to tinted white.*

112 **argénteo-guttàta,** Hort (*B álbo-pícta* × *B. ólbia*). Fig 529 Profusely branching lvs. shining green, ovate-acuminate, slightly lobed, smooth, 2½ in. wide, 3–5 in long, thickly dotted with white spots· fls in clusters, variable, petals white, tinged with pink. caps. rose-pink —Intro by Lemoine, 1889 Well worth a place in a collection on account of its decorative foliage.

113. **maculàta,** Raddi (*B. argyrostigma*, Fisch.). Very smooth: st erect, 2–3 ft., branching, woody when old lvs. cordate, lanceolate, wavy, 4–6 in long, upper surface sometimes with large white roundish or circular spots. fls. pale rose or white, males with 2 ovate and 2 narrow petals, females with 5 equal petals. It includes several forms. Brazil B R. 666. Var. **argyrostígma pícta,** Hort., is a common form, with very large white spots on the lvs An old greenhouse or conservatory plant. Var. **elegantíssima,** Hort., a variety with more slender habit of growth than the type and only sparingly maculated on the lvs, but forming a large free-branching specimen. Var. **Wrightii,** Hort., a variety with large lvs heavily maculated with white, especially in the young state· infl pendulous, 10–20-fld.; fls. white, an in. diam.; males short lived; females greenish white, remaining on the plant for several weeks.—This variety does not branch very freely as with the preceding variety but has the habit of sending up long stout shoots, 6 or 8 ft. high, from which the fine handsome clusters of fls. hang in the form of a chain —**B. coralìna,** Hort., is a free-flowering form, useful for conservatory, 8–10 ft on rafters lvs. dark glossy green, almost covered with bright coral-red long fls. in large drooping trusses. J H III. 51:339.



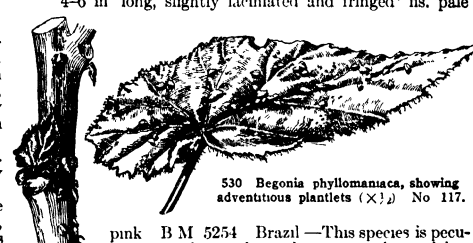
529. Begonia argenteo-guttata (×⅛) No 112

114 **Thúrstonii,** Hort (*B metállica* × *B sanguínea*). Smooth and shiny. st 2 ft. high lvs orbicular-acuminate oblique, rich purple, red on the under side, veins prominent. fls insignificant, small, rosy white, on slender peduncles A F 7 729 —Excellent for bedding on the north side of a building, and as a pot-plant. Originated with C Thurston, Paterson, N J.

115 **díchroa,** Sprague A tall-growing species but often remaining dwarf, woody in lower parts, habit half-pendulous sts green in upper parts only lvs. large for so dwarf a plant, elliptic-ovate, 6–12 in long, rich green, glabrous on both sides, occasionally toothed, prominently veined seedling plants beautifully maculated with white when young but the spotting is entirely lost in the adult stage infl dense, short, hidden amongst the upper lvs, fls large, males occasionally 2 in diam, petals 4, rich brick-red, females smaller, ovaries brick-red shaded with white and prominently winged Brazil B M 8412 —A distinct and handsome species, useful as a basket-plant

116 **coronàta,** Hort (*B carolinaefolia* × *B. polyántha*) St shrubby, coarse, 2–3 ft high, covered with numerous withered stipules lvs large, lobed, on long petioles fls pale pink, with large, somewhat drooping cymes

117 **phyllomaniaca,** Mart Fig 530 Hairy and shaggy. st perennial lvs obliquely cordate, attenuate, 4–6 in long, slightly lacinated and fringed· fls. pale



530 Begonia phyllomaniaca, showing adventitious plantlets (×½) No 117.

pink B M 5254 Brazil —This species is peculiar in producing from the st, petioles and lvs. innumerable buds and small growths. It is one of the most interesting of plants. It is covered with small fls. in early spring

118 **President Carnot,** (*B coccínea* × ———?). Figs 531, 532 Plant, 2–6 ft. high, spreading lvs. ovate-lanceolate, acute-lobed, ribs on the under side red fls in a large cluster; males small, insignificant; females large, bright red-carmine, 2 in long, including caps —A striking and handsome plant and one that should be in all collections. It is of very easy



531. Begonia President Carnot. No. 118

cult. and each shoot bears 1–3 of its immense clusters of brilliant female fls.

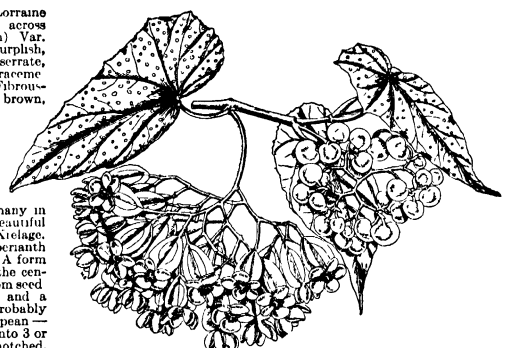
119. **lucérna**, Hort. Fig. 533. Hybrid of exceptional merit, with habit and constitution of President Carnot lvs heavily spotted with white, specially when young. fls. in long pendulous clusters that are often 1 ft in diam.; male fls. 1 in. across; females much larger, with bright pink ovaries, giving the plant a distinctive appearance as they persist for many weeks —The plant succeeds well in a warm greenhouse Should be in every collection. Named for Lucerne, where it originated Intro. to commerce in 1903.

B amábilis, Hort A large-fld form of the Gloire de Lorraine class, the clear brilliant pink blossoms being nearly 1½ in across (Rochford) —*B Balmisiàna*, Ruiz (B populifolia, Kunth) Var. *mitellifòlia*, Dav Tuberous rootstock st simple, erect, purplish, pubescent. lvs reniform, obscurely lobed irregularly serrate, whitish tomentose beneath fls pale rose, in a terminal raceme Mex. R H 1911, p 43 —*B Bárkeri*, Knowl & Wese Fibrous-rooted stiff, erect, sparsely branched sts somewhat woody, brown, densely hairy lvs peltate, ovate, acute, lobed, serrate, 5–7 in. long, light green in color, veins pale yellowish green, petioles long and fairly stout infl large and spreading, freely branched, fls pink, produced in early spring Mex —A distinct and pretty begonia —*B calubárica*, Stapf St short and pro-trate lvs peltate, oblique, broadly cordate-ovate, 2–3 in long, ciliate on margins fls red, small Calabar, W Trop Afr —*B crassicaúlis*, Hort (Lindl ?) Lvs large, nearly circular, coriaceous, clear green fls many in vertical clusters, small, rose-white, the bloom being more beautiful than that of B manicata, which it resembles —*B crispa*, Kielage. Fls large, on long, erect peduncles above the lvs , the 5–8 perianth segms crispate Country unrecorded —*B cristàta*, Hort A form or race of tuberous begonias with a crested outgrowth in the center of the fl the race is fixed and comes more or less true from seed —*B elatior*, Hort Veitch, is a cross between B socotrana and a tuberous begonia —*B Elsmeri*, Hort Of garden origin, probably hybrid fls stellate, large, flesh-colored, in winter European — *B. Faureàna*, Garn Lvs palmately parted to the middle into 3 or 5 main divisions and these divisions again parted or notched, beautifully colored with silvery white on a green ground and with brown-green on the ribs Brazil Intro to France in 1892; named for the former President of France I H 42 34 —Some at least of the B platanifolia of gardens is this species —*B Forgetiàna*, Hemsl Fibrous-rooted nearly 2 ft , more or less branched lvs. fleshy, glossy green, 6–7 in long and 2 in broad. fls pink and white, 1 in across, in clusters Brazil —Named for L Forget, collector for Messrs Sander Allied to B undulata —*B gemmàta*, Hort (B decora × B Rex var) Lvs angled, Rex-like, dotted with silver on a green ground very attractive as a specimen plant. G.



532. Begonia President Carnot (×⅓).

22 123 —*B gigantèa*, Hort Rootstock woody st. 2–3 ft.· lvs. caudate-acuminate, becoming 1 ft. long fls many, small, white or pale pink It is probably a form of garden origin.—*B Gilsonia*, Hort. Plant, 2 ft high st shrubby, coarse lvs large, lobed fls on long, erect peduncles, pale pink —Interesting as being a double-fld. fibrous-rooted begonia Named for Gilson, colored gardener to Mrs Livingston, N. Y —*B Héddei*, Warb Tall, branching lvs. triangular-ovate or broadly elliptic, acuminate, jagged and notched and usually lobed toward the base, green above and red beneath: fls. light rose, borne amongst the lvs German E Afr —*B Ideàla*, Hort Veitch Neat dwarf plant, B socotrana × a tuberous begonia 6 in fls semi-double, 2 in across, brilliant rose, long-lasting winter Gn 61, p 13 R H 1906, p. 131 —*B Kummeriæ*, Gilg Fibrous-rooted st erect and free-branching, green suffused with red lvs ovate, 6 in diam , shining, green veins and petiole red infl short, few-fld , fls. blush-white, tipped with rose, male, ¾in diam , female with bright yellow stigmas, ovary 3-celled bluntly triangular, swelling up to a large fleshy fr some 2 in long Trop. Afr —*B Kunthiàna*, Walp St erect lvs lanceolate, acuminate, serrate, smooth, green above, red below fls white, large B M 5284 Brazil —*B Lehmbachii*, Warb Allied to B Heddei herb, erect, 8–16 in , the sts. fleshy and red lvs oblique, 4–5 in long, irregularly 5-lobed, dentate, light green and somewhat hairy above, red-green beneath. fls. axillary, small, tinted and red-striate German E Afr. Gt. 49 1476 —*B Lindleyana*, Hort.=B incarnata —*B. lobulàta*, A DC Fibrous-rooted erect, branching sts light green lvs highly glabrous, pale green, ovate-acute, serrate, occasionally lobed, prominently veined, 6–8 in long, petiole red infl rather short, densely fld , fls small, white Mex —*B longicyma*, Bellair, is a garden hybrid of B. Schmidtiana and B semperflorens,



533. Begonia lucerna (×⅓) No 119

of the fourth generation much-branching, bushy lvs like those of B gracilis female fls few or none, terminal, males lateral, fls rose-tinted R H 1905, p 582 —*B Martiàna*, Link & Otto Tuberous st 1–1½ ft , with erect branches, glabrous, leafy lvs oblique, cordate-ovate, acuminate, double toothed, 3–6 in long fls solitary or clustered in axils, large, rose-pink, the males 4-merous and females 5-merous Mex Vars *grandiflòra*, *pulchérrima* and *racemiflòra* are known to growers B M 8322 All considered to be forms of *B gracilis* (p 474) —*B Pàtriæ*, Hort A garden hybrid of B socotrana and B Pearcei plant dense and free-flowering, 10–12 in fls many, rather small, bright rose-pink lvs similar to those of B socotrana (Lemoine.)—*B Péggei*, Warb Fibrous-rooted erect or spreading sts terete, woody in lower part, dull brownish green lvs only slightly oblique, elliptic, 4–6 in long, dark green above, suffused with red beneath infl in short axillary clusters, fls small, white veined with red, female with rather narrow petals, ovary distinct terete, not winged, bright red, 1–2 in long whole plant covered with rufous hairs A remarkably distinct begonia, but of little horticultural value —*B prunàta*, A DC. St erect or spreading, seldom branched, covered with greenish white spots lvs peltate, fleshy, on long terete petioles, spreading or erect, blades broadly ovate, lobed and undulate, dark green above, with prominent veins of a greenish yellow color, and dull grey beneath infl erect, large, branching freely, fls pure white. Costa Rica A fine winter-flowering species —*B pyramidalis*, Lemoine B manicata × B. carolinæfolia lvs. large, palmate, entire, thick, brilliant green fls large, in panicles, white-rose or rose-tinted —*B Queen* A garden hybrid, fibrous-rooted erect with brilliant-colored foliage sts. green, terete lvs. ovate-acuminate, undulate, finely serrate, upper side a brilliant purple-red, the veins being green, under side bright red fls rosy red seldom produced One of the finest and most ornamental of the fibrous-rooted begonias It is somewhat difficult to grow into a large specimen and should be kept slightly drier at the roots than most plants of this section —*B Reichenhèimii*, Hort (B rubella × B heracleifolia) Lvs all basal, large and long-petioled, parted to the middle fls on sts. upright above the lvs Gt 52, p 207.—*B Róchfordii*, Hort , is a bright rosy carmine begonia of the Gloire de Lorraine type, with larger fls. and foliage. F E. 31 (1911), p 434.—*B. Saúlii*, Hort , named for the

late John Saul, was intro. from Guatemala resembles B. Feastii in the shape and color of its lvs, but with a distinct red sinus at junction of petiole with lf. Probably not now cult. under this name.—*B. scéptrum*, Hort. Erect, sparsely branched sts. light brown colored with red on young growth. lvs. large, broadly ovate, deeply lobed, margins serrate, pale green suffused with red and irregularly blotched with white, prominently veined on the underside, petioles bright red. fls. 10–20 in a cluster, pink or white.—*B. stigmósa*, Lindl. St. a short, creeping rhizome. lvs. large, cordate-acute, irregularly toothed, smooth above, hairy beneath, green, with purple-brown blotches. fls. insignificant, white, in cymose panicles. Mex.—*B. Sturzii*, Hort. A floriferous form of B. semperflorens, with rose-pink fls. in broad panicles, and lvs. white-spotted.—*B. subpeltàta nigricans*, Hort. (B. nigricans, Hort.) Plant 2–3 ft. high. lvs. ovate, acuminate, blood-red below, silvery and slightly hairy above, 4–8 in. long, 2–4 in. across. fls. rose-pink, profuse. caps. wings equal, pink. Very useful for decoration. Var. *Pres de Boureuilles*, Hort., has lvs. of a much richer color, and more profusely studded with red hairs. fls. of a deeper pink.—*B. Témpleri*, Hort. Sport from B. phyllomaniaca var. variegata; differs in having its regular blotches over the face of the lvs. varying from true yellow to light sulfur-color, often with blending of shades of pink. 2½–3 ft. lvs. oblique, the margins ruffled and fringed. Originated with H. G. Wolfgang, of the Templin Co., Calla, Ohio, and put in the trade in 1905. F.E. 18:258.—*Tree*. A group of large-growing begonias produced by Mrs. Theodosia B. Shepherd, Calif. Some of them are described as a cross of Gloire de Jouy by Rubra, having the cane-like growth of Rubra (*B. coccinea*), with its long-stemmed fls. but larger sepals and petals, lvs. illuminated with red, terra-cotta, pink and yellow. Other giants are seedlings of Pink Rubra, with stronger canes, larger lvs., and more beautiful fls., the lvs. on young growth spotted with silver (Princess Alice, Rubra Bamboo, Striking Beauty, Hebe and others, are of this parentage).—*B. unifòlia*, Rose. A singular begonia from Mex., recently described (Rep. Mo. Bot. Gard., 1904, p. 79, Fig. 28). tuberous-rooted. lf. 1, lying on the ground, sessile, nearly orbicular, double-toothed. fls. on slender scape to 2 ft. high, nearly white. Not in the trade.—Voss has called the hybrids of the rhizomatous group *B. rhizohybrida* and of the fibrous-rooted upright caulescent group *B. caulohybrida*, these names represent such various and often unlike forms that they will probably have little application in common practice, although useful for taxonomic purposes.

L. H. B.

BELAMCÁNDA (East Indian name) *Iridàceæ*. BLACKBERRY LILY. LEOPARD FLOWER. A hardy, herbaceous perennial, which is an old garden favorite. The first of the popular names comes from the clusters of shining black roundish seeds, and the second from the flower, which is orange, spotted red. It is more commonly sold as a Pardanthus, which also means leopard flower.



534. Belamcanda chinensis (×⅓)

Perianth segms. oblong, the 3 inner slightly shorter and spirally twisting as they fade. stamens in one group only at the base. caps pear-shaped, the valves ultimately falling away. Prop. by seeds or by division. Of easy culture in rich, sandy loam and in a sunny place. Sometimes, but incorrectly, spelled Belemcanda. One species.

chinénsis, DC. (*Gemmingia chinénsis*, Kuntze. *B. punctàta*, Moench. *Ixia chinénsis*, Linn. *Morèa chinénsis*, Thunb. *Pardánthus chinénsis*, Ker. *P. sinénsis*, Van Houtte.) Fig. 534. Height 2–3 ft.: rootstock short, stoloniferous. lvs. about 6, equitant, striate, 1–1½ ft. long, 1 in. broad: outer spathe-valves ½–1 in. long: pedicels 1–2 in. long: caps. 1–1½ in. long; valves reflexing, persistent. China and Japan. B.M. 171 (as Ixia). F.S. 16:1632. L.B.C. 19.1874.—The seed-stalks are sometimes used with dried grasses for decoration. It is said that the birds sometimes mistake the seeds for blackberries. N. TAYLOR †

BELGAUM WALNUT: *Aleurites*

BELLADONNA: *Atropa*

BELLADONNA LILY: *Amaryllis*

BELLFLOWER: *Campanula*

BELLIDIÁSTRUM (*daisy* and *star*), is now referred to Aster. **B. Michélli,** Cass. (*Aster Bellidiástrum*, Scop.), is a small European composite, 1 ft., perennial, with white heads single on naked scapes and lvs. in a rosette, sometimes planted but probably not in Amer.



535. Bellis perennis (×½)

BÉLLIS (Latin, *bellus*, pretty) *Compósitæ*. ENGLISH DAISY. The true daisy, a low perennial with single heads on scapes, planted in borders and edgings and naturalized in grass land. Fig. 535.

The daisy, as it grows wild in England, has a yellow center, surrounded by numerous rays in a single row, but the favorite cult. forms are double, the rays rising in tier upon tier, and frequently crowding out every trace of a yellow center. The English daisy is essentially a pink or pinkish fl. in its general effect, the tips of the rays sometimes and the under surfaces usually being pink or red. There are about 10 species in the genus, only one of which is American. *B. integrifolia* is found in moist soil from Ky. and Tenn. to Ark. and Texas, but is too rare and sectional to become a general favorite. The plant that is most commonly called daisy in Amer. is *Chrysanthemum Leucanthemum*. For a list of the various plants known as daisies in Amer., see *Daisy*.

Daisies are favorite border plants, and are much used in spring bedding, especially for edging. They thrive in a cool soil and moist atmosphere, and are, therefore, much better adapted to English than American gardens. They can be grown, however, in a cool greenhouse where they will flower profusely during February and March. Although the English daisy is a perennial, it can be very easily grown as an annual. A light mulch is desirable for winter protection. In home gardening, the plants, after flowering, are divided into single crowns. These are planted about 6 inches apart in good rich garden soil. Each crown soon sends out side growths, which, in time, form new crowns. Before winter sets in the young clumps can be moved readily to any place in the garden in which they are wanted to bloom. Daisies are also forced by florists for winter bloom. When daisies are desired for edging spring flower-beds, the clumps are divided into single plants during the previous September, or early enough to allow the new plants to get a firm hold before winter, and are placed 3 inches apart in a narrow trench. These edgings must be renewed each year, as the plants, if they grow well, spread too wide, or irregularly. In dry summers many roots fail, and if they remain in the same spot year after year, the flowers will degenerate to the single condition.

The simplest way of propagating and growing English daisies for spring bedding in this country is to

sow the seed in shallow boxes about August 10. As soon as large enough to handle, transplant 5 inches apart into coldframes, and when the winter sets in put on the sash, giving air whenever the weather may be mild. Transplant to the flower beds as early as possible in the spring, where in a very short time they will be a mass of bloom, and will continue to bloom till the beginning of June, when they should be thrown out, and the summer bedding plants put in. Longfellow and Snowball are the two best varieties for this purpose. *Myosotis alpestris* and *Silene pendula* may be grown the same way, using the daisies as edging when in the beds, and the others as center pieces

The daisy is propagated by seeds (which are sown early), and by divisions, the choicest varieties being maintained by the latter method The main types grown from seed are the white, rose, quilled, and white with red center, all of which are double A dark red is less common. Of kinds propagated by seed, Longfellow is now the best rose-colored, and Snowball the best white variety, the latter being especially prized by florists for cut-flowers, as it has long, stiff stems. Other varieties are Maxima, Snowflake, and Rob Roy, which is perhaps the best red

perénnis, Linn. True or English Daisy. Hardy herbaceous perennial, 3–6 in high· lvs clustered at the root, spatulate or obovate fls 1–2 in across, solitary, on hairy scapes Apr.–June W Eu , escaped in Calif ; rarely runs wild in the eastern states B M. 228. F.S 6.584, which shows 11 well-marked types —An interesting but not permanent form is the "hen-and-chickens daisy," in which a number of small fl.-heads are borne on short stalks springing out of the main fl.-head Cockscomb forms, in which several scapes unite to produce a monstrous fl , are sometimes seen, but cannot be perpetuated The rays are sometimes wholly incurved, or reflexed, or quilled Other English names of the daisy are herb Margaret, ewe- or May-gowan, childing daisy, bone- or bruisewort, bone flower, March daisy, bairnwort.

J. B. Keller, E J. Canning, and Wilhelm Miller.

BÉLLIUM (from its resemblance to *Bellis*, the daisy). *Compósitæ* Miniature plants, sometimes planted in rock-gardens.

Leaves crowded or in a rosette, from which arise scapes bearing a single daisy-like head or "flower," white, with light yellow disk differs from Bellis largely in its pappus, which is unequal and double, of bristles and scales.—Four to 6 species in the Medit. region, annual and perennial. Require treatment given rock-plants and sod-plants

bellidioides, Linn Annual, 2 in , with creeping stolons lvs spatulate: heads white, all summer.—Like a miniature daisy. Apparently little known in this country.

L. H. B.

BELLWORT: In England, any member of the *Campanulaceæ*. In America, *Uvularia*

BÊLOU (Brahman name for the Bael fruit). *Rutàceæ*, tribe *Cítreæ* An older name for Ægle, recently reinstated by American taxonomic botanists. See description under *Ægle*

B Mármelos, A B Lyon.=Ægle Marmelos, the Bael fruit of India *B. glutinòsa*, Skeels=Chætospermum glutinosa, Swingle

BELOPERÒNE (name refers to the arrow-shaped connective). *Acanthàceæ* Hothouse evergreen shrubs of the Justicia group, rarely seen in cult and apparently not in American trade Lvs entire· fls usually red or purple, mostly in showy-bracted axillary or terminal clusters; corolla-tube narrow, often long, the limb 2-lipped; stamens 2, affixed on the tube, style filiform, entire or slightly 2-lobed· fr an oblong or ovoid caps — About 30 species inhabiting Trop Amer , of which 2 or 3 are listed as cult. plants. **B. violàcea,** Planch. & Lind., has lanceolate-acuminate lvs and violet-purple fls. B M 5244. **B. oblongàta,** Lindl., has oblong-lanceolate lvs. and axillary spikes of rose-purple fls. B R. 1657. A recent species is **B. angustifòlra,** Stapf, resembling *B. violacea*, with oblong-elliptic lvs. and a very narrow corolla-tube with a violet-purple limb.

BELVIDERE, or SUMMER CYPRESS: *Kochia.*

BENE: *Sesamum*

BENI, JAPANESE: *Caroyptería Mastacanthus.*

BENINCÀSA (name of an Italian nobleman). *Cucurbitàceæ*. Annual running squash-like herbs grown sparingly for the edible fruits

Leaves 5-lobed soft-hairy· fls solitary, yellow, monœcious, the staminate long-peduncled, the pistil-



536. Benincasa hispida

late nearly sessile; corolla deeply lobed; tendrils 2–3-branched —Two species in Trop. Asia.

hispida, Cogn (*B cerífera*, Savi) Fig 536 Wax Gourd. White Gourd of India Zit-kwa Chinese Preserving Melon Chinese Watermelon Vine long, like a muskmelon, hairy, with cordate lobed lvs : fr mostly oblong, 10–16 in long, hairy, white-waxy, with solid white flesh and small cucumber-like seeds. Cult the same as muskmelon or cucumber R H 1887 540 —Used for making preserves and sweet pickles; said to be eaten raw in warm countries, and the unripe frs. to be employed by natives in India in the making of curries.

L. H. B.

BENJAMIN BUSH: *Benzoin æstivale.*

BENT-GRASS: *Agrostis.*

BENTHÁMIA: *Cornus*

BENTÍNCKIA (named for Lord Bentinck, governor of Madras, 1803–1805). *Palmàceæ*, tribe *Gèonomeæ*. Tall stately unarmed palms, with equally pinnate, terminal leaves, not as yet well known to the trade, but deserving greater attention.

Leaves of many lfts which are usually 2-lobed at the apex spathes many, the 2 lower short and incomplete, spadix arising from among the lvs , branched, fls small, monœcious or polygamous. fr small, almost round, with a single seed pendulous from the top of the cavity. —There are only 2 species, both Indian. G.C II 22.595

The following is a graceful palm "in general appearance not unlike the coconut palm, than which it is, however, much more graceful." The young leaves for the first year are bi-partite, quite like young coconut palms

They should be grown in a warmhouse, never less than 60°, and should be given plenty of water at all seasons A mixture of rich loam and peat or leaf-mold, half and half, makes the best medium for growth.

nicobàrica, Becc Orania St 50–60 ft , solitary, usually from 7–10 in. thick lvs 5–8 ft. long, lfts 1–2 ft., sessile, linear and leathery, the tips distinctly 2-lobed; petiole and **rachis** glabrous, the former short:

spadix 1½–2 ft., many times branched, the branchlets inserted in woolly grooves. fr. about as large as a cherry. India. R.H. 1896, p. 249. N. TAYLOR.

BÉNZOIN (of Arabic or Semitic origin, meaning *a gum* or *perfume*). Syn., *Lindera Laurâceæ*. Ornamental woody plants, grown chiefly for their handsome aromatic foliage, some species also for their early yellow flowers and the brightly colored fruits in autumn

Aromatic shrubs or trees. lvs alternate, entire or 3-lobed, deciduous or persistent fls. polygamous or dœcious, apetalous, small, in axillary clusters with an involucre of 4 deciduous scales; sepals 6, rarely more; staminate fls with 9 stamens, pistillate with a globose ovary and 9–15 staminodes. fr a 1-seeded drupe —About 60 species, if Daphnidium and Aperula are included, in Temp and Trop. E and Cent Asia and in N. Amer

Some Asiatic species yield an odorous oil used in perfumery The cultivated species, with the exception of *B gracile*, are deciduous shrubs, with yellow flowers in small clusters before the leaves and red or black fruits in autumn. *B æstivale* is hardy North and *B obtusilobum* has proved hardy at the Arnold Arboretum in a sheltered position, *B hypoglaucum* is of about equal hardiness, the other species are more tender

They thrive best in peaty or sandy and moist soil Propagation is usually by seeds, which must be sown after maturity, as they soon lose their vitality; also by layers, which root best in peaty soil; of greenwood cuttings under glass, one-half may be expected to root. The benzoin of the druggists is a balsamic resin obtained from *Styrax Benzoin*

æstivàle, Nees (*Bénzoin Benzoin*, Coulter *B odoríferum*, Nees *Lindera Benzoin*, Blume) SPICE BUSH BENJAMIN BUSH WILD ALLSPICE FEVER BUSH Fig 537 Shrub, 6–15 ft, nearly glabrous: lvs. oblong-obovate, finely ciliate, bright green, pale beneath, 3–5 in long fls yellow, before the lvs berry red, oblong, spicy New Eng. southward and west to Kan Em 365.—The bark is aromatic, stimulant, tonic, astringent, the fr is likewise used medicinally. The shrub is attractive in early spring with its yellow, small, but numerous fls, and handsome in autumn with its foliage turning clear yellow and studded with the scarlet frs



537
Benzoin æstivale.
(×½)

B grácile, Kuntze (Daphnidium gracile, Nees) Lvs ovate, 3-nerved, chartaceous, persistent Habitat unknown Stove plant —*B. hypoglaucum*, Rehd (Lindera hypoglauca, Maxim B hypoleucum, Kuntze) Lvs penninerved, glaucous beneath clusters few-fld, with or before the lvs berries black Japan —*B. melissifólium*, Nees Allied to B æstivale Branches pubescent lvs. oblong, downy beneath Southern states B M 1470 —*B obtusilobum*, Kuntze Large shrub with very handsome foliage lvs 3-nerved, ovate or 3-lobed, grayish green and nearly glabrous beneath, 2 1½ in long clusters many-fld berries black Japan. G F 6 205 S I F 1 44 —*B précox*, Sieb & Zucc Lvs penninerved, elliptic-oblong, greenish beneath, acuminate clusters few-fld, before the lvs berries brownish, ½in diam Japan S I F. 2 19 —*B sericeum*, Sieb & Zucc Lvs penninerved, grayish pubescent beneath clusters many-fld, with the lvs Japan

ALFRED REHDER

BERBERIDÓPSIS (from *Berberis* and Greek *opsis*, *likeness*) *Flacourtiàceæ* Ornamental shrub cultivated for its crimson flowers and evergreen foliage.

Branches slender, terete. lvs. alternate, petioled, dentate fls perfect, long-pedicelled, in terminal racemes; bracts, sepals and petals gradually passing into one another, 9–15, the inner ones concave, larger, stamens 7–10 with very short filaments; ovary superior, 1-celled with many ovules, style short, with 3-lobed stigma. fr. a berry.—One species in Chile

This is a low, glabrous, slightly climbing shrub, with deep green foliage and crimson flowers in drooping racemes, for temperate regions or the cool greenhouse, growing in almost any soil Propagation is by seeds sown in spring, by greenwood cuttings in spring, or by layers in autumn

corállina, Hook Lvs cordate, oblong-ovate, coarsely spinulose-dentate, 2–3 in long fls globose, over ½in. long, crimson, in many-fld bracteate racemes B M. 5343 F S 20 2137 F.W 1875 97 G 2·547 32 175. H F 1863.148. ALFRED REHDER

BÉRBERIS (Arabic name) *Berberidàceæ* BARBERRY Ornamental deciduous or evergreen shrubs, cultivated for their handsome foliage assuming in most species brilliant autumnal tints, and for their bright yellow flowers and attractive fruit

Spiny shrubs with yellow inner bark and wood lvs alternate, often fascicled, usually glabrous, simple, deciduous or evergreen fls in elongated or umbel-like, rarely compound racemes, or fascicled or solitary, sepals 6 with 2 or 3 bractlets below, petals 6, often smaller than sepals and usually with 2 glands near the base, stamens 6, included, the anthers opening with valves, ovary superior, 1-celled, with 1 to many ovules fr a berry with 1 or several oblong seeds —Nearly 175 species in Amer from Brit Col to Patagonia, in Asia, Eu, and N Afr Monogr by Schneider in Bull Herb Boissier, Ser II. 5 33, 133, 391, 449, 655, 800, 813 (1905) Mahonia is now considered by most botanists as a distinct genus, differing from the true barberries by the pinnate lvs, by the racemes appearing in the axils of the bud-scales and by the spineless branches The spines of the barberry are, morphologically, lvs, and the lvs are borne on short branches in their axils (Fig 538) The stamens are sensitive, when the filaments are touched with a pin, the fls first open, and the stamens fly forward upon the pistil ALFRED REHDER

The different species of hardy deciduous barberries are excellent decorative shrubs with pleasing habits of growth The flowers of most of them in spring and early summer, whilst not conspicuous, are very attractive, and the fruits of nearly all are highly ornamental in late summer, fall and early winter on account of their red, dark blue or nearly black color *Berberis amurensis*, *B sinensis*, *B. diaphana*, *B Poiretii*, *B Regeliana*, *B. Sieboldii*, and *B Thunbergii* all assume brilliant fall colors in varying shades of orange and red Some species, as *B Thunbergii*, *B Sieboldii*, and *B Rehderiana*, retain their bright red fruits unchanged until the following spring, while the fruits of the other species shrivel and dry up during the winter

Berberis aristata is the strongest-growing species and attains a height of 12 to 13 feet in twenty years, with gracefully arching branches, and has violet-red fruits, the thickish leaves are semi-persistent *B. canadensis* forms a neat compact bush 3 to 3½ feet with upright spreading branches. The small clusters of bright red fruits are very attractive This is a rare shrub in cultivation, and *B. vulgaris* has often been sold for it *B sinensis* is a neat, graceful shrub with pendulous branches 3½ to 4 feet and bears numerous clusters of bright red fruits. *B diaphana* forms a dense compact shrub 2½ to 3 feet, but its chief decorative value is in its rich fall coloring, as the solitary flowers and fruits

are inconspicuous. *B Regeliana* has an upright dense habit, and grows from 5 to 6 feet. It has the largest leaves of any of the deciduous species, and the orange-red fruits are remarkably ornamental throughout late summer and fall, until midwinter. This is perhaps the most beautiful barberry in cultivation. *B Sieboldii* is slow-growing, but is a very choice species. The habit is upright and compact, and the fall coloring is brilliant The small vermilion-red fruit-clusters are very attractive *B vulgaris*, which is commonly grown and has become extensively naturalized, has large clusters of brilliantly colored fruits, and is a most useful shrub in border plantations It is prolific in many varieties Perhaps the most distinctive form is the one with yellow fruits, which are usually seedless, or, if the seeds are present, they are abortive. This species makes a good hedge plant as does also *B. amurensis*, for low ornamental hedges, *B Thunbergii* is excellent Since it makes a rather broad hedge, the plant is most beautiful when it is not necessary to trim it *B Wilsonæ* is a small beautiful shrub, 2 to 2½ feet with slender branches and small leaves. The coral-red fruits are very distinctive The tips of the branches usually are winterkilled, but the plants recover rapidly in summer.

Few of the evergreen species are dependable in the northeastern states. *B Sargentiana*, a handsome shrub, attaining a height of about 6 ft, with rather large oblong leaves, has proved quite hardy, and *B. buxifolia*, *B. stenophylla* and *B verruculosa* nearly hardy in Massachusetts. *B. Neubertii* rarely has the leaves scorched by winter's cold, but is very slow-growing. For other evergreen species, see *Mahonia* (formerly included in Berberis)

The root and the inner bark of several species are sometimes used for dyeing yellow Some species have medicinal properties The fruits of *B vulgaris* are made into jelly In wheat-growing districts, planting of Berberis should be avoided, as it is the host of the æcidium stage of *Puccinia graminis*, a fungus which causes the wheat-rust Destroying the Berberis, however, will not check the propagation of the fungus, as it is able to grow and to spread for years without forming the æcidium stage

To secure the best results from most of the barberries, they should be planted in moist, light loam, well drained The deciduous species, however, can be grown in drier situations

Barberries germinate readily from seeds The seeds should be separated from the pulp by maceration and sown in "flats" or broadcast in beds in the fall, and they will germinate the following season The seeds of rare and scarce species should be sown in the greenhouse where they will germinate during the winter *Berberis Wilsonæ* will germinate in two to three weeks in the greenhouse if sown as soon as ripe Some of the species cross when grown together, but *B sinensis*, *B Regeliana* and *B. vulgaris* appear to come true The progeny of *B. Thunbergii* sometimes seem to show that they have been affected by the pollen of *B vulgaris*.

Most of the barberries can be propagated from the green cuttings of the young wood taken from the first to the middle of June, and placed in sand in a shaded hotbed in precisely the same way as lilacs, viburnums or hydrangeas are treated This is the best way to perpetuate individuals of strikingly characteristic habits A very small percentage of the cuttings of the ripe wood placed in the greenhouse in the fall will "strike," but not enough to pay Some species may be propagated by suckers Rarer kinds and varieties are sometimes grafted on *B vulgaris* or *B Thunbergii*, in August or September under glass, or in early spring in the greenhouse Grafting, however, is not to be recommended, for the stock usually throws up suckers which are often overlooked on account of the similarity of the foliage of many species; they will overgrow the cion in a short time and smother it. A good plan is to use the purple-leaved barberry as a stock; the suckers are thus easily noticeable and may be removed in time.

JOHN DUNBAR.

INDEX.

alba, 1
albicaulis, 16
albo-variegata, 1
amurensis, 2, 3
angulosa, 5
angustifolia, 10
approximata, 16
aprena, 1
aristata, 4, 30
asiatica, 29
asperma, 1
atropurpurea, 1
aureo-marginata, 1.
buxifolia, 18
canadensis, 5
carolinana, 5
chitria, 30
concinna, 21
congestiflora, 26.
coraria, 4
Darwinii, 28
Dawsonii, 14
diaphana, 17.
dictyophylla, 16.
dulcis, 1, 18
edulis, 1
empetrifolia, 19.
epruinosa, 16.
floribunda, 4.
Francisci-Ferdinandi, 9
Gagnepainii, 23
Guimpelii, 11
hakeoides, 26
Hakodate, 3
heteropoda, 12
hypoleuca, 29
iberica, 11
ilicifolia, 27, 31.
integerrima, 13
japonica, 3
koreana, 6
latifolia, 31.
leucocarpa, 1
levis, 24
lutea, 1
macrocarpa, 1
macrophylla, 1
Maximowiczii, 14.
minor, 14
Neubertii, 31
nigra, 1
nummularia, 13.
pluriflora, 14
Poiretii, 10
polyantha, 8.
purpurea, 1
Regeliana, 3
sanguinolenta, 11
Sargentiana, 25.
Sieboldii, 3, 7.
sinensis, 10, 11
spathulata, 11
stenophylla, 20.
Thunbergii, 14
verruculosa, 22
violacea, 1
vulgaris, 1, 2, 3
Wilsonæ, 15
xanthocarpa, 1
yunnanensis, 17.

KEY TO THE SPECIES

A *Foliage deciduous, lvs membranous or chartaceous*
B. *Fls in elongated racemes or panicles (few-fld peduncled umbels in No. 7).*
C *Lvs dentate or serrate*
D *Infl simple, racemose*
E *Branches of last year gray, except those of the purple-lvd form of No 1*
F. *Texture of lvs rather thin, not distinctly reticulate beneath*
G *Shape of lvs generally obovate, setulose-dentate* 1 **vulgaris**
GG. *Shape of lvs oblong or elliptic, densely ciliate-dentate* 2 **amurensis**
FF. *Texture of lvs firmer than in* F, *distinctly reticulate beneath, often obtuse* 3 **Regeliana**
EE. *Branches of last year reddish brown or yellowish brown*
F *The lvs spinulose-dentate*
G *Fr purplish blue, oblong-ovoid, longer than the stout peduncls racemes longer than the lvs* 4 **aristata**
GG *Fr red, short-ovoid, shorter than the slender peduncls*
H *Breadth of lvs ⅓–¾ in., oblong-obovate to obovate, scarcely reticulate* 5 **canadensis**
HH *Breadth of lvs ¾–1½ in, usually obovate, reticulate, rounded at the apex* 6 **koreana**
FF *The lvs densely setose-ciliate, oblong racemes umbel-like, 3–6-fld* 7 **Sieboldii**
DD *Infl compound, paniculate, 2–6 in long*
E *Branches angled, grayish brown lvs rounded at the apex, subcoriaceous* 8 **polyantha**
EE *Branches nearly terete, brown lvs acute, thin* 9 **Francisci-[Ferdinandi**
CC. *Lvs. entire, at least those of the flowering branches*
D. *Fr red or purple lvs narrow-obovate or oblanceolate, acute or acutish, bright green*
E. *Bracts at least half as long as the short pedicels lvs green beneath, usually narrow-oblanceolate, entire* 10. **Poiretii**

EE. *Bracts much shorter than the elongated pedicels· lvs grayish or bluish gray beneath, those of the shoots often spinulose, broader* . 11. **sinensis**
DD. *Fr bluish or purplish black, bloomy lvs usually grayish or bluish green, broadly obovate to oblong-obovate.*
E *Racemes short, usually 5–7-fld branches slightly angular ovules slender-stalked* 12 **heteropoda**
EE *Racemes many-fld, dense branches terete ovules short-stalked* 13 **integerrima**
BB. *Fls solitary or sometimes in few-fld. umbels or in dense fascicles (in a variety of No 14 in 3–10-fld short racemes)*
C. *Lvs. always entire*
D *Young branchlets glabrous lvs not reticulate, generally obovate, ½ 1½ in long fr scarlet, rather dry* 14 **Thunbergii**
DD. *Young branchlets puberulous lvs reticulate, generally oblanceolate, ¼-1 in long fr salmon-red, juicy* 15 **Wilsonæ**
CC. *Lvs partly dentate, partly entire*
D *Pedicels ¼in long lvs chalky white beneath, not reticulate, less than 1 in long fr ⅓in long* 16 **dictyophylla**
DD. *Pedicels ¼in long, fls nodding lvs glaucous beneath, reticulate, more than 1 in long fr. nearly ½in long* 17 **diaphana**
AA. *Foliage persistent or half-evergreen*
B. *Lvs entire*
C *Shape of lvs obovate or elliptic fls solitary, long-pedicelled* 18 **buxifolia**
CC *Shape of lvs narrow-oblong to linear, revolute at the margin*
D *Fls 1 2, long-pedicelled lvs linear* 19 **empetrifolia**
DD *Fls 2–6, in peduncled umbels lvs narrow-oblong* 20 **stenophylla**
BB. *Lvs dentate*
C *Fls in fascicles or solitary*
D *Lower surface of lvs white or glaucous, ½–1 in long fls 1–2*
E *Branchlets angled, smooth* 21. **concinna**
EE *Branchlets terete, densely verruculose* 22 **verruculosa**
DD *Lower surface of lvs green fls several to many*
E *Shape of lvs oblong to narrow-lanceolate, with many teeth*
F. *Texture of lvs rather thin, lvs usually about ½in broad, indistinctly veined*
G *Pedicels slender, ½–1 in long, fls 3–8 lvs with 8–20 teeth on each side fr bluish black, bloomy* 23 **Gagnepainii**
GG *Pedicels ¼-⅓in long, fls many lvs with 5–12 teeth on each side fr jet-black* 24 **levis**
FF *Texture of lvs thick and firm, lvs ¼ 1¼ in broad fls many, pedicels about ½in long fr black* 25 **Sargentiana**
EE *Shape of lvs roundish to elliptic, with 3-6 teeth fls in dense globose clusters* 26 **hakeoides**
CC. *Fls in racemes or panicles*
D. *Branches spiny, young branchlets pubescent or puberulous lvs. always simple*
E. *Racemes simple*
F. *Ovary with long style lvs. green beneath*
G. *Branchlets puberulous. lvs 1-2 in long racemes shorter than lvs, 4–10-fld* 27 **ilicifolia**
GG. *Branchlets hairy lvs ½–1½ in long. racemes longer than lvs, many-fld* . . 28. **Darwinii**
FF. *Ovary with short style. branchlets puberulous lvs. whitish beneath, 1–2½ in long* 29 **asiatica**
EE. *Racemes compound lvs. obovate-oblong, with few teeth above the middle or entire, 1–2½ in long* 30 **chitria**
DD *Branches spineless, glabrous lvs occasionally 3-foliolate, half-evergreen* 31 **Neubertii**

1 **vulgàris,** Linn COMMON BARBERRY. Fig 538. From 4–8 ft, rarely 15 branches grooved, gray, upright or arching lvs oblong-spatulate or obovate, setulose-dentate, pale or grayish green beneath, membranous, 1–2 in long, racemes pendulous, many-fld, fls. bright yellow fr oblong-ovoid, scarlet, finally purple May, June fr Sept, Oct Eu to E Asia, escaped from culture and naturalized in E N Amer Gn 35·264 — Handsome in spring, with its golden yellow fls and light green foliage, and in fall, with its bright scarlet frs, remaining through the whole winter. A very variable species Of the many garden forms, the most effective is var. **atropurpùrea,** Regel (var *purpùrea*, Hort, not Loud, which is a form with purple fr), with purple-colored lvs (Gt 9 278, 1), little different is var **macrophýlla,** Kew Bull (*B vulgàris foliis purpùreis macrophýlla*, Paul & Sons), with larger lvs of deep purple color Other varieties are· Var. **álbo-variegàta,** Zabel, lvs variegated with white, rather small; Var **aûreo-marginàta,** Zabel, lvs with yellow margin, rather large, var **álba,** Don (var *leucocárpa*, Hort), white-fruited, var **aspérma,** Don (var *apyrena*, Hort), seedless, var **dúlcis,** Loud (var. *edùlis*, Hort), less acid, var. **lùtea,** Don (var *xanthocárpa*, Hort), yellow-fruited; var **macrocàrpa,** Jaeger, with larger fr The forms with black or purplish blue fr, as var *nìgra*, Don, and var *violàcea*, Don, do not belong here, but are either hybrids or belong to other species.

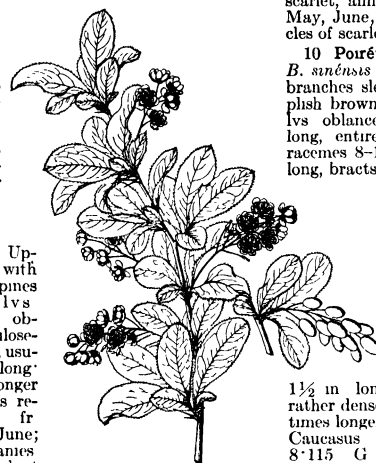


538. Berberis vulgaris (×½) **Showing the spines and foliage.**

2 **amurénsis,** Rupr (*B. vulgàris* var *amurénsis*, Regel) Three to 8 ft branches straight, gray, upright, grooved lvs cuneate, oblong or elliptic, densely ciliate-dentate, slightly reticulate and bright green and lustrous beneath, 1–3 in. long· racemes upright or nodding, 6–12-fld., about as long as lvs fr oblong-ovoid, scarlet. May· fr Sept Manchuria, N. China Gng 5 119. G W 7, p 413 See page 3566

3 **Regeliàna,** Koehne (*B. vulgàris* var *japónica*, Regel *B amurénsis* var. *japónica*, Rehd *B japónica*, Schneid, not DC *B Sieböldii*, Hort, not Miq *B. Hakodàte*, Hort) Fig 539 Upright shrub, to 6 ft · branches gray, grooved. lvs. elliptic-oblong and acute, or obovate or obovate-oblong and obtuse, 1–2½ in. long, setulose-dentate, often rather densely so, pale or grayish green and distinctly reticulate beneath, of firm texture· racemes upright or nodding, 6–12-fld., shorter or about as long as lvs fr oblong-ovoid, scarlet, with slight bloom. May, June fr Sept., Oct Japan. G F. 3 249 (adapted in Fig 539). A.G. 18:454.

4. **aristàta,** DC. (*B. coriària,* Royle. *B. floribúnda,* Wall.) Shrub, to 8 ft: last year's branches yellowish brown, slightly angular; spines mostly simple· lvs elliptic to ovate-oblong, acute or obtusish, spinosely dentate, occasionally entire, 1–2½ in long, of firm texture at maturity. racemes 10–25-fld., sessile, usually spreading and stout· fr nearly ½in long, longer than the stout pedicels, bright red, finally bluish purple and bloomy; stigma on a short distinct style June; fr Sept, Oct Himalayas. B R 27·46.—Hardy at the Arnold Arboretum Hybrids occur with *B vulgaris*



539 Berberis Regeliana. (×⅓)

5. **canadénsis,** Mill. (*B. carolinìana,* Loud *B angùlizans,* Hort.). Upright shrub, 1–3 ft, with arching branches· spines small, 3-parted· lvs cuneate-oblong to obovate, remotely spinulose-dentate, rarely entire, usually obtusish, 1–2 in long· racemes many-fld, longer than the lvs; petals retuse or emarginate fr ovoid, scarlet May, June; fr Sept, Oct Alleghanies G W. 1·101.—The plant sold under this name is usually *B vulgaris.* Lower and more graceful than *B. vulgaris,* the foliage turns scarlet in autumn.

6 **koreàna,** Palibin. Shrub, to 6 ft: branches grooved, yellowish or reddish brown, spines short, scarcely ¼in long, usually simple lvs obovate, or oval, rounded at the apex, cuneate at the base, 1–2½ in long and ½–1½ in broad, spinose-serrulate, reticulate and pale beneath racemes shorter than lvs, rather dense, slender-stalked, nodding fr subglobose-ovoid, ¼in long, bright red May. fr Sept, Oct Korea. J C T 26, 1.5.—Handsome species with broad lvs coloring deep red in autumn and with bright red fr persisting until the following spring; has proved perfectly hardy at the Arnold Arboretum

7. **Siebòldii,** Miq Shrub, to 3 ft last year's branches deep reddish brown, angular, 2-edged toward the end. spines 3-parted, slender lvs oblong-obovate, 1–2½ in. long, acute or obtusish, cuneate at the base, setosely ciliate and usually revolute at the margin, bright green below. racemes 3–6-fld, slender-peduncled, umbel-like fr. ovoid to subglobose, ¼in. long, rather dry, bright red and lustrous. May, June. fr. Sept Japan S T S. 1·14.—A very handsome shrub: lvs purplish when unfolding and marked with green veins, deep vinous red in autumn· the fr retains the bright color until the following spring It has proved perfectly hardy at the Arnold Arboretum Often *B. Regeliana* is cultivated under the name *B. Sieboldii.*

8. **polyántha,** Hemsl Shrub, to 12 ft· branches grayish brown, slightly angled, glabrous or puberulous with usually short spines lvs cuneate-obovate, rounded at the apex, leathery, spiny-serrate, rarely nearly entire, pale grayish green, ¾–1¼ in long fls deep yellow in pendulous short-stalked panicles 2–6 in long fr oblong-ovoid, narrowed into a distinct style, pale red, bloomy, ½in. long June, July; fr Sept W. China G. 33·269.—Very handsome with its large panicles of deep yellow fls, not quite hardy in Mass.

9. **Francísci-Ferdinándi,** Schneid. Shrub, to 10 ft.· branches red-brown, nearly terete, with long spines: lvs elliptic to ovate-lanceolate, acute, cuneate at the base, densely spiny-serrate, bright green, thin, 1–2½ in long fls yellow in pendulous, usually narrow panicles, with the slender stalk 3–5 in long fr ovoid-oblong, scarlet, almost ½in long, with nearly sessile stigma. May, June, fr Sept W China.—The drooping panicles of scarlet frs are very handsome

10 **Poirétii,** Schneid (*B sinénsis,* Hemsl, not Poir. *B. sinénsis* var *angustifòlia,* Regel) Shrub, to 5 ft: branches slender, arching, the younger grooved, purplish brown, spines about ½in long, usually simple· lvs oblanceolate, to narrow-oblanceolate, ½–1½ in. long, entire, slightly reticulate and green beneath: racemes 8–14-fld, 1–2 in. long, pedicels scarcely ¼in long, bracts about half as long fr ovoid-oblong, deep blood-red N China, Amurland.—Hardy and handsome, but rare in cult and usually confounded with the following species

11 **sinénsis,** Poir (*B spathulàta,* Schrad. *B ibèrica,* Stev & Fisch *B sanguinoléntа,* Schrad *B Guimpelii,* Koch) From 4–6 ft, with slender, often arching branches, the younger grooved, reddish brown, spines 1–3-parted, ½–¾in long lvs cuneate, oblong or obovate-lanceolate, entire or sometimes with a few teeth, grayish green or glaucescent beneath, ½–1½ in long racemes pendulous, slender-peduncled, rather dense, pedicels slender, about ½in long, several times longer than the bracts berries ovoid, purplish Caucasus B M 6573 G O H 63 L D 7 187 G W 8·115 G 34 379.—A hardy, graceful species, very handsome in fr

12 **heterópoda,** Schrenk. Fig 540 Three to 6 ft branches stout, spreading, the younger chestnut-brown, lustrous slightly grooved, spines sometimes to 2 in long, often wanting lvs broadly obovate or oval, entire or sometimes remotely serrate, pale bluish green, 1–2 in long, some short and some slender-petioled fls in stalked, usually 5–7-fld racemes, orange-yellow, fragrant, ovules long-stalked fr ovoid, dark blue with glaucous bloom. May Turkestan, Songaria G F 8:455 (adapted in Fig 540).—Handsome and very distinct species *B heteropoda* var *oblonga,* Regel, see *B. oblonga* in supplementary list

13 **integérrima,** Bunge (*B nummulària,* Bunge) Shrub, to 6 ft.: last year's branches terete, purplish brown, spines usually simple, to 2 in long lvs. obovate or broadly obovate, usually entire, sometimes remotely setose-serrate, grayish green· racemes dense, usually many-fld, fls small, on short pedicels, about ¼in long, ovules short-stalked fr black, globose-ovoid May.—A variable species similar to the preceding

14. **Thúnbergii,** DC Figs 541, 542 Dense, low shrub, 2–5 ft. branches spreading, deeply grooved, brown, with simple spines. lvs obovate or spatulate, quite entire, glaucescent beneath, ½–1½ in long fls 1–3, pale yellow: fr elliptic or nearly globose, bright red Apr, May. G.F 2·53 B M 6646 R H 1894·173. A G 18.357. Gng 4 241, 5.119, 353, 355 Mn. 2 118 A F 8·526.—One of the most valuable species, especially remarkable for its low, dense, horizontal growth, its large brilliant red frs, remaining fresh till the following spring, and for its bright scarlet fall coloring, hardy Very valuable for borders of walks and drives and for low ornamental hedges. Endures partial shade Cattle and sheep do not browse it much. Var **Maximòwiczii,** Franch & Sav., has the lvs green beneath Var **pluriflòra,** Koehne, has 3–10 fls in short, umbel-like raceme Var. **minor,** Rehd (var *Dawsonii,* Bean). Very low, dense shrub, ½–2 ft high, with small lvs about ½in long A variety with the lvs variegated with white is var Silver Beauty, which originated in

Franklin, Mass. G.C. III. 49:10. Hybrids with *B. vulgaris* occur

15. **Wilsonæ,** Hemsl Low shrub with spreading branches last year's branches reddish brown, angular, puberulous, spines 3-parted, slender, ½–¾in long. lvs oblanceolate or narrowly obovate, ¼–1 in. long, rounded and mucronate or acutish at the apex, rarely 3-pointed, pale green and dull above, glaucous beneath, reticulate, thickish. fls golden yellow, in dense clusters or in very short-stalked umbels fr globose, ¼in diam, salmon-red, usually yellow or whitish on the shady side May; fr. in Sept W China B M 8414 G C III 12 372 Gn 71, p 541 G 29·520 J H III 55·425 —Very distinct handsome shrub, with small foliage, assuming a brilliant fall coloring It has proved hardy at the Arnold Arboretum in somewhat sheltered positions

16 **dictyophýlla,** Franch Shrub, to 6 ft high, with slightly angular branches, usually covered with white bloom while young, reddish brown the second year lvs obovate to oblong-obovate, ½–1 in long, obtuse or acutish, entire or spinose-dentate, chalky white beneath fls solitary, pale yellow, ½–¾in diam, short-stalked fr red, ovoid, ¼in long May S W China —Very distinct, with its small foliage white beneath like the young shoots Var **albicaûlis,** Hort, is a form with the young branchlets distinctly bloomy and the lvs intensely white beneath Var **epruinòsa,** Schneid Branchlets angled, red-brown, not bloomy lvs light green beneath Var **approximàta,** Rehd (*B approximata,* Sprague) Lvs obovate, spinose-dentate, rarely entire, fls smaller B M 7833, the type of the species with all or nearly all lvs entire is figured in Franchet, Plant Delavay 11

17 **diáphana,** Maxim (*B yunnanénsis,* Hutchins, not Franch) Shrub, to 3 ft, with rather stout branches, grooved, light yellowish brown in their second year, spines 1–3-parted, ½–½, rarely to 1½ in long lvs obovate to oblong-obovate, obtusish, ¾–1½ in long, spinose-serrulate or sometimes entire, glaucous and reticulate beneath fls bright yellow, ½in diam, solitary, or in 2's or 3's on a common peduncle, pedicels ¾in long fr oblong, often attenuated at the apex, scarlet, slightly bloomy, nearly ½in long May, fr in Sept W China B M 8224 S T S 2 109 — Remarkable for its large fr, the lvs turn scarlet in autumn Hardy at the Arnold Arboretum

18 **buxifólia,** Poir (*B dulcis,* Sweet) One to 3 ft branches brown, grooved, spines usually 3-parted, short lvs cuneate, obovate or elliptic, ¼–1 in long fls solitary, on long pedicels, orange-yellow fr nearly globose, blackish purple May Chile to Strait of Magellan B M 6505. S B F G II 1 100 P M 10 171 L B C 20 1911 H F 1857 122 —A very graceful, free-flowering shrub, one of the hardiest of the evergreen species, will stand the winter even N if somewhat protected

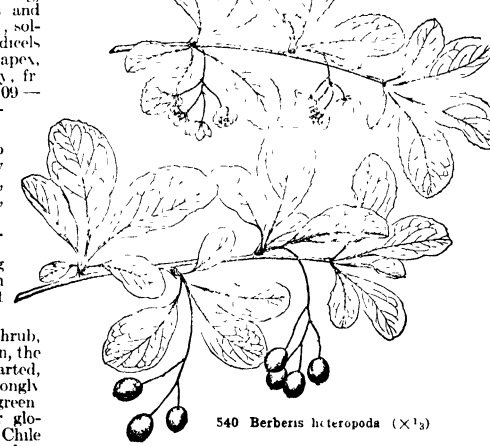
19 **empetrifólia,** Lam Low, densely branched shrub, to 2 ft last year's branches slightly angular, brown, the young ones purplish, often bloomy, spines 1–3-parted, ¼–¾in long lvs linear, ¼–¾in long, strongly revolute at the margin, spiny pointed, bright green fls 1–2, on slender pedicels, about ¼in long fr globose, bluish black, about ¼in diam May, June Chile to Patagonia B R. 26.27 S B F G 4 350.—Less often cult and not so handsome as the following hybrid, which has larger lvs and umbellate fls.

20 **stenophýlla,** Mast (*B Darwinii* × *B empetrifólia*). Height 1–3 ft, with slender, arching branches: lvs. narrow-oblong, revolute at the margins, spiny pointed, ½–1¼ in long, dark green above fls 2–6, in peduncled nodding umbels Of garden origin. May G C. III. 7.619. A.F. 6.325. Gn. 14, p. 46, 61, p. 305 (habit); 69, p. 318. G W 14, p. 593; 15, p 103.— Handsome shrub, hardy in sheltered positions at the Arnold Arboretum.

21 **concínna,** Hook f. Low, spreading shrub, to 3 ft branches of last year pale brown, angular, spines 3-parted, slender lvs obovate, ½–1 in long, rather thin and only half-evergreen, remotely spinose-dentate, bright green above, glaucous beneath fls solitary or in 2's on slender stalks, ¾–1 in long, bright yellow, over ½in across. fr. red, oblong-ovoid June Himalayas. B M 4714 —One of the most graceful barberries, similar to *B dictyophylla,* but easily distinguished by the slender-stalked fls and half-evergreen lvs It has proved hardy at the Arnold Arboretum in sheltered positions

22 **verruculòsa,** Hemsl & Wilson Dwarf, spreading shrub, to 3 ft, evergreen branches terete, densely verruculose, with slender spines often as long as lvs: lvs ovate or elliptic to ovate-lanceolate, remotely spiny-toothed, dark green and lustrous above, glaucous beneath, ½–1 in long fls 1-2, ½in across fr violet-black, bloomy, ovoid ⅓in long, with sessile stigma June, fr Oct. W. China B M 8454 —Very handsome with its dense dark green and lustrous foliage Has proved hardy at the Arnold Arboretum.

23 **Gagnepaínii,** Schneid Evergreen shrub, to 6 ft branches yellowish gray, terete, with slender, rather long spines lvs narrow-lanceolate, spiny-serrate revolute at the margin, light green beneath, indistinctly veined, 1½–3½ in long fls fascicled, 3–8, ½in. across, pedicels ½–1 in long fr ovoid, about ⅓in. long, bluish black, bloomy, with nearly sessile style. June, fr Oct W China G C III 46 226 B.M 8185 (as *B acuminata*).



540 Berberis heteropoda (×⅓)

24. **lèvis,** Franch Shrub, to 5 ft, evergreen branches light yellowish gray, angled, usually with long spines lvs narrow-lanceolate, remotely spiny-serrate, slightly or not revolute at the margin, light green beneath, indistinctly veined, 1–2 in long fls in many-fld. fascicles, ⅓in across; pedicels short, ¼–½in long fr short-ovoid, about ¼in long, black, stigma on a short style June; fr Oct. W. China See discussion page 3566

25. **Sargentiàna,** Schneid. Evergreen shrub, to 6 ft.. branches nearly terete, grayish brown, with usually short spines. lvs coriaceous, elliptic-oblong to oblong-lanceolate, acute or acuminate, densely spiny-serrate, dark green above, light green and reticulate below, 1½–4 in. long: fls fascicled, many. ½in across; pedicels ½–¾in long. fr. globose-ovoid, ½in long, black, with sessile stigma. May, June; fr. Sept , Oct. W. China —Very handsome with large dark green lvs. At the Arnold Arboretum it has proved the hardiest of the evergreen barberries. See page 3566.

26. **hakeoïdes,** Schneid (*B congestiflòra* var *hakeoïdes,* Hook f *B congestiflòra,* Hort , not Gay). Shrub, to 6 ft . last year's branches angular, grayish brown; spines small or oftener leafy., and semi-orbicular with



541. Berberis Thunbergii.

spiny teeth· lvs oval to nearly orbicular, 1–2 in long, rigid, spinose-dentate, bright green above, glaucous beneath fls in dense globose clusters; clusters very numerous along the branches and forming spikes toward the end which is often leafless· fr ovoid, ¼in , bluish black Chile G C. III 29·295. B M 6770—Very handsome with its numerous bright yellow fl -clusters. Not hardy N.

27 **ilicifòlia,** Forst Shrub, to 8 ft · last year's branches angular, purplish, minutely pubescent when young lvs obovate, ¾–2 in long, dark green above, coarsely spiny-toothed racemes 5–10-fld , shorter than the lvs with the peduncle about 1 in long, fls. orange-yellow Patagonia. B M 4308 F S 3 291.—Similar to the following Very rare in cult ; for the plants usually cult. under this name see No. 31.

28 **Dârwinii,** Hook Shrub, 1–3 ft branches brown, pubescent when young lvs cuneate, obovate, spiny-toothed and usually 3-pointed at the apex, glossy dark green above, light green and lustrous beneath, ½–1 in long racemes 6–20-fld , longer than the lvs , with the peduncle 2–4 in long, pendulous, fls orange-yellow, often reddish outside; style as long as the ovary. fr. dark purple June; fr Aug , Sept Chile to Patagonia. B M 4590 F S. 7 663. P F G. 2.46. J F. 2.111. G M 44 660

29 **asiâtica,** Roxbg. (*B hypoleùca,* Lindl). Shrub, to 10 ft last year's branches grayish yellow, grooved, puberulous when young, spines small lvs obovate to oblong, 1–3 in long, entire or with few teeth, whitish beneath racemes 8–25-fld , 1–2 in long. fr. purple, with distinct style Apr May. Himalayas. J H S 2:246.—Hardy only S.

30 **chitria,** Lindl. (*B. aristàta,* Sims, not DC.). Shrub, to 6 ft : last year's branches yellowish or reddish brown, slightly grooved or nearly terete, spines slender, to ¾in long lvs. oblong, or oblong-obovate, cuneate at the base, 1–3 in long, spinose-serrate or entire, subcoriaceous fls deep yellow, often reddish, in long-peduncled panicles. fr. purplish, ovoid-oblong, with distinct style June, July. Himalayas. B.R. 9:729 B M. 2549 (a few-fld. form, as *B umbellata*).—Often confused with *B. aristata,* which is easily distinguished by its simple sessile racemes.

31. **Neubérti,** Lem (*B. vulgàris* × *Mahonia Aquifòlium*) Branches grayish brown, without spines, upright· lvs. simple, oval or ovate, or sometimes oblong, cuneate at the base, often with 1 or 2 smaller lateral lfts., spiny-toothed, dark grayish green above, 1½–3 in. long. fls. in racemes Of garden origin. I H 1:111. G C. III. 9 73, 75. Var. **latifòlia,** Rehd. (*B. ilicifòlia,* Hort , not Forst *B latifòlia,* Hort) Lvs. broader, those of the shoots more rigid, with fewer and broader, more spreading spines, with broader often nearly truncate base —Hardy in sheltered positions at the Arnold Arboretum, but not evergreen, in the S. the lvs. are persistent.

B actinacántha, Mart Evergreen shrub, to 3 ft spines 4-7-parted lvs obovate to oblong, ½-1 in long, spiny fls slender-stalked, in clusters Chile B R 31 55—*B acuminàta,* Franch Allied to B Gagnepainii Evergreen shrub branches yellow, terete lvs lanceolate, 4–7 in long, acuminate, with numerous small spiny teeth fls fascicled, pedicels about 1 in long S W China J H F 1900 191—*B acuminàta,* Stapf=B Gagnepainii —*B acuminata,* Veitch=B Veitchii —*B atuensis,* Presl Low, dense, deciduous shrub branches yellowish gray, angular with numerous spines, about ½in long lvs oblanceolate or obovate, spinose-serrate, ½–1½ in long racemes short, 8–14-fld Sicily, Sardinia, Corsica —*B aggregata,* Schneid Allied to B polyantha Lvs oblong-obovate, spiny-toothed, ¾–1 in long panicles short and very dense, about ¾in long fr subglobose, salmon-red W China —*B Audreana,* Naudin=*B laurina* —*B aquifolìa,* Wall Deciduous shrub, to 4 ft young branchlets puberulous, angular, spiny lvs oblong-obovate, ½–1½ in long, whitish beneath, entire or sparsely spinulose fls. solitary or few, slender-stalked fr red Himalayas B M 7071—*B Aquifòlium,* Pursh=Mahonia Aquifolium —*B arguta,* Ball=Mahonia arguta —*B Belstaniana,* Hort =B virescens —*B Beymánniæ,* Schneid Allied to B Sargentiana Evergreen shrub, to 6 ft lvs coriaceous, elliptic, indistinctly veined, 1–1½ in long fls. fascicled, many fr oblong-ovoid, black, bloomy Cent and W China Var *acanthophylla,* Schneid Lvs to 2 in long, sinuately spiny W China Only the variety is in cult —*B Bretschneideri,* Rehd Allied to B Koreana Shrub, to 8 ft branches terete, reddish brown with few and small spines lvs obovate-oblong, 1½ 2½ in long, setose-serrate racemes about 1½ in long fr oblong, purplish N China S F S 2 110 Hardy N—*B brachypoda,* Maxim Allied to B amurensis Shrub, to 6 ft lvs elliptic-oblong, acute, pubescent on both sides, 1½-3½ in long racemes pubescent, slender, 2–3 in long fr scarlet Cent China —*B candidula,* Schneid. (B Wallichiana var candidula, Schneid B Wallichiana var pallida, Boiss) Allied to B verruculosa Evergreen prostrate shrub branchlets glabrous, yellowish lvs elliptic with few spiny teeth, white beneath, about 1 in long fls solitary Cent China V F 15—*B Càroli,* Schneid (B integerrima var stenophylla, Maxim). Similar to B Poiretii Shrub, to 6 ft lvs oblanceolate, usually entire, ¾–1½ in long: racemes 8–14-fld Mongolia Var *hoanghénsis,* Schneid Racemes many-fld , 1 1½ in long, pedicels ¼in. long fr subglobose, salmon-red W China Only the variety is in cult —*sedosa,* Schneid Allied to B sinensis, but lvs more often toothed, racemes shorter, hardly longer than the lvs and spines shorter, usually simple Of unknown origin —*B congestiflòra,* Gay Allied to B hakeoides Lvs oblong-ovate to orbicular, often entire fls in dense umbels on upright stalks ½-1 in long Chile —*B cratægina,* DC Shrub, to 5 ft branches brownish red, nearly terete lvs deciduous, oblanceolate to oblong-obovate, ½ 1½ in long, usually entire racemes 6–20-fld , 1 2 in long fr bluish black Asia Minor —The true B. cratægina does not seem to be in cult —*B. crética,* Linn. Deciduous shrub, to 3 ft branches purplish with



542. Fruiting twig of Berberis Thunbergii. (×½)

numerous spines often nearly 1 in long lvs lanceolate, ½-¾in. long, usually entire fls 3–7, in short umbel-like racemes S E Eu. Orient —*B crispa,* Gay Allied to B hakeoides Branches puberulous lvs thinner, ovate or oval, spiny-toothed, ½–1½ in. long. fls 5–8, on slender pedicels, clustered Chile —*B dealbàta,* Lindl Lvs persistent, nearly orbicular, with few spiny teeth racemes short, dense, nodding Mex B R 21 1750—*B élegans,* Hort =B Lycium —*B emarginàta,* Willd Possibly B sibirica × vulgaris. Low shrub spines 1–5-parted lvs obovate to obovate-oblong, ½–1¾ in long, setulose-dentate racemes shorter than the lvs , upright, petals usually emarginate Of unknown origin G O H 62—*B Fèndleri,* Gray Allied to B canadensis Shrub, to 5 ft spines 3–5-parted lvs obovate-lanceolate, ¾–1¾ in long, lustrous, entire or spinulose racemes dense, long-peduncled, pendulous Colo to New Mex G F 1 402—*B Fórtunei,* Lindl =Mahonia Fortunei.

—*B Fremóntii*, Torr =Mahonia Fremontii —*B. glaùca*, **Benth.**, not Kunth=B Jamesonii —*B grácilis*, Hartw =Mahonia gracilis —*B hæmatocárpa*, Wooton=Mahonia hæmatocarpa —*B heterophylla*, Juss Allied to B ilicifolia Branches glabrous, yellowish brown, spines 3–5-parted lvs persistent, obovate to oblong, ½–1¼ in long, entire, or with 2–4 spiny teeth fls solitary fr purplish black Straits of Magellan H E 1 14 —*B. heterophylla*, Zabel=Mahonia heterophylla —*B Hoòkeri*, Lem (B Jamesonii, Hort , not Lindl B Wallichiana, Hook , not DC). Allied to B Sargentiana Branchlets angular, stout, pale yellowish brown lvs elliptic-oblong to oblong-lanceolate, sinuately spiny-toothed, 1–2 in long fls 3–6, pedicels slender fr oblong, large, with 4–8 seeds Origin uncertain, probably Himalayas I H 6 207 B M 4656 —*B Hutchinsònii*, Rehd =Mahonia arguta —*B Jamesònii*, Lindl (B glauca, Benth , not Kunth) Evergreen shrub branches terete, brownish red lvs oblong, 2–3 in long, entire or with few teeth, lustrous, pale green beneath fls in close panicles, pedicels ½in long Peru —Often confused with B Hookeri and B Verschaffeltii —*B japonica*, Spreng =Mahonia japonica —*B Knightii*, Hort =B Wallichiana var latifolia —*B laurìna* Billbg (B Andreana, Naudin) Allied to B buxifolia Shrub, to 5 ft branches glabrous, terete, spines to 1 in long lvs oblanceolate, 1–3 in long, entire, pale beneath racemes pendulous, to 5 in long fr black, bloomy S Brazil R H 1899, p. 9 —*B laxiflòra*, Schrad Allied to B amurensis Lvs oval to oval-elliptic, obtuse, serration less dense, grayish green beneath racemes pendulous, 2–3½ in long Of unknown origin —*B Liechtensteinii*, Schneid Deciduous shrub, to 5 ft branches slightly angled, purplish with strong spines lvs ovate to lanceolate, sinuately spiny, light green beneath, ½–2 in long fls in racemes 1 1½ in long fr globose, red, with 2 seeds W China —*B loxensis*, Benth Lvs persistent, oblong-obovate, entire or sometimes with a few spiny teeth, lustrous fls small in peduncled, loose racemes Peru F S 6, p 69 —*B lucida*, Schrad Allied to B vulgaris Lvs elliptic to elliptic-oblong, dark green and lustrous above, obtuse, remotely and finely serrate racemes spreading, about 2 in long fr red Of unknown origin, possibly variety of B vulgaris —*B Lycium*, Royle (B ruscifolia, Hort , not Lam B elegans, Hort) Shrub, to 6 ft or more branches terete, yellowish gray lvs sub-persistent, obovate-lanceolate, ¾–2 in long, entire or spinulose racemes sessile, longer than the lvs , drooping fr violet Himalayas B M 7075 —*B macrophylla*, Hort =B Wallichiana var latifolia —*B macracàntha*, Schrad Possibly B aristata×vulgaris Branches yellowish gray lvs elliptic, acutish, remotely spiny-toothed, 1–2 in long racemes nodding, 1½ 2½ in long fr red Of unknown origin —*B microphylla* var *serrata*, Hort =B serrata —*B Mouillacana*, Schneid Deciduous shrub, to 10 ft branches grooved, purplish, with simple spines lvs obovate-lanceolate, obtuse, usually entire, light green beneath, ½–2 in long fls in racemes, to 1½ in long fr scarlet, with 2 seeds W China —*B oblonga* Schneid (B heteropoda var oblonga, Regel) Allied to B heteropoda Branches angular lvs obovate racemes 10–20-fld , usually compound near the base, ovary with 2 sessile ovules fr oblong Turkestan —*B nepalénsis*, Spreng =Mahonia nepalensis —*B nervosa*, Pursh=Mahonia nervosa —*B pallida*, Benth =Mahonia pallida —*B parviflòra*, Lindl =B ruscifolia —*B parvifolia*, Sprague Allied to B Wilsonæ Low shrub lvs half-evergreen, oblanceolate, entire or occasionally spiny-toothed, glabrous and reticulate beneath fls fascicled, 3–6 fr globose, terra-cotta color W China —*B pinnata*, Lag =Mahonia pinnata —*B Prattii*, Schneid Allied to B polyantha Shrub, to 10 ft lvs oblong-obovate, entire or with few spiny teeth, reticulate, thinner panicles narrow, to 6 in long fr globose, salmon-red W China Var *recurvata*, Schneid Raceme narrow, spike-like fr on reflexed pedicels W China —*B pruinòsa*, Franch Evergreen shrub branches brownish yellow, nearly terete, spines to 1 in long lvs ovate-oblong, ¾–2 in long, strongly spiny-toothed, whitish beneath fls 8–25, fascicled, rarely in a peduncled umbel fr bluish black S W China —*B Rehderiana*, Schneid Allied to B. koreana, but much smaller in every part, branches reddish brown, slightly angled, spines 3–5-parted lvs obovate to oblong, spinose-serrate, ¾–1¼ in long fls 8–15, in a peduncled raceme fr subglobose, bright red Origin unknown —Hardy, graceful shrub, the fr remains unchanged until the following spring —*B rèpens*, Lindl. =Mahonia repens —*B rotundifolia*, Hort =Mahonia repens var. rotundifolia —*B ruscifòlia*, Lam (B parviflora, Lindl) Allied to B buxifolia Branches terete, yellowish gray lvs oblong, entire or with a few coarse teeth, ½–1½ in long fls in a 1–5-fld peduncled raceme fr bluish black Argentine J H S 2 243 —*B ruscifòlia*, Hort =B Lycium —*B sanguinea*, Franch Allied to B Gagnepainii Lvs narrow-lanceolate, ¾–2 in long, spinose-serrate, pale beneath fls with red sepals, in fascicles of 2–4, pedicels ¾in long fr bluish black W China V F 16 —*B seròtina*, Lange Allied to B sinensis Lvs light green, oblanceolate, usually entire racemes short and dense Origin unknown —*B serràta*, Koehne (B microphylla var serrata, Hort) Low, deciduous shrub. branches grooved, reddish or yellowish brown lvs oblong-lanceolate, ½–1 in. long, spinulose-serrate racemes dense, short Origin unknown —*B sibirica*, Pall Deciduous shrub branches angular, yellowish brown, spines 3–9-parted lvs obovate, remotely toothed. fls solitary or 2, short-pedicelled fr red Siberia B R 6 487 —*B Sìlva-Taroucàna*, Schneid Deciduous shrub, to 10 ft branches grooved, brown, spines small or wanting lvs oblong-lanceolate or obovate-oblong, obtuse, entire or with few small teeth, pruinose beneath, ½–2 in long racemes 1–2½ in long, pedicels ⅓–¾in long fr globose-ovoid, scarlet, with 1–2 seeds W China —*B subcaulialàta*, Schneid Deciduous shrub branches strongly angulate lvs oblanceolate, ½–1 in long, acute, rarely 3-pointed at the apex, whitish beneath fls in very short, 6–8-fld racemes or rarely fascicled, nodding fr globose, red W China —*B tenuifòlia*, Lindl =Mahonia tenuifolia —*B thibética*, Schneid Deciduous shrub branches angular, purplish, bloomy lvs obovate-lanceolate, ½–1 in long, rounded or acutish, mucronulate, entire, whitish beneath fls. in 1–5-fld fascicles; pedicels about ⅛in. long W. China —*B. Tìschleri*, Schneid Allied to B. diaphana Shrub, to 8 ft branches angled, gray, spiny lvs. obovate to oblong, obtuse, spinulose-serrate, pruinose beneath, ½–1¾ in racemes 4–15-fld , pedicels ½–1 in long fr oblong, with a distinct style, pale red, pruinose W China —*B toluacénsis*, Hort =Mahonia heterophylla —*B triacanthóphora*, Fedde Allied to B Gagnepainii evergreen shrub, to 5 ft branches terete, brown lvs linear-lanceolate with 2 to 5 spiny teeth on each side or entire, glaucescent beneath, 1–2 in fls 2–5, slender-stalked fr black, ovoid, with sessile style Cent China —*B trifoliata*, Hartw =Mahonia trifoliolata —*B trifoliolata*, Moric =Mahonia trifoliolata —*B trifurca*, Forbes=Mahonia japonica var trifurca —*B umbellàta*, Wall Deciduous shrub branches angular, gray lvs oblanceolate, usually entire, rarely sparsely serrulate racemes long-peduncled, usually umbel-like, sometimes elongated Himalayas B R 30 44 —*B Veitchii*, Schneid Allied to B levis Evergreen shrub lvs narrow-lanceolate, acuminate, sinuately toothed with long and strong spines, 2–4 in long fls 5–8, slender-stalked fr ovoid, bluish black Cent China —*B Verschaffèltii*, Schneid (B Jamesonii, Lem , not Lindl) Evergreen shrub lvs oblong, 2–3 in long, sparingly spiny-toothed · fls orange in drooping panicles Ecuador I H 6 201 —*B virèscens*, Hook Deciduous shrub, 2–5 ft branches yellowish red or red, lustrous, terete lvs obovate, ½–1¼ in long, spiny-toothed or entire, light green, whitish beneath fls pale yellow, few, fascicled or in peduncled umbel-like racemes fr purple, bloomy Himalayas B M 7116 —Graceful shrub Hardy at the Arnold Arboretum —*B Wallichiana*, DC Allied to B Sargentiana Evergreen shrub, to 10 ft branches grooved, spiny lvs elliptic to lanceolate, spiny-serrate with numerous small teeth, lustrous above, light green beneath, reticulate, 2–4 in long fls 10–20, pedicels about ½in long fr ovoid, black, with usually 1 long-stalked seed Himalayas P F G 1, p 79 Var *latifòlia* Hook f & Thoms (B Knightii, Hort , not Koch B macrophylla, Hort) Branchlets less grooved lvs broader, thinner —*B Wallichiàna*, Hook =B Hookeri —*B yunnanénsis*, Franch. Allied to B diaphana Branches grooved, gray lvs obovate-oblong, 1 in long, entire, glaucous beneath fls 3–5, fascicled S W China —Has been confused with B. diaphana See page 3566

ALFRED REHDER.

BERCHÈMIA (derivation uncertain). *Rhamnàceæ* Ornamental woody climbers, grown chiefly for their bright green graceful foliage

Deciduous twining shrubs. lvs alternate, entire or nearly so, petioled, with conspicuous numerous parallel veins fls perfect; sepals, petals and stamens 5; calyx-tube shallow, ovary free, 2-celled, with a 2-parted style drupe oblong to cylindric with a 2-celled stone —About 12 species in S. and Cent Asia, N Amer and E. Afr

These slender climbing shrubs have inconspicuous greenish white flowers in terminal panicles followed by berry-like, small, usually oblong, black or red fruits. The cultivated species are not quite hardy North and prefer sunny positions; they grow in almost any soil and are useful for trellis-work, when no dense shade is desired. Propagation is by seeds and by root-cuttings in spring under glass, also by layering the young shoots and by cuttings of mature wood in fall under glass.

scándens, Koch (*B. volùbilis*, DC). SUPPLE-JACK. Ten to 15 ft · lvs ovate or oblong-ovate, acuminate, often undulate, 1–3 in long, with 9–12 pairs of lateral veins: fls. greenish white in small terminal panicles fr bluish black, ¼–⅓in long. June Southern states B B. 2:404. S.O B 3 153.

racemòsa, Sieb. & Zucc. Closely allied to the former. Lvs cordate, ovate, 1–2½ in. long, with 6–8 pairs of veins fls greenish in large terminal panicles· fr. first red, becoming black at length July. Japan, China —Hardier than the former, not high-climbing; attractive in late summer, with its red frs.

B Giraldiàna, Schneid Allied to B racemosa Lvs ovate-oblong, 1–3 in long, grayish white beneath, with 9–11 pairs of veins, petioles ¾in long W China —*B lineàta*, DC Allied to B. scandens Lvs smaller, oblong-ovate, obtuse, with about 9 pairs of veins, grayish white beneath. N and W. China.

ALFRED REHDER

BERGAMOT. Name applied to various aromatic plants, particularly to members of the *Labiatæ*, as menthas and monardas. The bergamot essence of commerce is made from a citrous fruit. See *Citrus*

BERGEROCÁCTUS (named for Alwin Berger, Curator of the Hanbury Garden, at La Mortola, Italy) *Cactàceæ*. A low, much-branched, day-blooming cactus with cylindrical, low-ribbed sts : areoles close together,

bearing many yellow spines· corolla short, funnel-shaped, greenish yellow: fr. globose, densely spiny.—A single species known.

Émoryi, Brit & Rose (*Cèreus Émoryi,* Engelm.). Prostrate or ascending, 6–10 in. high, 1–2 in. diam., often forming thick masses 10–20 ft. in diam : fls. 1–2 in broad· fr. 1–1½ in. diam On mainland and isls. of S Calif., and N Low Calif —This species, native of Calif , can easily be grown in the open in the southern part of that state It forms large masses and care must be taken that it does not preempt more than its share of the garden The species has long been in the trade, but it does not do well in the greenhouse, and it is hardly to be recommended for the small collection. Its slender sts., covered with striking yellow spines, are very unlike any of our other cereus-like plants

J. N. ROSE.

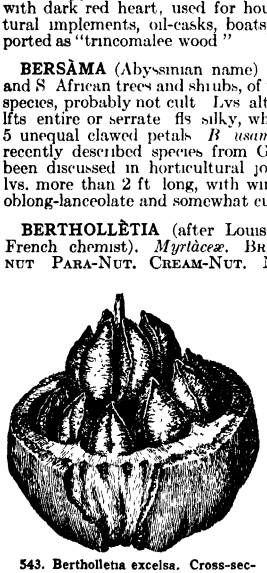
BERMUDA GRASS: *Cynodon dactylon.*

BÉRRIA (after Dr. Andrew Berry, a Madras botanist) Syn , *Berrya,* DC , not Klein *Tiliàceæ.* A timber tree of India, which has been sparingly introduced into this country. One species.

Ammonílla, Roxbg High tree: lvs entire, heart-shaped, long-petioled, smooth, 5–7-nerved, alternate· fls in racemes, small, white, very numerous: fr a 3-celled caps with 6 wings, the 3–12 seeds with stiff hairs, which readily penetrate the skin and produce a painful itching —Grows abundantly in British India, Ceylon, the Malay Archipelago, and the Philippines The wood is smooth-grained, yellow, with dark red heart, used for house-building, agricultural implements, oil-casks, boats, and the like Exported as "trincomalee wood" G. T HASTINGS.

BERSÀMA (Abyssinian name) *Sapindàceæ* Trop. and S African trees and shrubs, of perhaps a half-dozen species, probably not cult Lvs alternate, odd-pinnate, lfts entire or serrate fls silky, white, of 5 sepals and 5 unequal clawed petals *B usambarénsis,* Guerke, a recently described species from German E Afr , has been discussed in horticultural journals tree, 50 ft.. lvs. more than 2 ft long, with winged rachis, the lfts. oblong-lanceolate and somewhat cut, prickly-margined.

BERTHOLLÈTIA (after Louis Claude Berthollet, French chemist). *Myrtàceæ.* BRAZIL-NUT BUTTER-NUT PARA-NUT. CREAM-NUT. NIGGER-TOE. Large trees lvs. alternate, bright green, leathery, about 2 ft. long, 6 in broad: fls cream-colored; calyx parts united and tearing into 2 parts when the flower opens, petals 6; stamens many, united into a hood-shaped mass, the upper ones sterile· fr round, about 6 in diam , with a hard shell containing 18–24 3-sided nuts (Fig. 543).—Species several, all furnishing Brazil nuts and usually described as *B. excelsa.* The common trade name is Castanea, the name of the genus including the chestnuts.



543. Bertholletia excelsa. Cross-section of husks, showing Brazil-nuts (× ⅓)

excélsa, Humb. & Bonpl. Fig. 543. A tree 100–150 ft. with a smooth trunk 3–4 ft in diam : branches near the top —It forms large forests on the banks of the Amazon and Rio Negro. The natives gather the nuts in large quantities, chopping the fr open They are exported in large quantities, chiefly from Para. An oil is expressed from the kernels, and the bark is used at Para for caulking ships The tree is of little value for decorative purposes, and, is too tender for growth anywhere in the U. S. G. T. HASTINGS.

BERTOLÒNIA (after A. Bertolini, Italian botanist). *Melastomàceæ.* Excellent warmhouse foliage plants from Brazil.

Always dwarf, and sometimes creeping; the garden forms with membranaceous, 5–11-nerved lvs. 5–8 in.



544. Bertolonia marmorata.

long, and purple beneath fls white, purple or rose-colored, 5-petaled, in scorpioid racemes or spikes There are only 9 species, 5 of which were distinguished when the last edition was issued (A Coigneaux, in DC Mon Phan , Vol VII) Some earlier botanists do not separate certain allied genera which usually cannot be distinguished by habit alone The surest character is the inflated and 3-angled or 3-winged calyx of Bertolonia In Bertolonia, fl -parts are in 5's, but the ovary is 3-celled Gravesia has a 5-celled ovary, and Sonerila is trimerous In Bertolonia, the connective of the anthers has no appendage, in Salpinga there is a spur below and behind the connective, in Monolena there is a spur in front, and the calyx is not hairy

Bertolonias are essentially fanciers' plants It is somewhat difficult to bring out their true characteristics under ordinary stove treatment, as they require a more humid atmosphere than can usually be maintained, even in a small house The additional shelter of a small frame should be provided, where the atmospheric conditions will be much more easily regulated. A plentiful supply of water at the roots is necessary, syringing or sprinkling overhead is not advisable — The most convenient method of propagation is by cuttings, which strike readily, in a moderately close propagating-case filled with sharp, clean sand The pots should be thoroughly clean and drained, and the compost open and porous They may also be grown from seed They thrive in dense shade Old plants are not so brilliant as young ones (Wm. Scott)

Bertolonias and their allies furnish an excellent example of Van Houtte's triumphs in hybridization The two species described below have probably been important factors in the plant-breeding, and *Gravesia guttata* even more so. Gravesia is a Madagascar plant, and has, perhaps, been crossed with the Brazilian bertolonias Unfortunately, the pictures in Flore des Serres show no flowers, and the pedigree is not given The bertonerilas figured and described in I.H. 43, pp. 188 and 189, with colored plates 64 and 68, are presumably hybrids between Bertolonia and Sonerila. Excepting *B maculata* and *B. marmorata,* the following are hybrids·

A *Veins not lined on both sides with a colored band*

marmoràta, Naudin. Fig. 544. St. less densely hairy than *B maculata·* lvs more narrowly ovate, ovate-

oblong, acute, sparsely hairy, streaked with white along the veins calyx sparsely hairy, not glandular, petals somewhat blunter, dilute purple. R H 1848 381 (as *Eriocnema marmorata*, Naudin). F S 7 750 (as *B maculata* var *marmorata*, Planch.) Coigneaux recognizes 2 varieties, var **genuina,** with lvs green above, and banded with white along the veins, var. **ænea,** (*E ænea* and *B. ænea*, Naudin), with lvs dark green with a coppery cast, but not spotted or only slightly so.

Mirándæi, Van Houtte. Spots red on the lower lvs and white on the upper or younger ones: lvs. purple beneath F S 21:2235 (1875)

AA. *Veins lined on both sides with a white or colored band.*

B. *Bands and spots magenta or purple.*

maculàta, DC St short, decumbent, rooting at the base, densely clothed with rusty hairs lvs long-petioled, cordate, broadly ovate, obtuse, hispid above and at margins, dark velvety green above, often spotted calyx densely clothed with glandular hairs, petals obovate, somewhat acute, rose-colored B M 4551

Houtteàna, Van Houtte (*B Van Houttei*, Hort.). Lvs purple beneath F.S. 20 2120.—This was a sensational plant of 1875, and Van Houtte refused $2,000 for his stock of it

BB. *Bands and spots silvery white.*

C *Spots very distinct*

Hrubyàna, Van Houtte This has bars of white connecting the veins The under side of the lvs seems to be green instead of purple, at least toward the tip F S 23 2381

Rodeckiàna, Van Houtte Distinguished from the above and all others of this group by the abundance of dark red color on the upper surface of the lvs veins of the under side prominent and green F S 23 2382

CC *Spots very faint*

Legrelleàna, Van Houtte (*B Legrelli*, Hort.) There are a few longitudinal bars, but they do not connect the veins Referred to *Gravesia guttata* by Coigneaux. F S 23:2407.

Other trade names are *B guttata*, Hook f.=Gravesia guttata.—*B margaritàcea* Hort Bull.—Salpinga margaritacea.—*B primulæflòra*, Hort.=Monolena primuliflora.—*B pubéscens*, Hort., with long white hairs, and a chocolate band down the center Ecuador.—*B punctatíssima*, Hort.—*B superbíssima*, Hort (B superba?, Hort.), with rose-colored spots, which are larger and brighter near the margin F M 151 (1875).—Probably a variety of Gravesia guttata

WILHELM MILLER.
N. TAYLOR†

BERTONERÌLA. A class of handsome foliage plants, presumably hybrids between Bertolonia and Sonerila. *Bertonerila* is a combination of the names *Bertolonia* and *Sonerila* I H Vol 43 (1896), pp 188–190 For culture, see *Bertolonia*.—Rare in this country, perhaps not in cult outside of a few botanic gardens Some of the best-known forms are Madame Cahuzac, Madame de Brezetz and Madame Treyeran.

BESCHORNÈRIA (after H. Beschorner, German botanist). *Amaryllidàceæ.* Succulent desert plants, allied to Bravoa, Fourcroya and Doryanthes, planted far south and in California, and sometimes seen in collections under glass in the North.

Leaves in a rosette, glaucous, roughish at the margins, not so thick, firm or fleshy as in Agave (which has a strong end-spine and horny marginal prickles). rootstock short, tuberous. fls accompanied by showy colored bracts In Beschorneria, the perianth is usually reddish green, funnelform but with a very short tube and with long, oblanceolate segms.; in Doryanthes the perianth is bright red, the segms. long, narrowly falcate; in Bravoa the perianth is red or white, the tube curved, sub-cylindrical, and the segms. short From Fourcroya, to which the genus is closely related, Beschorneria is distinguished by its tubular-shaped perianth, long and narrow segms., thin and slender filaments, which are only slightly thickened below the middle The perianth of Fourcroya is campanulate, with spreading, ovoid or elliptic segms., and short thickened filaments, the fourcroyas are larger plants, and without large showy bracts, and often produce bulbils, which Beschorneria never does.

The species are very closely allied, and difficult to distinguish The following are the only kinds well known, and they are all from Mexico. If in good condition they bloom every year in warm countries from suckers of the previous year, but in the North they are likely to bloom only at long irregular intervals The species succeed best when treated similarly to agaves, with the exception of the soil, which may be made richer by the addition of crushed bone and a little vegetable-mold All of the species need greenhouse protection in the northern states They are hardy in the warmest parts of the British Islands Useful for bedding as striking foliage subjects

tubiflòra, Kunth No st or trunk: lvs 12 or more, 1½-2 ft long, 1 in broad, linear, long-acuminate, roughish on both surfaces, tufted, more or less recurved, thickened and triangular at base, minutely striated, glaucous-green scape 4 ft., terminating in an erect raceme, fls drooping, 2–4 together, the perianth divided to the top of the ovary, brownish green. B M 4642.—The oldest and best-known species

Tonélii, Jacobi (*B Tonelliàna*, Jacobi) Allied to *B. tubiflora*, but with looser habit, much broader foliage, bright red-purple scape and a colored panicle with drooping branches, longer purple and red fls with more acute segms st or trunk very short lvs very glaucous, roughish beneath and on the margins, 15–20 in number, 1–1½ ft long, 2-2½ in broad, short-acuminate, and contracted below the middle into a flat thick petiole 1 in broad B M 6091

Dekosteriàna, C Koch (*B Decosteriàna*, Baker). Lvs 15–20 or more, 2–2½ ft long, 2-2½ in broad, oblanceolate, long-acuminate, very gradually tapering both ways from the middle, 1–1½ in broad above the base, which is very thick fls in a deltoid panicle, green, 1½ in long, cut nearly to base, the ovary protruding. B M 6768

bracteàta, Jacobi. Stemless lvs 20–30, 1½-2 ft. long, 2 in broad, short-acuminate, texture thin but firm, contracted to less than 1 in wide above the dilated base, glaucous green, scarious or dry on the margin scape 4–5 ft., the panicle reddish brown, fls. 1½ in long, segms free but connivant, green, changing to yellowish red B M 6641

yuccoìdes, Hook f St none, or apparently present by shedding of older lvs in the rosette lvs. about 20, 1–1½ ft long, 2 in broad, lanceolate, short-acuminate, narrowed to ½in above the base, glaucous green. scape 3–4 ft, with fls on drooping red branches in the panicle, fls about 3 in long, dark green, tinged yellow. B M 5203. G C III. 46 8, 309, 313.—The lvs. are broader than in *A. tubiflora*, shorter acuminate, and more boldly narrowed below the middle.

Wrightii, Hook. f. Allied to *B. Dekosteriana*, but fls. pubescent. st. or trunk 18 in.: lvs. about 50, densely crowded, spreading or recurved, ensiform, 4–5 ft long by 2 in at the middle, the tip narrowed to a long brown stiff point, the base dilated and very thick and bi-convex, the margins very narrowly scarious, denticulate: panicle pyramidal, 8 ft ; fls. fascicled, nodding, greenish, pubescent B M 7779.

pubéscens, Berger. Smaller: lvs. 2 ft. long by 2 in broad, glaucous, rather stiff and fleshy along the midrib, nearly smooth underneath, rough only near tip, margins finely and deeply denticulate· panicle 4–5 ft, rather slender, the scape bright red; fls. fascicled in axils of

ovate bracts, green, fading to yellow, pubescent. G.C. III 40 350.

B argyrophýlla, Hort.=B Dekosteriana.—*B californica* is a nomen nudum.—*B supérba*, Hort. and *B viridiflóra*, Hort.=B. yuccoides

G. W OLIVER.
L. H. B.†



545. Bessera elegans

BESLÈRIA (after Basil Besler, Nuremberg apothecary, and reputed author of the superb Hortus Eystettensis, 1613). *Gesneràceæ* A genus of 50 species of Trop American plants, mostly subshrubs, with somewhat 4-angled sts, large, membranaceous, opposite, petiolate lvs prominently veined beneath, and yellow, white or purple fls calyx campanulate, at length globose, shortly 5-toothed, corolla tubular *B Imray* is herbaceous, with serrate lvs. and yellow axillary fls. B M 6341. Prop by cuttings over bottom heat None is known to be offered in Amer

lûtea, Linn. St 6–10 ft, glabrous or nearly so lvs elliptic or elliptic-oblong calyx about half as long as the yellow slightly gibbous corolla Trop Amer

N TAYLOR †

BÉSSERA (after Dr. Besser, professor of botany at Brody) *Liliàceæ*. MEXICAN CORAL DROPS An exceedingly pretty summer-flowering bulbous squill-like plant

Umbels pendulous, fls vermilion outside, with a white corona or cup within, and long, purple stamens; perianth cup-shaped, the tube shorter than the oblong-lanceolate segms, stamens 6.—A monotypic genus allied to Androstephium Culture simple Bulbs planted out, and lifted when ripe May be prop by offsets

élegans, Schult. f. Fig 545 Bulb globular, 1 in thick, tunicated lvs 2–3, about 10–12 in, or even 2 ft., long. scape 1–2 ft. long, hollow, fragile, umbels 4–10-fld, pedicels 1–1½ in. long, perianth 9–10 lines long, keeled on the back, variously marked with white within, but usually with vermilion margins and center-band, fls borne through two months of late summer and early autumn G F. 4·125 (adapted in Fig 545) Gn 25·42. B R. 1546 (as *Pharium fistulosum*); 25.34 F S. 4:424 (as *B miniatum*).—Strong bulbs sometimes throw up 6–10 scapes, with 12–20-fld. umbels

WILHELM MILLER

BÈTA (ancient name) *Chenopodiàceæ*. BEET-ROOT. BEET Annuals in cultivation, or biennials by the wintering of the roots, grown for the thick edible roots, edible leaves, and ornamental foliage.

Glabrous, mostly thick-rooted herbs, with alternate, entire or sinuate lvs.: fls. perfect, bracted; perianth urn-shaped, 5-lobed, adhering at base to the ovary, becoming hardened in fr.; stamens 5 on a fleshy ring or disk; ovary partly inferior, in fr covered by the withered and corky remains of the perianth; the fls usually stand 2 or more together and cohere into a "seed" or "ball" that is more than 1-seeded.—The species of Beta are much confused, but probably all of them can be referred to a half-dozen species. Eu., N. Afr., Asia.

vulgàris, Linn. (*B. maritima*, Linn.). The supposed source of the cult beets and foliage beets Probably a development from the perennial beet of the coasts in parts of Eu, a much-branched decumbent plant (Fig. 546), with thick, long and hard (not really fleshy) perennial roots In cult forms, the plant is erect in fls and fr, with greenish clustered fls, and ovate-oblong, smooth, more or less thick and wavy-margined lvs. There are 3 main races of the cult. beet-plant

Var **crássa**, Alef BEET-ROOT BEET of American gardens and fields, characterized by its thickened root of many forms, some of which are developed for their sugar-producing qualities See *Beet*.

Var. **cruénta**, Alef (*B hortènsis* and *B rùbra*, Hort.). RED and VICTORIA foliage beets. Root not highly developed lvs large and showy, red or green, with yellow ribs Var *metállica* is a form of this. In many brilliant forms, often used in bedding and for strong color effects

Var **Cícla**, Moq (*B Cícla*, Linn *B brasiliènsis* and *B. chilènsis*, Hort.) LEAF-BEET SICILIAN BEET. SEA-KALE BEET. SPINACH BEET. CHILIAN BEET. ROMAN KALE POIREI. Root small and branched, not thick or fleshy lvs very large, thick-ribbed, green, yellow-green, reddish green or even red, often with very wide and thick petioles.—Used as a pot-herb Differs widely in the coloration of the lf-ribs, and shape and development of lf-blade One form of it is *Chard* (which see)

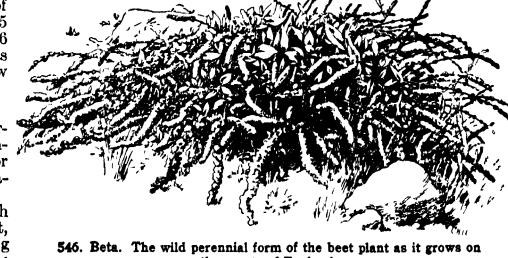
L. H B.

BETEL, or BETLE. The leaf of *Piper Betle*, a kind of pepper used in wrapping the pellets of betel-nut and lime which are commonly chewed in the Orient The pellets are hot, acrid, aromatic, astringent They redden the saliva and blacken the teeth, and eventually corrode them The betel-nut is the fruit of *Areca Catechu*, a palm See pp 16 and 24.

BETÓNICA and BETONY. *Stachys*

BÉTULA (ancient Latin name). *Betulàceæ*. BIRCH. Ornamental deciduous woody plants grown chiefly for their bright green handsome foliage. Page 3566.

Trees or shrubs winter-buds usually conspicuous, sessile, with several imbricate scales. lvs. alternate, petioled, serrate or crenate fls monœcious, apetalous, in catkins, staminate formed in autumn and remaining naked during the winter, every scale bearing 3 fls, each with a minute 4-toothed calyx and with 2 stamens divided at the apex; pistillate catkins oblong or cylindrical, bearing 3 naked ovaries in the axil of every scale



546. Beta. The wild perennial form of the beet plant as it grows on the coasts of England.

consisting of 3 connate bracts. fr. a minute nut, often erroneously called seed, with membranous wings, dropping at maturity with the 3-pointed scales from the slender rachis of the strobile —About 35 species in N. Amer., Eu , N and Cent. Asia, especially in the northern regions No tree goes farther north than the birch, in N. Amer *B papyrifera* reaches 66° north latitude, and in Eu *B pubescens* goes to the N Cape, and is still a forest tree at 70° Monogr by Regel Monographische Bearbeitung der Betulaceæ (1861), and in De Candolle, Prodromus, 16, 2, p 162 (1869); and by Winkler in Engler's Pflanzenreich Betulaceæ, p 56, quoted below as W. B

The birches are often conspicuous on account of their colored bark, and slender usually pendulous staminate catkins before the leaves and much smaller pistillate catkins, followed by subglobose to cylindric strobiles The hard and tough wood is often used in the manufacture of furniture and of many small articles, in making charcoal, and for fuel, from the bark, boxes, baskets, and many small articles are made; also canoes from that of the *B papyrifera;* in Russia and Siberia it is used in tanning leather The sap of some species is used as a beverage The birches are very ornamental park trees, hardy, except two or three Himalayan species, and especially valuable for colder climates. They are essentially northern trees and are short-lived in warmer regions, particularly mountain species like *B lutea*, while *B nigra* and *B lenta* are better suited for a warmer climate than most other species Their foliage is rarely attacked by insects, and turns to a bright or orange-yellow in fall Their graceful habit, the slender, often pendulous branches, and the picturesque trunks make them conspicuous features of the landscape Especially remarkable are those with white bark, as *B papyrifera*, *B populifolia*, *B pendula*, *B Ermanii*, and also *B Maximowiczii* with yellow bark

Most birches prefer moist, sandy and loamy soil, but some, as *B pendula* and *B populifolia*, grow as satisfactorily in dry localities and poor soil as in swamps and bogs, and they are especially valuable in replanting deserted grounds as nurses for other trees, both are comparatively short-lived trees

Propagation is readily accomplished by seeds, gathered at maturity and sown in fall, or usually kept dry during the winter, or stratified, but *B nigra*, which ripens its fruits in June, must be sown at once, and by fall the seedlings will be several inches high The seeds should be sown in sandy soil, rather thick, as the percentage of perfect seeds is not very large, slightly or not at all covered, but pressed firmly into the ground and kept moist and shady The seedlings must be transplanted when one year old Rarer species and varieties are grafted, usually on *B lenta*, *B papyrifera*, *B nigra* or *B pendula*. Cleft or tongue-grafting in early spring, on potted stock in the greenhouse, is the best method Budding in summer is also sometimes practised. Shrubby forms may also be increased by layers, and *B nana* by greenwood cuttings under glass.

INDEX.

alba, 8, 9, 10
asplenifolia, 10
atropurpurea, 9
Bhojpattra, 3
carpatica, 10
carpinifolia, 4
cordifolia, 11.
costata, 6.
dalecarlica, 9
elegans, 9.
Ermanii, 7.
excelsa, 5
fastigiata, 9, 14.
glandulosa, 13
gracilis, 9
grandis, 11.
humilis, 14
hybrida, 9
japonica, 9
laciniata, 8, 9.
lenta, 4
lutea, 5
Lyalliana, 12
Maximowiczii, 1.
minor, 11.
Murithii, 10
nana, 15
nigra, 2
occidentalis, 12.
odorata, 10
papyracea, 11, 12.
papyrifera, 11.
pendula, 8, 9.
persicifolia, 5
platyphylla, 11
populifolia, 8
pubescens, 9, 10
pumila, 14
purpurea, 8, 9.
pyrifolia, 11
pyramidalis, 9.
rubra, 2
songarica, 10.
Tauschii, 9.
tortuosa, 10.
tristis, 9
ulmifolia, 6.
urticifolia, 10.
utilis, 3
variegata, 10.
verrucosa, 9.
vulgaris, 9
Youngii, 9

A. *Veins of lvs. 7 pairs or more, usually impressed above Trees.*

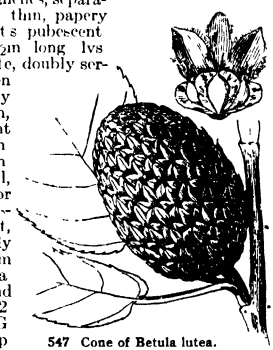
B. *Lvs. large, 4–6 in. long, deeply cordate cones cylindrical, racemose, 2–4.*

1 **Maximŏwiczii,** Regel Tree, 80–90 ft , with smooth, orange-colored trunk and dark reddish brown branchlets lvs. long-petioled, broadly ovate, coarsely and doubly serrate, membranous, pubescent on younger trees, nearly glabrous on older ones cones ½–3 in long, slender, nodding, fr with very broad wings Japan B M 8337 S I F 1 23 W B 90 — This is probably the most beautiful of all birches, perfectly hardy N and of rapid growth; its large foliage and the yellow color of the trunk render it a highly ornamental and conspicuous park tree

BB *Lvs. 2–5 in long cones solitary wings narrower than the fr*

C. *Under side of lvs glaucescent lvs rhombic-ovate, cuneate at base with 7–9 slightly impressed pairs of veins*

2 **nigra,** Linn (*B rùbra*, Michx) Red or River Birch Tree 50–90 ft bark reddish brown, or silvery gray on younger branches, separating into numerous thin, papery flakes branchlets pubescent petioles scarcely ½in long lvs rhombic-ovate, acute, doubly serrate, pubescent when young, at length only on the veins beneath, pale or glaucescent beneath, 2–3½ in long cones 1–1½ in long, cylindrical, ripening in May or June, scales pubescent, with erect, linear-oblong, nearly equal lobes From Mass south to Fla and west to Kan and Minn S S 9 452 L B C 13 1248 G F 2 591 Gn. 55, p 161 (habit) W B. 63 H T 122, 123 —



547 Cone of Betula lutea.
(Cone natural size.)

A moisture-loving, graceful tree, with slender, very numerous branches, and remarkable for its torn and ragged bark.

CC *Under side of lvs light green lvs rounded or truncate at the base, with 8–14 pairs of impressed veins*

D *Shape of lvs ovate or oblong-ovate, rounded and often cordate at the base, broadest about the middle, veins distinctly impressed above petioles less than ¾in. long* See page 3566

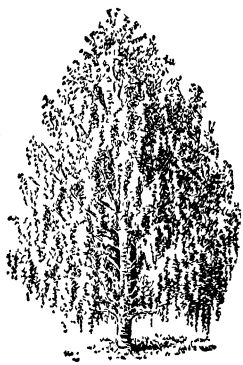
E *Cones peduncled, cylindric*

3 **ûtilis,** Don (*B Bhojpáttra*, Wall.) Tree, 40–60 ft trunk with reddish brown bark branchlets pubescent while young, not glandular lvs ovate, rounded at the base, acuminate, densely irregularly serrate, pubescent on the veins beneath, 2–3 in long, with 8–12 pairs of veins cones peduncled, cylindrical, 1–2 in long with erect oblong lobes, the middle one much longer Himalaya Japan S I F 1·23 —Not quite hardy N

EE *Cones sessile or nearly sessile, ovoid or ovoid-oblong.*

4 **lénta,** Linn (*B campinfòlia*, Ehrh) Cherry, Sweet, or Black Birch Tree, 60–70 ft trunk dark reddish brown, young bark aromatic, of agreeable flavor lvs oblong-ovate, usually cordate at the base, sharply and doubly serrate, hairy beneath when young, nearly glabrous at length, 2–5 in long cones ovoid-oblong, 1–1½ in long, scales about ⅛in long lobed

only at the apex, the middle lobe slightly longer. From Maine to Ala., west to eastern Ohio S S. 9.448. H T. 124, 125. Em. 232.—Very handsome tree, round-headed, and with pendulous branches when older; attractive in spring, with its long staminate catkins. Bark and lvs. largely used in domestic practice; branches and foliage yield an oil very similar to oil of wintergreen, and employed for all conditions in which the latter proves useful, bark as well as the oil much used for flavoring.



548 Betula pendula.

5. **lûtea,** Michx. (*B. excélsa,* Pursh, not Ait.). YELLOW BIRCH. Fig. 547. Tree, sometimes 100 ft.. bark silvery gray or light orange, on old trunks reddish brown, young bark aromatic, but somewhat bitter· branchlets usually pilose: lvs. ovate or oblong-ovate, usually rounded at the base, acuminate, sharply and doubly serrate, usually hairy along the veins beneath: cones like the last, but thicker; scales nearly ½in long, lobed to the middle, pubescent outside From Newfoundland west to Minn, south along the Alleghanies to the high peaks of N C. and Tenn. S.S. 9.449 Em. 235. H.T 126, 127 —One of the most valuable forest trees in the northern states, much resembling the former in habit. Var **persicifôlia,** Dipp, has larger and longer lvs., often ovate-lanceolate.

DD. *Shape of lvs ovate, broadest near the base and usually truncate or sometimes cordate. veins not impressed above petioles to 1 in. long.*

6. **ulmifôlia,** Sieb. & Zucc. (*B costàta,* Trautv). Tree, 50 ft.: bark yellowish brown branches not, or slightly glandular: lvs. ovate, rarely oblong-ovate, irregularly doubly serrate, with 9-14 pairs of veins, long-acuminate, 2–3½ in long, hairy when unfolding, glabrous at maturity· cones elliptic; scales glabrous, with short, rhombic or obovate lateral lobes, wings about half as broad as nutlet. Japan. Manchuria. S I F 1 22 W B. 63.

7 **Ermánii,** Cham. Tree, 60 ft.: trunk white· branches yellowish white or orange-colored; branchlets usually glandular and pubescent when young· lvs. broadly triangular-ovate, acuminate, irregularly coarsely serrate, 2–4 in long, hairy when unfolding, with 7–10 pairs of veins cones oblong; scales pubescent, with linear-oblong lobes, middle one somewhat longer; wings about one-third as broad as nutlet N. E. Asia, Japan S I F 1.22 W B 63.—Handsome round-headed tree, with slender branches. See page 3566.

AA. *Veins of lvs. 7 or less pairs, not impressed.*

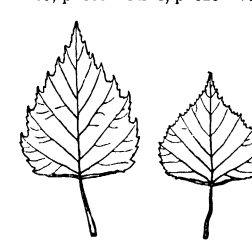
B. *Wings usually broader than the nut.*

C. *Bark white.*

D. *Branchlets glabrous and glandular· lvs. usually rhombic-ovate· scales of strobiles with divergent broad lobes larger than the middle lobe.*

8. **populifôlia,** Ait. (*B álba* var *populifôlia,* Spach). WHITE BIRCH. Small tree, exceptionally 40 ft , with smooth white bark: branchlets with numerous resinous glands: lvs. slender. petioled, triangular or deltoid, long-acuminate, coarsely doubly serrate, glutinous when young, glabrous at length and shining: cones slender stalked, cylindric, about 1 in. long; bracts pubescent, the lateral lobes divergent, about as long as the middle one. From New Brunswick to Del , west to Ont S S 9:450. H T 118, 119. Em. 1:242.—A small, graceful, but short-lived tree, yet thriving in dry and poor soil. Var. **laciniàta,** Loud. Lvs. incised-laciniate Var **péndula,** Loud Branches distinctly pendulous. Var. **purpûrea,** Ellwanger & Barry. Lvs. purple when young, green at length *B. populifolia* × *B. papyrifera* is shown in G F 8.356. It has been found wild in several localities, but is apparently not in cult.

9. **péndula,** Roth (*B verrucòsa,* Ehrh *B álba,* Linn., in part) Figs 548, 549. Tree, to 60 ft , with slender, in older trees usually pendulous, branches young branchlets usually glandular. lvs. rhombic-ovate, ¾–2½ in. long, glutinous when young, glabrous, usually cuneate, sometimes truncate at the base, acuminate, doubly serrate, petioles slender, about 1 in. long: strobiles cylindric, about 1 in. long, slender-peduncled, usually pendulous· wings of nutlet about one and a half to two and a half times as broad as its body Eu to Japan. H W. 2 15, p. 20 W B 76. Var **Taùschii,** Rehd (*B japónica,* Sieb. *B. álba* var *Taùschii,* Shirai. *B. péndula* var *japònica,* Rehd). Lvs broadly ovate, truncate or sometimes subcordate at the base, sometimes puberulous beneath and often with tufts of hairs in the axils S I F 1 21 Var **dalecárlica,** Schneid (*B lacinìàta,* Wahl. *B. hýbrida,* Blom) Lvs. more or less deeply lobed with irregularly serrate-acuminate lobes. branches on older trees pendulous —A very graceful tree Var. **fastigiàta,** Koch (*B álba fastigiàta,* Carr *B péndula pyramidàlis,* Dipp) With straight upright branches, forming a narrow columnar pyramid G C III 41:151 M D G 16:164. Var **tristis,** Schneid With very slender, strongly pendulous branches, forming a round regular head. Var **Youngii,** Schneid (*B álba péndula Youngii,* Moore. *B péndula élegans,* Dipp *B. álba elegantíssima péndula,* Hort). Branches very slender, strongly pendulous; primary branches spreading or recurved, forming an irregular picturesque head; similar in habit to the weeping beech F 1873, p 60 R H 1869, p 136 Gn 6, p 528 Var. **grácilis,** Rehd. (*B. álba laciniàta grácilis péndula,* Hort *B. élegans laciniàta,* Hort). Habit like the preceding, with laciniate lvs Much slenderer and smaller and of slower growth than var *dalecarlica* Var. **purpûrea,** Schneid. (*B vulgàris purpùrea,* André. *B. álba atropurpùrea,* Lauche. *B. pubéscens atropurpùrea,* Zabel). Lvs. dark purple R B. 4:185.



549. Leaves of Betula pendula. (×½)

DD. *Branchlets pubescent and slightly glandular or glandless: lvs. generally ovate, rounded at the base bracts with the lateral lobes upright or spreading, shorter than the middle lobe.*

10. **pubéscens,** Ehrh. (*B. odoràta,* Bechst *B álba,* Linn , in part) Tree, to 60 ft.: branches upright or spreading, rarely pendulous in old trees; branchlets pubescent and glandless lvs ovate or rhombic-ovate, 1–2 in long, rounded, truncate or cuneate at the base, acute, usually unequally and doubly serrate, pubescent beneath, at least while young· strobiles cylindric, about 1 in long, upright or nodding; scales puberulous, lateral lobes upright or spreading, rarely recurved. N. and Cent Eu. to E. Siberia. H.W. 2, pp. 24, 25. Var.

urticifòlia, Spach (*B urticifòlia,* Regel. *B. álba asplenifòlia,* Hort.). Lvs. small, deep green, irregularly incised. Var. **variegàta,** Zabel (*B. álba fòlus variegàtis,* Hort.). An inconstant form with variegated lvs There are also a number of geographical varieties as var **carpàtica,** Koch; var **songàrica,** Regel; var. **tortuòsa,** Koehne; var. **Muríthii,** Grem, which are rarely met with in cult and horticulturally are of no importance. —In the wild state this species is generally found in moist places, often in swamps, while the preceding species prefers drier situations.

11 **papyrífera,** Marsh (*B papyràcea,* Ait *B grándis,* Schrad) PAPER or CANOE BIRCH Figs 550, 551 Tree, 60–80, exceptionally 120, ft . branchlets slightly glandular, hairy when young lvs ovate, narrowed to cordate at the base, acuminate, coarsely and usually doubly serrate, pubescent on the veins beneath or nearly glabrous, 1½–4½ in long strobiles peduncled, 1–2 in long, scales with short and broad divergent lateral lobes Northern states from the Atlantic to Pacific coast S S 9 451 Em 238 G F 8·223 H T. 120, 121 I.T. 4 125 —Ornamental tree, with very white trunk and a loose, graceful head when older Bark known for its use in making Indian canoes Var. **cordifòlia,** Regel (*B pyrifolia* and *B platyphýlla,* Hort) Lvs broadly ovate, usually cordate S S 14:724 Var. **minor,** Tuckm Low, bushy tree with smaller lvs and frs Mts of New England and N Y.

cc *Bark orange-brown branchlets glandular and hairy when young lateral lobes of scales upright, shorter than the middle lobe*

12 **occidentàlis,** Hook (*B Lyalliàna,* Koehne *B papyràcea* var *occidentalis,* Dipp) Tree, to 100 ft branches in older trees often pendulous lvs ovate, 3–4 in long, usually rounded at the base, acute, coarsely and mostly doubly serrate, resinous while young and villous on the veins, glabrous at maturity except on the puberulous veins strobiles cylindric, 1¼–1½ in long; scales ciliate, with rhombic-ovate upright lateral lobes, about half as long as the oblong middle lobe B C to Wash. S S 14 725.



550 Staminate catkin (natural size) **and flowers** (enlarged) **of Betula papyrifera**

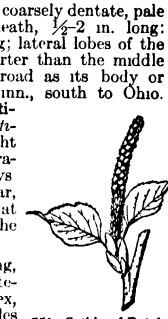
bb *Wings narrower than the nut shrubs, 1–15 ft lvs small, short-petioled· cones erect.*

c *Branchlets glandular, not pubescent*

13 **glandulòsa,** Michx Only 1–4 ft : lvs short-petioled, rounded or cuneate at the base, orbicular or broadly obovate, obtuse, dentate, glabrous, ¼–1½ in long: strobiles peduncled, ½–¾in long; lobes of scales nearly equal, slightly spreading; wings of nutlet sometimes as broad as its body. Newfoundland to Alaska, south to Mich., and in the Rocky Mts. to Colo. B.B. 1:510.

cc *Branchlets pubescent or nearly glabrous, not glandular.*

14 **pùmila,** Linn. Usually 2–8, rarely 15, ft.· branchlets tomentose or pubescent, at least when young lvs. orbicular or oval, acute or obtuse, coarsely dentate, pale and glabrous or pubescent beneath, ½–2 in. long: strobiles peduncled, ½–1 in long; lateral lobes of the pubescent scales spreading, shorter than the middle one, wings of nutlet half as broad as its body or narrower Newfoundland to Minn., south to Ohio. B B. 1·511. W B 71 Var. **fastigiàta,** Rehd (*B. húmilis fastigiàta,* Hort) Shrub, with upright branches, forming a narrow pyramid branchlets soft pubescent lvs broadly rhombic to suborbicular, 1–1½ in long, broadly cuneate at base, pubescent beneath only on the veins, resin-dotted on both sides


551. Catkin of Betula papyrifera (×½)

15 **nàna,** Linn Low, spreading, rarely 4 ft . lvs orbicular or cuneate-obovate, crenate, rounded at apex, glabrous, ¼–½in long strobiles nearly sessile, ¼–½in long· the upper scales usually entire, the lower ones 3-lobed; wings of nutlets very narrow. Arctic N E. Amer., N Eu , Siberia. B B 1.511. W B 71 —A low, graceful shrub for rockeries and rocky slopes

B acuminàta, Wall =B alnoides —*B alaskàna,* Sarg Allied to B occidentalis Tree to 10, rarely 80 ft bark grayish white branchlets densely glandular lvs rhombic-ovate, 1½–3 in long, truncate to broadly cuneate pubescent on the veins beneath or finally glabrous, petiole about 1 in long scales of strobiles ciliate Alaska S S 14 726 —*B alleghaniensis* Brit Intermediate between B lenta and B lutea Bark either close and furrowed or peeling off in thin flakes young branchlets pubescent lvs usually cordate at base and pubescent beneath strobiles ovoid-oblong, about 1 in long, scales ¼in long, 3-lobed about to the middle Que and Mich to Ga —*B alnoides,* Hamil (B acuminata Wall B cylindrostachya, Wall) Allied to B Maximowiczii Tree, to 60 ft young branchlets pubescent, bark brown lvs ovate-oblong to ovate-lanceolate, 2½ 6 in long, rounded at the base, doubly cuspidate-serrate, with 10–14 pairs of veins strobiles in racemes Himalayas, S W China W B 90 —*B alpestris,* Friess=B intermedia —*B Borggrèvei,* Zabel (B papyrifera × B pumila) Shrubby Intermediate between the parents, but more similar to B pumila Raised at Hann , Muenden, Germany, from American seed —*B cærulea,* Blanch Allied to B pendula Tree, to 60 ft young branchlets hairy lvs ovate, 2–3½ in long, rounded or cuneate at base, acuminate, sharply serrate, dull bluish green above slightly hairy along the veins beneath scales of strobiles similar to those of B populifolia Vt , Me S M 201 —*B carpinifolia,* Sieb & Zucc = B grossa —*B carpinifólia,* Ehrh =B lenta —*B coryliifólia,* Regel Allied to B nigra Lvs broadly elliptic or obovate, 1¾–2½ in long, coarsely dentate, silky on the veins beneath, with 10–14 impressed pairs of veins strobiles cylindric Japan S I F 2 14 W B 60— The plant cult under this name is usually B Ermanii —*B cylindrostachya,* Wall =B alnoides —*B dahurica* Pall Allied to B pubescens Tree, to 60 ft bark brown branchlets glandular, hairy when young lvs ovate, 1–2 in long, pubescent on the veins beneath strobiles oblong, wings of nutlet half as broad as body or less Dahuria, Manchuria Pallas, Fl Ross 39 — *B excelsa,* Ait (B alba var excelsa, Regel) Allied to B pubescens Large tree bark yellowish brown young branchlets densely pubescent lvs broadly ovate to obovate, 1½ in long, rounded or subcordate at the base, acute, pubescent beneath strobiles cylindric-oblong, upright or nodding, lateral lobes of scales slightly shorter than the middle one Of unknown origin W D B 2 95 N D 3 52 —*B fontinàlis,* Sarg (B occidentalis, Nutt , not Hook B rhombifolia, Nutt , not Tausch) Allied to B occidentalis Small tree, to 40 ft or shrubby: bark dark bronze color, lustrous: branchlets glandular lvs broadly ovate, 1–2 in long, truncate to broadly cuneate, sharply, often doubly serrate strobiles cylindric-oblong, 1–1¼ in long, scales glabrous or puberulous B C. to Calif , east to Dak and Colo S S. 9 153 (as B occidentalis) —*B fruticòsa,* Pall (B Gmelinii, Bunge). Allied to B glandulosa Shrub, to 15 ft branchlets glandular and pubescent lvs ovate-elliptic, ½–1½ in long, glabrous at length and usually glandular beneath strobiles oblong-cylindric, ¾–1 in long, wings about as broad as nutlet Siberia, Manchuria Pallas, Fl Ross 40 —*B globispica,* Shirai Allied to B ulmifolia Tree, to 60 ft bark grayish brown lvs broadly rhombic-ovate, 1½–2½ in. long, short-acuminate, unequally serrate, with about 10 pairs of veins, pubescent on the veins beneath strobiles subglobose or ovoid, about 1½ in long, scales deeply 3-lobed with spatulate lobes Japan S I F 1 21 W B 68 —*B Gmelinii,* Bunge=B fruticosa —*B grossa,* Sieb & Zucc (B carpinifolia, Sieb & Zucc) Tree branchlets glabrous lvs ovate, 2–4 in long, unequally serrate, with 10–15 pairs of veins, pubescent on the veins beneath and glandular-punctate strobiles nearly sessile, elliptic-ovoid, middle lobe of the scale slightly longer than the lateral ones Japan S I F 1 22 —*B húmilis,* Schrank Allied to B glandulosa Shrub, 2–6 ft. branchlets glandular and slightly pubescent at first lvs ovate or suborbicular, ½–1¼ in long, crenately serrate, glabrous strobiles ovoid, about ½in long N and W Eu , N Asia G W H 2 149. H.W 2·

p 26 R F G 12 1279 —*B intermèdia*, Thomas (B alpestris, Fries, B pubescens × B nana) Shrub lvs orbicular or ovate, ½–1 in long, crenate-serrate, usually pubescent while young, and often glutinous, finely glabrate, strobiles oblong, lateral lobes of scale upright and usually shorter than the middle one N Eu.—Natural hybrid, very variable —*B Jackii*, Schneid (B lenta × pumila) **Shrub:** bark of the odor of B lenta lvs, usually obovate, 1–2 in. long, usually with about 7 pairs of veins strobiles oblong, ½–¾ in. long, lateral lobes of scales spreading, somewhat shorter than the middle one Originated at the Arnold Arboretum. G F 8 245 — *B kenaica*, Evans Allied to B occidentalis Tree, to 40 ft. bark grayish white or light reddish brown branchlets glabrous, not or slightly glandular lvs ovate, 1½–2 in long, cuneate or rounded at the base, irregularly, often doubly serrate, glabrous strobiles cylindric-oblong, about 1 in long, glabrous Alaska S S 14 723 —*B. Köhnei*, Schneid (B papyrifera × pendula) Intermediate between the parents Tree branchlets sparingly pubescent lvs ovate, 2–3½ in long, usually truncate at base, acuminate, rather finely and doubly serrate scales of strobiles similar to those of B papyrifera Origin unknown —*B luminifera*, Winkl Allied to B alnoides Lvs. ovate, subcordate at the base, serrate with acuminate teeth, 3–5 in long strobiles solitary, 2-3 in long Cent China W 92 —*B Medwedjewii*, Regel Allied to B utilis Tree young branchlets hairy lvs broadly ovate to obovate, 2-3 in long, rounded or sometimes subcordate at the base, short-acuminate, glabrous or pubescent on the veins beneath strobiles cylindric-oblong, 1–1¾ in long, wings of nutlet often 4 times narrower than its body Caucasus Gt 36, p 384 —*B occidentalis*, Nutt , not Hook =B fontinalis —*B Purpusii*, Schneid (B lutea × pumila) Shrubby or small tree lvs oblong-ovate, 1–2 in long, with 7–9 pairs of veins, soft-pubescent beneath Intro to Eu from Mich —*B Raddeana*, Trautv Tree lvs ovate-pubescent on the veins beneath, with 6–7 pairs of veins, 1–2 in long strobiles oblong, upright, ¾in long, wings as broad as nutlet Caucasus. Gt. 36, p. 384 —*B rhombifolia*, Nutt =B. fontinalis

ALFRED REHDER.

BIÀRUM (old and obscure name) Incl. *Ischarum*. *Aràceæ* Dwarf, tuberous perennials of the same tribe with our native jack-in-the-pulpit They are hardy in England, but probably are suitable only for pot-culture in the Northern United States.

Biarums have a spathe which is tubular at the base, mostly with a long limb, and usually a long tail-like spadix, otherwise much as in Arum They grow a few inches high Odd Little known in Amer. A few species in Eu and Asia Minor

tenuifòlium, Schott (*Árum tenuifòlium*, Linn). Lvs linear-lanceolate or spatulate, appearing after the fls decay spathe long-acuminate, at length recurved and twisted spirally, about 10 in long, outside green, streaked purple, inside dull purple, spotted, margins wavy, spadix 15 in long Spain. B M. 2282.

Pyrámu, Engler (*Ischarum Pyrámu*, Schott). Lvs. oblong above the middle, narrowing abruptly to a very long petiole, resembling *Calla palustris* spathe green outside, shining, velvety purple within, shorter and broader than in *B tubiflorum*, at length revolute; tube swelling, connate only at the very base; spadix thicker and shorter Syria B M 5324.

Bòvei, Blume Lvs similar to *B. Pyramu;* spathe-tube connate a fourth of its length; blade of spathe longer and more narrowly lanceolate, green outside, dark purple within. Syria, Asia Minor. L. H. B

BÌDENS (Latin, *two-teeth*, in reference to the awns). *Compósitæ* BUR-MARIGOLD STICK-TIGHTS TICK-SEED. Annual, or rarely perennial, herbs, mostly American, related to Coreopsis, Dahlia, and Cosmos

Leaves opposite, serrate or incised, often pinnately or ternately divided heads radiate or discoid; rays yellow or white; disk yellow, involucre double, the outer set of bracts green and more or less foliaceous, the inner of quite different texture and shape, more appressed, thinner, more scarious and striate achenes flat or angled, pappus of 2–4 stiff bristles or awns, usually retrosely barbed —Plants grown as garden annuals. *B. frondosa*, a common weed, is the well-known bootjack bur or stick-tight

A. *Achenes obovate or cuneate-oblong, more or less flattened or triangular, the faces uni-costate texture of lf. medium.*

B. *Size of achenes small (1–2 lines long) with firm glabrous margins inner involucre dark dotted.*

coronàta, Fisch. (*Coreópsis aúrea*, Ait). St. 1–4 ft. high, branched above, glabrous or nearly so lvs ternately or pinnately divided: outer involucre about equaling the dark-dotted inner: achenes dark, very small, 1–2 lines long, narrowly cuneate, 3-angled, margin firm and glabrous; pappus of 2–4 minute awns and some chaff. S. E. U. S.—Very variable.

BB. *Size of achenes larger (2–4 lines long) with hispid margins: involucre not dotted.*

trichospérma, Brit. (*Coreópsis trichospérma*, Michx.). St. tall, 2–5 ft. high, glabrous, branched above. lvs. pinnatifid: outer involucre about equaling the undotted inner achenes dark, larger, 2½–4 lines long, cuneate, moderately flat, margin firm, usually pubescent, pappus of 2 upwardly hispid broad-based awns about ½ line long E U. S Var. **tenuifòlia,** Brit. Lf -segms. narrowly linear. achenes 2–3 lines long

aristòsa, Brit. (*Coreópsis aristòsa*, Michx) St 1–4 ft high, branched above, nearly or quite glabrous: lvs pinnatifid, often pubescent beneath outer involucre about equaling the undotted inner achenes olive or brownish, large, 2–4 lines long, broad and very flat 1–2½ lines broad, abruptly contracted at summit, margin thin and hispid, often crenulate, pappus awns 2, each 1–2 lines long, divergent, straminous, upwardly or downwardly barbed, or sometimes entirely wanting. Cent U S B M 6462. R.H. 1869.72

AA *Achenes linear-spindle-shaped, tapering gradually above, angled or costate texture of lf usually firmer*

B. *Lvs , in part, finely dissected. rays large, golden yellow.*

grandiflòra, Balb. St 1–4 ft. high, branched, glabrous and somewhat glaucous lvs pinnatifid, the divisions either lanceolate and serrate or dissected into narrowly linear divisions outer involucre about equaling the more or less hirsute inner; rays large, golden yellow achenes 3–6 lines long, awns 2, downwardly barbed, about 1 line long Mex —A showy plant sometimes cult. in Amer

BB *Lvs or their divisions lanceolate to ovate rays pale yellow or whitish*

Warszewicziàna, Regel Erect, glabrous perennial: lvs simple, or pinnate or rarely bipinnate, the lobes lanceolate or ovate-lanceolate heads corymbose, the involucral bracts ciliate, petals whitish or yellowish, of medium size: achenes compressed, angular, the angles ciliate Guatemala —Hardy N only with protection.

pilòsa, Linn. St. 2–5 ft. high, much branched, nearly glabrous lvs ternate or pinnate, divisions lanceolate, incised-serrate with somewhat rounded teeth outer involucre about equaling the glabrous or minutely puberulent inner rays short, 1–3 times as long as the involucre, creamy-white. achenes 4–7 lines long; awns 2–4, downwardly barbed, 1½ lines long Tropics — Sometimes grown in botanic gardens.

B dahlioides, Wats A perennial with dahlia-like tubers. Mex. G.C. III 48 226 R H. 1910, p 475.

K. M WIEGAND and N. TAYLOR.

BIENNIALS. Plants that bloom a year after the seeds are sown, then make seeds and die. Familiar examples among vegetables are cabbage, turnips, celery and onions, but in warm or long-season climates they become annuals Even in northern gardens, celery, carrots and beets, if permitted to crowd, will often run to seed the first year. On the other hand, many biennials, such as hollyhocks and others, are practically perennial because they self-sow, or multiply by offshoots, so that there is little danger of losing them. Such cases give rise to discussion as to whether a plant is an annual, biennial, or perennial, but the practical problems are few and simple, and are commonly connected with the following favorite flowers·

Hollyhock (*Althæa rosea*), snapdragon (*Antirrhinum majus*), English daisy (*Bellis perennis*), Canterbury

bells (*Campanula Medium*), steeple bellflower (*Campanula pyramidalis*), sweet william (*Dianthus barbatus*), foxglove (*Digitalis purpurea*), horned poppy (*Glaucium luteum*), French honeysuckle (*Hedysarum coronarium*), morning campion (*Lychnis dioica*), evening campion (*Lychnis alba*), rose campion (*Lychnis Coronaria*), honesty (*Lunaria annua, L biennis*), pansy (*Viola tricolor* ×) tufted pansies (*Viola cornuta* ×)

Every beginner desires to know what to do with the seedlings that spring up in every border by the dozen or hundred around sweet williams, foxgloves, larkspurs, hollyhocks, and the like All that is necessary is to thin the seedlings and transplant some at any convenient time before autumn to the positions in which they are to bloom next year This practice, however, does not suit those who want only the finest varieties, for these do not come true from seed Therefore, they must buy seeds every year of the best varieties of highly-bred groups, such as sweet william, foxglove, English daisy, Canterbury bells, and hollyhocks, or else buy plants If a very fine variety appears, it is desirable to multiply it by methods other than seed-sowing if possible, e g , by offsets, cuttings or division Named larkspurs cannot be kept a long time, owing to disease, unless propagated by cuttings every year Double hollyhocks can be maintained by division and by keeping the leaves coated constantly with ammoniacal copper carbonate, which is less unsightly than bordeaux A German cultivator avers that one should save seeds from diseased hollyhock plants instead of healthy ones, and declares that he has raised 1,500 such seedlings that proved immune So far as known, this has not been thoroughly tested in America

Those who do not want such expense and care, and prefer lusty, many-flowered plants of ordinary varieties to sickly specimens of high-bred types, will find it cheaper and easier to collect seeds as they ripen and sow them immediately Color discords can be mitigated by thinning out or transplanting offenders This is the way to secure gorgeous masses of blue delphiniums, if one cares more for color than size and form

What to do with famous English spring flowers that dislike our hot summers is another common problem. The beginner finds that violets, pansies, daisies, primroses, polyanthus, and auriculas, will not bloom all summer, as they do in the cool, moist climate of England, unless in similar climates (e g , at the seashore or in the northern tier of states), and then only with special care in seed-picking, cutting-back, fertilizing, watering At best the summer bloom is only intermittent, rarely massive, and the common practice is to treat these species frankly as spring bedding plants (April 15 to May 15 near New York), and when their glory is past discard them or move them to some moist, shady spot in which there is a better chance for casual summer bloom and a tolerable autumn show than in the hot sunny border

Those who cannot afford greenhouses may easily have larger and better flowers of the species just named by the use of coldframes They are particularly enjoyable while the snows of March are on the ground.

In these days of cheap greenhouses, everyone wants cut-flowers the year round, especially long-stemmed, long-lasting kinds in many colors. Consequently snapdragons and ten-weeks stocks have become popular

The commonest way of raising biennials is to sow the seeds in an outdoor seed-bed in summer, and in autumn transplant the seedlings to their permanent quarters English books have always disappointed Americans by advising that this be done in June But in America the best time is early August. Not only does one save two months' care, but June-sown biennials and perennials in our climate make plants that are too large to winter easily in coldframes, and they often try to bloom just when the killing frost of autumn comes.

A much better way is to sow the seeds in flats in coldframes (for protection against summer showers) and to winter the young plants in frames. This is the way to secure the finest white foxgloves, Canterbury bells, larkspurs, and steeple bellflowers.

Professional gardeners often prefer to treat biennials as half-hardy annuals, i.e., they sow the seeds in greenhouses in March and set the young plants outdoors in May On new places this saves a year, it is especially worth doing with snapdragons and intermediate stocks

Many of the flowers named above are technically perennial, but in practice they are so short-lived that it usually pays to raise a fresh batch from seed every year WILHELM MILLER

BIFRENÀRIA (Latin for *twice* and *strap*, referring to the two stalks of the pollinia) *Orchidàceæ*. Epiphytic plants, with pseudobulbs, plicate-veined lvs, and lateral infl fls. sometimes single and large, or more frequently smaller and several to many in a raceme; sepals about equal, spreading, the lateral adnate to the foot of the column, petals similar to the dorsal sepal; lip articulated to the apex of the column-foot, 3-lobed, pollinia 4, on 2 stalks — About 25 species in Trop Amer



552 Bifrenaria Harrisoniæ. (×⅓)

A *Foot of column or mentum short and broad fls deep yellow with golden purple spots*

aurantiaca, Lindl. Pseudobulbs ovoid, up to 1½ in long· lvs up to 8 in. long and 2 in broad raceme few- to several-fld ; fls about 1 in across, deep yellow and spotted with golden purple. Guiana and Trinidad. B M 3597 B R 1875.

AA. *Foot long, acute fls. not colored as above.*

B *Fls large, 1–3*

C. *Lip purple, darker-veined fls ivory-white.*

Hárrisoniæ, Reichb f Fig 552. Pseudobulbs broadly ovoid, up to 2½ in long, 1-lvd lvs up to 1 ft. long and 4 in broad peduncle with 1 or 2 ivory-white large fls about 3 in across, the lip purple with darker veins Brazil Lind 5 239 B R 897 B M 2927 (as Maxillaria)

CC. *Lip white, yellow or rose· fls. apple-green.*

inodòra, Lindl Resembles *B Harrisoniæ* in pseudobulbs, lvs , infl and size of fls . sepals apple-green; petals of the same color but brighter, smaller; lip white, yellow or rose; spur half as long as ovary. Brazil.

BB *Fls small, several*

vitellìna, Lindl. Pseudobulbs ovoid, up to 1½ in. long, 1-lvd.: lvs. up to 1 ft long and 1½ in broad: fls. about 1 in across, orange-yellow, with a purple spot on the lip; lip cordate. Brazil. B.R. 25:12. (As Maxillaria)

B. bicornàta, Reichb. Allied to B aurantiaca Fls orange-colored. Brazil —*B Fuerstenbergiana*, Schlecht Fls yellow Brazil —*B melandpoda*, Klotzsch Sepals and petals light green, lip fringed, white Brazil —*B tetragòna*, Hort Fls wax-like with greenish sepals and petals Brazil —*B tyrianthina* var *Goodsònæ*, Reichb. Fls light purple GEORGE V. NASH.

BIGELÒVIA (after Dr Jacob Bigelow, author of Florula Bostoniensis, Medical Botany of United States, etc.). Frequently written Bigelowia. *Compósitæ* More than thirty species of western American herbs or low shrubs, one or two of which are sometimes offered by dealers in native plants

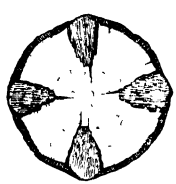
Heads 3–30-fld, without ray fls, small; involucre narrow, its bracts mostly lacking herbaceous tips. The only species in cult is the one originally described, which resembles a goldenrod, to which Bigelovia is very closely related. It differs in not having the racemiform infl of goldenrods Prop. by cuttings and by seed

gravèolens, Gray (*Bigelòwia dracunculoìdes,* DC). Low shrub, 1–3 ft high, densely white-tomentose when young, smoother in age, much branched, very leafy, malodorous only in drying lvs linear, 1–2 in. long fl-heads yellow, 5–8 lines high, very numerous, crowded, in terminal corymbose cymes, rayless Alkaline soils Dak to B. C and south to S Calif and Ariz —An extremely variable species. Var **albicaùlis** is more permanently and densely woolly, dwarfer, and has been recommended in the West for low hedges and edgings. N. Taylor.†

BIGNAY: *Antidesma.*

BIGNÒNIA (The Abbé Jean Paul Bignon, 1662–1743, Court librarian to Louis XIV). *Bignoniàceæ.* Woody tendril-climbers, grown in the open in the warmer parts and also under glass

Leaves opposite, compound (in proper representatives of the genus), the terminal lft often represented by a tendril· fls large, tubular or bell-shaped, enlarged above the calyx, obtusely 5-lobed, and more or less 2-lipped, the calyx slightly or not at all toothed; stamens 4, paired, and sometimes a sterile rudiment fr. a 2-celled septifragal caps. flattened parallel with the partition; valves thickened; seeds winged —The genus Bignonia is variously understood By Bentham & Hooker it is regarded as a polymorphous group of 150 or more species, by Schumann (in Engler & Prantl) it is reduced to 2 species with claw-like (not disk-bearing) tendrils, *B exoleta,* Vell, and *B Unguis-cati,* Linn. By the former authors Bignoniaceæ is held to contain about 50 genera, and by the latter about 100 Schumann distributes the bignonias of Bentham & Hooker into several genera. the common East American *B. capreolata* goes to Doxantha, a disposition that has not been accepted by American botanists As here employed, Bignonia is deprived of many of the tropical species that have been placed in it in horticultural literature, and the student is referred to Clytostoma, Cydista, Phædranthus, Pithecoctenium, Pyrostegia, Tabebuia and others Very recently the name Bignonia has been used for the species described in this work under Campsis, because Bignonia originally was based mainly on *B radicans* = *Campsis radicans.* In this case, the generic name for *B exoleta* and *B Unguis-cati* above becomes *Doxantha;* otherwise, this latter name remains a synonym of Bignonia, although, as stated above, Schumann has used it as the generic name of *B capreolata;* but the correct name for this plant appears to be *Anisostichus capreolata,* of Bureau The other species described here under Bignonia probably belong to different genera, but their correct botanical affinity has not yet been ascertained.



553. Cross-section of stem of a tropical climber of the bignonia family.

The bignonias are American climbers, mostly tropical, some of them and their allies constituting lianas of great length, and the profusion and beauty of their flowers makes them conspicuous and interesting The stem of some species shows a 4-parted or cross-like arrangement in cross-section, whence the name "cross-vine," and on this account, some of the natives of Spanish America attribute sacred virtues or attributes to the plants, calling them "bejucos de la cruz" Fig 553

The bignonias (using the term in the horticultural sense) are strong and rapid-growing evergreen greenhouse climbers, requiring considerable space for their best development, such as the roof of a large conservatory, or the back wall of a lean-to greenhouse. If convenient, they should be planted out under the plant stage of the greenhouse, or otherwise in boxes placed on the stage A box 5 feet by 1½ feet and 1 foot deep will be found a convenient size for them As with most greenhouse climbing plants, the roots like considerable freedom, but with bignonias the roots must be somewhat restricted (though not to the limitations of a flower-pot), otherwise an immense growth and few flowers will be the result. They are not very fastidious as to soil. A good, fibrous loam, to which one-third well-decomposed cow or sheep manure has been added, suits them admirably A winter temperature of 45° to 50°, with a gradual rise as the days lengthen, should be given them, admitting air freely whenever the weather is favorable They like plenty of moisture at the roots—especially during the spring and summer (the growing season)—but perfect drainage should be insured, as the soil at no time must become saturated or sour Except when in flower, a good syringing on all fine days will be very beneficial They should also be sprayed once or twice a week with a moderately strong solution of kerosene emulsion, or kerosene and water, to keep them free from mealy-bug, as they are very subject to this pest The vines should be trained so as to allow a free circulation of air among the branches for the purpose of ripening the wood, as upon this depends the assurance of flowers All superfluous branches and weak shoots should be removed, and before the growing season begins all the branches should be shortened from 1 to 3 feet, according to their strength; this will throw the energy of the plant into the lateral buds, which will produce the flowering branches, providing the wood has been properly ripened the previous season —Propagation is effected by cuttings taken in late spring and inserted in sand under a bell-glass, or in a propagating-box, in a warm temperature. Choose, if possible, stout, short-jointed lateral growths for the purpose. They must be carefully watered until rooted, which usually takes from six to ten weeks (E. J Canning)

A. *Lvs compound fls yellow or yellow-red.*

Chàmberlaynii, Sims (*Anemopægma racemòsum,* Mart) Glabrous. lfts. ovate-acuminate, glabrous, shining above, paler beneath, more or less tapering at base. fls tubular, contracted below, 3–4 in long, the limb comparatively short and spreading, bright yellow; cluster many-fld. Brazil. B M 2148 F S. 3 235. P M 14·3–4.—One of the freest and most beautiful tropical climbers, flowering well in a small house. Should be in all collections of tropical plants This plant bears the name of Consul-General Chamberlayne, stationed about 100 years ago in Brazil. The genus Anemopægma is kept distinct by many.

Ùnguis-càti, Linn (*B Tweediàna,* Lindl, not Griseb) Lvs. evergreen, lfts. 1 pair, lanceolate and pointed, cordate, 3 in or less long, with 3-parted claw-like tendrils: fls. trumpet-shaped, 2 in long, allamanda-like, tube clear bright yellow, upper surface of limb orange-yellow, and throat with orange lines, the limb of rounded, spreading lobes and from 2–4 in across. Argentina. B R. 26·45. Gn. 40·10 —Will stand a little frost if grown in the open in the S. *B. Tweediana,* Griseb, is a Macfadyena.

capreolàta, Linn. (*B. crucígera,* Linn., in part. *Anisóstichus capreolata,* Bur *Doxántha capreolàta,* Miers). TRUMPET-FLOWER CROSS-VINE. QUARTER-VINE Climbing to great heights (often 50 ft or more), glabrous, evergreen. lvs stiffish, ending in a branched tendril that clings by small disks; lfts stalked, oblong-acuminate, cordate, entire. fls in many 2–5-fld short-peduncled cymes, yellow-red and lighter within, tubular (2 in. long), with a stout limb. Native from Md. south and west, and often a pest in orchards, climbing on the trees. B.M. 864. Gng 1.370–1.—Handsome vine for outdoor use. Good for covering walls. Sometimes grown in conservatories. Not hardy N, but will survive in Mass as a creeping plant

Var. **atrosanguínea,** Hook. f (*B. atrosanguínea,* Hort.). Lvs longer and narrower. fls dark purple, the lobes short and triangular-ovate. B M. 6501. F.R. 2:27.—Handsome.

AA *Lvs simple, opposite (horticultural names, plants evidently not of this genus perhaps Tabebuias)*

magnífica, Bull. Free-growing and floriferous, needing warm treatment lvs ovate-elliptic, stalked, entire: fls. panicled, large (3½ in across), ranging from mauve to purple-red, the throat primrose limb wide-spreading Colombia G C II 12 73.—Requires hot sunny position under tropical conditions

regàlis, Hort Lvs elliptic-lanceolate· fls. large, yellow and red Guiana.—Requires warm treatment

argŷreo-violáscens, Hort Lvs ovate, cordate at base, short-stalked, purple when young, but becoming beautifully veined and blotched with white. fls. purple. S Amer (?) I H 13 469

β adenophýlla, Wall =Heterophragma.—*B æquinoctiàlis,* Linn =Cydista.—*B álba,* Hort =Pithecoctenium.—*B bucculatória,* Mart =Phædranthus.—*B Chérère,* Lindl =Phædranthus.—*B. chrysántha,* Hort =Tabebuia.—*B grandiflóra,* Thunb =Campsis.—*B jasminoídes,* A Cunn =Pandorea.—*B Lindleyi,* DC =Clytostoma.—*B littorális,* HBK Hairy on branchlets lfts roundish-ovate, acuminate, hairy fls red, pubescent, funnel-shaped, in axillary panicles Mex.—*B pállida,* Lindl =Tabebuia.—*B picta,* Lindl =Clytostoma.—*B purpúrea,* Hook =Clytostoma.—*B radicans,* Linn =Campsis.—*B rugósa,* Hook Hairy lfts 2, oblong acuminate fls axillary, 2–2½ in long, primrose-color, limb short. Venezuela Probably a Macrodiscus B M 7124.—*B speciósa,* Grah. =Clytostoma.—*B suaveolens,* Thunb =Stereospermum.—*B Thúnbergii,* Hort =Campsis.—*B venusta,* Ker=Pyrostegia L H B.

BILIMBI *Averrhoa.*

BILLBÈRGIA (after J. J. Labillardière, French botanist and traveler) *Pittosporàceæ* Six or eight species of tender Australian undershrubs, with twining branches, and terminal flowers suitable for outdoor planting South and for growing under glass

Leaves entire or sinuate, alternate. fls solitary or 2–3 together, sometimes as many as 15, yellow, purple or rarely blue, showy in *B longiflora.* fr succulent or fleshy, edible in some species Prop. by cuttings under a bell-jar or by seeds, which, at least in England, are produced freely in some of the species *B longiflora* and *B. scandens* are cult. abroad as greenhouse climbers. *B. cymosa* is cult. outdoors at Santa Barbara, Calif.

scándens, Smith. Fig. 554. Sts. twining, often extensively so. lvs variable, ovate-lanceolate to linear, obtuse or with a recurved point, 1–2 in long, entire or undulate· fls solitary, rarely 2 together, greenish yellow, violet or purple. Sweet. Fl. Aust., pl. 54. B M 801.—Offered by Montarioso Nurseries, Santa Barbara, Calif.

cymòsa, F. Muell. Shrubby with the branches more or less twining: lvs. oblong or lanceolate, sessile or nearly so, 1–2 in. long, obtuse or acute: corymbs several-fld.; sepals usually lanceolate-subulate; petals 7–8 lines long, bluish or violet-purple.

longiflòra, Labill Lvs. lanceolate, entire: fls. greenish yellow, often changing to purple, solitary; pedicels glabrous· berries blue. N. TAYLOR.

BILLBÈRGIA (for the Swedish botanist, J G. Billberg). *Bromeliàceæ.* About forty tropical American evergreen epiphytal herbs, now much cultivated by amateurs and in fancy collections. A few kinds are well known to florists A closely allied genus is Æchmea, which see for botanical differences



554 Billardiera scandens. (×¼)

The fls are in a spike or spicate panicle, which rises from the center of the rosette of long, spiny-edged, and usually stiff, pineapple-like lvs, showy, with 3-parted calyx and 3 long petals, 6 exserted stamens, thread-like style, and berry-like fr The colored bracts of the fl.-clusters are usually very showy. Of Charles Mez, the latest monographer, in DC Phaner Monogr 9 Species confused but the artificial arrangement given below may aid the gardener.

Billbergias can be cultivated best in greenhouses, planted in pans, pots, wooden cribs, or wire baskets, with loose, light material about their roots, such as pieces of charcoal, roots of very fibrous plants, or fern roots and sphagnum moss, and such material They demand little water at the roots in winter, and nothing but light sprinkling over the foliage is required to keep them alive during that time But in summer, when the heat is great and they are making their growth, they can withstand an abundance of moisture at the roots as well as at the top, most of the time holding water in the funnel-like center or body of the plant They usually produce their conspicuous showy bloom in the spring, when moisture overhead or sprinkling should be withheld in order to prolong the beauty of the flowers They require at night a temperature of 50° to 75°, but, of course, can stand any amount of heat in summer Billbergias, like all other bromeliads, make very good house plants, and they will thrive exceedingly well in a living-room temperature They love plenty of light and sun All first-class private garden establishments should have at least a few of this class of plants.—They are propagated best from suckers or sprouts, which arise from the base of the old plant, usually after it has bloomed and performed its functions The old plant then gradually deteriorates, sending out two to five young plants from its base. These can be taken off as soon as they are hardy and substantial enough, and can be mounted or potted into the same kind of material Then, suspended in the greenhouse, conservatory, or window for an exhibition, they thrive best.—Besides their beautiful and attractive flowers, billbergias have very handsome foliage, which is of a tough and leathery texture Billbergias, æchmeas, and the like, are natives of the tropics, and, therefore, require a warm temperature Æchmeas are usually larger than billbergias and tillandsias (H A Siebrecht)

A. *Petals curling spirally after fl expands* (*Helicodea.*)

zebrina, Lindl. (*Bromèlia zebrìna,* Herb *Æchmèa zebrìna,* Hort.) St very short, or none: lvs sheathing, deep green, with blotches and zones of gray-white, strongly spine-margined: fl.-cluster loose, long and drooping, fls green or yellow-green, the stamens becoming long-exserted, bracts salmon or rose, long-lanceolate. S Amer L B C 20.1912 B M 2686

decòra, Poepp & Endl (*Helicòdea Baraquiniàna,* Lem.). Differs from the last in having longer petals,

denser spikes and longer bracts. lvs. 8–10, from 1–2 ft. long, mealy, white-blotched and banded. Brazil. I.H. 11:421. B.M. 6937.

AA. *Petals not spirally twisting.*

B *Infl. nodding.*

C. *Fls in panicles.*

speciōsa, Thunb (*B. amœna,* Lindl. *B. pállida,* Ker) Lvs strap-shaped, connivent, and forming a tube at the base, 1–2 ft long, somewhat spine-margined, green above and lepidote and somewhat striped on the back fl.-cluster large and loose, drooping, bracts rose, fls pale green or whitish, tipped with blue. Brazil. —An old and well-known species

CC. *Fls in racemes.*

nūtans, Wendl Stemless, stoloniferous lvs linear and long-pointed, 1–2 ft, distantly small-toothed, finely striate on the back. fls. 4–8, in a loose, drooping raceme, petals green, blue-edged, bracts lanceolate, red. Brazil B M 6423 Gn 32. p 107

Morélii, Brongn (*B. Morelœna,* Hort *B. Wétherellii,* Hook.) Lvs short, 1–1½ ft., with few weak spines, wide, glabrous and green fl.-cluster exserted and drooping, with showy, pointed red bracts, the rachis woolly, fls with red sepals and purple-limbed petals. Brazil. B M 4835 J F 2, pl. 138 —Very showy.

BB. *Infl. erect*

C. *Fls red*

thyrsoídea, Mart Lvs 1–2 ft., broad-ligulate, spine-margined, concave on upper surface, green above and paler beneath, abruptly acuminate fl.-cluster shorter than lvs, farinaceous, densely red-bracted, fls numerous, bright red, petals reflexing Brazil B M 4756 J F. 3, pl. 267 —Showy. Runs into several varieties, some of them with purple-tipped fls (as vars **splēndida** and **fastuōsa,** André, R H 1883 300) *B. splēndens,* Hort., is evidently one of the forms Species too near the next

pyramidālis, Lindl (*Bromèlia pyramidàlis,* Sims. *B. Croyàna,* De Jonghe). A foot high differs from the last in having more gradually acuminate lvs., which are more strongly and distantly toothed and whitish, or even banded on the back fl.-cluster less farinaceous, broader and looser, the fls less numerous Peru. B M. 1732



555. Billbergia vexillaria.

CC. *Fls purple.*

vexillària, André Fig. 555 Hybrid of *B. thyrsoidea* and *B. Morelii* Fls purple, lower bracts long-pointed and red; spike erect, exceeding the lvs R.H. 1889:468.

vittàta, Brongn. (*B. Lèopoldii,* Hort, not Morr.). Vigorous, 2–3 ft lvs long and large, concave above, recurved at the summit obtuse, or abruptly pointed, red-spined, cross-banded on the back fl.-cluster loose and nodding, shorter than the lvs, red-bracted; fls deep blue, with recurving limbs. Brazil Gn 32.106. R. H 1869, p 87.

Liboniàna, De Jonghe. Small, 1–1½ ft, producing runners. lvs long-linear or strap-shaped, spiny, very sharp-pointed, concave and green above and whitish-mealy below. fl.-cluster erect or nearly so, rather slender, the bracts not prominent, fls with red sepals and erect blue petals. Brazil. B.M. 5090. F S 10:1048. J.F. 2, pl 197

In the American trade the following names have been used: *B clavàta longifòlia,* once offered by Pitcher & Manda, is probably an Æchmea.—*B fasciàta*=Æchmea fasciata.—*B máxima*=(?)—*B ornata*=(?)—*B Quesneliàna*=Quesnelia —*B rhodocyánea*=Æchmea fasciata.—*B stricta*=(?)

Any of the following may be expected to appear in the American trade at any time *B andegavénsis,* Hort., is B thyrsoidea × Morelii fls red and blue.—*B Bàkeri,* Morr (B pallescens, Baker) Fls. greenish, tipped purple B M 6342.—*B. Breauteàna,* André (B pallescens × vittata), has reddish, purple-limbed fls R H 1885 300.—*B Brùantii,* Hort (B Bakeri × decora) Fls greenish, bracts red.—*B Búderi,* Regel Small fls very deep blue, bracts coral-red Brazil.—*B Forgetiana,* Hort Lvs large with bands of white on a green ground G C III 33 258.—*B trídentàta,* Lindl Fls red and yellow, blue-tipped Brazil B R 1068.—*B. Lietzei,* Morr Fls and bracts rose Brazil.—*B nóbilis,* Bull Cat Bracts cerise-carmine, petals green, curling spirally after flowering lvs barred.—Perhaps only a form of B decora, Poepp & Endl.—*B Porteàna,* Brongn Fls green the petals rolling spirally Brazil B M 6670.—*B Sanderiàna,* Morr Fls green, tipped blue Brazil.—*B Saundersii,* Bull Fls greenish, tipped blue lvs striking, green above, reddish beneath white-blotched and red-spined Brazil Gt 39 1316

L H. B.

BILSTED· *Liquidambar*

GEORGE V. NASH.†

BÍLTIA *Rhododendron Vaseyi*

BINDWEED Name applied to various twining weedy plants, particularly to various kinds of Convolvulus

BIOPHÝTUM (life-plant, some of the species being sensitive to the touch). *Oxaludàceæ* Oxalis-like perennial herbs, sometimes grown under glass as curiosities: lvs. abruptly pinnate, with many lfts valves of caps. separating to base There are about 20 species in Trop. Asia, Afr and Amer **B. sensitívum,** DC., with 6–15 pairs of lfts., has lvs that contract at the touch fls. small, yellow 6 in Generally spread in the tropics B.R. 31 68 (as Oxalis) **B. Fóxii,** Sprague, is a recently described species from Peru, with st 2 in high and bearing 8 lvs at the apex in a whorl lfts. 3–6 pairs: fls white

BIÒTA: *Thuja.*

BIRCH. *Betula*

BIRD CACTUS. *Pedilanthus*

BIRD-OF-PARADISE FLOWER: *Strelitzia;* also *Cæsalpinia Gilliesii*

BIRDS. The horticulturist has the opportunity to avail himself of a mighty band of helpers in the birds It seems not to be understood that it is perfectly possible for a bird to be eating something useful to man at some particular moment, and at the same time to be spending by far the greater part of its time eating things that are harmful to man, for which service it should be carefully protected. Very thorough studies of the food of birds have proved that the great majority are helpful to one who raises crops. Most birds are beneficial most of the time, and very few have no redeeming traits in this regard. Moreover, if useful birds are protected at all times, so as to encourage the natural increase, they will do their part in an emergency, such as an invasion of insects Aside from these economic reasons for bird-protection is the gain that comes from their presence as attractive and interesting objects in nature, as much to be desired as blossoms and gardens

It is said that there is less need of birds now that insects are being destroyed by arsenical sprays. This is perhaps to some extent true, but even in fruit-plantations the birds are still effective; and there are hosts of insects that are not effectively held within bounds by the sprays. Spraying will never take the place of birds.

Protection of birds from their enemies

Birds should be both protected and attracted. Men and boys with guns and sling-shots, cats, and the Eng-

lish or house sparrow are the most common enemies or destroyers of birds. The red squirrel, weasel, crow, and shrike are destroyers as well, but they seem to be regulated naturally, although frequently one may interfere to good effect, particularly in the case of squirrels in parks But man, the cat and the English sparrow should be controlled. Our boys can be educated to protect the wild birds It is being done in many homes and schools As soon as a boy learns the interesting habits of the common birds he loses the desire to kill, and he prefers to protect and observe. A bluebird or wren nesting on the premises will do more than all the laws to correct the lawlessness of boys.



556. Pouring the food on the "food-tree"

Experience shows that one must deal with the house or English sparrow, if one is to win back our insect-eating birds in any great numbers The increase of other birds is in inverse ratio to the decrease of English sparrows However, not everyone should be allowed to take part in the warfare against them Schoolboys and inexperienced men make too many mistakes in trying to destroy them and their nests, and the taking of the eggs from the nest seems too much like an outrage on the instinct of motherhood, to be tolerated. The English sparrows should be kept within bounds as to numbers They can be kept in check by the use of poisoned grain in winter Some persons object to this practice from sentimental reasons, but it is no worse to despatch house sparrows than mice, prairie dogs, insects or other pests, and if man does not keep the sparrows within limits, they will destroy or drive away other birds A certain number of house sparrows is desirable in winter, particularly in towns where there are few other winter birds, but they should not be allowed to become nuisances See page 507

It has been estimated that a cat destroys on an average about fifty song birds in one season A new attitude toward cats is needed They should no more be allowed to roam at will than should chickens or goats All cats away from home are trespassers, and should be so regarded, they should fall to the care of a bird-warden. Bird-killing cats should be destroyed or kept within doors.



557. The "food-stick"

To attract birds, it is of course necessary to win their confidence. They must feel comfortable and secure. They must be aided to live through severe winter weather, and they must have adequate nesting-places and drinking-places. Measures to secure these ends have been put to the test and found to be genuinely satisfactory.

Feeding birds in winter.

Many birds perish for want of food in every severe winter They digest their food so quickly that lack of it for a few days results in death. The real necessity is in the time of blizzards and continued cold, when they cannot find their natural food.

For insect-eating birds, suet and fat pork or a split bone may be fastened to the trunks of trees by means of wire netting and stout cord. Woodpeckers, nuthatches, and chickadees will be attracted. The netting prevents crows, jays and squirrels from carrying off the whole piece of food

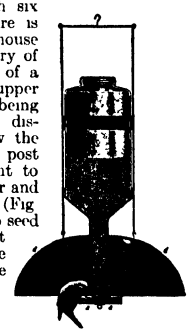
Seed-eating birds may be fed crumbs, nuts, millet, chaff, sunflower seeds, squash seeds, and various grains, including corn; also any kind of poultry-food, and even dog-biscuit. These materials may be placed on the ground after removing the snow, but should be protected to prevent waste Many a bob-white has survived a heavy snowstorm by coming regularly to such a place All kinds of sparrows, juncos, and snow buntings are among the birds that are attracted by such supplies

Many ways for feeding birds near the residence have been more or less successful, depending largely on the prevalence of the English or house sparrows. The tree-shelf, window-shelf, moving shelf or counter, and the coconut filled with pork and kernels of nuts, are among the most useful devices



558 A "food-house" that can be easily made.

In Germany, Baron von Berlepsch has experimented effectively in the winter-feeding of birds, with the idea of securing the protection of the food, and of making it accessible at all times to all birds. On his estate at Seebach he uses the "food-tree," the "food-stick," the "food-house" and the "food-bell," all of which were devised after many years of study of the habits of birds. The food-tree (Fig 556) imitates a coniferous tree closely covered with insect eggs and larvæ A mixture of hot liquid food which hardens as it cools is poured upon the tree. This food consists of white bread (dried and ground), meat (dried and ground), hemp, millet, sunflower seeds, and other seeds mixed with water The food-tree is especially interesting to children and has brought good results in the study of winter birds The food-stick (Fig. 557) is merely a part of a branch with six holes in which the food mixture is placed at intervals The food-house (Fig 558) is the most satisfactory of all ways of feeding It consists of a roof on four corner posts with upper and lower food-tables, the lower being used only until the birds have discovered the upper table Below the roof a strip of glass is fixed from post to post. This is very important to protect the food from the weather and also to admit light The food-bell (Fig 559) is a device for making hemp seed always accessible to the birds. It is very popular, except with the English sparrows It may be placed on trees or buildings.



559. Section of "food-bell." *a*, food-dish, *b*, tube, *c*, food reservoir, *d*, metal bell.

Nesting-houses.

The birds that naturally make their nests in holes in trees are the ones that have been induced to build in artificial houses Accordingly, the most successful houses are those that somewhat resemble a hollow limb, although great success has been attained with board houses, and other styles, as gourds, and coconuts, and even tin-cans In fact, some bird will adapt itself to almost any kind of house, provided cats, red squirrels and English sparrows are kept away.

A most satisfactory cat-proof box for a bluebird can be made of weather-stained boards, if the following

precautions are taken: The hole should be well near the top with no perch near: the roof should slope from the back toward the front and should project about three inches If the box is deep, the young bluebirds find it difficult to leave the house until they are strong and able to care for themselves, and this is a great advantage. The roof prevents rain from beating in, and keeps the cats out. From whatever direction the cat may attempt to reach the hole, the projecting roof stands in the way of reaching the nest. Twelve by 6 by 6 inches are good dimensions for such a house. It should be placed 8 to 15 feet above the ground.



560. The Hilbersdorfer food-house

The house wren is the easiest of birds to attract. It will easily appropriate any little house if the English sparrow does not interfere A good size is 7 by 5 by 5 inches, with the hole only as large as a 25-cent piece. It should be placed 6 to 8 feet from the ground, with the long axis of the box backward. The wren has the habit of filling the front of the house with sticks and leaving a hollow in the rear for the eggs The hole should be in the upper half of the box. The middle of April is not too early to place it, in the northern states, although houses put out late may attract for the second brood. It is well to make the house so that it can be opened, to permit of its being cleaned for the second brood, for the wren will choose a clean house if it can find one.

The purple martin is an attractive neighbor Unlike the wrens, which will not nest near one another, the martins are gregarious, so that the houses should have a number of compartments, each part 9 by 11 inches, with entrance 2¾ inches across The house should be placed 15 to 20 feet above the ground To prevent English sparrows from building before the martin arrives in the spring, the openings should be covered until April, or better, the house may be taken down in the fall and put up again in April.



561 Berlepsch Nesting-box.



562 Longitudinal section of Berlepsch's nesting-box.

Woodpeckers may be induced to live in houses. The opening should always be circular and with an upward slant; the bottom of the nesting cavity should be gourd-shaped and end in a pointed trough within which a few shavings are placed; and the inner walls should be roughened somewhat to allow the young birds to cling more easily. Of the 10,000 or more of these houses tried in parts of Germany, more than 90 per cent are occupied.

Drinking- and bathing-places for birds.

Birds need free access to water. If a brook or pond is near by, no more is necessary; but, otherwise, special provision should be made The presence of water is a great factor in inducing birds to nest in a given locality.

There are many kinds of bird-fountains, but the chief characteristics are that the water be shallow, that the edge of the container be not slippery, and that they be placed where there are no hiding-places for cats Most interesting styles have been devised, varying from constructions of natural rocks holding little pools, with wild flowers and ferns close by, to those made of flowerpot saucers, or of special pans, placed safe from molestation. School children are readily interested in the placing of bird-fountains and in watching the birds that come to drink and to bathe.

Nesting-places for birds that build in the open.

Birds breeding in the open nest in bushes and trees and on the ground, and among reeds or in banks These comprise by far the larger class, and yet these birds are finding it more and more difficult to secure nesting-places One cuts off hedges along roads and fences, cleans the pastures and meadows, digs away the banks and seals up the roofs of barns with little thought of the birds that would like to nest there.



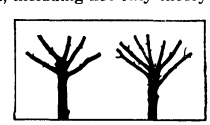
563. Nesting-box.

While all trees provide more or less shelter for birds, the conifers are most useful for this purpose It is practicable so to plant as to have wild fruits for birds at all times of the year, and especially in cold winter days, and perhaps during the time in which one wishes to protect cultivated fruits It seems to be agreed that the best single tree is the mulberry, either the white or the Russian The fruiting season is long, and the trees are easily grown Four good plants are: early sweet cherry, Juneberry or shadbush, mulberry, Virginia creeper. Probably more birds visit these plants than any others Many other shrubs and herbs are of great value, as elder, black cherry, raspberry, blueberry, dogwood, pokeberry, and mountain-ash Many growers protect their cherries and strawberries with mulberry and shadbush, or they plant a sweet early variety of the given fruit, to be left unpicked especially for the birds Elder, Virginia creeper, and black cherry will serve as protectors for grapes Raspberries and blackberries may be protected by mulberry, chokecherry, and elder

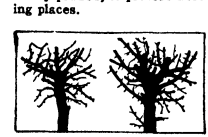


564. Nesting-box.

Germany recognizes Seebach as the great bird experiment station. Representatives of many states and countries have visited the place, making effective observations of methods. For these students, special winter courses in bird-protection have been arranged, including not only theory but practical instruction They find many acres of wood, thicket, and park made attractive to birds, with luxuriant undergrowth about the trees, special care as to the species, the shrubs specially pruned (Figs 565, 566), hundreds of nesting-houses, food-houses and food-bells in various situations for winter-feeding In the spring of 1905, the trees of the Hainich wood, south of Seebach, were stripped bare by the larva of a little moth (*Tortrix viridana*), whereas the wood at Seebach with its nesting-boxes was untouched. At a distance of a little more than a quarter of a mile the first traces of the plague were apparent.



565. One-year-old whorls recently pruned, to provide nesting places.



566. Old whorls recently pruned.

THE ECONOMIC IMPORTANCE OF FAMILIAR BIRDS.

Woodpeckers are especially fitted for the care of trees The downy is the most useful woodpecker It is the bird of the old orchard, preferring neglected trees, under the scales of which the codling-moth larva lies during the winter It has been known to visit as many as 181 woodland trees between 9 40 A M and 12 15 P M, making, meanwhile, twenty-six excavations for food, most of

which exposed galleries of wood-boring ants The hairy woodpecker (Fig 567) is equal to the downy in importance, being fond of wood-boring beetles and wood-boring ants Its large size and strong beak give it much power in drilling deep A few ears of corn and a little suet will attract him. He is becoming less common than the other woodpeckers The flicker is much misunderstood. Ants constitute about 40 per cent of his food, and he eats, also, many beetles, grasshoppers, and caterpillars, besides some wild fruit The



567 Hairy woodpecker. (Length 9 in)

red-headed woodpecker is especially fond of beech-nuts and acorns, he stores them for winter use In its storehouse are often to be found quantities of dried grasshoppers also. It is an irregular permanent resident in the East, but in the West it migrates regularly. The yellow-bellied sapsucker (Fig 568) doubtless does considerable harm, in fact, it is responsible for most of the objections to woodpeckers in general Whether the good done in destroying insects in the breeding season balances the harm done in sucking sap is an open question The sapsucker drills holes in the trunks of many of the most valuable trees, as sugar maple, birch, pignut hickory, pine, apple, mountain-ash, beech, and others The death of the trees may result not only from the loss of sap, but from the work of borers that deposit eggs in the holes If the sapsuckers are to be destroyed, care must be taken not to kill the downy woodpecker at the same time Fortunately, the sapsuckers are resident in fruit sections for only a short time in the spring and autumn In the northern breeding-grounds they destroy many noxious insects The red-belled woodpecker annoys growers of Florida by its fondness for orange juice Elsewhere it is of much value as a destroyer of ants and beetles and other insects

The chickadee is a permanent resident Many other birds seek their company, so that one has but to follow them as they rove to find many smaller birds This is particularly true in spring and fall, when the warblers are in migration In an experiment in Massachusetts, chickadees were attracted to an orchard in the winter by means of suet fastened to the trees The birds destroyed multitudes of eggs of the fall canker-worm moth The conclusion was reached that one chickadee would destroy in one day 5,550 eggs, and in the twenty-five days during which the canker-worm moths crawl up the trees 138,750 eggs might be taken by one chickadee Chickadees readily accept a nesting-box

The white-breasted nuthatch is the constant companion of the chickadee and the downy woodpecker It takes from the bark great numbers of eggs of canker-worms, and many of the oyster-shell bark-louse, and even the hairy caterpillars of the gypsy moth. It is easily attracted by suet and will often eat crumbs as well. The red-breasted nuthatch, a smaller bird with dull reddish breast, comes from the North in September, spending the winter in attending to tree-trunks, and returning North in the spring

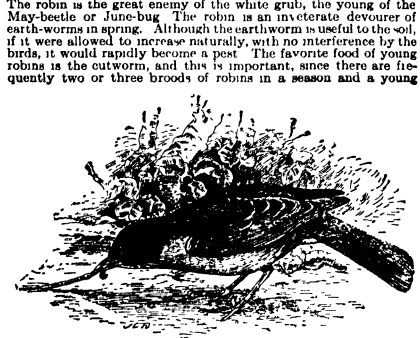
The brown creeper, with its long curved beak, rounded back, and stiff tail, is especially valuable for service among shade trees. It starts at the base of the trunk, ascending spirally, quietly investigating crevices as it goes



568 Yellow-bellied woodpecker, or sapsucker (Length 8½ in)

The slate-colored junco, or snowbird, comes from the North in autumn and remains all winter, busy all the time in reducing the number of weed-seeds The snowbirds rove in little flocks, and easily respond to seeds and crumbs put in any open place In the North the junco destroys many insects, for the young eat insect food only

The American robin (Fig 569), (which is a very different bird from the robin of Europe), is protected by law in all of the United States excepting seven of the southern states The National Association of Audubon Societies is making efforts to secure the passage of laws better calculated to protect it. An examination of the stomachs of 330 robins showed that vegetable food constituted about 58 per cent of the contents Of this, 47 per cent was wild fruit, with only a little over 4 per cent cultivated fruit. The United States Department of Agriculture has shown by recent investigation that in the South the robin is essentially an insect eating bird The robin is the great enemy of the white grub, the young of the May-beetle or June-bug The robin is an inveterate devourer of earth-worms in spring. Although the earthworm is useful to the soil, if it were allowed to increase naturally, with no interference by the birds, it would rapidly become a pest The favorite food of young robins is the cutworm, and this is important, since there are frequently two or three broods of robins in a season and a young



569 The American robin (10 in)

robin's appetite is nearly insatiable The cutworm feeds at night and is going back to its hole at daybreak, when the robin intercepts it One may prevent the robin from eating cherries by planting trees that are in fruit at the same time, as the Russian mulberry, and the shadbush and wild cherries, or even a cheap variety of cherry The strawberry-grower may plant a variety of inferior strawberries to attract the robins from his choice fruit

The bluebird (Fig 570) destroys quantities of cutworms and other caterpillars In August and September grasshoppers constitute more than 60 per cent of its food It is fond of wild fruit, especially berries Unfortunately, the bluebird is becoming uncommon

The sparrows are among the most valuable birds to the farmer The food of the native sparrows, as a family, consists of 25 to 35 per cent of vegetable matter, and 65 to 75 per cent animal matter Young sparrows are almost entirely insectivorous until they leave the nest Many sparrows rear two broods in a season As soon as the insect season is over, they turn their attention to weed-seeds, of which Beal estimates that tree sparrows alone eat 875 tons in one season, and even this estimate may be too low Forbush found, among other things, that a song sparrow, even after it had been eating seeds for about an hour before he began to count, ate 154 seeds in ten minutes and forty-five seconds Song sparrows eat the seeds of such troublesome things as chickweed, purslane, sorrel, dandelion, and dock, also pests like plant-lice and cutworms, and caterpillars of the brown-tail and gypsy moths The field sparrow (Fig 571) is smaller than the song sparrow and very shy It scarcely comes into our towns, but its clear trill from the fields suggests the warm days of late spring and early summer It has been seen to eat May-beetles, leaf-hoppers, saw-flies, spiders, ants, and some earthworms In the field it prefers weed-seed to grain The chipping sparrow has the distinction of being the most useful sparrow, having an astonishing list of services to its credit In the spring it feeds largely upon small caterpillars, as the gypsy, brown-tail, and tussock moths It destroys at least three species of caterpillars on the cabbage, it is fond of wild cherries, chickweed seeds and seeds of ragweed, smartweed and many other weeds, including dandelions and the crab-grass of the lawn The vesper sparrow is nearly as abundant as the song sparrow It eats quantities of grasshoppers and beetles and weed-seeds The English sparrow was introduced into the United States in 1850 for the purpose of destroying cankerworms and other insects just then becoming numerous At first it was received with delight A very short time, however, showed conclusively that it did more harm than good, and now every locality has its "sparrow problem" The charges against the English sparrow are serious An investigation in Illinois showed that out of twenty-five stomachs of English sparrows at a time when 30 per cent of the food of the robin, 30 per cent of the food of the catbird, and 90 per cent of that of the bluebird consisted of insects, no insects were found in these sparrows, excepting traces of grasshoppers making perhaps 6 per cent of the food However, during the first sixteen days of the nestlings' life, 40 per cent of the food consists of caterpillars, 10 per cent of beetles, and 40 per cent of small grains This is perhaps the best that can be said for the English sparrow It is so pugnacious that it has driven most of the bluebirds, wrens, and purple martins from the towns, while they themselves do not eat the insects that these birds would eat Organized warfare against them has been more or less successful. But to



570 Bluebird. (7 in)

allow the public in general to attempt destroying the nests, poisoning them or shooting them, is running a great risk in the use of guns and poison, and to offer prizes for their nests and eggs is sure to result in the destruction of many nests of valuable sparrows. This work should be done systematically by specially appointed persons at the public expense In some European cities, there is an official known as the "Sparrow Warden," whose duty it is to proceed energetically against the sparrows

The house finch, or linnet, has been the source of much complaint on the part of the fruit-growers of California, so that the investigations of the Biological Survey were of great interest It appears that its claim to protection is in its enormous consumption of the seeds of weeds, as well as for its esthetic value,—for it certainly is a trim little bird and a good singer Inasmuch as the linnet's food has been proved to be 86 2 per cent weed-seeds, and since examination of the contents of many stomachs shows that fruit is far from being its principal article of diet, many Californians protect the bird and plant shrubs and trees to attract them away from the fruit These birds are fond of elderberries and many other wild fruits.



571. Field sparrow. (5½ in.)

The cedar waxwings or cherry-birds (Fig 572) go in small flocks in search of food Their fondness for cedar berries has given them their name although they have a wide range of food In early summer they feed almost exclusively on insects and become expert fly-catchers. Unfortunately, they have a bad reputation among fruit-growers because of their fondness for cherries It has been shown, however, that they abundantly pay for the cherries taken From an orchard infested with canker-worms, the stomachs of seven cedar-birds were examined, all of which were full of worms, averaging 100 to each It was estimated that this flock would destroy 90,000 of the pests if they stayed in the orchard a month. At Washington, 152 stomachs of cedar-birds were examined showing that 74 per cent of the food consisted of wild fruits, 13 per cent of cultivated fruits, 5 per cent of which was cherries The remainder consisted of grasshoppers, bark-lice, and beetles, among them the elm-leaf beetle.

The Carolina wren adapts itself to civilized conditions, and often nests about houses and farm buildings, as well as in old logs and tree-trunks It is an eminently useful species, destroying great numbers of beetles, ants, weevils, especially the boll-weevil, which it destroys during its period of hibernation Like its relative, the house wren, it may be attracted by nesting-houses It is not migratory and may be heard all the year round from the Gulf north to Connecticut and Illinois The house wren (Fig 573) will occupy almost any little box, provided it be water-tight The English sparrow will do its best to drive the wren away, but with a small opening the wren is safe and will usually win in the contest The diet of the wren is mainly insectivorous, consisting of grasshoppers, ants, beetles, grubs, spiders, and hairy caterpillars Many a fruit tree has been saved from the ravages of the tussock moth caterpillar by a family of wrens in the vicinity Wrens gather spiders' egg-sacs full of eggs, putting them inside the house on the wall, ready for the first meal of the young birds

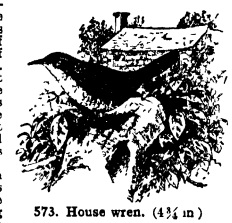
The catbird (Fig 574) is fond of fruit The robin is often blamed for the deeds of the catbird Inasmuch as the nestlings eat 95 per cent animal food, mainly insects and spiders, it is far better to plant fruit trees especially for the catbirds than to destroy them on account of their fruit-eating habits. In case of insect outbreaks, the catbird attacks gypsy, brown-tail, canker-worm, and tent-caterpillars.



572. Cedar-bird, or cedar waxwing (Length 7 in.)

The attacks that the Baltimore oriole makes on the cherries, grapes, and the pea-pods, are more than paid for by its destruction of insects Tent-caterpillars and other hairy larvæ that many other birds will not touch are eagerly eaten by it The oriole does not swallow the whole caterpillar, but carefully removes a small portion of the inside The orchard oriole is a related bird Investigations in the cotton fields of Texas and Louisiana show that nearly a third of the specimens examined contained remains of the cotton-boll-weevil Like the Baltimore oriole, it is mainly insectivorous in its diet and destroys a great many injurious species

Blackbirds are of several kinds The purple grackle and the bronzed grackle are together known as crow blackbirds (Fig 575). Their food has been thoroughly studied An examination of 2,258 stomachs showed that corn is consumed every month At the same time, were found insects, spiders, myriapods, crawfish, earthworms, sow-bugs, harvestmen, snails, fishes, tree-toads, salamanders, lizards, snakes, birds' eggs, and mice Of the 48 per cent of animal food, 46 per cent consisted of insects Of these, beetles were present in the greatest numbers Many stomachs were crammed with large white beetle grubs Often more than thirty grasshoppers were found in a single bird. Young blackbirds are fed on insect food entirely They flock to caterpillar outbreaks Many cases are reported in which fields have been entirely freed of sudden growths of grasshoppers and crickets The red-winged blackbird has a bad reputation and is unprotected in many states. These birds appear early in the spring and remain late in the fall They feed their young on insect food Examinations of the stomach contents of the adults show that about seven-eighths of the red-wing's diet is made up of noxious insects and weed-seeds. The slaughter of blackbirds that occurred in the West during the twelve years previous to 1877 was in reality a national loss The cowbird was named from its habit of accompanying the cattle and eagerly picking up the insects which are started up as they feed The cowbird's food habits are on the whole beneficial, since it eats many insects and weed-seeds The fact, however, that each young cowbird is raised at the expense of several more valuable birds (by appropriating their nests) makes it too costly Brewer's blackbird is the western representative of the eastern rusty blackbird Examination of 146 specimens gave the following facts (1) Grasshoppers constitute more than half of its animal food, (2) more than 88 per cent of the vegetable food is grain, which is freely eaten at all seasons, even when insects are abundant, (3) seeds of harmful weeds are eaten sparingly On the other hand, it does not attack fruit, which is an important point in a California bird The yellow-headed blackbird, while wintering in the South, wanders over the country in quest of scattered and wild grain, weed-seeds, various insects, grubs and worms, and does little harm In the spring, however, the birds congregate at their nesting-haunts and supplement their insect and waste-seed diet by various grains planted by the farmer of the Great Plains, and they are deservedly regarded as a great problem In the plowing season, they follow the plow and greedily devour the earthworms and insects turned out, also the white grub, the cockchafer, and grasshoppers, the last forming a large part of the food of the young So far as it has gone, the published work of the Biological Survey on the food of the yellow-headed blackbird, indicates that on the whole the good done by this bird somewhat overbalances the harm



573. House wren. (4¾ in.)

The meadowlark destroys quantities of grasshoppers, cutworms, beetles, chinch-bugs, crane-flies, and 'thousand-legs," where it takes only a few useful insects and a little scattered grain. In summer, 99 per cent of its food consists of insects, and in winter it takes many weed-seeds

The kingbird (bee martin) (Fig 576) is esteemed by agriculturists for its pugnacious disposition in driving off crows and hawks. Ninety per cent of its food consists of flying insects It belongs to the family of flycatchers, of which the phœbe, the wood pewee and the great crested flycatcher are conspicuous members They all obtain their food on the wing, darting out frequently from some chosen limb and back again Bee-keepers have contended that the kingbird catches and kills honey-bees In an investigation of 281 stomachs, only fourteen contained any remains of bees, fifty in all, of which forty were drones, four were workers, and six undetermined At the same time, nineteen robber-flies were found, which more than compensated for the four workers. It is probable that kingbirds do eat a few bees, mostly drones, but they certainly also protect bees from insects that prey upon them

Of swallows, there are five species in Eastern North America that one may expect to see the barn swallow, the cliff swallow, bank swallow, tree swallow, and the purple martins All of them do valuable work in clearing the air of insects, but the horticulturist will do well to encourage especially the purple martin It feeds largely on some of the greatest pests rose-beetles and May-beetles, the striped cucumber-beetle, as well as house-flies and flies that trouble cattle and horses



574. Catbird. (Length 9 in.)

The blue jay (Fig. 577) has been shown by investigation to be beneficial as a rule, and that, except in cases in which it is discovered actually engaged in doing harm, it should be protected. Nearly 300 stomachs showed that the real food is composed of about 25 per cent animal matter, and about 75 per cent vegetable matter. The animal matter is chiefly insects, with a few spiders, myriapods, snails, fish, salamanders, tree frogs, mice, and birds. Remains of birds were found in only two out of 300 examined. Only three contained eggs of small birds. Apparently its nest-robbing propensities are not so general as is supposed. In August, the percentage of insects reaches 66 per cent. They prefer mast, or seeds of trees and shrubs, to corn or any other vegetable food. Corn is the only vegetable food of which the farmer suffers any loss, and here the damage is small. The California jay is a problem. Very careful and extensive investigations of the bird have resulted in the conviction that it has many more bad qualities than good. In fact, it has few redeeming virtues. Something may be said in his favor, from the esthetic side, as he is a handsome bird, and people interested in country life would no doubt miss his presence. Beal says that if they could be reduced to a fourth or to half of their present numbers, the remainder would probably do no serious harm. They eat very few insects, and destroy many eggs and young birds. They eat grain from the newly sown fields, but do not pull it up after it has sprouted, so that this is of minor importance. They are insatiable fruit thieves, not only eating enough for present need, but storing it away for future use.

The black-billed and yellow-billed cuckoos are valuable to the forester, orchardist, and the farmer. They feed mainly on the medium-sized and larger caterpillars and grasshoppers, as well as many other insects. In May and June, when the tent-caterpillars are defoliating forest trees, these insects constitute half of the cuckoo's food. One stomach was so full that the bird had evidently



575. Crow blackbird, or purple grackle. (Length 12 in.)

devoured the whole tent-colony. It is impossible to over-estimate the value of the cuckoo's work. The cuckoo of Europe is a bird of very different habits.

The common crow is a subject of much dispute. In a report of the United States Department of Agriculture, 1895, the evidence for and against the crow is clearly summarized as follows: (1) Crows seriously damage the corn crop and injure other farm crops, usually to a less extent; (2) they are very destructive to the eggs and young of domesticated fowls; (3) they do incalculable damage to the eggs and young of other birds; (4) they do much harm by the distribution of seeds of poison-ivy, poison sumach, and perhaps other noxious plants; (5) they do harm by the destruction of beneficial insects. On the other hand, they do much good: (1) By the destruction of injurious insects; (2) by the destruction of mice and other rodents; (3) they are valuable occasionally as scavengers. On the whole, it seems that the crow is not to be encouraged, although it need not be altogether exterminated.

The bobolink does nothing but good while it is feeding the young, insects forming about 85 per cent of the food. No fault can be found with him in the North, although he becomes a veritable pest in the South, destroying much rice. The annual slaughter of the "rice-birds" in the South accounts for the gradual decrease in numbers in New England.

An examination of eighty-two specimens of California thrasher shows that vegetable food exceeds the animal in the proportion of 59 to 41. Since it is commonly a bird of the ground, it is surprising to find that in addition to very many beetles, caterpillars, ants and spiders, a great number of bees and wasps were found in the food, also. There were many more wasps than bees. The vegetable food consisted of fruit, poison-oak seeds, and miscellaneous material. The thrasher must be added to the list of birds that assist in the dissemination of poisonous plants. It is not probable that the thrasher will ever become a resident of the orchard.

The western tanager, like the robin, sometimes becomes a nuisance in the orchard. It breeds north of the fruit-growing sections of California, but does injury to the cherry crop on its way north during the migration period. The investigation of the Biological Survey shows that it has a fair right to protection at the hands of the farmer, and even of the orchardist. It is suggested that wild cherry trees planted around cherry orchards may attract the birds away from the fruit.

The California bush-tit has been made the subject of special study. From 353 stomachs of bush-tits collected in every month, less than 1 per cent of the food was found to consist of fruit, and over four-fifths consisted of insects and spiders. The largest item was plant-lice, or bark-lice, or scale insects. Several stomachs were entirely filled with them. The stomachs of eight nestlings contained pupæ of the codlin-moth. It would probably be difficult to find a more valuable bird than the bush-tit. The birds live in flocks nearly nine months of the year.

The black-headed grosbeak has been the subject of complaint by the Pacific coast fruit-growers, for it is fond of figs, cherries, and berries. However, it eats many insects that cost the horticulturists much annoyance. The codlin-moth, canker-worm, flower-beetles, and scale insects are among its favorites. An examination of 226 stomachs, the majority of which were collected in California, shows that during the six months of its stay in that state the bird consumes about 34 per cent of vegetable food, and 66 per cent of animal food, with a distinct preference for the black olive-scale, one of the most destructive insects of the coast. This insect alone constitutes a fifth of the entire food. To put it graphically, the black-headed grosbeak, for every quart of fruit eaten, eats more than three pints of black olive-scales, and more than a quart of flower-beetles, besides a generous supply of canker-worms and pupæ of codlin-moths.



576. Kingbird. (8½ in.)

The mourning dove has scarcely an equal as a weed-eradicator. The Biological Survey has shown that of 237 stomachs examined, over 89 per cent of the food consisted of seeds. Wheat, oats, rye, corn, barley, and buckwheat, were found in 150 of the stomachs and constituted about 42 per cent of the whole food. Three-fourths of this, however, was waste grain picked up from the fields after the harvesting was over. Wheat was the favorite grain, and about the only one taken while in a good condition. Corn, the second in amount, was damaged grain, taken after the harvest. The principal and almost constant diet, however, is weed-seed eaten at all seasons, constituting 64 per cent of the annual food-supply and showing little variation in any month. Three mourning doves which were examined had destroyed 23,000 prospective weeds. Yet they moved silently, and no one knew of their work.

The dickcissel, or black-throated bunting, is common in field and prairie in the Middle West, where its plaintive song gives variety to the silent days of July and August. Its food is more than half grasshoppers and crickets, and the remainder seeds of weeds and grasses. In some localities it is known as the "little meadowlark," its color being like that of the meadowlark, even to the black locket on a breast of brilliant yellow.

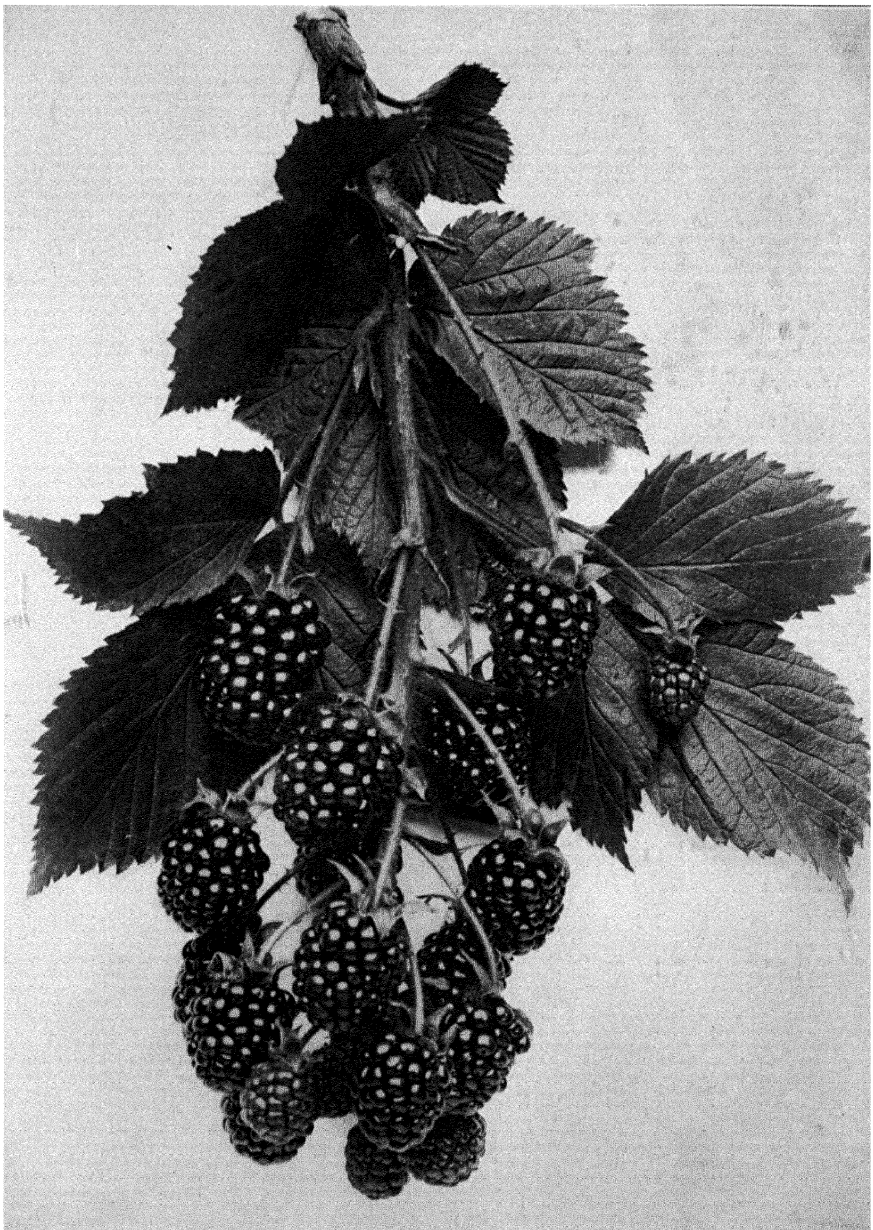
The cardinal and his mate are indeed a conspicuous pair. They are known as cardinal grosbeaks, redbirds, crested redbirds, and Virginia nightingales. They are most abundant in the southern United States, although frequent records show the limit of their range to be approximately a line drawn from New York City westward to southern Nebraska, and thence south to Texas. The cardinals' food is varied, consisting of seeds of numerous plants, especially those of rank weeds and grasses. The large and powerful beak readily breaks into large seeds, as corn, wheat, rye, and oats. It eats great quantities of adult beetles, especially rose-beetles, also crickets, grasshoppers, flies and ants. It enjoys grapes, berries,



577. Blue jay. (11½ in.)

mulberries, cedar-berries, preferring the wild varieties always. These habits, added to the striking beauty of its plumage and of its song, make the cardinal a great favorite.

The mockingbird is omnivorous. While investigating the feeding habit of this remarkable bird, Beal found that in fifty-two specimens 29 per cent of the food consisted of vegetable matter, of which 50 per cent was fruit. The birds' appetite for fruit and



XV. The American blackberry.—The Agawam; about natural size.



XV. The American blackberry.—The Agawam; about natural size.

(6) The Evergreen blackberries, of unknown origin, to which the Himalaya is closely related, are commonly put in *R laciniatus*, Willd, but may be but a cut-leaved form of the European bramble (*R fruticosus*, Linn). The vines are clinging, the foliage evergreen or nearly so, and the berries in the Pacific coast climate are large, black, sweet, and ripen through a period of two or three months. The Oregon Evergreen is the typical variety.

Propagation.

In nature the blackberry propagates itself from suckers and under cultivation young plants from suckers are thriftiest, but many varieties produce but few suckers and the natural process is a slow one with all kinds. A more expeditious method is to use root-cuttings. Such cuttings are usually made during the dormant season by taking up old plants and cutting the roots with pruning-shears into parts 2 inches long. The cuttings are then started under glass, or sown in furrows in well-prepared nursery beds in the spring. The cuttings should fall in sowing 2 inches apart in furrows 3 inches deep and should be covered with well-pulverized soil. The soil must be such that it does not bake as the young shoots appear. It sometimes requires two summers to produce plants ready for setting, but in the South, the Pacific coast, and under favorable circumstances in the East, yearling plants are strong enough for setting. Cuttings should be made from the roots of thrifty, healthy plants, preferably from a young plantation. It is contended and there are many facts to substantiate it, that propagating successive generations of blackberries from root-cuttings results in unproductive or even sterile plants.



579. The short-cluster garden blackberry. (×½)

Some blackberries from the several varietal groups may be grown in almost every condition of climate and soil in temperate regions, yet this fruit does best in a carefully selected environment. Blackberries cannot stand, without protection, more winter cold than the peach. In dry, hot climates the plants suffer and the berries are few, small, poorly colored and lacking in flavor. A deep, mellow, clay loam, well filled with humus, is most suitable for this fruit. Gravelly and sandy lands are usually too hot and dry. Flat wet lands are quite unsuited and in such soils the plants suffer alike from cold and heat; whatever else may be said of the soil, good drainage is imperative. A northern exposure is usually desirable. Fertilizers are little needed if the land be rich enough naturally to grow fair farm crops. Stable manure often induces rank-growing canes which produce but little fruit. Cover-crops of vetch or clover and some grain as oats or barley, sown in August, will supply much-needed humus and about all the plant-food usually necessary to add.

Field cultivation.

The plants are set in rows, 7, 8, or 9 feet apart, depending on the soil and the variety, and from 3 to 4 feet apart in the row. There should be room between the rows for a two-horse harrow or cultivator to keep the plantation in good condition. Planting may be done by spade or in furrows 6 or 7 inches deep. A hoed-crop is usually grown between the rows the first year but seldom the second, as the plants need all the food and moisture to make sufficiently strong plants to bear a crop the third season. The canes are allowed to grow the first year to a height of 18 to 30 inches, when they should be cut back a few inches. The plants are thus pruned to cause them to grow low, stocky and upright, with many lateral branches, and so avoid the necessity of a trellis and yet be able to hold the crop up well. Trellising is troublesome and expensive.

Subsequent training and pruning consist in keeping the plants well branched, low and stocky, and in regulating the amount of bearing wood. Success in growing blackberries depends largely upon proper training and pruning. The fruit is borne upon one-year-old canes which should be removed as soon as the crop has been harvested. To allow them to stand through the growing season jeopardizes the proper development of the new canes, and often exposes them to infection from fungi. Five or six canes to the plant are quite enough; if there are more, the size and quality of the crop will be reduced. The canes should be headed-in annually during the growing season, as recommended for the first year. In the spring laterals are shortened-in, the amount of cutting-back depending upon how close the fruit is borne to the cane on the variety in hand. The laterals are usually left from 12 to 20 inches long. This spring pruning may be and often should be made a thinning process. Managed according to the directions just given, the plants need neither stakes nor trellises. In some plantations, however, a wire is stretched along each side of the row to hold the plants up, and in others, notably along the Hudson River, the plants are trained on two-wire trellises. In northern climates the training must be such as to provide for winter protection for many varieties.

Winter protection consists in laying down the canes and covering them wholly or in part with a thin mulch of straw or earth. The method of laying down must be varied with the variety, the soil and the amount of protection to be given. Three men can do the work most expeditiously; one goes ahead and digs the earth from the front and back of the roots, a second with fork or foot pushes the plant forward to the ground, the third puts on the mulch of earth or straw. Tender varieties are wholly covered, but the hardier sorts need only a covering on the tips of the canes. The plants are raised in the spring just before or as the buds begin to

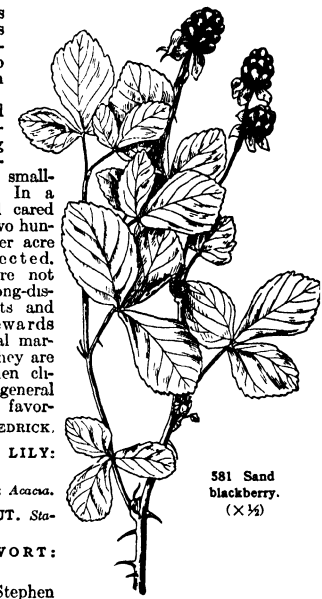
burst. Care must be taken not to break or split the canes. Such protection at present prices of labor will cost from eight to twelve dollars per acre Winter injury is sometimes a matter of moisture as well as of temperature, and, in irrigated regions, late irrigation may obviate the necessity of a winter covering.

Thorough cultivation is essential for the proper conservation of moisture in a blackberry plantation, abundant moisture being a prime requisite for this fruit It must be frequent and constant until the berries begin to turn in color After the crop is harvested, the cultivator should be used to put the ground in shape for the cover-crop. The cultivator must be shallow-cutting since deep cultivation injures the roots, thereby weakening the plants, and inducing suckering Mulching to take the place of cultivation is not to be recommended, except in small patches, and in the row with cultivation between rows.

Blackberries should not be harvested until fully ripe, and the sooner eaten after picking the better the quality. The fruits are not ripe when they attain full color but must be left on the bushes until soft, at which time they should part from the stem readily when the cluster is shaken. In picking, the berries should not be exposed to the sun. Well treated, the plants should bear some fruit the second season, and the third summer should give a fair crop. The length of time the plants will bear depends upon the variety, the soil and the treatment. When the stools become thin, the canes weak and the fruits small, the plantation should be cut down, this time coming usually when the bushes are ten or twelve years old

Blackberry-growers have several troubles to contend with Late frosts occasionally do much harm in northern latitudes Borers often do much damage to canes and can be circumvented only by cutting out infested stalks Two fungous diseases, orange rust and anthracnose, are dangerous, and are successfully kept in check only by cutting out the diseased wood Root-galls are often found but it is doubtful whether they do much damage, and it is certainly not worth while trying to control them. Good treatment, especially as regards cultivation and pruning, with careful attention to destroying the pests mentioned as soon as practicable, will keep the plants in health.

The yields and profits in blackberry-growing are most encouraging to small-fruit-growers. In a plantation well cared for, a crop of two hundred bushels per acre may be expected. Blackberries are not suitable for long-distance shipments and monetary rewards come from local markets and here they are often large when climate, soil and general conditions are favorable. U. P. HEDRICK.



581 Sand blackberry. (×½)

BLACKBERRY LILY: *Belamcanda.*

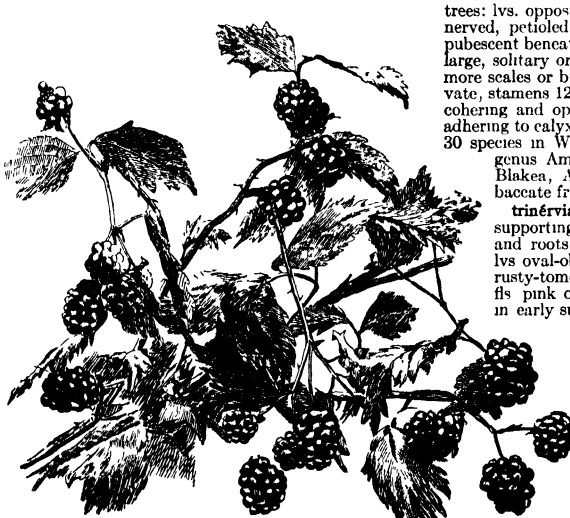
BLACKWOOD: *Acacia.*

BLADDER-NUT. *Staphylea.*

BLADDERWORT: *Utricularia.*

BLÀKEA (Stephen Blake, gardener, of the island of Antigua in the West Indies, who wrote "Compleat Gardener's Practice," London, 1664). *Valdesia*, Ruiz & Pav *Melastomàceæ*. Hothouse or greenhouse evergreen shrubs, of which two species are in cultivation for the showy flowers and prominent foliage

Erect or scandent woody plants, sometimes small trees: lvs. opposite, leathery, mostly prominently 3-7-nerved, petioled, nearly or quite entire, often rusty-pubescent beneath fls rose-purple or white, showy and large, solitary or fascicled in the axils; calyx with 4 or more scales or bracts at base, petals 6, oblong or obovate, stamens 12 with thickened filaments, the anthers cohering and opening by 2 pores at the apex; ovary adhering to calyx, 4-6-celled fr a fleshy berry —About 30 species in W Indies and S Amer. By some the genus Amaraboya (which see) is included with Blakea, Amaraboya has capsular rather than baccate fr.



580. Wild probable hybrid of blackberry and dewberry

trinérvia, Linn. Shrub, in the wild the branches supporting themselves on neighboring bushes, and roots sometimes springing from the sts lvs oval-oblong to elliptic, dark green above, often rusty-tomentose beneath, prominently 3-nerved. fls pink or rose-color, solitary, on long stalks, in early summer Mountain woods, Jamaica — A good plant for the warm conservatory

grácilis, Hemsl. Compact shrub, 2–3 ft. lvs elliptic, acuminate, leathery, glabrous. fls. solitary, fragrant, 2 in. across, the petals white with a rose-colored spot at the base Costa Rica.—Needs an intermediate temperature. L. H. B.

BLANDFÒRDIA (after George, Marquis of Blandford). *Liliàceæ*. Tender rhizomatous plants from Australia and Tasmania, placed by

Baker (Jour. Linn. Soc. 11:364) between Kniphofia and Funkia; adapted to culture in greenhouses. Blandfordia of Andrews is a synonym of Galax.

Roots thickly fibrous. lvs in two vertical ranks, narrowly linear, hard, persistent. fls large, 1½–3 in. long, showy, nodding, in short racemes, usually orange-red to crimson, with yellow tips.—The authorities recognize only 4 botanical species, but those below are horticulturally distinct from one another.

Being tenderer than the poker plant, and of more difficult culture, blandfordias are rarely grown in America. *B flammea* var. *princeps* is the best kind. In New South Wales they grow in peat bogs and on shady mountain sides. During the growing season they must be shaded from bright sunshine, and during the resting season they may be placed in a light pit, in which they are not crowded or shaded by taller plants. They like a moist atmosphere and plenty of air, but not draughts. The chief element of the potting soil should be peat, if the peat is heavy, use freely; if light, use some loam, and pack firmly; if spongy, add some charcoal. Pot after flowering, in early spring, being careful not to overpot, and plan to leave roots undisturbed for two years at least. A top-dressing each year and liquid manure during growing season, is necessary to produce a good flowering. Perfectly hardy in central Florida when grown in lath-houses.—Propagation is by seeds sown in sandy peat with mild bottom heat, or usually by careful and not too frequent divisions of the root, made in early spring, after flowering at the time of repotting, and preferably when strong offsets are formed.

A. *Margin of lvs. not roughish*

Cúnninghamii, Lindl. Lvs. 18–24 in. long, 3–4 lines wide, broader than in *B flammea*. fls. 10–15, or even 20. Blue Mts. of Austral. B.M. 5734. Gn. 24:366.—This has been held to be synonymous with *B grandiflora*, but it is horticulturally distinct, and the pedicels are shorter. Considered by Bentham the same as *B grandiflora*.

AA. *Margin of lvs. roughish*

B. *Fls. golden yellow, without any red.*

aûrea, Hook. f. Lvs. 8–12 in. long, 1½–2 lines wide. fls. 3–6, the only ones in the genus not touched with red, perianth wide-swelling, sometimes nearly as wide as long, more bell-shaped than any other species. New S. Wales. B.M. 5809.—By some considered a mere variety of *B flammea*.

BB. *Fls. red-tubed and yellow-tipped*

c. *Perianth long, 3–4 times as long as wide.*

nóbilis, Smith. Lvs. 12–18 in. long, ½–¾ lines wide, dark green, sharply 3-angled. fls. 4–9, smallest of the genus, and narrowest. Near Port Jackson. B.M. 2003. B.R. 286. Var. **imperiàlis,** Hort. Fls. bright orange-red, margined with yellow or gold, larger than the type.

flámmea, Lindl. Lvs. 12–18 in. long, 2–2½ lines wide. fls. 4–12, typically constricted near the base of the tube and much lower down than in *B Cunninghamii*. E. Austral. B.M. 4819. P.M. 16:353. F.S. 6:585, 18:1829 (as *B. Cunninghamii*). Var. **prínceps,** Baker (*B princeps*, W. G. Smith), has larger and brighter-colored fls. and is the best of the genus. The perianth is longer and less spreading than in the type, and swells very gradually from the base, instead of being constricted near the base. B.M. 6209. F.M. 1875:170. F.S. 22:2314. Gn. 47:324.

cc. *Tube short, scarcely twice as long as wide.*

grandiflòra, R. Br. Lvs. 12–18 in. long, 3–4½ lines wide. fls. 10–30. Distinguished from all others by having the filaments inserted instead of at the middle, but in var. **intermèdia,** Baker, which connects *B grandiflora* and *B nobilis*, the filaments are inserted at the middle of the tube, the lvs. are narrower and the fls. smaller. Tasmania. B.R. 924.—The name *B. grandiflora* is now a misnomer, as the fls. are smaller than in any other species except *B nobilis*.

B cordata, Andr. = Galax aphylla.

WILHELM MILLER.

BLANKET FLOWER. *Gaillardia.*

N. TAYLOR †

BLAZING STAR. *Liatris;* also *Mentzelia.*

BLÉCHNUM (Greek name for some fern) *Polypodiàceæ.* Rather coarse greenhouse ferns, with pinnatifid or pinnate lvs., and rows of almost continuous sori parallel to the midvein and close to it, covered with a membranous indusium. Blechnum is here recognized as including the species sometimes classified under the generic name Lomaria in addition to those species which all writers agree to put in Blechnum. The differences on which Lomaria has been based are very slight and are not recognized by leading European fern students. Besides, if the species included in Lomaria are kept separate, it is practically certain that they must be classified under the older name Struthopteris.

In Blechnum occurs a singular knot in nomenclature. Linnæus described two species in 1753, and to the West Indian one he gave the name *B orientale*, citing figures, etc., showing that it is the plant that recent writers call *B occidentale*. His East Indian plant he similarly called *B occidentale*. The normal or ordinary usage has been followed below, the name *B orientale* being given to the eastern plant.



582. Blechnum brasiliense.

Blechnums will thrive in almost any compost, but their leaves quickly turn brown and then black if watered overhead. Propagation of Blechnum is effected by spores.

Blechnums are very useful to florists for jardinieres, and for specimen ferns. To attain best results, it is necessary to maintain an abundance of moisture at the roots, with a drier atmosphere than most other ferns require, to prevent leaves from turning brown during winter months. Average temp. 60° to 65° F. Soil, equal parts of rich loam and leaf-mold or peat. The spores of most blechnums germinate very freely if sown on a compost of loam and leaf-mold or peat in equal parts, and placed in a moderately moist and shady position in a temperature of 60° to 65° F. Some of the species send out creeping rhizomes, which develop young plants at the ends. When of sufficient size these may be detached and potted, and in a short time they will develop into good specimens. Some very attractive species are found among the hardy British blechnums. (N. N. Bruckner.)

INDEX.

brasiliense, 1	lanceolatum, 7	platyptera, 9.
corcovadense, 3	Moorei, 6	serrulatum, 5.
crispum, 3	nitidum, 2,	spicant, 11
discolor, 8	occidentale, 4	tabulare, 10
gibbum, 9		

A. *Fertile lvs. not strongly different from the sterile lvs.*

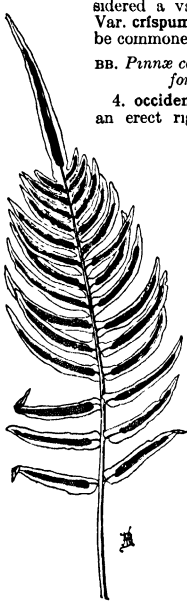
B. *Pinnæ strongly decurrent at the base, joining with the one next below.*

1. **brasiliénse,** Desv. Fig. 582. Growing from a stout, slightly arborescent trunk 1 ft. or more long. lvs.

2–3 ft. long, 1 ft or more wide, with the pinnæ set at an acute angle with the rachis, the lower much shorter and more distant. Brazil S 2 4 —Rather tender in Cent. Fla and needs protection during winter.

2 **nítidum,** Presl Habit of *B brasiliense*, but much smaller. lvs. pinnate, pinnæ oblong-falcate, thickish, 2–4 in. long, serrate Brazil —Plants 1–2 ft high.

3. **corcovadénse,** Raddi Pinnæ not cut to the rachis, much crowded and shorter than the last, longest pinnæ less than 6 in long, attenuate at the tips, lvs crimson when young, and gradually turning to a metallic hue before becoming permanently green. By some considered a variety of *B. brasiliense*. Brazil. Var. **crispum,** Hort, with wavy edges, may be commoner in cult. than the type.



583. Blechnum occidentale.

BB. *Pinnæ contracted at the base to the midrib, forming a very short stalk.*

4. **occidentàle,** Linn. Fig 583 Lvs. from an erect rigid st, which is covered with brownish scales, 9–18 in. long, 4–6 in wide, with the pinnæ truncate or even cordate at the base and slightly falcate Mex. and W Indies to Brazil —A beautiful small fern

5. **serrulàtum,** Rich. Growing from an ascending nearly naked rootstock lvs 1–2 ft long, 6–15 in wide, with numerous narrow pinnæ, which are contracted at the base and of nearly uniform width throughout; margins finely serrulate, texture coriaceous Fla to Brazil —Especially adapted for the edges of boggy ponds, river banks and the like Soon forms dense clumps 2–3 ft high.

AA *Fertile lvs. distinct from sterile lvs, very much narrower* (*Lomaria*)

B. *Plant with an erect rigid st*

C *Lvs 6–12 in. long.*

6 **Moòrei,** C Chr. (*Lomària culàta*, Moore) St 6 in high, 1½ in thick stipes blackish. lvs 8–12 in long, the upper pinnæ with a rounded auricle at the lower side of the base; fertile lvs. narrow-linear. New Caledonia

7. **lanceolàtum,** Sturm St elongate, densely clothed with dark brown scales lvs 6–12 in long, 2–4 in wide, with close, slightly falcate pinnæ; texture leathery; fertile pinnæ linear spreading Austral and Polynesia.

CC *Lvs 1½–3 ft. long.*

D *Lower pinnæ connected at base.*

8 **díscolor,** Keys St. ascending· stipes black, glossy, with dense scales at base lvs. 1½–3 ft long, 4–6 in wide, with pinnæ narrowed suddenly toward the point; fertile pinnæ narrower and shorter Austral and New Zeal

9. **gíbbum,** Mett. St 2–3 ft. high: stipes short, with black scales lvs 2–3 ft long, 6 in wide; fertile pinnæ narrower, 4–6 in. long Var. **platýptera** is advertised. *L. intermedia*, Hort, may be derived from this species. New Caledonia.

DD. *Lower pinnæ narrowed at base and distinct.*

10. **tabulàre,** Kuhn (*Lomària Boryàna*, Willd.). St. stout, erect 1–2 ft high, woody, densely scaly· lvs. 1½–2 ft. long, 6–8 in wide, narrowed and sometimes auricled at base; fertile pinnæ narrow-linear, close. W. Indies to Patagonia, Mauritius and S. Afr.—Probably includes 2 or 3 species, among them *L. zamæfolia*, Hort.

BB. *Plant with a stout, short, creeping rhizome.*

11. **spicant,** With Sterile lvs lanceolate, 6–9 in long, 1–1½ in wide, gradually narrowed below; fertile lvs. 1 ft. long, with longer stalks (6–9 in) and narrowly linear pinnæ Eu, W. N. Amer —The large Californian form with lvs 2–3 ft long is possibly a distinct species. The European plant was early called *Struthiopteris spicant* by Scopoli, by which name it is now cited as the earliest generic name. Hardy, needs deepest shade *Lomària nipponica*, Kunze, Japan, usually larger than preceding, is much like it in other respects and probably is better to be considered as a form of *B. spicant* rather than as a distinct species.

B orientàle, Linn., is a large E Indian and Polynesian fern with lvs. often 3 ft. long —Well worthy of cult

L. M UNDERWOOD.

BLEEDING HEART: *Dicentra* R C BENEDICT.†

BLÉPHARIS (Greek, *eyelash;* referring to fringed bracts) *Acanthàceæ*. A large (80 species) genus of dwarf, often spiny shrubs and herbs, allied to Acanthus, and of similar culture Fls in bracted spikes; calyx cruciate, 4-parted nearly to the base, the 2 inner sepals much shorter than the outer; corolla short-tubed, the limb blue or white, caps ellipsoid, flattened and woody.

carduifòlia, T Anders (*Acánthus carduifòlius*, Linn. *Acanthòdium carduifòlius*, Nees) Plant villous lvs. lanceolate, sinuate-dentate, spiny spike terminal, cylindrical bracts roundish, palmately 5-spined at the apex S Afr —Not commonly cult

N. TAYLOR †

BLEPHAROCÀLYX (*eye-lash* and *calyx*, probably referring to a fringed condition) *Myrtàceæ* Woody plants, differing from Myrtus in having a thin crustaceous testa of the seed instead of a thick and horny one, and other minor characters, and by some authors united with that genus There are about 30 species in S Amer, but very little known in cult **B. spiræoides,** Stapf (*Eugènia myriophylla*, Hort), is a much-branched shrub, 9 ft high, free-flowering lvs. lance-linear, ¾ in. or less long fls small, pale yellow, in terminal panicles; petals 4 Brazil B.M 8123

BLÈTIA (named for Louis Blet, a Spanish botanist). *Orchidàceæ* Terrestrial orchids with globose or depressed pseudobulbs, from the apex of which arises a leafy st, mostly hothouse plants.

Leaves plicate-veined fls borne on a lateral leafless st, sepals and petals spreading, similar, or the latter broader, lip attached to the base of the column, 3-lobed, the lateral lobes erect, the middle lobe spreading, the disk with several entire or denticulate-crisped ridges, pollinia 8 —A genus of about 20 species in Trop Amer

A. *Middle lobe of lip much crisped.*

B *Petals as wide as sepals. fls. rose.*

verecúnda, R Br. Lvs up to 3 ft long, 2–4 in wide. scape 2–4 ft tall, the upper portion a raceme or panicle of numerous rose-colored fls W. Indies and Fla G C. II. 26, p 141 B M 3217 (as *B acutipetala*).

BB *Petals broader than sepals, undulate. fls deep purple.*

Shépherdii, Hook. Lvs up to 2 ft long, 3–4 in. broad scape, 2–3 ft tall, the upper portion a raceme or panicle of numerous deep purple fls; sepals oblong, acute, the petals broader, undulate; lip with the lamellæ white Jamaica. B.M 3319 P M. 2·146.

AA *Middle lobe of lip not crisped.*

Sherrattiàna, Batem. Lvs. up to 4 ft long, 3–4 in. broad fls bright rose, in a raceme of 10 or more; sepals oblong-lanceolate, obtuse; petals much broader,

rounded at apex; middle lobe of lip not crisped, deeply emarginate. Colombia. B.M. 5646

B campanulàta, La Llave & Lex Fls bell-shaped, purple, with white center Mex —*B hyacinthina*, R Br =Bletilla —*B pàtula*, Hook Fls up to 2 in across, deep pink Said to be a native of Haiti B M 3518 —*B Tánkervillæ*, R Br =Phaius

GEORGE V. NASH.

BLETÍLLA (diminutive of *Bletia*). *Orchidàceæ* Terrestrial orchids with pseudobulbs, and a leafy st. with a terminal infl sepals and petals nearly alike, somewhat spreading; lip 3-lobed, furnished with lamellæ, the lateral lobes surrounding the slender column, pollinia 8 —Outdoor orchids

hyacinthina, Reichb f (*Blètia hyacinthìna*, R Br.). Pseudobulbs tuberform sts up to 1 ft tall, with 3–6 plaited lvs fls racemose, on short pedicels, sepals and petals amethyst-purple, lip 3-lobed, amethyst-purple, the middle lobe nearly quadrate, denticulate China and Japan Gt 15 527 Gn 16 416 B R 33·60 (as *Bletia Gebina*) B M 1492 (as Cymbidium) —Grows beautifully in half-shady, moist places, soon forming large clumps Prop by division of the clumps

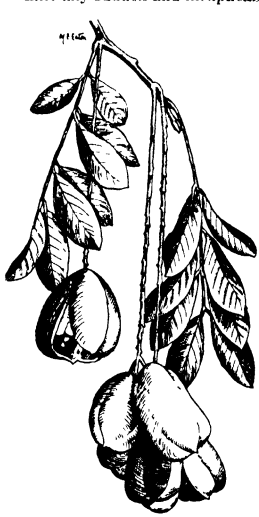
GEORGE V. NASH.

BLÌGHIA (W Bligh, British mariner, who wrote on a journey in the South Seas, 1792) *Sapindàceæ* Trees and shrubs with pinnately compound lvs and axillary, racemose fls , differs from Cupania in having a deeply cut calyx (rather than separate sepals) with the parts only slightly imbricate, and also in the fr —One species in Guinea, now naturalized in the W Indies, and yielding the akee, a 3-parted fr with edible red aril that is much improved by cooking The fls are so fragrant as to deserve distilling The tree reaches a height of 30 ft , and is cult in Jamaica to an altitude of only 3,000 ft , but can endure slight frost It is also cult in S Fla

sápida, Kon (*Cupánia sápida*, Voigt) AKEE TREE Fig 584 Lfts 3 or 4 pairs, obovate-oblong, entire, veined fls pubescent, the oblong petals white and rather showy, bearing scales and stamens

N TAYLOR †

BLIGHT. An indefinite term, popularly used to designate any sudden and inexplicable death of plants The term is now restricted by botanists to parasitic diseases These diseases are of two classes,—those due to bacteria or microbes, and those due to parasitic fungi For an account of these troubles, see *Diseases.*



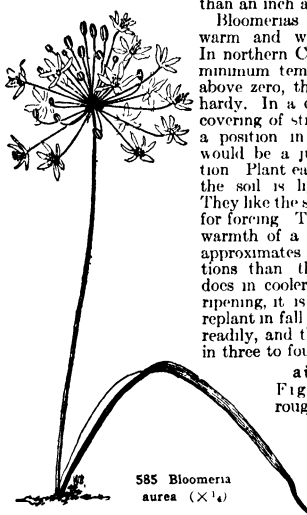
584. Blighia sapida. (×⅓)

BLITE *Chenopodium*

BLOODROOT. *Sanguinaria*

BLOOMÈRIA (named for Dr H G. Bloomer) *Liliàceæ* Small summer-blooming bulbous plants of the allium kind

A genus of 2 species, natives of S Calif In every way they are closely allied to Brodiæa, but differ in having the perianth parted nearly to the base Bloomerias have a flattish corm, much like Crocus, covered with fiber, and not often producing offsets The lvs. are radical, slender, and grass-like scape slender but stiff, 6–18 in high, naked, except for short bracts beneath the many-rayed umbel; pedicels slender, jointed; fls nearly rotate, less than an inch across, orange



585 Bloomeria aurea (×¼)

Bloomerias prefer a sandy, warm and well-drained soil. In northern California, with a minimum temperature of 15° above zero, they are perfectly hardy. In a colder climate, a covering of straw or leaves or a position in the coldframe would be a judicious precaution Plant early, and see that the soil is light and sweet They like the sun, and are good for forcing The light soil and warmth of a pot more nearly approximates natural conditions than the open ground does in cooler climates After ripening, it is best to dig and replant in fall The seeds grow readily, and the plants flower in three to four years

aùrea, Kellogg. Fig 585 Scape roughish, 6–18 in lf. ½–½in broad· fls numerous, bright orange, in a dense umbel, stamens nearly as long as the perianth, the filaments dilated at the base B M 5896 (as *Nothoscordum aureum*) G C III 20 687.

Clèvelandu, Wats More slender lvs 3–7· fls. smaller, keeled with brown, the stamens shorter G C. III 20 687 —Less valuable than the other

CARL PURDY.

BLUEBELL: *Campanula*

BLUEBERRY-CULTURE. Fig 586 Blueberries are fruit-bearing shrubs of the genus Vaccinium, long gathered wild in North America in great quantities and now about to be cultivated with success

Success in blueberry-culture rests especially on the recognition of two peculiarities in the nutrition of these plants first, their requirement of an acid soil, second, their possession of a root-fungus that appears to have the beneficial function of supplying them with nitrogen.

If blueberries are planted in a soil with an alkaline or neutral reaction, such as the ordinary rich garden or fertile field, it is useless to expect their successful growth In such a situation they become feeble and finally die Blueberries require an acid soil, and they thrive best in that particular type of acid soil which consists of a mixture of pure sand and peat The peat may be of either the bog or the upland sort

Good aeration of the soil is another essential It is commonly but erroneously supposed that the swamp blueberry (*Vaccinium corymbosum*), the species chiefly desirable for cultivation, grows best in a permanently wet soil It is to be observed, however, that the wild plants of the swamps occupy situations which though perhaps submerged in winter and spring are exposed during the root-forming period of summer and autumn, or, when growing in permanently submerged places, they build up a hummock or a cushion of moss which rises above the summer water-level and within which the feeding-roots of the bush are closely interlaced. In actual culture, moreover, it has been found that the swamp blueberry does not thrive in a permanently wet or soggy soil.

Although some species of Vaccinium, such as the common low-bush blueberry, *V. pennsylvanicum*, grow and fruit abundantly in sandy uplands that are subject to drought, the swamp blueberry grows best in soils naturally or artificially supplied with adequate moisture

These then are the three fundamental requirements of successful blueberry culture (1) An acid soil, especially one composed of peat and sand; (2) good drainage and thorough aeration of the surface soil, and (3) permanent but moderate soil-moisture Under such conditions, the beneficial root-fungus which is believed to be essential to the nutrition of the plant need give the cultivator no concern, for it will propagate itself spontaneously and adequately, without any necessity of soil or plant inoculation.

Propagation.

Blueberry plantations may be formed by the transplanting of unselected wild bushes or by the growing of seedlings, but such a course is not the best. Seedling plants, even from the largest-berried parents, produce small berries oftener than large ones Until nurserymen are prepared to furnish plants asexually propagated from superior stocks, the cultivator should begin by the transplanting of the best wild bushes, selected when in fruit for the size, color, flavor, and earliness of the berry, and the vigor and productiveness of the bush. These he should propagate by layering and by cuttings until his plantation is completed By means of a combination of these two methods, a valuable old plant can be multiplied by several hundred at one propagation, the fruit of the progeny retaining all the characteristics of the parent.

Large berries cost less to pick than small ones and bring a higher price. A berry ½ of an inch in diameter has already been produced under cultivation and others of still larger size are to be expected

While grafting and especially budding are useful in experimental work, neither method is suitable for commercial plantations because blueberry bushes are continually sending up new and undesirable shoots from the stock. The best season for budding is from the middle of July to the end of August The budded plants should be protected from direct sunlight, and special care should be taken that the raffia wrapping does not become wet for the first three weeks.

The easiest way to propagate the swamp blueberry is by a special process of layering known as "stumping" In early spring, preferably before the buds have begun to push, all the stems of the plant, or as many as it is desired to sacrifice for propagation, are cut off close to the surface of the ground. The stumps are then covered to the depth of 2 inches with a mixture of about four parts of clean sand and one of sifted peat. The sand-bed must not be allowed to become dry, except at the very surface The new growth from the stumps, which without the sand would consist of stems merely, is transformed in working its way through the sand into scaly, erect or nearly erect rootstocks which on reaching the surface continue their development into leafy shoots. Although roots are formed only sparingly on the covered bases of stems, they develop quickly and abundantly on these artificially produced rootstocks By the end of autumn the shoots are well rooted at the base. They should remain in place in the sand-bed through the winter, exposed to freezing temperatures. Early in the following spring, before the buds have begun to push, each rooted shoot is carefully severed from the stump The upper portion of the shoot is discarded, the cut being made at such a point as to leave on the basal portion about three buds above the former level of the sand-bed. The rooted shoots are potted in clean 3-inch porous pots in a soil consisting of two parts of rotted upland peat to one of sand and one of clean broken crocks. They are then plunged in sand in a shaded coldframe or greenhouse, with abundant light but no direct sunlight. For the first two months the temperature should be kept below 65° F When subjected to high temperatures, the newly cut shoots are liable to die and rot from the base upward. Watering should be infrequent, only sufficient to keep the soil moist but well aerated The frame should receive ventilation but not enough to cause the new twigs to droop. They are very susceptible to over-ventilation and overheating just before they complete their primary growth After the new twigs have stopped growing and their wood becomes hard, new root-growth takes place Then secondary twig-growth follows Not until this has occurred is the life of the plant assured Those plants that make sufficient growth to require repotting during the first summer should be transferred to clean pots of 2 inches larger diameter in a standard blueberry soil mixture.

A very successful potting mixture, or nursery-bed mixture, for blueberry plants consists of one part of clean or washed sand, nine parts of rotted upland peat, either chopped or rubbed through a sieve, and three parts of clean broken crocks No loam and especially no lime should be used Manure is not necessary, and in the present state of our knowledge may be regarded as dangerous, although in small amounts it serves to stimulate the plants, at least temporarily The danger from manure apparently lies in its tendency to produce an alkaline condition in the soil



586. Swamp Blueberry. A cluster of berries on a budded greenhouse plant. (×½)

The use of crocks in the potting mixture is based on the fact that the rootlets seek them and form around them the same mats that they form at the wall of the pot, thus increasing the effective root-surface and the vigor of growth

The peat most successfully used for potting blueberry plants is an upland peat procured in kalmia, or laurel, thickets In a sandy soil in which the leaves of these bushes and of the oak trees with which they usually grow have accumulated and rotted for many years untouched by fire, a mass of rich leaf-peat is formed, interlaced by the superficial rootlets of the oak and laurel into tough mats or turfs, commonly 2 to 4 inches in thickness These turfs, ripped from the soil and rotted from two to six months in a moist but well aerated stack, make an ideal blueberry peat A good substitute is found in similar turfs formed in sandy oak woods having an underbrush of other ericaceous plants than laurel Oak leaves raked, stacked, and rotted for about eighteen months without lime or manure are also good The leaves of some trees, such as maples, rot so rapidly that within a year they may have passed from the acid condition necessary for the formation of good peat to the alkaline stage of decomposition, which is fatal to blueberry plants Even oak leaves rotted for several years become alkaline if they are protected from the addition of new leaves bearing fresh charges of acidity.

By ordinary methods, cuttings of the swamp blueberry have been rooted only in occasional instances. Two successful methods, however, have been especially devised for these plants. The most novel of these but the one

easiest of operation is that of "tubering" This method involves the same principle as that employed in stumping, namely the forcing of new shoots in such a manner that their basal portions are morphologically scaly rootstocks, with a strong rooting tendency This method of propagation from stem cuttings is called tubering because the treatment as well as the behavior of the cuttings is essentially identical with that which takes place in reproduction from tubers, as in the case of the potato.

The cuttings are made in late winter or early spring, and the whole plant may be used, including old stems an inch or more in diameter With a saw and knife cut the wood in pieces about 4 inches long Lay these horizontally in a shallow, well-drained box containing a bed of clean sand and cover them with half an inch of the same material Water the sand well, cover the box with glass, and keep it at a temperature of 60° to 65°, or less if the equipment does not permit the maintenance of such a temperature The sand-bed must be kept moist, although if there are only slight apertures beneath the glass, a second watering may not be required for several weeks

At the temperature already specified, shoots should begin to appear above the sand within six weeks The boxes should then be placed in good light but protected from direct sunlight, and, when warm weather approaches, they should be given the coolest situation available so as to keep the temperature below 65° as long as practicable When the first shoots have stopped growing and their foliage has turned to a mature green color, they are ready to produce roots A half-inch layer of finely sifted rotted peat should then be added to the surface of the sand-bed and thoroughly wet down with a fine spray The box should remain in this condition, with a little ventilation but a saturated or nearly saturated atmosphere, until new shoots cease to appear Meanwhile, during the spring and early summer the older shoots will have formed roots between the surface of the ground and the point at which they sprang from the cutting After a shoot is well rooted it will make secondary twig-growth, and if the development of roots has not already been ascertained by direct examination, the making of such secondary growth is good evidence that rooting has actually taken place If the rooted shoots have not already disconnected themselves from the dead cuttings they should be carefully severed with a sharp knife They are then potted in 2-inch pots in the standard blueberry soil mixture already described, and during a period of three or four weeks they should be gradually changed from their saturated atmosphere and full shade to open air and half sunlight If preferred, the shoots may remain in the original cutting-bed until the following spring, before potting, the cutting-bed being exposed to freezing temperatures during the winter

When blueberry plants, either large or small, are grown in porous pots, the surface of the pot should never be allowed to become dry, for the rootlets, which grow through the soil to the wall of the pot for air, are exceedingly fine and easily killed by drying, to the great injury of the plant This danger may be eliminated by plunging the pots to the rim in a well-drained bed of sand, or by setting the pot in another pot of 2 to 4 inches greater diameter, with a packing of moist sphagnum between, and crocks at the bottom.

A burning of the young leaves and growing tips of twigs is often produced by the hot sun from the middle of June to the middle of September Plants in pots or nursery beds are easily protected from such injury and forced to their maximum growth by a half-shade covering of slats, the slats and the spaces between being of the same width. On cloudy days the shade should be removed. It should not be used in fall or spring

During the winter the rooted cuttings or one-year-old plants should be kept outdoors, exposed to freezing temperatures, their soil mulched with leaves, preferably oak leaves. When kept in a warm greenhouse during the winter they make no growth before spring. Even then their growth is abnormal, often feeble, or sometimes deferred for a whole year.

Plants from cuttings or rooted shoots are ready for permanent field planting when they are two or three years old and about 1½ to 2 feet high. They are best set out in early spring before the buds have begun to push.

The field plantation.

It is a curious fact that these plants send out no new roots in spring until they are in full leaf, their flowering is nearly or quite finished, and their principal twig-growth has ceased It is important, therefore, in taking up either a wild or a cultivated plant from the open ground, that as much as possible of the old root-mat be lifted with the plant, for upon this they depend for moisture until their new rootlets are formed.

In the case of mature wild bushes with very large root-systems, when it is practicable to secure but a fraction of the root-mat, say a disk only 3 or 4 feet in diameter, it is the best procedure to cut all the stems to the ground at the time of transplanting The bush will then produce a new and symmetrical top of a size suited to the capacity of the roots The wood that is removed may be used for cuttings if the plant is sufficiently valuable.

A plant pollinated with its own pollen, or with pollen from its asexual offspring, produces fewer, smaller, and later berries than a cross-pollinated plant In a field of plants propagated from cuttings or layers, two parent stocks should be used, a row of plants from one stock being followed by a row from the other.

In the permanent field plantation the bushes should be set 8 feet apart each way When they reach mature size they will nearly or quite cover the intervening spaces

To secure full vigor of growth, the ground between the bushes must be kept free from all other vegetation. On rocky uplands a continuous mulch of oak leaves, when it is practicable to secure them, will help toward this end as well as keep the soil in the necessary acid condition It is more economical, however, to choose such a location for the plantation as will permit the use of horse-drawn machinery, and will make mulching unnecessary

The most favorable location for blueberry-culture is a boggy area with a peat covering and sand subsoil, the peat preferably of such a thickness that a deep plowing will turn up some of the underlying sand

The land should be so ditched that the water-level can be kept at least a foot below the surface of the ground during the growing season or can be raised for subirrigation during a drought

The ground should be plowed to the depth of about 8 inches and repeatedly harrowed during the season preceding the planting, in order to kill the vegetation. After the plants are old enough to have formed a root-mat, the harrowing should be very shallow, not more than 2 or 3 inches, so that the roots will not be injured.

By proper manipulation in the greenhouse, seedling blueberry plants can often be made to ripen a few berries in less than a year, but they do not come into commercial bearing in field plantations until they are about five years old, when the plants are 3 to 4 feet high They then increase slowly to full size and full bearing.

The field plantings resulting from the recent experiments in blueberry culture are too young to show the mature yield Fortunately, however, there has been found, near Elkhart, Indiana, a small blueberry plant-

ing of mature age, believed to be the only commercial plantation in existence, which sets forward our knowledge of yields by at least a decade. The plantation is a little less than two and a half acres in extent. It was started in 1889 in a natural blueberry bog, which was first drained and then set with unselected wild blueberry bushes. Exact records of yield and receipts are available only for the years 1910 to 1912. They are as follows:

Year	Yield Qts	Price (approx avg per qt.)	Receipts
1910 (a year of "almost total failure" because of late spring freezes)	1040	17½ cts	$178 25
1911	5620	12⅞ cts	725 25
1912	5900	12⅞ cts	758 25

The annual expenses for weeding, cultivation, and irrigation were about $50. The cost of picking was 5 cents a quart. The general cost of maintenance of the equipment was about $5 per year, the crates and boxes being used repeatedly.

Estimating an annual charge of $30 for interest, $5 for taxes, and $10 for depreciation, the profits for these three years are computed as follows:

Year	Profits per acre
1910	$10
1911	139
1912	147

It must be borne in mind that these figures are based on the yields from wild bushes transplanted without selection as to individual productiveness or the size of the berries. With bushes propagated from selected stocks, the yield should be greater and the berries much larger, this greater size probably effecting a reduction in the cost of picking and certainly an increase in the selling price. FREDERICK V. COVILLE.

BLUE FLAG: *Iris*

BLUETS: *Houstonia*

BLUMENBÁCHIA (after Dr. J. F. Blumenbach, professor at Gottingen, 1752–1840). *Loasàceæ*. S. American plants allied to Loasa and Mentzelia (prairie lilies), not cult. in Amer. because of their covering of stinging hairs. The fls. are odd and pretty, axillary, solitary and bracteate. lvs. opposite, lobed. The garden forms are mostly treated as tender annuals. Prop. by seeds, to be sown in pots in spring. Transplant only when danger from frost is over.

B. chuquitensis, Hook. f. Lvs. 8–10 in. long; fls. 1½–2 in. long, brick-red, tipped yellow without, and yellow within, petals 5–10, boat-shaped. Peru, Ecuador. F S. 22: 2358. B M. 6143. —*B. coronàta*, Haage & Schmidt. 1½ ft.; lvs. narrow, bi-pinnatifid; fls. half hidden by the lvs., 2 in. diam., pure white. R H. 1874, p. 58. F M. 1874: 139. —*B. grandiflòra*, Don (*B. contorta*, Hook. f. B M. 6134). Lvs. 4–6 in. long; fls. 1½–2 in. long, wholly red, scales ¼in. long, cup-shaped, green, stamens in 5 bundles, with long filaments. Peru. *B. insignis*, Schrad. St. climbing, 4-sided; petals white, unguiculate. B M. 2865. —*B. laterìtia*, Brit. (Cajophora laterìtia, Benth.). Lvs. pinnate, with roundish lobed lfts.; fl.-stalks, twin, single-fld.; fls. orange-red. S. Amer. B M. 3632. B R. 24: 22.

N. TAYLOR.†

BOCCÒNIA (after Dr. Paolo Bocconi, Sicilian botanist and author). *Papaveràceæ*. PLUME POPPY. TREE CELANDINE. Tall garden herbs, suitable to the hardy border.

Herbs, but sometimes almost shrubby, glaucous: lvs. lobed: fls. small, many, in terminal panicles; sepals 2, colored; petals wanting; stamens many: fr. a stalked caps., few-seeded.—Four or 5 species in American tropics, and China and Japan. The well-known China-Japanese species, *B. cordata*, is by some recent authors referred to Macleya, *B. frutescens* and *B. integrifolia* (latter apparently not cult.) representing Bocconia as limited.

The large, handsome leaves remind one, by their texture and lobing, of bloodroot and Stylophorum, which belong to allied genera. The flowers are very unlike our common poppies, being small and without petals, but they are borne in great feathery or plumy masses, in terminal panicles raised high above the heavy foliage, making the plant unique in its picturesque general appearance. Hence, it is much used for isolated lawn specimens, or for very bold and striking effects, being especially adapted to be viewed at long distances. It is also placed in shrubberies, wild gardens, and at the back of wide borders. It spreads rapidly by suckers, any of which, if detached, will make a strong plant in a single season. The plume poppy seems to be much hardier in America than in the Old World. It was popular early in the century, but was neglected,



587. Bocconia cordata.

probably because it spread so rapidly. Lately it has become popular again. It deserves to be permanently naturalized in the American landscape. To produce the largest specimens, it is well to plant in very rich soil, give the old clumps liquid manure in spring, and cut off the suckers. Propagation chiefly by suckers. See Pflanzenreich, hft. 40, p. 217 for the latest monograph.

cordàta, Willd. (*B. japónica*, Hort.). Fig. 587. Hardy herbaceous perennial; height 5–8 ft.: lvs. large, glaucous, heart-shaped, much lobed, deeply veined; fls. pinkish, stamens about 30. China, Japan. B M. 1905. Gn. 54, p. 279. Gng. 5:342.

microcárpa, Maxim. Perennial, 9 ft.; fls. golden brown or bronzy, in immense panicles, summer; lvs. much as in *B. cordata*. N. China. R H. 1898, p. 362, f. 125.

frutéscens, Linn. Perennial, somewhat shrubby, 4–9 ft.: lvs. pinnatifid, pale green, often glaucescent beneath, ovate-oblong, cuneate at the base, 6–12 in. long: fls. greenish, the panicle often a foot long. Oct. Mex. and Peru. L.B.C.: 83. —Intro. by Franceschi in 1895.

B. integrifòlia, Humb. & Bonpl. 9 ft.; fls. greenish; lvs. nearly entire. Peru. Is sometimes cult. —*B. microcárpa*, *B. Giràldii* and *B. Thùnbergii* are trade names, the first two referable to B. cordata, the last probably to B. microcarpa.

N. TAYLOR.†

BOÈA (name obscure, probably personal). Sometimes spelled *Boœa*. *Gesneràceæ*. Allied to Streptocarpus, sometimes found in choice collections. Differs from Streptocarpus in having a short corolla-tube and a broadly campanulate fl., no disk, and very minor characters. Boeas are perennial herbs with ovate or oblique lvs. radical or opposite on a very short st.: peduncles axillary or elongated leafless scapes, the fls. small or medium in size, blue.—Species 16–20 in E. Asia and to Austral. and Seychelles. **B. Clarkeàna,** Hemsl., from China, has been offered in the trade. lvs. radical, roundish, strongly crenate, petioled, bronze-green above and maroon-red beneath; fls. 3–4 on each peduncle, clear azure-blue with a whitish spot.

BOEHMÈRIA (G. R. Boehmer, a German botanist). *Urticàceæ*. A fiber plant, and a greenhouse shrub or tree.

Leaves alternate or opposite, often 3-nerved; fls. monœcious or dioecious, in dense clusters, petals none; sepals 2–5; fr. a flattened achene. *B. nivea*, Gaud., of Trop. Asia, is cult. in some countries as a fiber plant, and has been intro. into this country for that purpose. Now grown extensively in Calif. and La. for its fiber. See Report No. 2, office of Fiber Investigations, U. S. Dept. Agric., and Cyclo. Amer. Agric. II, p. 284. It produces ramie. It is a strong-growing, large-lvd. perennial, well suited to the border as an ornamental subject. A genus of 45 widely distributed species of shrubs, trees or herbs.

argéntea, Lind. Fig. 588. Tree, 10–30 ft.; lvs. alternate, ovate, long-acuminate, 8–10 in. long, 3–5 in. wide, usually silvery; fls. in an axillary compound catkin-like cluster, 6–10 in. long. Mex.—An excellent warmhouse plant, cult. mostly in botanic gardens, but worthy of wide attention.

B. macrophylla, Don. A shrub or small tree; lvs. lanceolate, 6–9 in. long, serrate, prominently 3-nerved; spikes slender, usually shorter than the lvs. Himalayan region.

N. TAYLOR

BOG-GARDENING. The growing of plants in swamps, marsh-spots and bogs, distinguished from water-gardening or aquatic-gardening in the fact that the plants are not immersed or floating but grow mostly free above the soil. When water-gardening is made to include bog-gardening, confusion in practice is likely to result because the cultural requirements are unlike.

Bog-gardens may be separate areas in themselves, or they may comprise the edges of water-gardens or the spongy ground along runnels or the margins of pools. Bog-gardening is mostly a practice in colonizing plants, finding the ones that are specially adapted to the particular place. The artistic scheme is one of informality. If the place is very soft, stepping-stones may comprise the walks. Hereabouts may be grown the many marsh and wet-land plants, many of which are showy and also little known to cultivators. The sparganiums, pontederias, some of the hibiscus (page 338), many orchids, loosestrifes, cephalanthus, utricularias, and a host of others will occur to frequenters of morasses and distant shores.

L. H. B.

BOLÁNDRA (H. N. Bolander, Californian botanist). *Saxifragàceæ*. Two species of small W. American herbs offered for borders and wild gardens.

Flowers purplish in lax corymbs, petals 5, inserted on the throat of the 5-lobed calyx, stamens 5, alternate with petals. Delicate herbs, suitable for rockwork where there is a plentiful supply of moisture.

oregàna, Wats. A foot or 2 high, pubescent and glandular; lvs. laciniately toothed and lobed; fls. deep purple, tube of the calyx equaling the teeth and a little shorter than the petals; pedicels reflexed in front. Ore. and Wash.—Intro. by Gillett in 1881.

The first-described species, *B. californica*, Gray, seems not to have been offered in the trade. It is a smaller species, less pubescent with smaller fls., the lower lvs. round-reniform and 5-lobed. plant 3–12 in. high, the sts. weak and slender.

BOLDÒA FRÀGRANS, cult. in S. Calif.: *Peumus.*

BOLÈTUS: *Mushroom.*

BÓLLEA (in honor of Dr. Karl Bolle). *Orchidàceæ*. Epiphytic greenhouse orchids without pseudobulbs, with flat lvs., and lateral 1-fld. peduncles; sepals and petals nearly alike, spreading, the lateral sepals forming a distinct chin; lip articulated to the column-foot, entire, the margin revolute, furnished with a thick ridged plate, over which the stout column extends; pollinia 4.—A Trop. American genus of 4 species.

A. *Recurved tip of lip purple*

violàceum, Reichb. f. (*Huntleya violàcea*, Lindl. *Zygopétalum violàceum*, Reichb. f.). Fls. deep violet; sepals and petals broad, undulate; lip ovate, cordate, the tip recurved. British Guiana. F. S. 7: 678. P. M. 8: 1.



588. Boehmeria argentea. (×⅓)

AA. *Recurved tip of lip yellow*

B. *Fls. violet or purple*

cœléstis, Reichb. f. (*Zygopétalum cœléste*, Reichb. f.). Lvs. up to 1 ft. long and 2 in. broad; fls. 3–4 in. across, sepals and petals bluish violet, with yellow tips, the dorsal broadly obovate, petals similar to the dorsal sepal, lip colored like the petals, the crest buff. Colombia. B. M. 6458. Gt. 31: 1075. Lind. 2: 61. G. 16: 99. Gn. 31, p. 121.

BB *Fls. rose-colored.*

C. *Sepals and petals light rose*

Pátinii, Reichb. f. (*Zygopétalum Pátinii*, Reichb. f.). Lvs. up to 1 ft. long and 2–3 in. wide; fls. 3–4 in. across; sepals and petals light rose, undulate, the lower side of the lateral sepals darker; lip triangular-hastate, yellow. F. M. 1875: 147. G. C. II. 3: 9.

CC. *Sepals and petals dull rose, tipped with yellow and margined white or yellow.*

Lalíndei, Reichb. f. (*Zygopétalum Lalíndei*, Reichb. f.). Lvs. as in *B. Patinii*, but fls. smaller and darker, lip ovate-hastate, yellow. Colombia. B. M. 6331. O. R. 8: 369.

GEORGE V. NASH.

BÓLLEO-CHONDRORHÝNCHA. A cross of *Bollea cœlestis* with probably *Chondrorhyncha Chestertonii*, with both of which it was found growing in Colombia, whence it was intro. to the collection of Otto Froebel of

Zurich in 1898 It has received the name **B.-C. Froebeliàna,** Coxn. This natural hybrid has a slender erect peduncle 4 in. long, at the top bearing 2 membranous bracts half the length of the ovary fl 3¼ in wide, the sepals and petals lanceolate-ligulate, yellow-white, lightly tinged with rose, especially at the summit, dorsal sepal pointed, curving outward at the top, the lateral ones much incurved, petals obtuse, almost flat, curved



589. Boltonia latisquama (×⅛)

back at the tip; lip somewhat thick and fleshy, more delicate than in *B. cœlestis*, the blade widely obovate and rounded, crest orange-yellow, with a yellowish border and an edge of brown-purple.

BOLOCANTHUS, BOLUSANTHUS: *Lophocarpus.*

BOLTÒNIA (James Bolton, English botanist). *Compósitæ.* False Chamomile Four or 5 species of aster-like glabrous often glaucous herbs of the United States and eastern Asia, sometimes planted in borders and wild gardens

They are tall and leafy plants, blooming profusely in late summer and autumn, and excellent for the hardy border They have alternate, entire and sessile or clasping lvs and angled, often striate, sts. Differs from Aster in having very few pappus bristles which in Aster are numerous, and in other technical characters.

Boltonias are of easiest culture They take care of themselves when once established Propagation is effected by division Should be better known to gardeners. They stand without staking

asteroides, L'Her. (*B. glastifòlia,* L'Her) Sts 2–8 ft., simple below and branching at the top: lvs broadly lanceolate or the upper narrower heads short-peduncled, numerous, the rays varying from white to violet and purple, involucral bracts lanceolate and acute, greenish; scales of the pappus numerous and conspicuous, the 2 awns sometimes missing Pa to Ill and S B.M. 2381, 2554. Mn. 1:33. Gn. 74, p. 438. R.H 1903, p. 59 —Perennial.

latisquàma, Gray. Fig. 589. A handsomer plant, with larger and more showy heads with blue-violet rays. involucral bracts oblong or obovate and obtuse (often bearing a minute point); pappus scales small, the awns present and conspicuous. Kan. and Mo. to Ark. G.F. 5:271 (adapted in Fig. 589). C.L.A. 7:490 Perennial. Var. **nàna,** Hort. A dwarf form scarcely 2–3 ft tall, with pinkish rayed fls Branches freely from the base.

B cantoniénsis, Franch & Sav , is native to Japan, where the young plants are used for greens See Georgeson, A G 13, p 8, fig. 4. It is annual Has not yet appeared in the American trade Gray restricts Boltonia to the U S , and regards his species as of another genus *B lævigata,* Hort =*B asteroides*(?)

L H. B.
N. Taylor.†

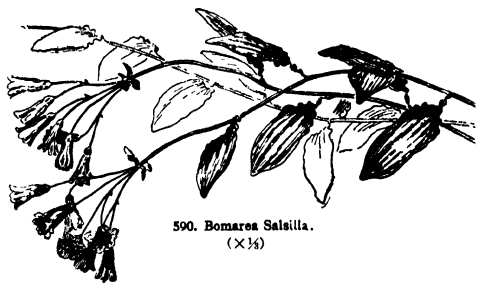
BOLUSANTHUS *Lonchocarpus.*

BOMÀREA (named after the French botanist, J C. W de Bomare) *Amaryllidàceæ* Tender South American plants allied to Alstrœmeria, and with similar fls. but a twining habit Lvs parallel-veined, usually borne on short, twisted petioles fls in pendulous umbels, variously colored and spotted, borne in early spring and summer, perianth funnel-shaped, tube none

The most beautiful species now grown is probably *B Carderi* It has large terminal cymes of rose-colored flowers, about 2 inches long, with dark purple spots and blotches Another valuable form is *B Shuttleworthii* with pale yellow flowers, spotted with green

Bomareas delight in a rich, fibrous soil, and require plenty of water during the growing season, which begins early in the spring A little well-decayed cow-manure mixed with the soil improves the growth and results in larger clusters of flowers, as does also manure watering during the growing season Late in fall the stems are cut down to the ground and the roots are kept in the soil in a dry state While they often make satisfactory pot-plants, they do best when planted out in an open sunny position in a cool conservatory where they have plenty of air in summer In the south, bomareas may be grown in the open air on trellises in half-shady places All are woodland plants and cannot be successfully grown in the glaring heat of the sun.

Propagation is by fresh seeds, which germinate readily if sown in shallow pans in a warm propagating-house, also, and more rapidly, by careful division of the rhizome, to which some of the roots should be attached.



590. Bomarea Salsilla. (×⅛)

A. *Perianth-segms. equal.*
B *Umbel simple, fls medium-sized.*

oligántha, Baker Lvs 3–4 in. long, oblong, acute lax, thin, densely pubescent beneath: fls 6–8 in an umbel; bracts large, lf.-like; segms. 1–1¼ in. long, outer dull red, inner bright yellow with reddish brown spots Peruvian Andes

BB. *Umbel compound.*

C *Fls. small.*

Salsílla, Herb (*B oculàta*, M J Roem *Alstrœmèria oculàta*, Lodd.) Fig 590 Lvs. 2–4 in long, ½in. broad, lanceolate or oblong-lanceolate, moderately firm, glabrous beneath: umbel 4–15-rayed; rays 1–3 in. long, 1-3-fld.; bracts small; fls. pink or red, marked with blue and dark purple within. Chile. L.B.C 19: 1851. B.M. 3344.



591. Bombax malabaricum (×1/6)

CC. *Fls. large.*

Cárderi, Mast. Lvs 4–6 in long, 1½–3 in broad, oblong, acute: umbel 1 ft long, 6–9-rayed; rays 1–4-fld; bracts large, leafy, perianth-segms. 2 in long, outer pale pink, spotted brown near the top, inner greenish white, much spotted. F. M 1876 239. G.C. II 5 793

chontalénsis, Seem Lvs 6–8 in. long, broadly lanceolate umbel very large, rays 4–6-fld, fls numerous, 2½ in long, outer segms waxy, wavy margined, rosy red or pink with brown spots, inner ones thinner, pale greenish yellow, spotted —The largest-fld species, very effective when well grown

Shúttleworthii, Mast Lvs 5–6 in long, oblong, acute, glabrous umbel 1 ft long, 5–10-rayed, rays usually 3-fld, perianth-segms 2 in long, outer reddish, inner greenish yellow Colombian Andes G C II. 17 77, 85 —The curious egg-shaped tubers terminate unbranched roots, which spring from a rhizome about 1 in wide Having no eyes or buds, they cannot be used for propagating

AA *Perianth-segms not equal, the inner longer.*

B. *Umbel simple.*

patacocénsis, Herb (*B conférta*, Benth) Sts purple-tinted, pubescent lvs 5–6 in long, oblong-lanceolate, pubescent beneath fls 20–30, outer segms. 1½ in long, bright red, inner ones 2½ in long, bright red, yellow-keeled, with a few spots Andes of Ecuador and Colombia G C II 17 187. B M 6692 —When well grown, the umbel is very dense and many-fld.

Caldasiàna, Herb Lvs thin, spreading, oblong, acute, distinctly petioled, 3-6 in long, glaucous, puberulent beneath umbel 6–30-fld; bracts many, oblong-lanceolate, pedicels 1–2 in long, pilose, outer segms reddish brown, about 1 in long, inner ½in. longer, bright yellow. B M 5442 (as *Alstrœnesia Caldasii*).

BB *Umbel compound.*

vitellìna, Mast. Lvs 3–4 in long, ovate-oblong: umbel about 12-rayed; perianth-segms bright yellow, outer 1½ in long, inner 2 in long; bracts large, leafy. Peruvian Andes G C II. 17:151.

B Wérckleı, Lemoine Lvs lanceolate, acuminate, bright green fls about 12 in a terminal umbel, vermilion—orange with orange-yellow inside Costa Rica N. J Rose.†

BÓMBAX (a Greek name for *raw silk*, alluding to the cottony contents of the pods) *Bombacàceæ*. Silk Cotton Tree A genus of 50 species of tropical shrubs and trees, with digitate 5–9-foliolate lvs., 1-fld. axillary or clustered peduncles, and usually large white or scarlet fls Specimens are rarely seen in cult. in fine glasshouses, and only 1 of the species appears to be in the American trade. The bark of some species produces commercial fiber such as the Kapok fiber.

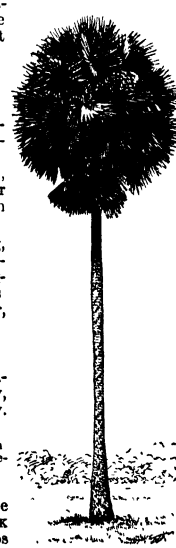
malabàricum, DC (*B. Ceìba*, Burme). Fig. 591. Large deciduous tree, the branches in whorls, the trunk and branches spiny· lvs 5–7-foliolate, palmate, the lfts entire, cuspidate fls 6–7 in long, clustered near the ends of the branches, red or scarlet, sometimes white fr a 5-valved caps, silky India —A very showy plant, excellent for warmhouse, but tender. Intro in U S. by Royal Palm Nurseries in 1912. N Taylor.



592 Borage—Borago officinalis. (×1/3)

BONESET: *Eupatorium perfoliatum*

BOOKS· *Literature*



593 Borassus flabellifer.

BORAGE (*Boràgo officinàlis*, Linn) Fig 592 *Boraginàcæ* A coarse annual plant grown for culinary use in some parts of Eu., as in Germany Used as a potherb and sometimes with salads. Only the young lvs are palatable. Mostly known in this country as a bee-plant and for its handsome blue or purplish racemed fls It is a hairy plant, 1½–2 ft high, with oval or oblong lvs Eu, N. Afr Eng Bot 1 36 *Boràgo laxiflòra* DC, is a small, decumbent alpine, but of easy cult, offered in the trade It has alternate, ovate lvs, hairy throughout, and pretty, long-peduncled, purple or violet fls Corsica B M. 1798.—Little known in Amer. N. Taylor †

BORÁSSUS (an old name, of no significance here) *Palmàceæ*, tribe *Borássineæ* Tall unarmed palms, with ringed trunks

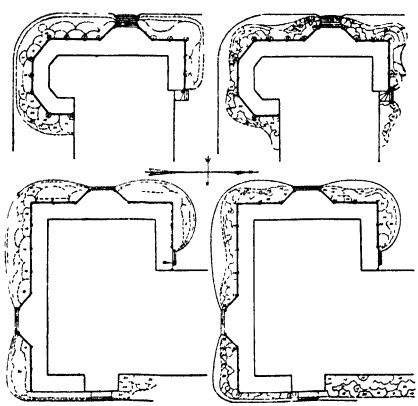
Leaves large, palmately flabelliform; plicate sheath short, petiole spiny; ligule short rigid fls small, densely packed in pits on the catkin-like branches of a spathe which comes out between the lvs, stamens 6· fr large, subglobose, brown.—Species 1. Trop Afr For cult, see *Latania* The seeds are

very hard and do not germinate readily unless given strong bottom heat and abundant moisture.

flabellifer, Linn. (*B. flabelliformis,* Murr. *B. æthiopum,* Mart.). MEELALLA, a native name for young plants, called also PALMYRA PALM by the Hindoos Fig 593. St 60–70 ft high: lvs. 8–10 ft. long, broader than long: lf-segms. bifid at the apex, lanceolate or sword-shaped in outline.—Widely cult One of the most useful palms of India. The frs are very large Many parts of the plant are utilized by the natives as food and in the arts. Wood black, very hard. This plant requires rich soil and strong heat for its best development, and is rather slow-growing under cult., especially while young.

N. TAYLOR †

BORDER. In gardening practice, the term "border" is employed to designate definite strip-planting on the margins. The margin may be along the boundary of a yard, park or other area; close about a residence or other building; or a parallel of walks and drives In all these positions, the border becomes a part of the artistic landscape plan. In some cases borders are designed separately as flower-garden or ornamental features, as margins or boundaries of an avenue of sod



594 Border planting about a residence

or of a formal walk The border derives its value from its relationship as well as from its intrinsic character It is a conception of boundaries and inclosures, and consequently is part in a design of open centers and good lawns. It develops mass effects rather than the detached and spot effects of lawn beds and of single planting; and it derives much of its pleasing result from its length, distance and perspective The border may be permanent, comprised of hardy plants; or it may be a bedding form of gardening, using temporary subjects; or it may have a framework of hardy material, with inter-planting of bulbs and annuals and greenhouse plants. Borders are often designed to carry and emphasize one idea,—the idea of larkspurs or of hollyhocks, for example; and in such cases the dominance is secured by similarity, and repetition of one plant-form. These borders, when well made, are most effective; but they do not cover the entire season unless expensive efforts are made to replant with other things as soon as the desired effects are passed. Figs. 594–596 show the placing of borders in recognized landscape plans; and Fig. 597 suggests how a mixed hardy border works itself out. Fig 598 shows the emphasis of a single strong plant-form set against a border rather than to be placed alone in the lawn without background or support.

L. H. B.

The hardy border.

The hardy border has assumed a new relation to ornamental planting within recent years in America. Once only occasional, it now forms a dominant part of many gardens previously given up almost entirely to the display of greenhouse plants or tender annuals. Properly designed for a specific purpose, it is capable of giving a maximum of pleasure for a minimum of effort and expense. Now that plants, especially American native plants, are coming to be valued for their intrinsic beauty and interest rather than for their rarity and cost, the hardy border is a more personal and individual expression than some other forms of garden effort.

The informal hardy border is often the most charming, and nature has provided us with many roadside or meadow-corner examples of exquisite beauty. Such a border may change not only with the day but almost from morning until afternoon during the luxuriant June weeks It may follow the chromatic balance of the season from the brightness of spring hues through the cooler tones of summer until the rich tints of the autumn asters and goldenrods blend into the warmer colors of the aftermath that remains to enhance the effectiveness of the winter's snow in making the border a continuous pleasure This informal planting can be handled with individuality and changed to suit knowledge, circumstance and surroundings without destroying its charm The wild things that are picked up—let us hope without ever exterminating a plant colony anywhere—in a day's woodland ramble, belong in this informal border Often the border is built around or with reference to some essential tree or larger shrub, as a rugged old pine, or a picturesque clump of lilac, or a mass of rhododendrons. It may combine shrubby, herbaceous and bulbous plants to advantage

The formal hardy border has been exemplified in some notable New England gardens It is usually formed with masses of similar plants—as a long strip of delphiniums, a great body of aquilegias, serried rows of phloxes, or lupines,—and at times is effectively combined with architectural adjuncts in the so-called "Italian" style, or with evergreen trees of formal or clipped outline. But the "barbered" formal border is passing, and even in the best American example of a formal hardy garden, made up of various borders, the edging of the daintily informal evergreen pachysandra gives a note of variation that is significant and pleasing. The hollyhocks, foxgloves and similar treasures of all gardens are indispensable in the formal border to carry line and give contour and mass. In one notable example, the background of a succession of fine hardy borders is a clambering mass of Crimson Rambler roses hanging over a great wall.

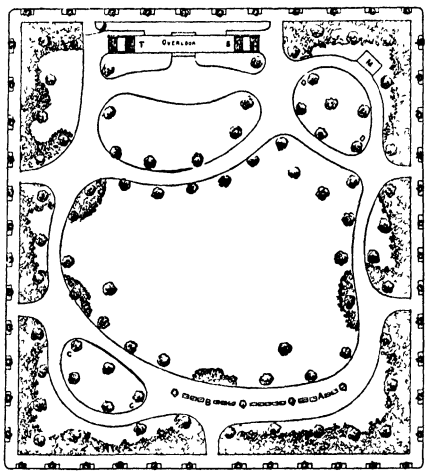
In the conventional hardy border, the shrubby plants are used less freely than the herbaceous perennials, and the bulbs still less freely, as yet. The shrubs, if selected properly as to character, eventual height, color, time of bloom and effect of foliage, may well form a framework in which to set the higher colors of the composition supplied by the herbaceous plants—the peonies, iris, gaillardias, veronicas, and the like. Or it is practicable to build the border entirely without shrubs, depending only on the masses and forms available in the plants that die to the ground each winter. With the increase in variety of herbaceous plants now commercially available everywhere, a very delightful and continuous succession of bloom may be had.

The bulbous plants—of course as fully herbaceous as any, but distinguished in trade parlance by their "onions" instead of roots, and their different dormant conditions—should come to more importance in the hardy border. They give colors, forms, fragrance and effects unique to the class. The popular conception of "bulbs" has centered around tulips and hyacinths, the so-called "Dutch" bulbs, but the various narcissi, the



XVI. Botanic garden.—The formal garden of Johns Hopkins University

scillas, snowdrops, anemones, and especially the lilies, are more adapted to the permanent border than these. The narcissus, for instance, in several largely grown forms, adapts itself to both the informal and formal border plantings Combined with iris and lilies, and using certain of the late-flowering tulips, effects as permanent as they are pleasing are now produced, and at little expense. The fancier of rare things may indulge



595 Border inclosure of a city square.

himself according to his resources with the newer and more unusual forms, there are narcissi in commerce at $60 each and $5 is cheerfully paid for a gladiolus bulb

While the nature of hardy garden flowers, with the relief of varied green foliage, seems to make agreeable a heterogeneous color-combination, yet more pleasing pictures are painted in harmonizing or properly contrasting hues The raw scarlet of the oriental poppy or the kniphofia, for example, does not "go" or compose agreeably with pink or magenta phlox It is well to keep tiger lilies and certain pink hibiscus colors from fighting each other, as another example Indeed, a fascination of the hardy border is this opportunity to select and combine hues that shall match and succeed each other agreeably A border is in mind that blended insensibly from deep crimson at one end through white to pink and white to yellow along to orange and scarlet at the other end There was no clash It must be said, however, that if the larger and more vividly colored flowers are judiciously placed, the general mixture of blooming plants in a border is wholly agreeable, even as an oriental rug including many hues in small masses is agreeable

Fragrance, also, is a quality to plan for in hardy borders,—here a bit of bergamot in a half-shady corner, there the stateliness and the sweetness of many lilies The funkia scents the evening air, and the wild rose is as fragrant in foliage as in flower There is added delight in the odorous quality of certain shrubs

An interesting feature of the border is the seasonal succession of its bloom It may begin before spring is more than an atmospheric hint, with its hepaticas, certain violets, and the snowdrops and crocuses After that there need be no flowerless moment until a freeze—not a mere frost—stops the glow of the chrysanthemum and finishes the dainty display of the monkshood The garden may also continue to please through extended weeks by changing foliage and by bared twigs of bright colors, as well as by glowing fruits that hang, like the barberries, until the next spring signals retirement

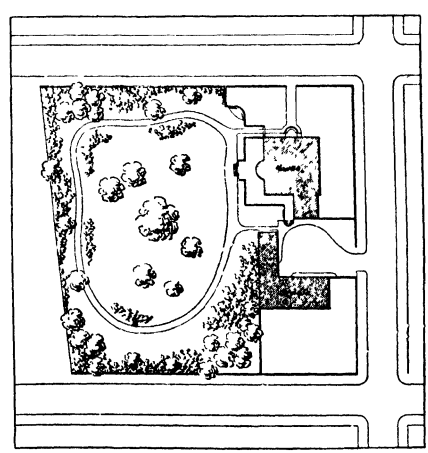
A pleasing way of creating hardy borders is by the segregation of genera and families Iris will cover four months with varied flowers of as varied heights. All the columbines may cover many weeks in time of beauty. A collection of viburnums makes a shrub border of long showiness Lilies are gorgeous, or dainty, they are short or stately, and they include months of bloom-time as a family There is great delight in studying plant families grouped in neighborly fashion

The hardy border may endure full sun or deep shade with all variations between, if its citizens are selected for their adaptability. Some plants of the border need wet feet, others are best, like the moss pink, on a dry and sterile sunny bank It is this great range that makes the good border so very good, for it reflects the adaptability of nature for thousands of years

The plants for a border are now legion The nurserymen in these days have considered the needs of the planter, and there is little difficulty in securing what is wanted Certain tradesmen grow perennials in small pots, available nearly all the growing season But a personal hardy border can be made with little aid from the nurseryman The man—or woman—who loves them can transplant hardy plants with success at any time of the year when the ground is not frozen deeply, and such persons find plants in the wild that may be separated without destroying colonies of a kind There is also the fascinating and inexpensive method of growing the perennials from seed, resulting in more knowledge gained through failures; and in enough successes to furnish plenty of plants to the grower and his friends The hardy border of the personal sort is a great educator in patience, perseverance and knowledge of plant life. J. HORACE MCFARLAND.

The making of the border.

Perennial herbaceous plants should form the major part of the planting in most borders, as these are permanent and eliminate the necessity of replanting the whole each year. Biennials, such as the Canterbury bells and foxglove,—for these are best treated as such,—

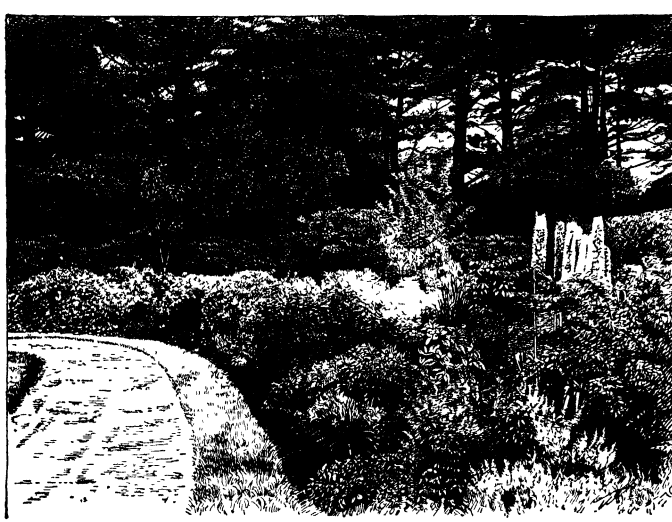


596 Border inclosing the back area of a city place, the central area being planted for shade.

hollyhocks and sweet williams are an essential that should be provided for in a reserve garden, and moved to the place in which they are desired to bloom as gaps occur Annuals are necessary, such as mignonette, larkspur, candytuft, asters, stocks and other favorites to help out the display during July and August, for this is a period when perennials in bloom are scarce. There should be a background of shrubs with a group or individual dwarf shrub here and there to break up the flatness, especially in winter and early spring

It is a question whether spring-flowering bulbs are admissible in this type of permanent border. It is better to keep them in a place by themselves for the reason that it is difficult to make changes when the ground is planted with bulbs, and to lift these at stated periods necessitates disturbing all the other occupants A group of Darwin tulips here and there is much admired and in keeping, but a general planting is better made elsewhere, as under trees and among ferns

A border being permanent, no effort should be spared to prepare thoroughly in the beginning Deep-rooting plants, as peonies, hemerocallis, delphiniums and columbines, require deep preparation of the soil and liberal enrichment, double-digging or trenching being essential It is better, if possible, to prepare and plant a portion at a time rather than to plant in a hurry and go over it all again later. If the soil is heavy, add sand and coal-ashes, so that it may be easier to work at all times If the soil is inclined to be wet, it must be drained to take care of surplus water A dry soil can be improved by the addition of leaf-mold, and provision must be made for watering in dry seasons. It is not necessary to lay the pipes deep if there is a natural pitch to the land, the water then being turned off late in the year and the pipes drained for safety. Faucets should be so placed that 50 feet of hose will water any part that needs it; thus the outlets may be 100 feet apart.



507. A good mixed border, with many attractive plant forms.

The grouping of plants in a mixed border is governed by the width and extent of this border. In large, wide spaces, ample groups of each plant are necessary to secure the desired effect and to avoid "spottiness." Large-growing permanent plants, as peonies, boltonias, heleniums, rudbeckias and even silphiums and late-flowering asters should be planted at the back, in front of these, the phlox in separate colors, or at most two colors together that will harmonize, German iris in masses of one or more colors, bleeding heart, campanulas, *Veronica subsessilis*, monarda, oriental poppy, columbines, pyrethrums, perennial candytuft, and, in front of these, the usual dwarf edging plants, as arabis, alyssum, the Carpathian harebell, shooting-star, cryssimum, *Tunica saxifraga*, geum, *Heuchera sanguinea* and others If the border is narrow, individual treatment must be followed to secure a greater variety, and it is always permissible to add the old favorite sweet-smelling plants and herbs, such as balm, thyme, lemon verbena, southernwood, rosemary, rue, marjoram, borage and fennel, and some sweet geranium. All these give interest when flowers are waning, and call up associations helping to take the memory back to old friendships

A border of this kind will need the addition of annuals to take the place of the earlier flowering plants that are past Seeds of mignonette may be sown in the place where they are to flower; snapdragons may be raised in frames or hotbeds and set out among other plants that are passing; the scarlet salvia may be put where its color will not clash when in flower; gladiolus may be set out in groups of one color; *Hyacinthus candicans* looks well in fall when planted at the back, in fact, the mixed border of today should contain every desirable plant that has either sentiment or blossoms — possibly both — to recommend it.

Lilies often do well in partially shaded situations in which moisture is sure and leaf-mold has been added. They should never be treated to manure They are best seen when planted in masses sufficient to make a display in their season *L. auratum* never lives long but is good for a year or two; *L. speciosum* is a better lily to keep; the tiger lily always remains with us as do also *L. umbellatum*, *L. Hansonii*, *L. Thunbergianum* or *L. elegans*, and great results are expected from the new Chinese *L. myriophyllum* andothers of recent introduction. The flower-stalks of lilies should never be pulled up in fall, but cut off at the ground. It is a protection to the heart of the bulb to let the stem remain.

Perhaps the most important detail of the management of the border is that of protection in winter. The border should be protected and nourished at the same time, this is possible when a quantity of well-decayed manure and leaf-mold is available for a top-dressing, preferably after a little frost has penetrated the soil. This can be lightly forked into the soil in spring, but a spade should never be used except when making

changes. The great charm of this form of gardening is, after all, the necessity of change from year to year It must not in any sense be considered changeless Some plants will outgrow their allotted space and must be restricted, biennials will die out and need replanting, some color scheme may be wrong and need alteration, other really good things will need to be divided and replanted, and in this way the interest is kept up by the taking of notes through the season for reference at



598. The single specimen set against a border planting.

the planting-time, and this is best done after the fall rains in September and early October before the soil loses its warmth, root-action being rapid then, and the roots soon become established before winter There is always enough to do in spring, and changes in the borders left for that time are often made at the sacrifice of the display due in summer-time Much misconception was the result of the term "perennial border" The plants were not all permanent, and the display was not continuous Out of it has been evolved a much more satisfactory thing in that it calls for endless study, a greater variety containing all the good things, and the possibility of change each season as fancy dictates.

In wide borders especially, it adds greatly to the effect to plant some dwarf-growing shrubs near the path, such as Lemoine's deutzia and philadelphus, some specimens of the new choice lilacs (double and single), *Daphne Cneorum*, the dwarf flowering crabs like *Malus Toringo* and *M. Ringo* These are all very beautiful and stand close inspection The shrubs may be so arranged as to form bays for groups of plants, either for certain seasons or color effects, and if there is a tendency to outgrow the situation, pruning judiciously will help if done directly after the flowering season is past, with no sacrifice of bloom, always taking care to keep the individual shape of each shrub Shears must never be used on shrubs, but shorten-in the longer shoots with a knife

The Japanese iris, if used in the border, must be planted near water so they can be frequently irrigated in dry times or failure is sure to ensue. They are semi-aquatic and will take much nourishment also The German kinds require a warm sandy soil, and a dry time in late summer suits them well. They are also best transplanted in September before the heavy rains, as root-action begins at this time and they become reëstablished before the winter sets in

Borders need constant care in summer to keep them trim and clean. All seed-stems and dead flowers should be removed. tall-growing plants staked up with neat stakes, and, above all, plants grown in reserve to take the place of such as are dying out after blooming There is no more interesting phase of gardening than this, because it calls for care and study all the time, year by year, and our failures of this season are with us to profit by during the next. E. O. ORPET.

BORECOLE: *Kale*

BORÉTTA: *Daucus.*

BORÒNIA (after Francis Borone, an Italian who lost his life at Athens in the service of Dr Sibthorp). *Rutàceæ*. Greenhouse shrubs, interesting, and very fragrant

Boronia is a genus of Australian shrubs with numerous fls, having a rue-like fragrance lvs. opposite, odd-pinnate, or simple fls axillary and terminal, red, rarely white or purplish, on the plan of 4, bearing a thick entire disk: fr 2-4 carpels, each 1- or 2-seeded *B. megastigma* and its allies, *B. elatior* and *B. heterophylla*, are remarkable for their very large stigma (which is 4-lobed at the base), and their curious stamens, 4 of which are small, yellow, pollen-bearing, and hidden under the stigma, while the 4 large, conspicuous ones are dark purple or black, and bear no pollen —About 60 species, in Australia.

The chief value of boronias is their delicious fragrance. A small specimen will perfume a whole house for two or three weeks Boronias are cultivated like Cape heaths in a cool greenhouse. After flowering they should be cut back, in order to make compact, bushy specimens. The leading shoots may be frequently pinched, to prevent a straggling growth As most of them are native of barren sandy places, not bogs, good drainage is necessary. "Sour" soil is very disastrous to them The English florists set their young plants in the open ground during summer, being careful to shade them with lath frames Plants that have flowered two seasons are thrown away and replaced by younger specimens. They are propagated by cuttings from half-ripened wood inserted in 4-inch pots, which are filled to within an inch of the top with a compost of finely sifted loam, peat and sand, over which is spread a layer of sharp sand After a thorough watering, they may be placed under a bell-glass in a greenhouse in which the temperature ranges from 45° to 50° F, and shaded from bright sunshine Seeds germinate readily in the same temperature, and make good flowering plants in one season Seeds can be obtained from German or Australian dealers, large quantities being collected in the wild. Boronias belong to a large class of hard-wooded Australian plants that were popular along with the Cape heaths in the early part of the nineteenth century These were largely replaced by quicker-growing, soft-wooded plants. The renewed interest in boronias is largely due to the more recently introduced species, of which the first three described below are the best. American florists have lately grown them somewhat for Easter, especially *B. heterophylla*. Many species are likely to be introduced, as these shrubs are very brilliant in Australia, blooming when very young, and remaining attractive for two or three months.



599. Boronia megastigma. (×½)

A. *Stigmas large.*

B. *Lvs. less than 1 in. long, lfts. in 1 or 2 pairs, plus an odd one.*

C *Fls borne singly.*

megastígma, Necs. Fig 599. Height about 2 ft.: lvs. very sparse, ½–⅔in long, sessile, the upper with 1 pair, the lower with 2 pairs of lfts beside the end one; lfts narrowly linear: fls maroon-purple outside, yellow within, borne less densely than in *B elatior.* At times some fls are chiefly brown, others chiefly purple B.M 6046 —Var. **aûrea,** Hort., has pale creamy yellow fls.

CC. *Fls. borne in whorls of 4 or 6.*

heterophýlla, F. Muell Height 5–6 ft. in Austra: lvs 1–1½ in long, sometimes simple, usually with 1 pair, rarely 2 pairs, of lfts: fls bright scarlet, but usually pictured as purplish crimson. Differs from *B elatior* and *B megastigma* in its larger lvs, fewer lfts, more brilliant fls and longer filaments Cult only in its var. **brévipes,** Hook f, which differs merely in the shorter peduncles. B M. 6845 Gn 32:442 —Of late years it has been grown for Easter by florists to a considerable extent

BB. *Lvs. more than 1 in. long, lfts. in 2–6 pairs, plus an odd one*

elàtior, Bartl. Height about 4 ft · pubescence variable lvs close-set, 1–2 in long, ½–¾in. broad, petioled, with lfts in 2–6 pairs, lfts. broader and shorter-acuminate than in *B megastigma* fls dark red-brown, or rosy red, or purple, sometimes showing groups of widely different colors on the same branch, and borne so densely as to hide one side of the branch. B.M 6285 Gn. 10:312. F E 9.491

AA *Stigmas small*

pinnàta, Smith Lfts in 2–4 pairs, very smooth, acute: peduncles dichotomous, 5–7-fld, stamens 8. B.M. 1763. L B.C 5 473.

tetrándra, Labill. Lfts in 4–5 pairs, obtuse, glabrous: branches pilose pedicles short, 1-fld · stamens 4.

B denticulàta, Smith 2–6 ft lvs mucronate, denticulate fls in peduncled corymbs, rose-purple —*B Fràseri,* Hook (B anemonifolia, Paxt) 1–3 ft lvs trifid, the wedge-shaped segms. entire or 2–3-toothed fls axillary, solitary, pink New Holland P M 9·123 —*B pulchélla,* Turcz (B Drummondii, Planch) 2 ft · lvs. pinnatifid fls rose-pink, freely produced in spring and summer. Var *álba* A white-fld form is known F S 9 881

WILHELM MILLER.
N. TAYLOR.†

BORZICÁCTUS: *Cereus.*

BÒSEA (after Kaspar Bose, German amateur of plants, at Leipzig, about 1700). *Amarantàceæ* Syn., *Bosia.* Woody plants, rarely cultivated for their ornamental crimson berries

Upright shrub lvs petioled, alternate, ovate to ovate-lanceolate, entire fls small, with 2–4 bracts at the base, in terminal spikes or racemes; sepals and stamens 5; petals wanting; ovary with 3 subulate stigmas fr a 1-seeded berry —Three species in the Canary Isls., Cyprus and Himalayas They can be cult only in warmer temperate regions Prop by seeds and probably by cuttings of young wood.

Amherstiàna, Hook (*Rodètia Amherstiàna,* Moq.). Glabrous shrub. lvs ovate, acute or acuminate, 3–6 in. long, narrowed at the base into a petiole ¼–½in. long. fls. perfect, greenish, ⅛in. across, sessile, with 2–4 bracts at the base, in terminal panicles: berries globose, ⅛in across, crimson W. Himalayas —Adv as *Bohea Amherstiana.* The closely related *B yervamòra,* Linn., from the Canary Isls, is sometimes cult in Old World botanic gardens, it differs chiefly in its short-stalked, polygamous fls., with only 2 bracts at the base.

ALFRED REHDER.

BOSTON FERN: *Nephrolepis*

BOTANIC GARDEN. A collection of growing plants, the primary purpose of which is the advancement and diffusion of botanical knowledge

This purpose may be accomplished in a number of different ways, and by placing emphasis on different departments of the science. Some gardens, for example, are preeminently centers of systematic botany, or taxonomy; others of plant physiology and morphology; while in two or three cases, more than special emphasis is placed on botanical education, or formal instruction, as distinguished from, or in close connection with, research. But whatever the method, or wherever the emphasis, the aim is the advancement of botany as distinguished from horticulture or agriculture Some of the ideas embodied in botanic gardens are displayed in Figs 600–603

All the scientific and educational work of a botanic garden centers around the one important and essential problem of maintaining a collection of living plants, both native and exotic The extent to which this may be done depends largely on the local climate, and extremes are found in such gardens as Christiana, Norway, where the glasshouse is of prime importance, and Havana, Cuba, or Buitenzorg, Java, where the tropical climate renders a conservatory superfluous. At Buitenzorg there are coolhouses instead of hothouses



600. Entrance to botanic garden, Roseau, Dominica, B W Indies.

Many ancient gardens were little more than olive orchards, and one of the earliest of these of which there is any authentic record is the temple garden of Karnak There was recently discovered at Thebes the tomb of Nekht, the head gardener of this place, who is believed to have designed it during the reign of Thotmes III, about 1500 B C.

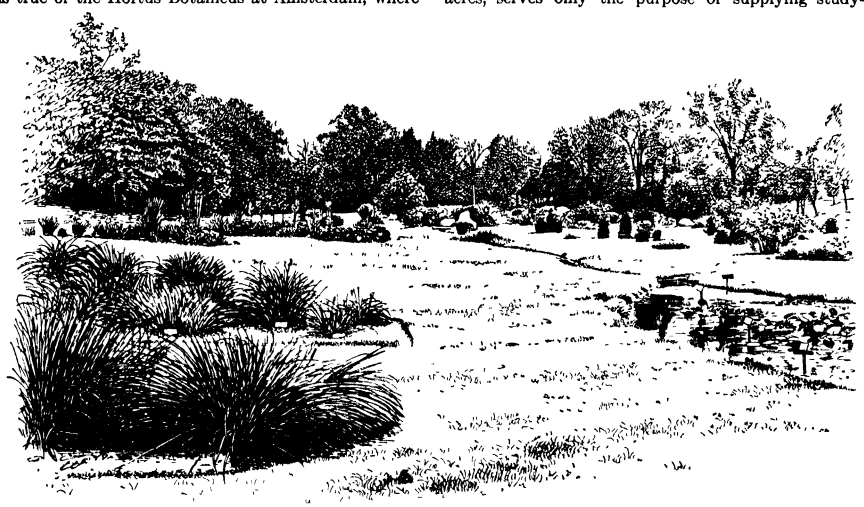
While the early gardens were cultivated largely for economic rather than ornamental purposes, yet the Greeks, as may well be expected, developed ornamental flower-gardens, and this idea, with so many others of Greek origin, was borrowed by the Romans Among the best known of the Roman ornamental gardens were those of Lucullus, and of Pliny the younger.

We learn from Pliny that during the first century of the Christian era, Antonius Castor maintained in Rome a garden of medicinal plants. Four hundred years previous to this however, or about 350 B. C., a botanic garden was established in Athens by Aristotle. The first director of this garden was Theophrastus, a pupil of Aristotle, who fell heir to it on the death of the latter, and was able to improve it by means of funds supplied by a philanthropic citizen of Athens

The gap between these more ancient gardens and those of today is, however, a wide one, and the modern botanic garden may be considered as more immediately derived from the private gardens of the herbalists in the sixteenth and seventeenth centuries. One of the best known of these was the garden of John Gerarde, in Holborn. The plants here grown were chiefly medicinal herbs, and the study of these collections, together with the attempts to describe the plants accurately, gradually developed into modern systematic botany.

The organization of all modern botanic gardens is very similar in broad outline. There is usually a director, with a scientific staff, and a head gardener, with assistants Some gardens are purely scientific institutions. Such were the early gardens of Michaux, in Charleston, South Carolina, of Darlington, in Chester, Pennsylvania, of Bartram, in Philadelphia, and of Hosack, in New York City, all long since extinct, and the Cambridge (England) Physic Garden A large number of "botanical stations" and "acclimatization gardens" in the various colonies of European countries, the Desert Botanical Laboratory of the Carnegie Institution of Washington, at Tucson, Arizona, and the Acclimatization Garden of the same Institution at Carmel, California, all devoted entirely to scientific research, are often classed as botanic gardens, although not such in a strict sense of the term

Many of the more purely scientific gardens are connected with universities, or other institutions of learning, or closely affiliated with them This, for example, is true of the Hortus Botanicus at Amsterdam, where



601. View in a botanic garden, showing related plants in groups.

were conducted the epoch-making experiments of De Vries with the evening primrose, *Œnothera Lamarckana*, and other species, culminating in the elaboration of the mutation theory, giving a new stimulus to studies in experimental evolution and plant-breeding, and incidentally illustrating how studies in pure botanical science, made primarily for their own sake, and seeming, at first thought, ever so academic or impractical, may be of inestimable value to such applied sciences as horticulture and agriculture.

Among other botanic gardens forming an integral part of the organization of collegiate or university departments of botany may be mentioned those of Aberdeen, Dundee and St. Andrews universities in Scotland; those of Birmingham, Cambridge and Oxford universities, and of the Royal Agricultural College at Cirencester (Gloucester), in England; that of Trinity College (Dublin), in Ireland; those of the universities at Budapest, Czernowitz, Krakau, Lemberg, Prag, and Vienna, in Austria-Hungary; of Ghent and Liege, in Belgium; of Copenhagen, in Denmark; of the Catholic university, in Lille, and the medical college and the veterinary college in Lyons, France, those of the universities of Bonn, Breslau, Gottingen, Halle, Munich, Strassburg, and Wurzburg, in Germany; of Athens, in Greece; of Groningen, Leiden, and Utrecht, in Holland; of Genoa and Modena, in Italy; of Kiev, Odessa, and St Petersburg, in Russia; of Basel, in Switzerland; of Nikko and Tokyo, Japan, and in the United States, those of the University of California (Berkeley), Harvard University (Cambridge, Massachusetts), Smith College (Northampton, Massachusetts), Mt Holyoke College (South Hadley, Massachusetts), Michigan Agricultural College (Lansing), the University of Michigan (Ann Arbor), the University of Minnesota (Minneapolis), the University of Pennsylvania (Philadelphia), and Johns Hopkins University (Baltimore).

It is not uncommon in European countries to find botanic gardens in connection with gymnasia (high schools), and normal schools, but the only instance of this kind in the United States, known to the writer, is the botanic garden of the Michigan State Normal School, at Ypsilanti. This garden, with an area of 3 acres, serves only the purpose of supplying study-material for the courses in botany, nature-study and agriculture.

It will be seen at a glance that botanic gardens are much more common in Europe than in the United States, and especially under governmental auspices. The National Botanic Garden, at Washington, D. C., has not been developed as a scientific institution to the extent of several private or semi-private foundations.

Other so-called botanic gardens are little more than public pleasure parks Golden Gate Park, the municipal park of San Francisco, and primarily a pleasure park, is administered with some regard to scientific ideas, and is sometimes referred to as a botanical garden. Here, also, for example, may be classed Prospect Park, in Brooklyn, in which the labeling of the trees gives a somewhat botanical aspect to the place This park is said to contain more different species of trees, both native and foreign, than can be found elsewhere in America outside of a true botanic garden or arboretum

A third type of garden combines the features of a scientific institution for research and education with those of a public park. Of this nature are the Kew

Gardens, near London, the Jardin des Plantes, Paris, the Berlin Botanic Garden, at Dahlem, the New York Botanical Garden, in Bronx Park, the Missouri Botanical Garden, St. Louis, the Botanic Garden of the Imperial University, at Tokyo, Japan, and the new Brooklyn Botanic Garden.

It has already been implied above that the early study of botany was closely connected with the use of plants for medicine, gardens being largely, or even exclusively, devoted to growing medicinal herbs. In this connection it is interesting to note that while the staple food, fodder, and fiber plants are grown as crops, pharmacists and physicians have, with few exceptions, such as the opium-poppy and the ginseng, always depended upon wild plants. This practice of gathering only wild herbs doubtless accounts in large part for the well-known and, until recent date, quite general adulteration of drugs

The total number of botanic gardens outside the United States is approximately 325. In our own country there are about sixteen, eleven of which are college and university gardens The following foreign gardens are referred to in the order of their establishment.

Foreign gardens

1. Pisa, Italy, founded in 1543, by order of the Grand Duke Cosmo de Medici I The second director of this garden was Cæsalpino, after whom the leguminous genus Cæsalpinia, was named. This was one of the earliest gardens devoted to the public study of botany.

2. Muséum d'Histroire Naturelle, Paris, founded in 1635 by Guy de la Brosse, physician to the king. Its first name was Jardin Royal des Plantes Medicinales, which was changed to the present name in 1790. The gardens proper occupy 14 hectares out of a total of 23.

3 Chelsea Physic Garden, London. Established by the Society of Apothecaries, in 1673, for the stated purpose of furthering the teaching of botany, and of providing material and opportunity for botanical research. The educational and scientific influence of this garden can hardly be overestimated. It was founded by the Society of Apothecaries of London, in 1606, and originally comprised the Grocers' Company, an ancient guild In 1617 a new charter was granted by James I, and the Society of Apothecaries became separate from the Grocers' Company. From the start the Society was active in advancing botanical knowledge, and soon after its incorporation, field trips, called "herbarizings," were held at irregular intervals, and to these irregular trips a regular annual one was added about 1633. The botanical interests and activities of the Society found natural expression in 1673 in the establishment of the Physic Garden At first the ground was utilized not only for growing specimens for scientific study, but also for growing crops of medicinal plants sufficient to furnish crude drugs for the commercial use of the Society. However, when Sir Hans Sloan, in 1722, deeded to the Society additional ground, adjacent to the original 4 acres of the garden, in the terms of the deed was a prohibition of this practice, and the garden became from thenceforth devoted to investigation and instruction.

The garden entered upon a new epoch with the appointment, as "gardener," of Philip Miller, well known as the author of the classic "Dictionary of Gardening." The title of "gardener" was subsequently changed to "curator " In 1681 steps were taken toward the development of a botanical library, which, by 1769, contained about 300 bound and unbound books, dealing chiefly with botany In 1835 John Lindley was appointed Director of the Garden

It was in connection with the Society's endeavor to grow successfully plants that could be grown only with difficulty or not at all in the smoky atmosphere of London that the well-known "Wardian case" was devised, by Nathaniel Bagshaw Ward, Fellow of the Royal Society, and a friend and patron of the Physic Garden. These "closely-glazed cases" were first described by Ward in a letter to Sir William Hooker, dated 1834, and published in the "Companion to the Botanical Magazine," in May, 1836. It was also found possible, by employing these cases, to ship living plants across the tropics from the southern to the northern hemisphere with the loss of scarcely a plant, whereas, under former methods of shipment many more plants perished than survived.

Among many important publications growing out of the work of the Chelsea Physic Garden or produced by members of its staff, may be mentioned Curtis's "Linnæus's System of Botany," and his "Botanical Magazine," and "Flora Londonensis;" Lindley's "Flora Medica," and Lindley and Moore's "Treasury of Botany," Miller's "Gardeners' Dictionary," mentioned above; and Hudson's "Flora Anglica " In 1902 a well-appointed laboratory building was opened in the garden. In this building are two small rooms which contain the private library of Charles Darwin. The library equipment is used by students of the Royal College of Science, and the Professor of Botany of the college is Scientific Advisor to the Committee of Management. The garden is used freely and largely by teachers with classes, and living material for class study is supplied in quantity to the University of London, the Royal College of Science, and other local schools.

4. Royal Botanic Gardens, Kew, London (1759). The present gardens resulted from the fusion of two royal estates, the Richmond Gardens and the original Kew Gardens. Richmond Gardens, composing the western portion of modern Kew, were the grounds of the royal residence of Edward I The second half was the private grounds of Kew House Lord Capel, who, by marriage, came into possession of Kew House in 1696, was greatly interested in the cultivation of plants, and his collections formed the nucleus of the modern Kew plantations. The property was leased to Frederick, Prince of Wales, about 1730, and after his death, his widow, Princess Augusta of Saxe Gotha engaged, in 1759, William Aiton, a former pupil at the Chelsea garden, to establish a physic garden. its rank as a true botanic garden may be considered to date from this year The union of Richmond and Kew was effected in 1802.

Under Aiton was inaugurated the plan of sending out expeditions for botanical exploration in foreign countries, a practice which has greatly enriched the herbarium and living collections, and which has been carried out on a large scale and with similar results in America by the New York Botanical Garden. Perrédès states that the specimen on which L'Héritier founded the genus Eucalyptus was collected on one of these expeditions to the Cape in 1772 In 1789 Aiton published his now classic "Hortus Kewensis." He was succeeded in the directorship by his son William T. Aiton, and the latter, in 1841, by Sir William J. Hooker, although Aiton retained directorship of the pleasure-grounds until 1845.

Hooker's aims were to make Kew so attractive as to create in the general public an interest in plants, to advance pure and applied botany, and to train collectors and gardeners. The area of the garden has increased from 15 acres, when Sir William Hooker became director, to about 95 acres at the present time. The former pleasure-grounds are now developed and known as the Arboretum. In 1875, on the retirement of Sir J. D. Hooker, who succeeded his father in 1865, Sir William Turner Thistle-Dyer was appointed director. The present director is Lieut.-Col. Sir David Prain.

In scientific matters the power of the Director of Kew is absolute, but in matters of administration, he is under the governmental Board of Agriculture. The library consists of about 20,000 volumes, over one-half

of which are set apart, primarily in the office of the Keeper of the museums.

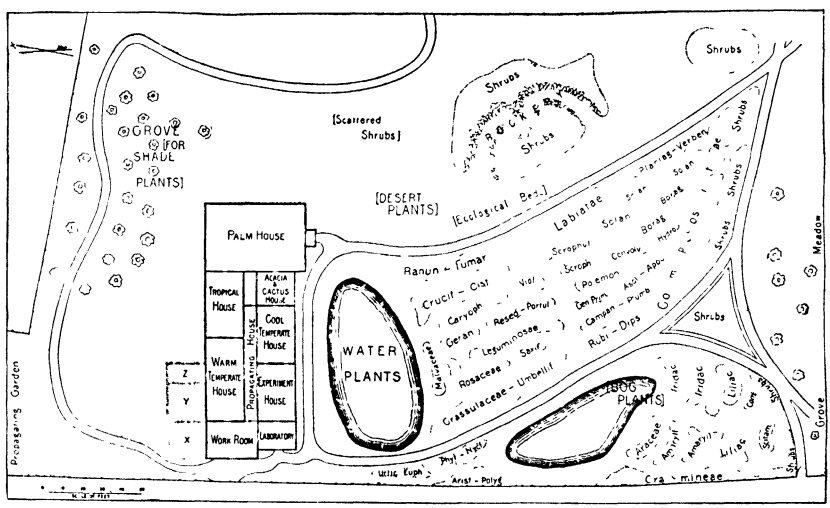
Kew has throughout exerted a profound influence on the development of botanical science, and by the training of gardeners, and in numerous other ways, has forwarded and really made possible the development and work of the numerous colonial gardens and botanic stations The latter are in reality experiment stations, and while administered by the colonial office, depend upon Kew for scientific advice and for much economic plant material. Consult *Arboretum*

5. Royal Botanic Society's Gardens (1740). Special mention should be made of the Royal Botanic Society's Gardens at Regent's Park, London, since so much attention has been given there to the various aspects of horticulture Prior to being taken over by the Royal Botanic Society, about 1840, the area of the garden was occupied by a nursery. Originally flat and circular in outline, it has been given, by artificial treatment, a diversified topography, and the plantations include an

A practical gardening school was established in 1897, and in 1902 a laboratory building was erected for the use of the school. A portion of the grounds is also set aside for this school, and the head of the gardening staff is the chief instructor in the gardening school Occasional exhibitions are given to illustrate the nature-study work of local schools.

The work of the garden in supplying study-material for schools is unusually extensive, from 50,000 to 60 000 specimens of living plants being supplied annually to students. Several hundred students' tickets are issued each year by teachers in various schools. These tickets admit the bearer daily until three o'clock, after which hour the garden is closed to all except Fellows and other visitors

The grounds are leased from the Crown, and the money for this and other purposes is derived entirely from private subscriptions by Fellows of the Royal Botanic Society. On this account provision is made to provide attractions for those not primarily or entirely



602. Plan of a small botanic garden.—Smith College, Northampton, Mass Early plan.

American garden (which is said to be now restricted to a planting of rhododendrons), an herbaceous garden, and an economic garden Much attention is given to the growing of medicinal plants An arboretum was started, but eventually abandoned on account of the small area.

The arrangement of plants in the herbaceous garden is that devised by Marnock, the first curator, and the one who planned the entire garden Each of the different-shaped beds is devoted to one family of plants, so that the relative size of the families is seen at a glance, and beds of nearly related families are grouped together. The economic division comprises trees and shrubs, but the economic herbaceous plants are included in the general herbaceous garden This is the most extensive exhibit of economic plants grown in London, and it is said that the first banana ever tasted by the late Queen Victoria came from a plant in this garden

The main part of the conservatory, built in 1845, was the first large plant-house of glass and iron to be erected in England The system of heating is that of hot water, and the pipes are underground, but this arrangement has not proved to be economical.

interested in botany The attractions include a tennis-court, croquet-ground, flower-shows, garden fêtes, and a club-house.

There is a set of meteorological instruments in the garden, and records of barometer, wet- and dry-bulb thermometers, temperature of the soil at depths of 1 foot and 4 feet, maximum temperatures in sun and shade, minimum temperatures in shade and "on grass," precipitation, wind direction (but not velocity), duration of sunshine, and general remarks are published in the Botanical Journal of the Society This journal, issued quarterly, is now (1912) in its second volume

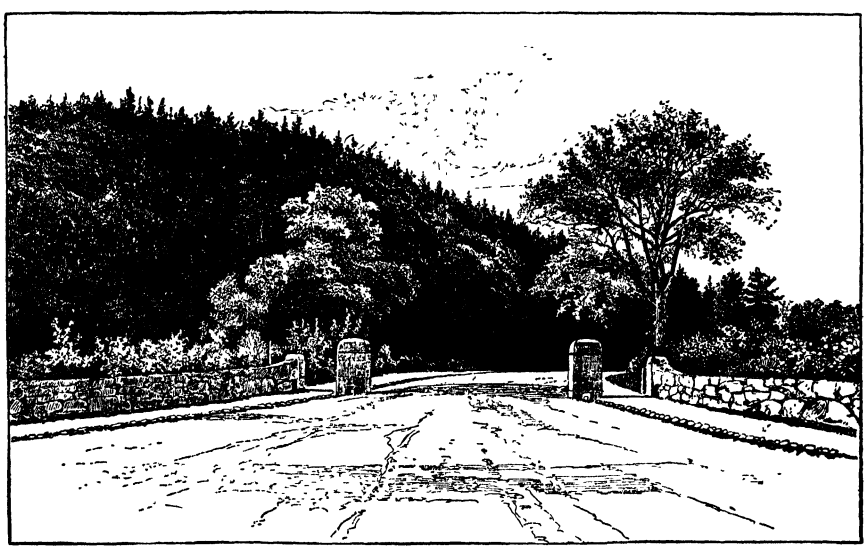
6. Buitenzorg (1817). The botanic garden at Buitenzorg is known officially as 's Lands Plantentuin (Botanic Garden of the State) Its Latin name, "Hortus Bogorensis," is derived from Bogor, the native name of Buitenzorg. The garden is a division of the governmental Department of Agriculture of the Dutch East Indies, and has been described as the most beautiful botanic garden in the world. It was established in 1817 by Reinwardt, and is located 36 miles from Batavia. This location was fortunate for climatic rea-

sons, for while on the Java east coast there is a drought season of three to four months, there is no drought season at Buitenzorg The total annual precipitation is between 180 and 200 inches, or approximately five times that of New York State. The incessant rains are accompanied by a general lowering of the temperature, and this makes possible the cultivation of plants from the higher altitudes The altitude of Buitenzorg is 900 feet. There are in reality three gardens: First, the botanic garden proper, in the center of the city, with an area of 89 acres. Each division of this garden has a blanket label, giving a list of the genera it contains, and each species is represented by two specimens, one of which bears a label, giving the scientific name, the common name, if there is one, and usually the economic products of the plant The climbing plants are arranged systematically in a group by themselves The vast majority of plants are arborescent, and there are about 10,000 species cultivated. The garden is open day and night. The second division is the agricultural garden, about a league from the center of Buitenzorg, and having 173 acres Only plants of economic importance, including medicinal plants, are grown here The third division or garden is some distance from Buitenzorg, on the slopes of the volcano of Gede Its area is 74 acres, and its altitude is 5,000 feet, thus making possible the cultivation of plants that cannot be grown in the other two gardens. There is a museum building in connection with the garden proper at Buitenzorg.

"The Annals," the well-known publication, was founded by the third director, Scheffer.

American gardens.

1. Bartram's Garden (1728). The first botanic garden in America was that of John Bartram, established in 1728, and still existing, although in a greatly modified form At about the same date (1725), Robert Prince, one of the early settlers on Long Island, began to raise a variety of trees for the purpose of ornamenting his own grounds, and this activity soon developed into a nursery, ultimately well known, not only in America, but throughout Europe Such a venture was favored by a growing interest in ornamental and edible plants resulting from the importation of various French fruits by the Huguenots, who settled at New Rochelle, New York, and along the north shore of Long Island. This nursery continued under the supervision of the same family for five generations (130 years). For a number of years the proprietors confined their attention to fruit trees The institution was visited by President Washington, and on August 29, 1796, after the battle of Long Island, the British General Howe placed a guard around the garden to protect the trees and plants until all danger was passed. In many old English gardens today are numerous native American plants derived from the Prince nurseries In 1793 the nursery was christened the Linnæan Botanic Garden, and a catalogue of plants here grown passed through more than twenty editions. The mahonias,



603. Entrance to a botanic garden (or arboretum), showing the utilization of natural features and woods as well as planted specimens.

Under the directorship of M Treub, the garden became a mecca for investigators from all over the world. One large laboratory is reserved entirely for the use of visiting botanists. In the herbarium the sheets are not kept in folios as ordinarily, but in tin boxes, a necessary protection against insects and excessive moisture. There is a library of several thousand volumes. The director distributes annually, under the authority of the government, and free of charge, seeds and plants of useful vegetables.

described in some of the earlier manuals as "from Oregon," are said to have been first grown in the Linnæan garden, being one of the many novelties received from the Lewis and Clark expedition. One of the plant-houses was devoted to camellias, one to azaleas, one to oranges and lemons, one to African and Asiatic plants, and two to miscellaneous collections. The proprietors were ever alert for novelties, and at the time of the potato famine in Ireland, Prince paid $600 for less than a pint of bulbs of *Dioscorea Batatas*, for the pur-

pose of testing them as a possible substitute for the Irish potato At one time there were over 100 varieties of strawberries under cultivation here, including the once famous Isabella, which originated as a chance seedling or mutant in the garden of Isabella Graham, in Brooklyn. While not a botanic garden in the modern or scientific sense, the Linnæan garden exerted such a profound influence on American horticulture and arboriculture that it should not be entirely passed over in this place.

2 Evans's Garden (1828). The garden of John Evans is located along Ithan Creek, near Philadelphia, within walking distance from Rosemont Station, on the Pennsylvania Railroad It was established about 1828, and was one of the fruits of Bartram's garden Evans frequently visited the Bartram garden and other gardens in Philadelphia and vicinity, and became greatly interested in plants His father was a miller, and the vicinity of the mill, with the creek and millpond, and the diversified land adjacent, afforded a wide range of habitat conditions. Evans corresponded with Sir William Hooker and exchanged seeds with him, as well as with the son, Sir Joseph Hooker, including material collected by the latter in the Himalayas He also had a correspondent in Germany In Evans's garden the plants were arranged almost entirely on an ecological basis, in "the order of nature," and in this respect it differed materially from most other gardens before or since Mr Evans was his own director, curator, and head gardener, doing most of the manual labor in the garden himself It is of interest to note here that he used sawdust from his father's mill to kill the weeds around the cultivated plants, and this, on decaying, made a rich fertilizer, which was spaded under The garden is said to have been, in its prime, practically unrivaled in shrubs and trees, and to have had few equals in the richness of its herbaceous material Many of the trees and shrubs were labeled with lead labels, but no catalogue of the collections was ever published

3 The Missouri Botanical Garden (1859) The Missouri Botanical Garden, at St Louis, was established by a gift of money and land from Henry Shaw It is popularly known in St Louis as "Shaw's Gardens" On November 6, 1885, Mr Shaw established the Henry Shaw School of Botany as a department of Washington University, at St Louis, and the garden and school became closely affiliated The professor or one of the professors in the school shall be director or director's assistant, or both The grounds were formerly closed to the public on Sundays, except the first Sunday of June and September, but since 1912 they have been open every Sunday afternoon from April to December Each year there is preached in a local church a sermon on "the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom." The first director of this garden was William Trelease, who resigned in 1912, and was succeeded by George T Moore. The grounds comprise about 45 acres, the herbarium about 800,000 sheets, and the library about 50,000 books and pamphlets One of the features of the garden is a vegetable-garden, which gives pupils practice in the growing of vegetables, and, by means of a forcing house, this work is continued throughout the year The best-known publication is the Annual Report "The Missouri Botanical Garden Bulletin," established in January, 1913, will hereafter contain the annual reports of the officers of the board and the director, while the volume hitherto known as the "Annual Report" will in the future be devoted exclusively to the results of scientific research carried on at the gardens.

4 Elgin Botanic Garden (1801) The first botanic garden in New York City was located on Murray Hill, about 1656, and was the precurser of the Elgin Botanic Garden, established in 1801, by David Hosack, on 20 acres of ground, located at what is now the northwest corner of Fifth Avenue and 47th Street. This garden was transferred to New York State in 1810, and became known as The Botanic Garden of the State of New York. It was later transferred to Columbia University, but finally abandoned for lack of funds. In the spring of 1913 the area was sold by the university for $3,000,000

5 New York Botanical Garden (1894). The present New York Botanical Garden, established in 1894, is located at Bronx Park, in the Borough of the Bronx, New York City. It comprises an area of approximately 250 acres, and besides two extensive ranges of plant-houses, a range of six propagating-houses and the plantations, includes the largest purely botanical museum in the country, if not in the world. On the third floor of the museum building are located the herbarium, library and laboratories The grounds, conservatories, and museum are open daily without charge The present Director-in-Chief, N L Britton, is also Professor of Botany in Columbia University, and has served since the foundation of the institution. Under the auspices of this garden, the director and members of the staff have conducted a systematic exploration of continental and insular America, the results of which are being embodied in the "North American Flora," the most extensive botanical work ever undertaken in America, appearing at intervals in fascicles or parts. The herbarium, composed of the herbariums of Columbia University, the Torrey Botanical Club, and that of the garden proper, contains over 1,500,000 specimens, and the library has over 40,000 volumes and pamphlets The scientific policy of the institution is directed by a Board of Scientific Directors, and the financial administration by the Board of Managers of the Trustees The scientific staff comprises (1912), besides the director-in-chief, an assistant director, a head curator, four curators, two assistant curators, head gardener, director of the laboratories, bibliographer, librarian, and other officers Free public lectures on botanical and closely related subjects are given on successive Saturday afternoons, and the following publications are issued "Journal" (monthly), "Mycologia" (bi-monthly), "Bulletin" (irregularly, and containing the Annual Report), "North American Flora," Memoirs, and Contributions. The Garden is supported by municipal and by private funds

6 Brooklyn Botanic Garden. The Brooklyn Botanic Garden, established in 1910, is a department of The Brooklyn Institute of Arts and Sciences, and an outgrowth of the work of the Department of Botany of the Institute It was the wish of the founders to develop an institution that, in connection with research, would place more than usual emphasis upon formal instruction in botany. It is also the intention to emphasize chiefly departments of botany other than taxonomy, such as plant physiology and ecology, morphology, and pathology, experimental evolution, and plant-breeding. The first and present director is C Stuart Gager The new laboratory and instruction building, in process of erection (1912), will contain offices of administration, several large laboratories, a small herbarium room, a library, physiological and photographic darkrooms, and twelve private research rooms A range of plant-houses is also under construction The grounds comprise about 43 acres, located in the heart of the borough of Brooklyn Through the center runs an artificial brook, with swamp The plantations are classified under ten heads, as follows (1) Systematic Section, comprising hardy herbaceous plants, chiefly perennials, not native within 100 miles of the Garden, and arranged in beds according to their natural affinities (2) Local Flora Section (Native Wild-flower Garden), containing herbaceous and woody plants growing without cultivation within a radius of 100 miles of the Garden (the Torrey Botanical Club Range). The strictly native

sorts are designated by labels of different color from those of introduced species (3) Morphological Section, with divisions of (*a*) External Anatomy and (*b*) Comparative Morphology (4) Ecological Section, adjacent to and including the swamp section of the brook and extending back to include a dry knoll Here is illustrated the adjustment of plants to environmental influences (5) Evolution Section, illustrating such subjects as variation, inheritance, artificial and natural selection (including the origin of horticultural forms), struggle for existence, and survival of the fittest. (6) Economic Section with divisions of (*a*) Foods and Condiments, (*b*) Medicinal and Poisonous Plants, and (*c*) Fiber Plants (7) Weed Section, to show the botanical characteristics of weeds, as bearing on their economic significance (8) Formal Garden Section, in front of the laboratory building and greenhouses, and serving to illustrate the uses of plants, chiefly horticultural, for purely ornamental purposes (9) Arboretum, a collection of trees, chiefly native (10) Fruticetum, a collection of shrubs, both native and exotic. The arboretum and fruticetum features are developed in close connection with the other sections, and in the systematic garden the aim has been to group the shrubs and trees as near as practicable to the herbaceous material with which they are most closely related The willows and alders are grown along the brook.

The Garden issues an administrative quarterly, "The Brooklyn Botanic Garden Record" (the April number of which contains the Annual Report), Contributions, and Guides. A series of Memoirs and of Educational Leaflets is also projected Admission to the grounds is free daily, including Sundays and holidays, from 8 A M. until sunset The Garden is supported by annual municipal appropriations, by the income from an endowment, amounting at present to over $50,000, and by gifts.

Suggestions from the foregoing

As may be inferred from what has preceded, the history of botanical gardens has shown a steady progressive development from collections of medicinal herbs, gathered and studied with reference to their economic uses, to institutions endeavoring to maintain collections of all kinds of plants, both herbaceous and woody, some ornamental and useful, but perhaps most of them collected and studied for their own sake, from the standpoint of pure science, with an endeavor to understand the nature as well as the uses of plants. The Chelsea Garden affords a concrete illustration of this, for while the collections here were at first almost entirely confined to medicinal plants, these now form only a comparatively small portion of the collections In this way, and in this way only, may botanical science be most rapidly and most surely advanced, to the advantage not only of pure science itself, but of horticulture, agriculture, forestry, pharmacology, and all phases of applied botanical science

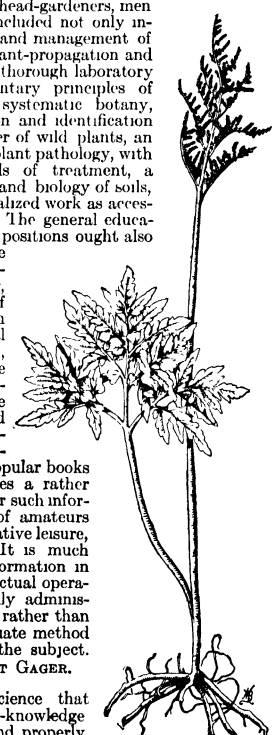
It was one of the marks of greatness and of sound judgment of Sir William Hooker, that he aimed definitely to make Kew Gardens not only a scientific institution of the first rank, but to make them beautiful,—attractive to the general public. This latter aim has been too often neglected or minimized, on the theory that a botanic garden is a scientific institution, and should, therefore, be developed with little regard for the non-scientific public. This is an unfortunate and unfair attitude, unfair to the general public, especially in those gardens which are supported in part by public money, and unfortunate for botanical science because it not only neglects a very important aspect of botany—applied botany,—but loses the opportunity of enlisting the intelligent sympathy of the community with botanical endeavor Many persons who might otherwise remain quite indifferent to botanical work in general, or even to the work of a given garden in particular, may, through being attracted primarily by the beauty of the collections and grounds, be led to give generous support to such work, or even to discover that their own main interest is botany, and ultimately to advance the science by their own studies.

It is unfortunate that the United States government has no national garden to do for our own country what Kew has done for England. The climate and location of Washington combine to make the capital city an admirable place for the development of a botanic garden, and two or three branch gardens could be established to advantage in parts of the country, giving wide diversity of climatic conditions, such as one of the extreme southern states, the great American desert, and one of the most northern states.

With only very little additional expense, many city parks could be made more interesting and instructive, and none the less beautiful and attractive, by giving potions of them more the character of a botanic garden, at least by suitably labeling the trees and shrubs and growing them with some regard to botanical affinities

With the exception of the Missouri Botanical Garden, there is nowhere offered in the United States a thorough course of study for the purpose of training gardeners to take charge of botanic gardens The training received in a few months' experience with a commercial florist or seedsman is not sufficient, nor do horticultural courses in our agricultural colleges answer the purpose Botanic gardens need for gardeners, and especially for head-gardeners, men whose training has included not only instruction in the care and management of greenhouses, and in plant-propagation and cultivation, but also a thorough laboratory course in the elementary principles of botany, a course in systematic botany, including the collection and identification of a minimum number of wild plants, an elementary course in plant pathology, with emphasis on methods of treatment, a course in the physics and biology of soils, and also in such specialized work as accessioning and labeling The general education of men for these positions ought also to be such as to enable them to express themselves well in writing, and to give courses of instruction to others in the various practical phases of their work, such as greenhouse economy, plant-propagation, and the care of herbaceous and woody plants out-of-doors The recent success of a number of popular books on gardening indicates a rather widespread demand for such information on the part of amateurs and people of comparative leisure, as well as others. It is much better to get this information in connection with the actual operations of a scientifically administered botanic garden, rather than by the wholly inadequate method of reading a book on the subject.

C. STUART GAGER.



604. Botrychium obliquum. (×⅓)

BOTANY. The science that treats of plants; plant-knowledge In its widest sense, and properly, it includes much that, by common consent, is usually included in

horticulture,— as amelioration of plants by domestication, hybridizing, and the like Horticulture is a part of the large conception of botany, so far as its scientific aspects are concerned.

BOTRÝCHIUM (Greek, in allusion to the grape-like sporangia). *Ophioglossàcæ.* A genus of mostly temperate plants allied to ferns, with fleshy roots, short underground sts, each of which bears a single free-veined lf, consisting of a short petiole, a usually triangular, divided blade, and a single erect panicle bearing the fleshy sporangia

These plants may be grown in the hardy border, or against a building on the shady side They require no special treatment They are little cultivated, but are of interest to the collector or fancier.

A *Petiole as long as the fertile portion.*

virginiànum, Swartz MOONWORT. Six in. to 2 ft high, with a broad, triangular blade, with 3 main triquadri-pinnatifid divisions fertile portion long-stalked. E U. S.—The only species large enough to make a display.

AA *Petiole much shorter than fertile portion.*

obliquum, Muhl Fig 604 Plant, 6–15 in high, with a ternate blade 2–6 in wide segms obliquely ovate or oblong, ½–¾in long fertile part long-stalked. (*B. ternatum,* Authors, not Swartz, which latter is a different Japanese species) E U. S

disséctum, Spreng Plant, 6–18 in high, with a ternate, finely dissected blade, 3–8 in wide, the ultimate divisions ⅛in or less wide E U S —Evergreen, delicate and graceful Grows in woods and meadows

R. C BENEDICT.

BOTTLE-BRUSH: *Metrosideros*; also *Callistemon* and *Melaleuca*

BOTTOM HEAT. Soil temperature that is higher than that of the superincumbent air Most tender plants require to have the roots warmer than the tops, particularly when grown under glass

BOUGAINVÍLLEA (De Bougainville, 1729–1811, a French navigator). *Nyctaginàceæ.* South American shrubs, often climbers, with very gaudy large bracts, grown under glass, and as arbor plants South

Leaves alternate, petioled, entire fls small and inconspicuous, tubular, the margin 5–6-lobed, stamens, 7–8, on unequal capillary filaments; ovary stipitate The small and inconspicuous fls are inclosed with large and showy magenta-purple or red bracts that constitute the decorative value of the plants. Two more or less scandent species are chiefly known in cult. Less than a dozen recognized species

The bougainvilleas have been much grown of late as pot-plants. The young stock (started from cuttings) may be grown in the field and be lifted in early autumn; this will produce plants for spring bloom but not for early flowering For earlier bloom, the plants may be carried through the summer in pots Half-ripened or old wood, in 6- to 12-inch lengths, may be used for cuttings in April to June The subsequent culture is simple. For glasshouse work the plants may be kept cut back and the branches trained. In California, Florida, and other southern regions, bougainvilleas are plentifully used as porch-covers, where they make a most brilliant show Not hardy.

The cultural requirements of the bougainvilleas are of the easiest. They thrive in almost any kind of soil and should be grown in full sunshine. *B. glabra* and its varieties are the best for ordinary purposes, as they bloom when small, and thrive readily in a cool greenhouse or in the open where free from frost. *B. spectabilis* and its var *lateritia* require more tropical conditions and reach large dimensions All are readily propagated, and will root in a few weeks from cuttings of the young shoots a few inches in length and placed in sandy soil in bottom heat and moisture at a temperature of 65° or 70° F *B glabra* and its varieties make most excellent pot-plants, either as large or small specimens. They are also valuable for summer bedding. All the kinds make very desirable subjects for clothing verandas, arches and pergolas or for planting at the base



605. Bougainvillea glabra (×⅛)

of trees (where the climate is suitable for outdoor culture), which they will rapidly clothe in a mass of most beautiful and highly colored flower-bracts Another and most effective purpose to which these plants can be put is that of hedge or fence plants in tropical and subtropical countries They stand drought exceedingly well and may be pruned with impunity. (C P. Raffill)

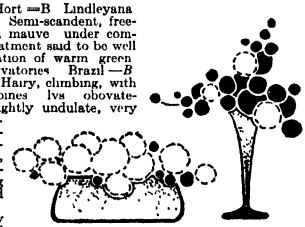
glàbra, Choisy Fig 605 Grows 10 and more ft high and wide, when planted in the ground and allowed to have its way, glabrous, lvs ovate and acuminate, glabrous and bright green bracts cordate-ovate, bright rosy red, distinctly veined Brazil. G C III 23 168, 30: 265 Gn. 54, p 257; 64, p 353 R H 1889 276 A G 16 15 A F. 11·1371 F E 10.106 —Free-flowering and handsome, often grown in pots and kept dwarf Var. **Sanderiàna,** Hort. Very floriferous, blooming even in very small pots. Gn 45.418. A F 10:307, 11.977; 12 1185 Gng 4 281; 5 345. G. 27:457 —A very worthy plant both for pot culture or as a shrub or climber Often blooms when 1 ft high, but reaches a height of 10–20 ft Var. **Cỳpheri,** Hort A much larger and finer plant than the type; the large and bright-colored deep rose bracts are freely produced in long plumose clusters on all the principal growths, and are more highly colored than those of the var *Sanderiana* It may be treated the same as var *Sanderiana* as to cult It is an acquisition as a decorative plant. Var **variegàta,** Hort. Lvs. prettily variegated with creamy white; useful as a neat and quick-growing foliage plant for summer bedding

spectábilis, Willd (*B specìòsa,* Lindl *B spléndens,* Hort) Taller and stricter, with larger and thicker lvs., hairy. fls. in large panicles; bracts larger, deep rose-color, but varying to purple and greenish Brazil. B.M. 4810, 4811 P.M. 12·51. I H 42·30—An immense and strong-growing climber, rising by means of numerous stout hooked spines Variable; known also as *B.*

brasiliensis, *B. bracteata* and *B. peruviana*. Var. **lateritia**, Lem. (*B. lateritia*, Hort.), has brick-red bracts. I H. 13.466 More showy than the last when in full bloom, perhaps distinct; said to be more difficult to start from cuttings than the type, at least without bottom heat.

B aurantiaca, Hort =B Lindleyana —*B formosa*, Bull Semi-scandent, free-flowering purplish mauve under comparatively cool treatment said to be well adapted for decoration of warm green houses and conservatories Brazil —*B Lindleyana*, Hort Hairy, climbing, with strong curved spines lvs obovate-rounded, acute, slightly undulate, very hirsute bracts elliptic, short-acuminate, cinnabar-color —*B refulgens*, Bull Lvs pubescent racemes long and drooping, and bracts purple Brazil Apparently a less valuable and shy-flowering form of *B spectabilis*.

L. H. B.



606, 607. Flower theme (at the left) and foliage theme (at the right). In Figs. 606–616, the outline circles represent flower masses, and the black circles foliage masses.

BOUQUETS. The aim in flower-arrangement is beauty (1) A display of the natural beauty of the plant, or (2) the creation of a beautiful group of floral material

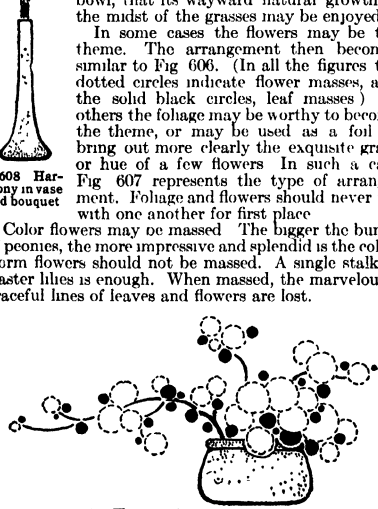


608 Harmony in vase and bouquet

(1) Plant beauty combines two chief elements color and form In such plants as the pansy, the peony, and the full-blown rose, color is the dominant element In such plants as the calla, the Easter lily, and many of the orchids, form is the dominant element In some flowers, as rosebuds, nasturtiums, and chrysanthemums, the two elements are so nearly balanced that either one may be selected for special display. In any case, one element, color or form, should predominate in the arrangement Plate XVIII shows at *a*, the yellow-centered daisy massed to emphasize its beauty of color, *b* shows the same flower arranged to display its beauty of form A single clump of the plant has been transplanted to a bowl, that its wayward natural growth in the midst of the grasses may be enjoyed

In some cases the flowers may be the theme. The arrangement then becomes similar to Fig 606. (In all the figures the dotted circles indicate flower masses, and the solid black circles, leaf masses) In others the foliage may be worthy to become the theme, or may be used as a foil to bring out more clearly the exquisite grace or hue of a few flowers In such a case Fig 607 represents the type of arrangement. Foliage and flowers should never vie with one another for first place

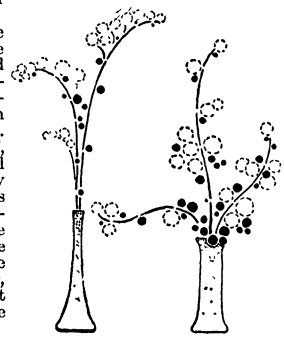
Color flowers may be massed The bigger the bunch of peonies, the more impressive and splendid is the color. Form flowers should not be massed. A single stalk of Easter lilies is enough. When massed, the marvelously graceful lines of leaves and flowers are lost.



609. Harmony in vase and bouquet.

Receptacles should always be less attractive than that which they hold. Brilliant colored vases, those with gilding, cut glass, vases decorated with pictures, or with flowers modeled in high relief or represented in color, are all to be avoided. They are too obtrusive. They force the flowers to take second place. Receptacles of clear glass which take on the color of the stems put into them, of dull soft colors, of unpolished metal, are likely to be most serviceable in displaying the natural beauties of flowers

The receptacle should be of the shape best adapted to holding the flowers as nearly as possible in the position in which they grew. In Plate XVII at *d*, the broad bowl (full of pebbles to steady the stems) makes possible such an arrangement for the apple blossoms The tall vase with the narrow neck, at *c*, insures the right position for the spray of bayberry.

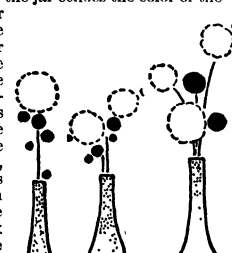


610, 611 Simple and reversed curves.

Of course the natural beauty of a plant cannot be displayed to advantage when confused with other plants This is the reason for the general rule Use in a bouquet only flowers of one kind, with their own foliage.

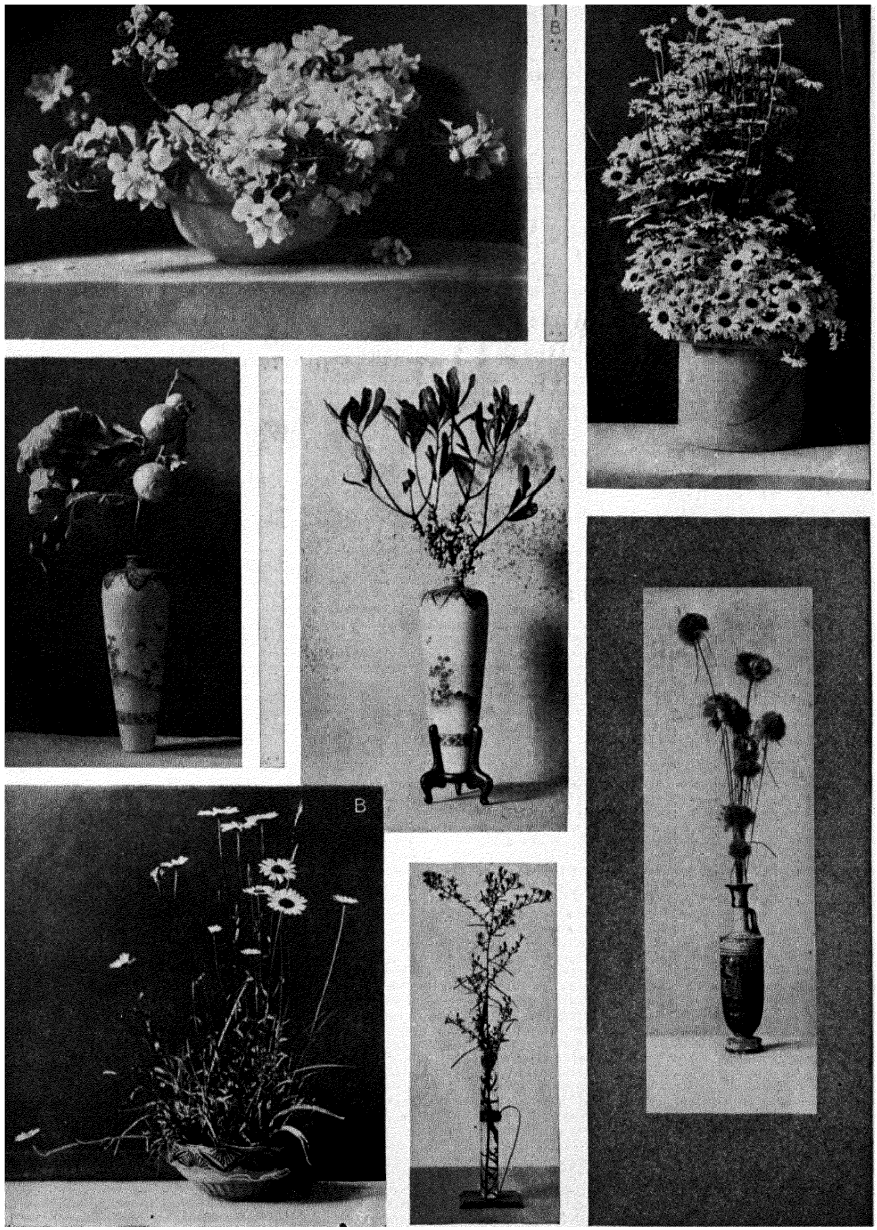
(2) Beautiful groups of plant forms present, (*a*) unity, (*b*) rhythm, and (*c*) balance

(*a*) An arrangement has *unity* when all the parts of which it is composed are so related that the whole makes its appeal to the eye first All the parts must have something at least in common to bind them together. In nature the common element may be *texture*, as in the snakeroot, *color* as in the mullein, *line* as in the goldenrod. In flower-arrangement the receptacle must have some element in common with the plant, in *a* (Plate XVIII) the color of the jar echoes the color of the flowers; in *b* both the color and the ornament of the bowl echo the character of the sod, in *d*, the shape of the bowl echoes the shape of the apple blossom and its color echoes their color In *c*, the shape of the vase echoes the shape of a bayberry leaf, its contours echo the lines of the stems; its pattern echoes the speckle of the bayberries; and the dark stand gives the receptacle a color repeating the dark color of the leaves The receptacle must have something at least in common with the plant, but must never vie with it in any way. If the bouquet is tall and slim, the vase may have similar form (Fig 608); if it is short and broad, the vase may repeat that shape (Fig 609) In Fig 610, the sprays have one line in common, a simple forceful curve repeated in the vase In Fig 611, the sprays have the reversed curve in common, echoed softly in the vase.



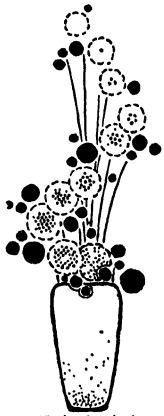
612, 613, 614, respectively, showing simple rhythm forms.

(*b*) *Rhythm* means orderly variety of some kind. Fig. 612 exhibits orderly variety in the sizes of leaves, all subordinate to the one flower. Such an effect can always



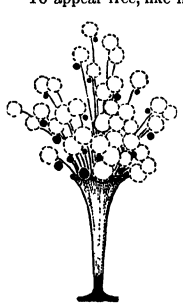
XVII. The arrangement of bouquets.

be produced by pruning the spray. Fig. 613 shows an orderly variety in sizes in both leaves and flowers. The parts are in pairs, a larger and a smaller composing each pair like march time in music. Fig. 614 shows an orderly variety in which each set is composed of a series of three, large, smaller, smallest,—something like a three-part measure, waltz time, in music. Figs. 610 and 611 show rhythm of measure in the lengths of the sprays and rhythm of line in their curves. In each case there are three similar curves, but three which form a series from least bent to most bent. Fig. 608 presents a rhythm of measure in the sizes of the flowers, another in the sizes of the leaves, and another in the lengths of the stems. Fig. 615 shows a rhythm of color. When flowers of one kind present a wide range of tone,—pinks, for example, running from white to red through various tones of pink, they may be arranged agreeably by making evident the rhythm of color from lightest to darkest. When the flowers vary in hue as nasturtiums do, from yellow through orange to red, a rhythm of hue may be established in a similar way. Such sequences of color (unless too formal) are always more pleasing than haphazard spottings of color. All these arrangements show rhythms of mass. Fig. 608, 610, and 611 show a triple subdivision, large, smaller, smallest, but not so disconnected as to destroy the unity of the whole in any case. Figs. 609, 615, and 616, show more complex rhythms of mass, but in a general way they present a simple movement from the diffuse to the compact. This the eye can take in at a glance. Each review of this rhythm gives additional pleasure to the sense of sight. A rhythm, an orderly sequence of some kind, for the eye to follow, is essential in floral arrangement.



615. A color rhythm.

(c) *Balance.*—A flower-arrangement must not be too formal. It must present something of the freedom of wild nature but it must appear to be in stable equilibrium. Every spot, every color, every stem line, every space between these elements, presents an attraction for the eye. All these attractions must be adjusted to one another so that the whole appears to stand securely. This means that the parts must be disposed with reference to the vertical center line of the vase. The principle is that of the steelyard. A large, a brilliant, a solid mass, near the center line, may be balanced by a small, a dull, or a diffuse mass, farther removed from the center line. To appear free, like nature, the attractions on one side must not duplicate, in form, size or position, the masses on the other. Such an arrangement is formal, and belongs in the realm of structural and conventional art; but, however varied the elements may be, they must be so disposed as to counterbalance each other, and maintain the balance of the whole. Compare the illustrations with this principle in mind.



616. Complex rhythm of mass

Lovers of natural beauty do not overlook the possibilities of winter bouquets. Sprays of seed packs, withered leaves, and the like often present soft dull colors in such harmonious groups of tones that they may serve as models for color schemes for costumes and the interior decoration of rooms. They often present exquisite rhythms of measure, subtle refinements of line, charming combinations of erratic curves and surprising oppositions of harmoniously related details, unrivaled in the growing period of the plant's life. Plate XVIII shows at e a picturesque spray of white oak with "oak apples."

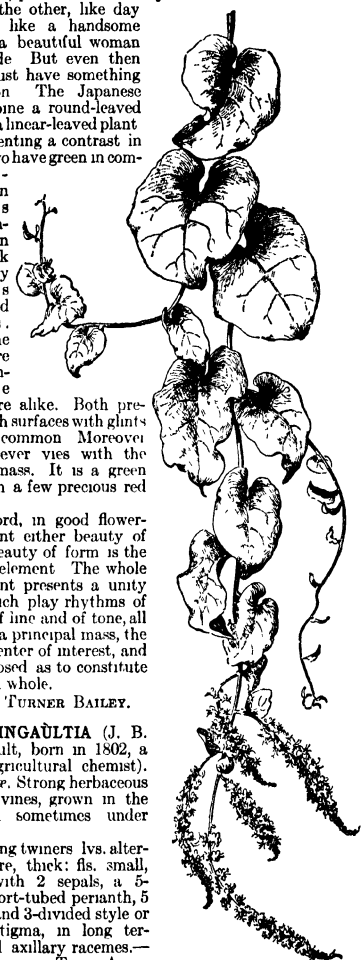
More than one kind of plant may be used in an arrangement, provided the beauty of one enhances the beauty of the other, like day and night, like a handsome man and a beautiful woman side by side. But even then the two must have something in common. The Japanese often combine a round-leaved plant with a linear-leaved plant. While presenting a contrast in form the two have green in common. Nature often combines strong contrasts, as in the dark green holly with its bright red berries. While the colors are complementary, the textures are alike. Both present smooth surfaces with glints of light in common. Moreover the red never vies with the green in mass. It is a green spray, with a few precious red dots.

In a word, in good flower-arrangement either beauty of color or beauty of form is the dominant element. The whole arrangement presents a unity within which play rhythms of measure, of line and of tone, all related to a principal mass, the supreme center of interest, and all so disposed as to constitute a balanced whole.

HENRY TURNER BAILEY.

BOUSSINGAÙLTIA (J. B. Boussingault, born in 1802, a famous agricultural chemist). *Basellàceæ.* Strong herbaceous perennial vines, grown in the open and sometimes under glass.

Branching twiners. lvs. alternate, entire, thick: fls. small, perfect, with 2 sepals, a 5-parted, short-tubed perianth, 5 stamens, and 3-divided style or 3-lobed stigma, in long terminal and axillary racemes.—Ten species in Trop. Amer. Anredera is a related genus.



617. Boussingaultia basselloides. (×⅓)

baselloides, HBK. MADEIRA VINE. MIGNONETTE VINE. Fig. 617. Perennial, root tuberous. sts. smooth, reaching 10–20 ft. in a season, and in late summer or fall bearing profusely of the fragrant white fls. (which become nearly black with age), and producing little tubercles by means of which the plant is prop. Ecuador. B.M. 3620.—A common

vine, prized for porches and arbors. The roots are stored in the winter, and planted out after danger of frost is past The plant will not endure frost. Sometimes grown in the conservatory and window-garden. It has run wild in Fla. and Texas. L. H B.

BOUVÁRDIA (Charles Bouvard, 1572–1658, physician to Louis XIII, and Superintendent of Royal Gardens in Paris) *Rubiàceæ*. Handsome greenhouse flowering shrubs, once popular as florists' plants.



618. The common garden form of Bouvardia. Cluster from a side growth.

Small shrubs (rarely perennial herbs), with simple, sometimes verticillate, lvs and subulate stipules: fls. in terminal cymes, showy, in red, yellow and white; calyx 4-lobed, the lobes persistent; corolla long-tubular or salver form, with 4 spreading lobes; stamens 4, alternate with corolla-lobes and attached in the tube or throat; styles inserted or exserted in different fls., the stigmas 2; ovary 2-celled: fr. a loculicidal caps.—About 30 species, from Texas and Ariz to Colombia and southward, chiefly in Mex. and Cent Amer.

Bouvardias were once very important florists' flowers, but they have now given place, along with camellias and others, to chrysanthemums, carnations and other plants. The plants have such merit in themselves, however, and are so likely to return to favor in this country, that a rather full cultural treatment is here given. The bouvardias of florists do not represent any of the type species They are sports, hybrids, and other types of variations. The Latin-form names in American trade catalogues nearly all belong to these garden forms. The species which are of most importance to the horticulturist are mentioned below:

A. *Fls in shades of red.*

B. *Lvs. normally in 3's (except, perhaps, on the branchlets).*

triphýlla, Salisb (*B Jácquinii*, HBK). Small pubescent shrub, 2–6 ft. high: lvs. in 3's or 4's (or opposite on the branchlets), lanceolate to lance-ovate, glabrous above. fls. an inch long, pubescent, bright scarlet Mex. and reaching north to Ariz. B M 1854;3781 (as *B. splendens*, Graham) —The genus Bouvardia was founded upon this species, which was intro into England more than 100 years ago. It is evidently the most important parent strain, although it is probably not in cult in its original form. Figs 618 and 619 partake very strongly of this species In fact, Fig 618 compares well in botanical characters (except less long-pointed lvs.) with the early pictures of *B triphylla*.

leiántha, Benth Much like *B. triphylla*, more bushy and better grower sts hairy. lvs. hairy above: fls. glabrous. Mex. R H. 1851:81.—Perhaps only a form of the preceding. It is said that the first recorded hybrid bouvardia appeared about 1857, with Mr. Parsons' nurseries at Brighton, England, being between *B. leiantha* and *B. longiflora* Many secondary forms have come from this cross, some of them being white, as *B. Davidsonii* or *B. Vreelandii* (G. 27:632).

Other red-fld. 3-lvd. species are: *B. angustifòlia*, HBK. Lvs. lanceolate, revolute, glabrous above and fine-pubescent below: branches nearly glabrous. Mex. *B. hirtélla*, HBK. Very similar: lvs. pubescent on both surfaces. Mex. *B. scàbra*, Hook. & Arn. Lvs. ovate, short-stalked. fls. large in dense clusters, pink: st. hairy. Mex.

BB. *Lvs. opposite.*

Cavanillesii, DC. (*B. multiflòra*, Schult.). Hairy: lvs. ovate-acuminate, broad at base, short-stalked, edges hairy: fls. 1½ in. long, very slender, glabrous. Mex.

AA. *Fls. yellow.*

flàva, Decne. Lvs. opposite, ovate-lanceolate or lance-elliptic, very short-stalked, ciliate: fls. very long drooping, in 3–5-fld. racemes, bright yellow. Mex. F.S. 1:43.

AAA. *Fls. white.*

longiflòra, HBK. Glabrous, branching shrub: lvs. opposite, ovate-acuminate, stalked: fls 1½–2 in long, with a very slender tube and a wide-spreading, large limb, 2 or 3 together and aggregated into a terminal cyme. Mex B.M. 4223. F S 2:123

Húmboldtii, Hort Lvs opposite, ovate-acuminate: fls. very large, fragrant, in a large, terminal cluster G.C 1873:717. G 27:331 (var *grandiflora*) —This is a choice conservatory plant It is usually catalogued as *B. Humboldtii corymbiflora*. Blooms from summer to winter. Probably a derivative of *B. longiflora B candidissima*, Hort , white-fld , is said to be a hybrid, with *B Humboldtii* as one of its parents.

jasminiflòra, Hort. Compact and dwarf, very floriferous, the fls in close, terminal clusters G C 1872 215. —Probably a derivative of *B. longiflora*. I. H B

All the cultivated species and varieties of bouvardia are evergreen greenhouse plants They thrive best in a mixture of equal parts of rich turfy loam, leaf-mold and sand, which should be rammed moderately firm but not too hard. They require an abundance of water during the growing season, and, once they have started into growth in the spring, should never be allowed to suffer for the want of water at the roots A house in which the temperature can be maintained at 55° F. with fire-heat, suits them best, but the temperature may, with advantage, be allowed to run up to 80° or



619. The double-flowered form of the garden Bouvardia. Terminal truss.

90° F. with sunheat, providing they are given an abundance of ventilation at the same time. The plants should be frequently syringed during the growing season to keep down insect pests and to help to maintain a healthful growing atmosphere. All the bouvardias revel in a fair amount of sunshine, and may be described as sun-loving plants, but under glass during the hottest part of the day, it is an advantage to shade them lightly to break the direct rays of the sun. Under this

treatment growth is rapid, and the plants require to be frequently pinched back at the points in order to induce sturdy, well-balanced specimens If this pinching-back is neglected, the plants will become ill-balanced and few flowers will be the result. The time of flowering can be readily regulated by the time of the last pinching back, and a succession of flowering plants may be maintained practically throughout the whole year. Amongst market-growers, the aim should be to secure the bulk of the flowers in the winter period, for which purpose very little pinching of the shoots should be practised after September, and the plants should then be allowed to grow on until the flowers appear. When in flower, the plants should be removed to a somewhat drier house, and they last much longer if kept in a temperature of about 50° F

Many growers plant out strong healthy plants upon benches under glass, or in favored situations outdoors Under these conditions growth is rapid, and if carefully watered and attention is paid to pinching-back the leading growths, fine flowering specimens are quickly secured. For the cut-flower trade, this method has a considerable advantage over pot culture All through the growing period, it is absolutely essential that the plants should never be allowed to suffer for the want of water and, when well established, they should be fed liberally with manure

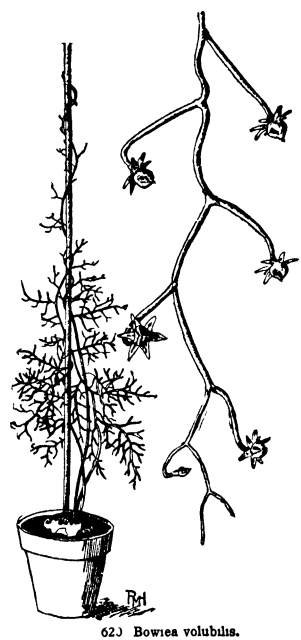
Specimens planted out in the open, should be lifted with a good ball in early autumn, potted up and placed in a close shaded house until the roots again become active These plants will furnish a large supply of flowers during the winter months

After the flowering period is over, bouvardias should be kept somewhat cooler and drier at the roots for a few weeks, after which they should be cut back and started again in heat and moisture If kept frequently syringed, they will soon break freely and furnish a good supply of cuttings These are best removed with a heel when about 2 inches long, and placed in 4- or 5-inch pots in an open compost of equal parts sand and peat or fine leaf-mold, and placed in a moist and close frame with a brisk bottom heat Roots are soon emitted, when the plants should be potted up singly and moved on into larger-sized pots as required Most of the garden varieties are also readily propagated from pieces of the larger and thicker parts of the roots in spring These may be cut into lengths of about 2 inches and planted the same as cuttings, leaving a small piece exposed above the soil Adventitious shoots are soon formed on these and soon make good serviceable plants

The numerous garden forms are all so distinct in habit, shape and poise of the flowers from all the known species, that it is difficult to identify any of them as varieties of any one species. It is probable that they are complex hybrids of *B. triphylla*, *B. lerantha*, *B Cavanillesii*, *B scabra* and possibly *B. flava*, all of which species are more or less villose and scentless The garden forms are extremely handsome, and useful as cut-flowers, for indoor decoration, also for buttonholes and for making up into ladies' sprays, wreaths and so on Other purposes for which they are largely grown, are the decoration of the greenhouse or conservatory, and, in warm localities, as bedding plants A selection of some of best varieties is given herewith:

Alfred Neuner. Double, pure white fls ; an old variety of great merit, of good constitution *Bridal Wreath* White, free-flowering, with large loose trusses, one of the best for cut-fls. *Brudesmaid* Double, pink fls, brighter than President Garfield *Brilliant* Bright crimson, floriferous, and of easy cult *B candidissima* White, an improvement on B jasminoides *Dazzler* Rich scarlet, free and compact-growing *B elegans* Scarlet, large truss of loose habit *B flavescens* Light yellow, distinct, bad habit *B flavescens flore-pleno* Double form of last-named *Hogarth* Brilliant scarlet, large truss, a well-known variety *Hogarth flore-pleno* Double, scarlet *B jasminoides* White, a free-flowering dwarf form, of easy cult *King of the Scarlets* Light-scarlet, large truss of very fine large fls , a new variety of great merit *Maiden's Blush* Light rose, floriferous *Mrs Robert Green* A fine salmon-pink sport from President Cleveland, distinct and beautiful *President Cleveland* Brilliant scarlet, with crimson tube, the richest and best of its color, floriferous and of easy cult *President Garfield* Double, pink; floriferous, large truss *Priory Beauty* Delicate rose or deep pink; one of the most beautiful, elegant habit; medium and compact truss *Purity.* White; fragrant, free, large fls , loose truss *Sans Lorraine* Bright vermilion-scarlet, double *The Bride* White, tinted with pink, one of the best for bouquets, etc *Thomas Meehan.* Double, bright scarlet, with pale rose-scarlet tube, floriferous *Triomphe de Nancy* Double bright orange-red, large truss, distinct *Victor Lemoine* Large, very double fls , brilliant scarlet *B Vreelandii* (B Davidsonii) Pure white, extremely floriferous, a favorite variety in gardens, and of very easy cult *Vulcan* Scarlet, medium-sized truss *White Bouquet* Pure white, exceedingly dwarf and compact

C. P. RAFFILL.



620 Bowiea volubilis.

BOWÈNIA (bears the name of Sir Geo F Bowen, once Governor of Queensland) *Cycadàceæ*. Zamia-like plant, grown to some extent in Florida and hardy in the central part.

Bowenia, a monotypic genus, differs from Macrozamia in foliage characters and in the absence of a point on the cone-scales, and from Zamia largely in its bipinnate lvs. **B. spectábilis,** Hook Trunk thick, scarcely rising above ground, plant glabrous lvs 3–4 ft long, loosely bipinnate, each pinna or lft 1 ft. or more long, the 9–20 segms ovate or ovate-lanceolate, oblique or falcate, acuminate: cones short-peduncled, the sterile ones 1½–2 in. long and half as thick, the fertile ones 3–4 in diam , and the scales expanded between the seeds into a broad and thick truncate apex Queensland, Austral. There is a var *serrulata* B M 5398, 6008 —This charming little cycad makes beautiful clumps, thriving well under lath houses in Fla , when given proper shade, good supply of moisture and soil rich in humus, the lvs. are easily broken if the plant is roughly handled.

L. H. B.

BOWIÈA (after J Bowie, collector for Kew). *Liliàceæ* A monotypic genus containing one of the most curious plants in the vegetable kingdom, sometimes grown under glass as an oddity, and as an illustration to students of botany.

A round, green bulb 4–5 in. thick throws up yearly a very slender, twining fl.-st. 6–8 ft high, with many compound, forked, curving branches below, and numerous small green fls above This branched fl.-stalk is green and performs the function of the usually absent lvs.; somewhat asparagus-like. There are no lvs except 2 small, linear, erect scales at the apex of the bulb, which quickly vanish. The lvs. show its relation to Drimia and Scilla.

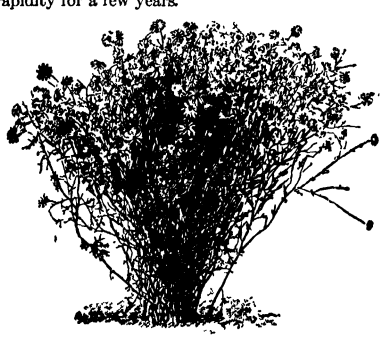
volûbilis, Harv. Fig. 620. Perianth 6-cleft to the base, persistent, green or greenish white, the segms. incurved at the tips, ultimately reflexed. S. Afr. B M. 5619.—Sold by dealers now and then, and cult. in botanic gardens with cactus-like euphorbias and other curiosities. *B. volubilis* is a remarkable bulbous-rooted twining greenhouse climber. The bulbs grow to be very large, sometimes becoming 19 in. circum. and some 6 or 7 in. deep. The slender, twining vine seems out of proportion to the size of bulb. It does not produce lvs., but the lower part of the vine is furnished with pendulous, abortive panicles which seem to perform the function of lvs. The small insignificant greenish white fls are borne at the upper end of the vine. This is a useful plant for twining on the supports of a moderately warm greenhouse, and is of the easiest possible cult. Prop. is effected by seeds, or occasionally by the natural division of the bulbs. The season of growth usually begins about the first of Oct., when the bulbs should be repotted in any light, rich soil, and kept well watered until the sts. begin to mature, which usually occurs in May, when water should be gradually withheld, and the plants stored away in some shaded part of the greenhouse and kept quite dry until the season of growth begins again.

WILHELM MILLER.
E. J. CANNING.

BOWKÈRIA (Henry Bowker and sister, botanists in S. Afr.). *Scrophulariàceæ* South African shrubs of 5 species, one of which is rare in cult. in south of England, and likely to be intro into this country. Allied to Scrophularia, differing in being ligneous and in technical floral characters. **B. Gerrardiàna,** Harv. (*B. triphýlla,* Hort.). Erect-branched shrub, 8–10 ft., with gray hairs. lvs. in 3's, sessile, elliptic or oblong-lanceolate, 4–6 in. long: fls. in small axillary cymes, 1 in. across, satiny white, calceolaria-like, red-dotted inside, the upper lip flat, lower lip shorter and ventricose and 3-lobed. B M. 8021. G C III 36, Suppl. Dec. 10.—Hardy in the Isle of Wight.

BOX: *Buxus*

BOX ELDER (*Acer Negundo,* which see). A very popular small native tree for planting on the prairies and in trying climates. It propagates most readily from seeds. It is an excellent nurse tree for other species. The wood is of inferior quality. It grows with great rapidity for a few years.



621. Brachycome iberidifolia.

BOYKÍNIA (named after Doctor Boykin, of Georgia). *Thérofon,* Raf. *Saxifragàceæ* Glandular-pubescent perennial herbs, 7 species, of which one is Japanese and the others in the S. Alleghany region and Calif., two of which have been offered for wild gardens. Lvs. alternate, but mostly radical, stalked, blade orbicular or very broad and lobed or cleft: fls. white, small, in terminal clusters; petals 5, entire or nearly so; stamens 5; styles 2–3, fr. an urn-shaped or globose caps., erect or pendulous. Mostly mountain plants. **B. rotundifòlia,** Parry. Villous-pubescent, 2–3 ft., leafy: lvs. 2–4 in. across, orbicular or broadly ovate, crenately cut and toothed: fls. short-pedicelled, on one side of the branches; petals little surpassing the acute calyx-lobes. Water-courses, San Bernardino Mts. **B. aconitifòlia,** Nutt. Erect, 1–3 ft. lvs. 2–6 in. across, nearly orbicular or reniform, palmately 5–7-lobed. fls. in a glandular-pubescent corymb, petals eroded, sepals triangular-ovate. Mt. slopes, Va. to Ga.—A pretty foliage plant for wild gardens and borders.

L. H. B.

BRACHYCHÆTA (Greek, *short bristle*). *Compósitæ.* A monotypic genus, growing in open woods from Ky. to N. C. and Ga. Closely allied to Solidago, from which it differs in the very short pappus (the bristles shorter than the achene), and the lower lvs. cordate. **B. cordàta,** Torr. & Gray (*B. sphacelàta,* Brit.), which has been intro. by dealers in native plants, is 2–3 ft. high, soft-pubescent, with thin, serrate, ovate to orbicular-ovate lvs.: fls. golden yellow, in small heads, which are borne on the thyrsoid, secund branchlets; disk-fls. perfect.—Recommended for the native border, particularly in half shade.

BRACHYCHÌLUS (*short lip,* the labellum being suppressed). Spelled also *Brachychýlum,* from the name as a subgenus of *Hedychium. Zingiberàceæ* Herbaceous plants of two species, one or both of which have been cultivated abroad, in warmhouses. Closely allied to *Hedychium.* The species are *B. Hórsfieldii,* Peters (*Hedýchium Hórsfieldii,* Wall.), from Java; and *B. tenéllum,* Schum., from Moluccas. The former has been cultivated as *Alpinia calcarata.*

BRACHYCHÌTON (name referring to the short imbricated hairs and scales) *Sterculiàceæ.* Australian trees (about eleven species), grown to some extent in Florida and perhaps elsewhere South, often included with Sterculia, from which they differ (when the genera are distinguished) by bearing the radicle next the hilum in the seed, having the seeds and inside of carpels villous, and other technical characters.

Leaves entire or rarely lobed. fls. unisexual or polygamous, in panicles or racemes, calyx with 5 or 4 spreading lobes; petals wanting; stamens 10–15 in a column united with the pistils, ovary with 5 nearly or quite distinct carpels, the styles united under the peltate or lobed stigma.—Two showy-fld. species are reported in this country. **B. acerifòlium,** Muell. (*Sterculia acerifòlia,* Cunn.). Large timber tree in its native country: lvs. long-stalked, 5- or 7-lobed, 8–10 in. across, the lobes oblong-lanceolate or almost rhomboid. fls. rich red, in loose racemes or small panicles; calyx ¾ in. long, glabrous, broad-lobed, ovary borne on a short stalk or column. fr. large follicles, long-stalked, glabrous. **B. diversifòlium** may be either *B. diversifòlium,* R. Br. = *Sterculia caudata,* Heward; or *B. populnèum,* R. Br., = *S. diversifolia,* Don, probably the latter and here described. tree, 20–60 ft., glabrous except the blossoms: lvs. long-stalked, ovate to ovate-lanceolate and entire, or more or less deeply 3- or 5-lobed: fls. yellowish white, reddish within, in axillary panicles that rarely exceed the lvs.; calyx broadly campanulate, about ¾ in. diam., acutely lobed to middle: follicles nearly ovoid, sometimes 3 in. long, on stalks 1–2 in. long. Both species are reported as growing vigorously in high pine-land garden in Fla.; trunk unusually thick near the ground, characteristic in the open cone-like tops.

L. H. B.

BRACHYCÒME (*short hair,* from the Greek, alluding to the pappus). *Compósitæ.* About 40 species of Australian herbs, with membranaceous involucral

bracts, naked pitted receptacle, very short pappus bristles, and diffuse leafy growth, one of which is cult. as a garden annual, of very simple cult.

iberidifòlia, Benth SWAN RIVER DAISY. Figs. 621, 622 A very graceful little annual (6–16 in. high), suited to borders, and also attractive in pots, seeds may be sown in the open or under glass fls blue, rose or white, an inch across. lvs small, pinnate, with narrow divisions. H F. 4 96. J H III. 54·461. V. 3 170 A good winter-bloomer 4 or 5 mos. after sowing L. H. B.



622 Brachycome iberidifolia. (Natural size)

BRACHYSÈMA (short standard, referring to the flower) *Leguminòsæ* Shrubs or undershrubs, Australian, making good pillar or climbing plants for greenhouse; allied to Baptisia and Thermopsis

Evergreen lvs opposite or alternate, simple, sometimes reduced to scales fls red or yellowish or almost black, solitary or several together or sometimes crowded on short radical scapes, the keel turned upward by the curving of the pedicels, stamens not united with each other fr ovoid or elongated, turgid —About 14 species, a few of which are known in gardening literature **B. acuminàtum,** Truff (*B. speciosum,* Hort.), is now offered as a good red-fld pillar plant sub-frutescent lvs opposite, oval-elliptic, entire, more or less narrowed to base and short-petioled, the older ones long-acuminate fls deep carmine-red to nearly purple, in short axillary clusters, the corolla much exceeding the yellow-green calyx, the standard very small R H. 1866.413 —An attractive free-flowering species L. H. B.

BRACHYSPÀTHA. *Amorphophallus variabilis, A. Titanum,* and others

BRADLÈIA: *Phyllanthus* and *Wisteria*

BRÀHEA (Tycho Brahe, the Danish astronomer) *Palmàceæ,* tribe *Coryphex* Medium-sized, usually spineless palms except on the leaf-stalks, with ringed trunks, the upper part of which is usually clothed with the persistent leaf-bases.

Leaves usually numerous, nearly round and somewhat peltate, the many lfts plicate and deeply 2-parted, sometimes slightly spiny on the margin, more often filamentous, petioles flattened, dentate or rarely spiny along the margins, very fibrous at the sheathing base spathes usually linear, firm, almost woody, frequently perfectly glabrous, spadix much branched, sometimes twice or thrice paniculate and bearing among the dense white wool 1 or many sessile fls. in each cluster, fls hermaphrodite, sometimes with inconspicuous bracts, 3 nearly round sepals, 3 valvate petals and 6 stamens· fr small, ovoid, sometimes pubescent. Beccari admits only 4 species, all Mexican except *B. salvadorensis.* From its nearest horticultural relative, Sabal, Brahea is distinguished by the purely technical character of having 3 free carpels.

In a moderately warm house, the cultivated braheas will thrive very well. A mixture of sand, rich loam and well-rotted horse- or cow-manure is best. They require plenty of water. They are not very common in the trade but two species are grown outdoors in southern California Propagation is by seeds, which are rare.

A. *Fls. solitary on the spadix.*

dúlcis, Mart. PALMA DULCE Sts. several in a cluster, 10–20 ft., 6–8 in. thick, cylindrical. lvs 4–5 ft long, petiole plano-convex, green, with pale margins; ligule short, nearly triangular, green, the scarious villous margin at length deciduous, lfts 36–50, linear, acuminate spadix 6–8 ft , pendulous from among the lowest lvs , much branched fr edible Mex I H 10.379

calcàrea, Liebm (*B nitida,* André) Trunk 8–15 ft high, covered with the woody persistent lf -bases. lvs. usually 20–30 in a dense bushy crown, unarmed, membranaceous, covered below with *f.* brownish powder spadix long, more or less erect and considerably longer than the lvs , after flowering more or less pendulous, fls solitary, with a single bract fr ovoid Mex R.H 1887, p 344 Gn. 35, p. 285.—Offered by Montarioso Nursery.

AA. *Fls. in more or less dense, though small, clusters on the spadix*

Pìmo, Becc. St 8–12 ft much the same as the last in general appearance and vegetative characters spadix 3–4-branched, the finer ramifications very slender and bearing small clusters of whitish yellow fls , stamens 6, forming by union a 6-lobed ring fr unknown —A rare Mexican species, known in the trade only at Santa Barbara, Calif

B edùlis, Wendl , sometimes offered in Amer , is Erythea edulis, Wats —*B filamentòsa,* Hort =Washingtonia filifera, Wendl —*B filifera,* Hort =W filifera —*B glauca,* Hort =Erythea armata, Wats —*B. robusta,* Hort =Washingtonia —*B Roezlii,* Lindl = Erythea armata, Wats N TAYLOR

BRÀINEA (C J Braine, Hongkong). *Polypodiàceæ* One species related to Woodwardia Lvs in a crown, 1-pinnate, the venation as in Woodwardia, consisting of a single row of areoles along each midvein with free simple veins extending to the margins· sporangia along the free veins, not reaching the margin, without indusium

insígnis, J Smith A beautiful small tree fern from S. E. Asia. Requires rich soil, moisture and shade R C BENEDICT.

BRAKE. A name applied to various coarse ferns, particularly to *Pteris aquilina.*

BRAMBLE. Thorny plants of the genus Rubus,—raspberries, blackberries, dewberries.

BRASÈNIA (meaning unexplained). *Nymphæàceæ.* WATER-SHIELD or -TARGET One species of aquatic plant widely distributed (in N Amer , Asia, Afr., Austral) Lvs oval, entire, floating, centrally peltate; submerged parts coated with thick transparent jelly· fls axillary near the summit of the st , small (½in.), purple; sepals 3 or 4; petals 3 or 4, linear, stamens 12–18, on filiform filaments, carpels 4–18, separate, forming indehiscent 1–2-seeded pods **B. Schréberi,** Gmel. (*B peltàta,* Pursh *B purpurea,* Casp), is not a showy plant but is interesting and suitable for edgings of small aquatic gardens. Grows in 1–6 ft of water. Easily prop by division of roots or by seed. H. S. CONARD.

BRASSÁVOLA (A. M. Brassavola, Venetian botanist) *Orchidàceæ* About twenty tropical American epiphytes, closely allied to Læha, and demanding similar treatment.

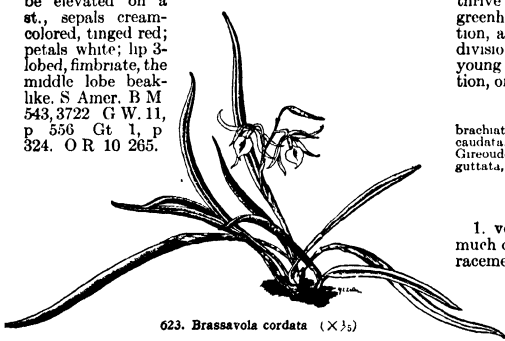
The fls are large, solitary or racemose, the sepals and petals narrow and greenish, the lip white: lvs thick, solitary For the cultivator, the treatment of Brassavola is identical with that of the Mexican lælias. Plenty of sun to mature the young growths, and water

when growing, with a somewhat drier atmosphere when resting, will be found to suit them Suspend on blocks. *B Digbyana*, Lindl, is *Lælia Digbyana; B. glauca*, Lindl, is *Lælia glauca*.

A. *Fls. solitary.*

B. *Lvs. long and narrow lip fimbriate-toothed.*

cucullàta, R Br (*B cuspidàta*, Hook) Lf terete and subulate, grooved above· scape very short but bearing a very long-tubed fl, so that the blossom seems to be elevated on a st., sepals cream-colored, tinged red; petals white; lip 3-lobed, fimbriate, the middle lobe beak-like. S Amer. B M 543, 3722 G W. 11, p 556 Gt 1, p 324. O R 10 265.



623. Brassavola cordata (×⅓)

BB *Lvs. short lip entire.*

acaùlis, Lindl & Paxt Low lvs very narrow: fls. large, greenish white, lip cordate; tube red-spotted at base Cent Amer

AA *Fls in racemes*

B *Blade of lip not longer than claw.*

cordàta, Lindl Fig 623 Lvs linear, rigid, recurved: fls corymbose, sepals and petals lance-linear, acuminate, pale green, lip roundish-cordate, cuspidate, entire, scarcely as long as the claw Jamaica, Brazil. B M. 3782.

BB. *Blade of lip longer than claw.*

c *Claw ¼–1 in long*

nodòsa, Lindl (*B grandiflòra*, Lindl). Lvs lanceolate, acuminate, channeled above fls few and large, corymbose; sepals and petals linear-acuminate; lip round-ovate, long-cuspidate, entire, longer than the claw Jamaica, Mex, S B M 3229, of this name, is *B. subulifolia*

cc. *Claw very short*

fràgrans, Rod Lvs up to 16 in long, terete, deeply furrowed above raceme of 4–12 large fls, sepals linear-lanceolate, yellowish white and faintly purple-spotted; petals linear, yellowish white, lip obovate, with a very short claw, a yellowish green spot at the base Brazil. I.H. 5.180.

GEORGE V. NASH †

BRÁSSIA (named in honor of William Brass, a botanical collector of the last century) *Orchidàceæ* Epiphytic orchids, thriving in intermediate temperatures

Pseudobulbs bearing 1 or 2 terminal lvs, and lateral or axillary racemes sepals narrow, acuminate, or sometimes tailed, spreading, equal or the lateral longer; petals similar to the dorsal sepal or smaller; lip sessile on the foot of the column, spreading, flat, entire, shorter than the sepals; pollinia 2, waxy —A genus of about 30 species extending from Mex to Brazil and the W. Indies

The brassias are plants of easy culture and add considerable interest to collections. They have little value as a florists' flower since the colors are not suitable, but a well-grown specimen, such as is often seen in old gardens, makes a most attractive object The long-tailed sepals and petals are a characteristic of the brassias, and some have an agreeable odor. Pot culture is best, with the usual peat fiber as a rooting medium In winter-time much less water is necessary than in the growing time, although the plants must never be dried off completely or the flowering will be interfered with. One often sees plants of *B maculata* brought here by visitors to Jamaica, and other species are now introduced there from the mainland of South America, and thrive well. These may all be grown in an ordinary greenhouse with other plants, in fact a mixed collection, and give satisfaction. Propagation is effected by division only Green-fly is often troublesome on the young flower-spikes and must be kept down by fumigation, or sponge dipped in soapy water (Orpet)

INDEX

brachiata, 2
caudata, 5
Gireoudeana, 4
guttata, 3
Lanceana, 7
Lawrenceana, 6, 8
longissima, 6
maculata 3.
verrucosa, 1.
Wrayæ, 3.

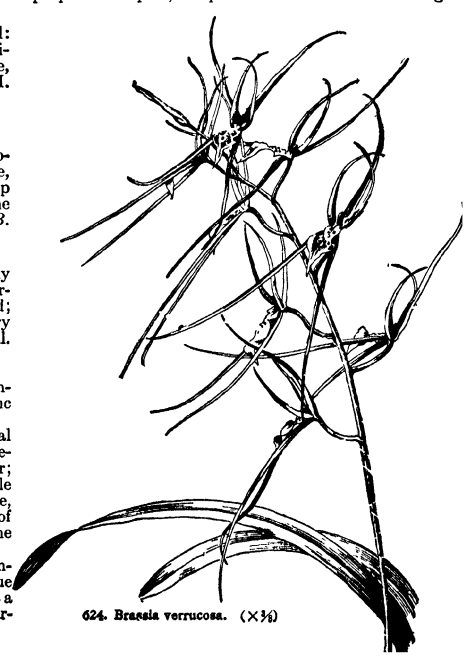
A *Lip with flat green warts.*

B *Sepals 3–4 in. long lip white.*

1. verrucòsa, Batem Fig 624 Pseudobulbs ovoid, much compressed, up to 4 in long· lvs up to 1 ft long: racemes 8–15-fld, sepals and petals light yellowish green, spotted at base, the sepals 3–4 in long, the petals about half as long, lip white, with numerous dark green warts, with a broad dilated claw, the upper part nearly orbicular, abruptly acuminate Guatemala

BB *Sepals 6 in long· lip light yellow*

2 brachiàta, Lindl Pseudobulbs 3–5 in long, oblong, compressed lvs up to 1 ft long racemes 6–12-fld; sepals and petals light yellowish green, with a few purple basal spots, the petals about two-thirds as long



624. Brassia verrucosa. (×⅓)

as sepals; lip light yellow, with dark green warts, constricted at the middle, the basal part nearly orbicular, the upper portions broadly triangular-ovate, acuminate. Guatemala. B R. 33·29.

AA *Lip without warts.*

B. *The lip with a broad claw, broadly obovate or nearly orbicular above*

C. *Lateral sepals lanceolate, about 3 in. long.*

3. **maculàta,** R Br. Pseudobulbs 3–4 in. long, 1-lvd. lvs up to 9 in long racemes of 5–10 fls; sepals and petals yellowish green, brown-spotted on the lower part, the sepals about 3 in long, the petals two-thirds as long, lip cream-white, purple-dotted, with broad claw, the upper part broadly ovate, acute. Jamaica. B M 1691 P M 6 5 Var **guttàta,** Lindl (*B Wràyæ,* Skinner) Fls smaller and greener. Guatemala. B M 4003

CC *Lateral sepals narrowly linear, 4–5 in long.*

4 **Gireoudeàna,** Reichb Pseudobulbs 1-lvd, 3–4 in. long and about half as broad, much compressed: lvs up to 1 ft long racemes with 6–12 fls; sepals yellowish green, the base brown-spotted, the lateral sepals up to 5 in long, the dorsal a little shorter, petals about half as long as dorsal sepal, the base brown, the remainder yellowish green, lip yellow, brown-spotted, with a broad claw, the upper part nearly orbicular, acute Costa Rica.

BB *The lip not clawed.*

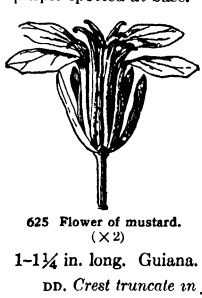
C *Lateral sepals 6–8 in long.*

D *Sepals greenish yellow, lip ovate.*

5 **caudàta,** Lindl Pseudobulbs up to 5 in. long: lvs up to 10 in long racemes with 6–12 fls; sepals and petals greenish yellow, brown-spotted at base, dorsal sepal about 3 in long, the lateral 6 in, petals about 1 in long, lip without a claw, ovate, acuminate, light yellow with brown spots W Indies. B R. 832. B.M. 3451 A F 6 609

DD *Sepals deep orange-yellow, lip oblong-lanceolate.*

6 **longissima,** Nash (*B Lawrenceàna,* Lindl, var. *longissima,* Reichb.) Pseudobulbs 2–3 in long, compressed, 1-lvd lvs up to 9 in long racemes of numerous fls, sepals and petals deep orange-yellow, with a few large basal blotches, the dorsal sepal about half as long as the lateral which are 7–8 in long and about ¼in wide at base, the petals 2–3 in long, lip oblong-lanceolate, about 3 in long, pale yellow, acuminate, purple-spotted at base. Costa Rica. B M. 5748.



625 Flower of mustard. (×2)

CC *Lateral sepals 2½–3 in. long.*

D. *Crest 2-lobed, lip oblong.*

7 **Lanceàna,** Lindl Pseudobulbs 2-lvd, 3–5 in long, much compressed and ribbed: lvs up to 1 ft long, racemes of 7–12 fls, sepals and petals light yellow, brown-spotted below, the sepals 2½–3 in long, the petals about half as long, lip oblong, yellow, unspotted or with a few basal brown spots, undulate, acute, 1–1¼ in. long. Guiana. B.R 1754. B.M 3577.

DD. *Crest truncate in front, lip oblong-lanceolate.*

8 **Lawrenceàna,** Lindl. Pseudobulbs 2-lvd, 3–5 in. long, ribbed and much compressed lvs. up to 1 ft. long racemes of 7–12 fls; sepals and petals light yellow, brown-spotted below, the sepals about 3 in. long, the petals about 1½ in long; lip oblong-lanceolate, light yellow, about 1½ in long, acute, undulate. Brazil. B R. 27·18. J.H. III. 30.275.

B Forgetàna, Hort Fls whitish with chocolate markings, the crest of the lip orange Related to B maculata G C III 48 471. —*B. Josetàna,* Reichb f. Brazil. Gt 3 408.

GEORGE V. NASH.

BRÁSSICA (old classical name) Including *Sinàpis. Cruciferæ* Annual and biennial herbs, including cabbage and turnip, and their allies, and also the mustards.



626 Pod or silique of mustard.—Brassica juncea. (×1½)

Leaves various, the lower ones mostly lyrate or pinnatifid fls yellow, mostly in erect racemes, petals and stamens 4. pod long and slender, compressed-cylindrical or 4-sided, beaked, seeds not winged, the cotyledons conduplicate (Figs. 625, 626).—Nearly or quite 100 species in Eu., Asia, Afr, and many of them widely naturalized. The brassicas possess a remarkable natural tendency toward the thickening of parts under cult., as of root, st, axillary buds, lf.-rosettes, midribs and even of fl.-clusters Oil is extracted from the seeds of several species, and the ground mustard of commerce is made from the seeds of *B nigra* and others.

The brassicas are botanically much confused, particularly in the groups containing cultivated species The manuals probably contain too few rather than too many species of Brassica; at least, the miscellaneous throwing of rutabagas, turnips, rape and other plants into *Brassica campestris* is unnatural, and, therefore, unfortunate One of the best presentations of the true brassicas is that of De Candolle's Prodromus, as long ago as 1824 (also in Trans. Lond Hort Soc, Vol V, and in Systema, 2.582–607), and the present treatment follows that outline in general Some of the forms that are here kept separate as species may be derived from their fellows, but the evidence of such origin is lost, and perspicuity demands that they be kept distinct in a horticultural treatise The taxonomic arrangement here presented can be regarded as only tentative, however, and new systematic studies should be made of the entire group

The confusion into which our brassicas have fallen is in some measure due to the various vernacular names in the different countries The French use the word chou generically to include all forms of *B oleracea* and the rutabaga—that is, all the blue thick-leaved brassicas; while in England the rutabaga is called the Swedish turnip. A tabular view of the different vernaculars may be useful·

French.	*English*	*American.*
Chou cabus	Cabbage	Cabbage
Chou de Milan	Savoy cabbage	Savoy cabbage
Chou de Bruxelles	Brussels Sprouts	Brussels sprouts
Choux-verts	Borecole or Kale	Borecole or Kale
Chou-rave	Kohlrabi	Kohlrabi
Chou-nave	Swede, or Swedish turnip / Turnip-rooted cabbage	Rutabaga
Chou-fleur	Cauliflower	Cauliflower
Navet	Turnip.	Turnip

The Latin names in Brassica, particularly in the oleracea-campestris group, have been so variously used that it is practically impossible to place some of them accurately.

INDEX.

acephala, 1.
alba, 10
arvensis, 11
botrytis, 1
campestris, 3
capitata, 1
Caulo-Rapa, 1.
chinensis, 5.
cuneifolia, 9
gemmifera, 1.
integrifolia, 9.
japonica, 8.
juncea, 9
laxigata, 9
lanceolata, 9.
napiformis, 6.
Napo-Brassica, 3.
Napus, 2
nigra, 12.
oleifera, 2, 3, 4.
oleracea, 1, 3.
patens, 9.
Pe-tsai, 7.
ramosa, 9
Rapa, 4
rugosa, 9
Sinapistrum, 11
sylvestris, 1

A. *Whole plant glaucous-blue when in fl: lvs of the fl.-sts. clasping: fls various. (Mostly Brassica proper)*

B. *Lvs. from the first more or less fleshy throughout, and glaucous-blue even when young: fls large and creamy yellow, the petals conspicuously long-clawed, and the sepals usually erect.*

1 **oleràcea,** Linn CABBAGE, CAULIFLOWER, BRUSSELS SPROUTS, KALE Fig 627. Lvs smooth from the first, and the root not tuberous fls. large and long (¾–1 in lengtn, at least often), light-colored, slender-pedicelled, in long and open racemes pods large, long-beaked If the name *Brassica oleracea* is held for a generalized group without a type form, then the wild plant may be designated as var *sylvéstris*, Linn In the present treatment, however, the wild form is regarded as the type and is therefore not given a varietal name. *Brassica oleracea* grows wild on the sea-cliffs of W and S Eu. Fig. 628, from nature, shows the common form as it grows on the chalk cliffs of the English Channel. It is a perennial plant of short duration, or perhaps sometimes a biennial, with a very tough and woody root, a diffuse habit, and large thick deep-lobed lvs in various shades of green and reddish, and more or less glaucous The lvs of this plant were probably eaten by the barbarous or half-civilized peoples; and, when history begins, the plant had been transferred to cult grounds and had begun to produce dense rosettes or heads of lvs. It appears to have been in general use before the Aryan migrations to the westward There were several distinct types or races of the cabbage in cult in Pliny's time From the one original stock have apparently sprung all the forms of cabbages, cauliflowers, brussels sprouts and kales For this family or group of plants the English language has no generic name. The French include them all under the term *Chou*, and the Germans treat them under *Kohl*. These various tribes may be classified as follows.



627. Flowers of cabbage.—Brassica oleracea. (×½)

Var. **acéphala,** DC Fig 706. The various headless cabbages, comprising kales or borecoles, in many types and varieties, as the tall or tree kales, curled or Scotch kales, and collards. Its likeness may be found wild on the cliffs of the southeastern coast of England today. The thick, tender lvs. of the kales are used as "greens." See *Collards* and *Kale*. It is not certain that all the kales and collards belong here; some of them may be *B. campestris*.

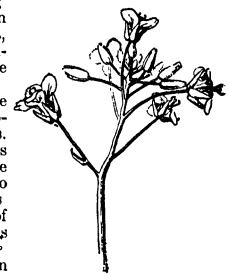


628. Wild cabbage on the cliffs of the English Channel.

Var. **Caùlo-Ràpa,** DC. KOHLRABI (which see). St. tuberous above the roots, the tuber bearing the lvs.

Var **gemmífera,** DC. The bud-bearing cabbage, or brussels sprouts (see Fig 672) In this group, the main st. or axis is tall and erect, and axillary buds are developed into little heads See *Brussels sprouts*.

Var. **capitàta,** Linn The head-bearing, or true cabbages, kraut of the Germans. In this group, the main axis is short and thick, and the lvs are densely packed into a gigantic bud or head (Figs 701–705) The varieties of cabbage are very numerous and various See *Cabbage* A serviceable classification of them might follow this order:



629 Flowers of rutabaga—Brassica campestris (×½)

- A. Lvs plain (not blistered).
  - B Head oblong or conical (Fig 701).
    - c Green
    - cc Red
  - BB. Head oblate or flattened (Fig 702), including c and cc, as above
- AA. Lvs blistered or puckered The Savoy cabbages, Fig 703 (*B oleracea* var *bullata*, DC, or var *sabauda*, Linn), to be further divided as in A.

Var. **botrỳtis,** Linn Cauliflower and broccoli, in which the head is formed of the condensed and thickened fl.-cluster Broccoli produces its heads later in the season than cauliflower, and in mild climates it is allowed to remain and make its heads in spring See *Cauliflower*.

2 **Nàpus,** Linn RAPE Lvs smooth from the first differs from *B oleracea* chiefly in habit and more deeply scalloped lvs. There are oil-producing forms (var. *oleífera*, DC). The botanical position of the rapes is doubtful

3. **campéstris,** Linn First lvs hairy, all lvs glaucous and thickish or somewhat fleshy, the lower ones lyrate and toothed, the st.-lvs cordate-amplexicaul and



630. Pak-choi—Brassica chinensis.

acuminate fls shorter and also smaller than in the *B. oleracea* series (Fig. 629) A weed in waste places, in its run-wild form, but rarely persisting long or becoming troublesome There are oil-bearing forms (var. *oleífera*, DC.).

Var **Nàpo-Brássica,** DC (*B. oleràcea* var *Nàpo-Brássica*, Linn), is the rutabaga evolution of the plant. The rutabaga tuber is either white-fleshed or yellow-fleshed, but the preference in this country seems to be for the yellow kinds. For contrasts with turnips, see No. 4; also *Turnip* in Vol. VI.

BB. *Lvs. (except upon the fl -st) thin and green: fls. smaller and bright yellow, less prominently clawed.*

C. *Plant potentially biennial (that is, the root hard and thickened, often distinctly tuberous): foliage firm in texture.*

D. *Foliage distinctly hairy.*

4 **Ràpa,** Linn COMMON TURNIP. Lvs. prominently lyrate or interrupted below, the root tuberous —Whatever the origin of the rutabaga and turnip may be, the two plants show good botanical characters The tubers of the two are different in season, texture and flavor In the rutabaga, the small lvs immediately following the seed-lvs are sparsely hairy, but all subsequent lvs. are entirely smooth, densely glaucous blue, thick and cabbage-like, with a fleshy petiole and midrib. In the turnip, the radical lvs. are always more or less hairy, and they are green and radish-like, thin, with slender petiole, and the lvs are much more lyrate, with interrupted lfts on the petiole; the small lvs. following the seed-lvs are also thinner and narrower and more deeply scalloped In the rutabaga, the fls. are large and creamy-yellow, whereas in the turnip



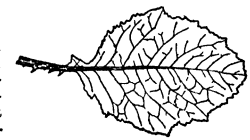
631 Tuberous root of pak-choi —Brassica chinensis.

they are small, yellow and mustard-like, with shorter claws and more spreading calyx The turnips vary in hairiness, but the cone of expanding lvs , or the "heart-lvs ," always shows the hairs distinctly, while the heart-lvs of the rutabagas are normally entirely glabrous, fleshy, and remind one of the young shoots of sea-kale The turnip usually produces seed freely if the bottoms are left in the ground over winter, and thereby the plant spreads, becoming a true annual and a bad weed, with a slender hard root Oil-producing forms are var *oleifera*, DC.

DD. *Foliage not hairy*

5 **chinénsis,** Linn. PAK-CHOI CABBAGE Fig 630. Radical lvs broad and ample, glossy green, obovate or round-obovate in general outline, either entire or obscurely wavy or even crenate, tapering to a distinct and thick strong petiole, which is usually not prominently margined. pod large and tapering into a beak half an inch long root sometimes tuberous (Fig 631). —This plant is grown by the American Chinese, and is occasionally seen in other gardens (see Bailey, Bull No 67, Cornell Exp Sta) It is impossible to determine whether this particular plant is the one that Linnæus meant to distinguish by his *Brassica chinensis*, but it best answers the description in his Amœnitates (Vol IV). In Linnæus' herbarium is a Brassica marked "chinensis" in his own handwriting, but it shows purple fls and has lyrate-lobed lvs , whereas Linnæus described his plant as having yellow fls and cynoglossum-like lvs.; probably not the original

6 **napifórmis,** Bailey (*Sinàpis júncea* var *napifórmis*, Paill & Bois) TUBEROUS-ROOTED CHINESE MUSTARD. Fig. 632. Radical lvs comparatively few, the blade thin and oval in outline, and on long and slender, slightly feathered petioles, sharply and irregularly toothed, with a thin bloom· beak of the pod more abrupt. root distinctly hard and tuberous. China.—This vegetable appeared in France in 1882 from seeds sent by Bretschneider, of the Russian legation, Pekin It was offered by American seedsmen as early as 1889. The plant is a biennial, with thin bluish foliage, and a small tuberous root like a conical turnip These roots reach a diam of 3 or 4 in , and are scarcely distinguishable from white turnips in appearance, texture and flavor In China the tubers are used as a winter vegetable, the seeds being sown in summer The plant does not appear to have been brought to the attention of botanists until Bretschneider published an account of it in a French journal in 1881 Paillieux and Bois (Le Potager d'un Curieux) regard it as a variety of *Brassica juncea*, to which the Chinese mustard belongs, but it is very different from that plant It is nearly related to pak-choi, and it may have sprung from the same species; but it is clearly distinguished by its sharply toothed lvs , one of which is shown in Fig 632



632. Lower stem leaf of Brassica napiformis.

CC *Plant truly annual foliage profuse, loose and soft*

7. **Pe-tsài,** Bailey PE-TSAI CABBAGE Fig 633. Numerous radical lvs , large and light green, oblong or ovate-oblong, crinkled and very veiny, and the margins wavy, contracted into a flat and ribbed petiole 1–3 in. wide, which is provided with a wide thin notched or wavy wing; st -lvs sessile and clasping pod of medium size, with a short cone-like beak —The pe-tsai, or Chinese cabbage, is no longer a novelty in American gardens, although it does not appear to be well known and its merits are not understood. Its cult. and peculi-



633. Brassica Pe-tsai.

arities were described in France as long ago as 1840, by Pepin, who says that, while the plant had been known in botanic gardens for 20 years, it was brought to notice as a culinary vegetable only 3 years before he wrote. It appears to have attracted little attention in Eu. until late in the last century, however. It began to attract attention in the U S probably about 25 years

ago. The lvs. tend to form an oblong loose head, like cos lettuce. *Cabbage;* also page 3582.

AA. *Whole plant green or but slightly glaucous when in fl.. lvs. on the fl.-sts. not prominently clasping: fls. small and yellow. Annuals.* (*Sinapis or Mustard*)

B. *Pod long, terete or nearly so: pedicels spreading.*

8. **japónica,** Sieb. POT-HERB MUSTARD. Fig. 634. Annual, self-sowing: rather numerous radical lvs., oblong or oblong-obovate, the margins either crisped or cut into many very fine divisions, the petiole distinct at its lower end; st.-lvs. all petioled. pod very small, with a slender beak. —The very soft thin lvs. make excellent "greens." Long known, but with no designative name, in old gardens in this country, and sometimes run wild about premises. Intro. in 1890 by John Lewis Childs as California pepper-grass A very worthy plant (Bull. 67, Cornell Exp. Sta.).



634. Brassica japonica, the radical leaves used for greens.

9. **júncea,** Coss (*Sinàpis júncea,* Linn.) CHINESE MUSTARD. Figs 626, 635. Rank and coarse grower, in the common forms making great tufts of root-lvs if sown early: radical lvs usually abundant and often very large, oval or obovate in outline, the blade angled or toothed, tapering into a narrow petiole, which generally bears leafy appendages, lower st.-lvs more or less toothed and petiolate, the upper ones oblong or oblong-lanceolate, entire and usually sessile or alternate: flowering sts. and lvs. more or less lightly glaucous fls. bright yellow: pod slender, of medium size, tapering into a short seedless beak Asia.—This species is held by Hooker and Thomson (Journ. Linn Soc. v 170) to include a great variety of forms, as *Sinapis lævigata,* Linn.; *S. integrifolia,* Willd., *S ramosa, S. rugosa, S patens, S cuneifolia,* Roxbg ; *S. lanceolata,* DC , and others. There are two types of it in cult. in our gardens, one with the radical lvs somewhat sharply toothed and nearly smooth below (sometimes grown as *Brassica* [or *Sinapis*] *rugosa*), the other with root-lvs. obtusely toothed and spinescent on the veins below (comprising Chinese mustard, Chinese broad-leaved mustard, and brown mustard). Linnæus founded his *Sinapis juncea* on a figure in Hermann's Paradisus (Hermann, Paradisus Batavus, t 230, 1705), which represents a plant very like the former type mentioned above, and which Hermann described as "lettuce-leaved."



635. Broad-leaved Chinese mustard —Form of Brassica juncea.

10. **álba,** Boiss. WILD MUSTARD. Tall: lvs pinnatifid and rough-hairy: pods spreading, hairy, the lower part thick and few-seeded, the beak longer. seeds pale brown, large. Weed, from Eu.

11 **arvensis,** Kuntze (*B Sinapistrum,* Boiss *Sinàpis arvénsis,* Linn. *Sinapistrum arvénse,* Spach). CHARLOCK Tall: lvs. strong-toothed, or sometimes nearly lyrate: pods knotty, glabrous or hairy, the upper third indehiscent and 2-edged, usually 1-seeded. Weed, from Eu

BB. *Pod short, distinctly 4-angled: pedicels and pods appressed*

12. **nigra,** Koch. BLACK MUSTARD Fig 636. St tall and upright, with wide-spreading branches: lvs pinnatifid, somewhat hairy: pods short and erect, glabrous, seeds small and dark brown, pungent, supplying the mustard of commerce Cult in Eu , but a weed in this country —Commercial mustard is the flour of the seeds of this species chiefly, but the seeds of *B. alba* and probably of *B. juncea* are sometimes used

B adpréssa, Boiss Annual or biennial, much like *B nigra* but st stiffer, lvs less divided and plant somewhat hoary pods with a short 1-seeded beak. Occasionally adventive from Eu —*B. sinénsis,* Hort = B. chinensis

Many forms of Brassica have been described that it is not necessary to endeavor to account for here Studies in crossing may be expected to indicate some of the relationships The writer has found, no difficulty in crossing cabbage-kale-cauliflower and others See Lund and Kjaerskou, Landbrugets Kulturplanter No. 4, and "Morfologisk-anatomisk beskrivelse af Brassica oleracea, B. campestris og B. Napus'

L H. B.



636 Siliques of Brassica nigra. (×1)

BRASSOCATTLÆLIA (compounded from *Brassavola, Cattleya* and *Lælia*). *Orchidàceæ* A small group of trigeneric hybrids between the genera Brassavola, Cattleya and Lælia.

B balarucénsis (B. Digbyana × L.-C. Schilleriana).—*B. Fuerstènbergii* (Brassolælia Gratrixiæ × C. Trianæ) —*B. Mácka yi* (B Digbyana × L.-C elegans). See also *Adamara* and *Linneara.*

BRÁSSOCÁTTLEYA (compounded from *Brassavola* and *Cattleya*) *Orchidàceæ* A genus established to include hybrids between the species of the genera Brassavola and Cattleya.

The following, among others, are offered in the American trade:

B. Akèbeni (B. Digbyano-gigas × C. Luddemanneana).—*B Alexánderi* (B. Digbyana × C. citrina).—*B. Chámberlainæ* (B. Digbyana × C. quadricolor).—*B. Cliftoni,* Hort. (B.-C. Digbyana-Massiæ × C Trianæ var. Uplands). G C. III. 45:34. O R 18:48 — var. *Wéllesleyæ,* Hort G C. III 51:135 —*B. conspícua* (B glauca × C. Leopoldii).—*B. Digbyàno-Fórbesii* (B Digbyano × C. Forbesii).—*B. Digbyàno-gigas* (B. Digbyana × C. Gigas).—*B. Eva* (C Lawrenciana × B. Digbyana) —*B. gesneriæflòra* (B. fragrans × C. maxima). —*B. heatonénsis* (B. Digbyana × C Hardyana).—*B. Hólfordii* (C Forbesii × B Digbyana).—*B. Hjeæ* (B.

Digbyana × C. Harrisoniana).—*B. langleyénsis* (B. Digbyana × C. Schroederæ).—*B. Laurentiàno-glaùca* (B. Laurentiano × C. glauca).—*B. Leemánniæ* (B. Digbyana × C. Dowiana). O.R. 11·57.—*B. Mariæ* (B. Digbyana × C. Warneri).—*B. Maròniæ* (B. Digbyana × C. Warscewiczii).—*B. nivàlis* (B. fragrans × C. intermedia).—*B. Peètersii* (B. glauca × C. Lawrenceana).—*B. Pocahóntas* (B. Digbyana × C. Eldorado). —*B. Sánderi* (B. glauca × C. Schroederæ).—*B. sandhaghénsis* (B. Digbyana × C. Setullerana).—*B. striàta* (B. fragrans × C. Mossiæ). Fls. rose-colored, fragrant R.H. 1903 276, desc.—*B. Súsannæ*. (B. Digbyana × C. Thayeriana).—*B. Thórntonii* (B. Digbyana × C. Gaskelliana) J.H. III. 61 601.—*B. Vèitchii* (B. Digbyana × C. Mossiæ).—*B. Vilmoriniàna* (B. Leemanniæ × C. Mossiæ).—*B. Wéllesleyæ* (B. glauca × C. Mossiæ Wageneri)

Brassavola Digbyana, Lindl., is now considered a Lælia, so the above hybrids, under that conception, might be designated Lælio-Cattleya.

GEORGE V. NASH.

BRÁSSO-LÆLIA (compounded of the genera *Brassavola* and *Lælia*) *Orchidàceæ*. Established to include hybrids between the two genera.

The following are to be found in the American trade: *B. Canàri* (B. Digbyana × L. xanthina).—*B. Digbyàno-purpuràta* (B. Digbyana × L. purpurata).—*B. fladòsa* (B. nodosa × L. flava).—*B. Helen* (B. Digbyana × L. tenebrosa) O.R. 10 169.—*B. Jéssopii* (B. Digbyana × L.-C. xanthina).—*B. Lelliewàxii* (B. Digbyana × L. anceps).—*B. Rólfei* (B. Digbyana × L. crispa). —*B. Thwàitesii* (B. Digbyana × L. grandiflora).—*B. Vèitchii* (B. Digbyana × L. purpurata).—*B. westfieldiensis* (B. glauca × L. flava)

Brassavola Digbyana, Lindl., is now considered a Lælia, so the above hybrids, under that disposition, might be designated as hybrid Lælias.

GEORGE V. NASH.

BRÁSSO-LÆLIA-CÁTTLEYA. *Orchidàceæ*. A trigeneric hybrid *B.-L.-C. Fòwleri* (C. Schroederæ aurantiaca × Brasso-Lælia Mrs. M. Gratrix) Fls. yellow, tinged, and veined with salmon-rose G.C. III. 41: 303. *Brassavola Digbyana*, one of the elements, is now considered a Lælia, and the plant would then belong to Lælio-Cattleya.

GEORGE V. NASH.

BRAVÒA (Bravo, Mexican botanist). *Amaryllidàceæ*. A small genus, much resembling in some of its species the tuberose (Polianthes), and hardly distinct from it.

Stems slender, from small thickened rootstocks. lvs. mostly basal. infl. a lax spike or raceme; fls. always in pairs, more or less bent or curved, stamens 6, included within the perianth-tube. fr. 3-celled, many-seeded. Native of the mountain and tableland region of Mex. — Five species have been described formerly, but recent explorations have discovered some 5 or 6 additional species.

While the flowers are not so showy as the common tuberose, yet the genus should be found in every choice bulb collection. Only one species has been cultivated to any extent, and even this species is not well known. As the species often grow in the high mountains of Mexico, they ought to be hardy in the southern stretches of the temperate zone.

geminiflòra, Llav. & Lex. MEXICAN TWIN-FLOWER. Sts. 1–2 ft. high: bulbs small, 1–1½ in. long, the outer scales cut into fine fibers at the top: basal lvs. linear, erect, 6 lines or less broad, smooth: fls. in a slender raceme, reddish or orange-colored; lobes minute, rounded. B.M. 4741.—Handsome, and worthy of more attention.

B. Bulbàna, Baker. Basal lvs. described as lanceolate, 1–1½ in. broad: fls. in 5 or 6 pairs, white. Seemingly too near the little-known Polianthes mexicana. Not in cult.—*B. sessiliflòra*, *B. densiflòra*, and *B. singuliflòra*, are rare species, only known from herbarium specimens. The latter two, however, should probably be excluded from this group.

J. N. ROSE.

BRÀYA (Count de Bray, 1765–1831, German botanist). *Cruciferæ*. Small tufted alpine or boreal perennial herbs, sometimes grown in alpine gardening. There are a dozen or more species in Eu., Asia and Amer. Plant glabrous or cano-tomentose: lvs. radical, spatulate or linear, entire or dentate. fls. on scapes that often are naked and sometimes only 1-fld. but mostly bearing racemes or corymbs, white or rose-colored or purple. *B. alpìna*, Sternb. & Hoppe, is the usual species, with white fls. *B. pinnatifida*, Koch (probably properly *Sisymbrium pinnatifidum*, DC.), has white-lilac fls. Practically unknown in cult. in N. Amer.

BRAZIL-NUT: *Bertholletia*.

BREAD-FRUIT: *Artocarpus*.

BREAD-NUT: *Brosimum Alicastrum*.

BREEDING OF PLANTS. The definite producing of kinds of plants adapted to given uses and conditions is known now as plant-breeding. The existing varieties are of course the result of the action of natural tendencies and laws, but the producing of them has not been, for the most part, a conscious, or at least not a regulated, act on the part of man. The laws of variation and inheritance are now beginning to be understood, and the application of this knowledge is to produce orderly and more or less predictable results.

In beginning the artificial cultivation of plants, our early ancestors, even with their crude understanding and methods, probably selected seed for planting from the best wild individuals of any plant. The selection of seed from the best individuals has thus been continuing for thousands of years, ever since the dawn of civilization. While this is a crude method of breeding, if long continued on an extensive scale, it could not, as is now recognized, fail to have results. The greatness of the changes produced is shown by the fact that some of the most extensively cultivated crops, such as wheat and maize, have been so modified that the wild types from which they sprang cannot now be recognized, although the original wild ancestors probably still exist.

Breeding did not become established as an art until comparatively recently. The sexuality of plants was not established until it was proved experimentally by Camerarius in 1691, and the first hybrid of which there is record was made in 1719 by Thomas Fairchild, an English gardener, who crossed the carnation with the sweet william. The first exact knowledge of hybridization dates from about 1761 when Koelreuter began publishing the results of his observations, but even his work had little bearing on practical plant-breeding. The systematic breeding of plants may be said to have begun with the work of Knight and Von Mons about the beginning of the nineteenth century.

Knight worked mainly in hybridization and in 1806 said "New varieties of every species of fruit will generally be better produced by introducing the farina of one variety of pollen into the blossoms of another than by propagating from a single bud." Von Mons worked mainly in selection and it is interesting to note that his experiments were made primarily with pears. He emphasized continuous selection and produced very many valuable varieties. It is probable that a large part of the success of Von Mons' work was due to the fact that pears are normally sterile to their own pollen, requiring cross-fertilization, and, therefore, many of his new varieties were probably hybrids. He was not aware of this fact, however, and it made no great difference in the establishment of the principle which has since proved to be so important.

A most important stimulus to the development of

plant-breeding was given by the publication of Darwin's famous works, particularly his "Animals and Plants under Domestication," in 1868. His extensive researches, masterful compilation and systematization of the existing knowledge may be said to have established breeding on a systematic basis

Following Darwin, little advance was made in the knowledge of the principles of breeding until in 1900, when Mendel's papers on plant hybridization, describing his now famous principles or laws of inheritance, were rediscovered independently and brought to attention by DeVries, Correns and Tschermak The discovery of these laws and the publication of DeVries' "Mutation Theory" in the same year, marked the beginning of a new era in plant-breeding. No matter what the final conclusions may be regarding Mendel's principles and the mutation theory, the stimulation which these two theories have given to breeding has already served greatly to modify and extend knowledge, both in scientific and practical directions



637. Variations in size of wheat plants grown side by side in field.

The great advance that has been made in the discovery of the underlying principles of breeding puts experimentation in this field on a much surer basis and the breeder can now approach his subject with definite understanding.

Classification of varieties.

To understand clearly the character of organisms with which breeding deals, careful definitions of the different groups of cultivated plants which are ordinarily known as varieties are needed One speaks of varieties of wheat, corn, apples and pears, yet it is known that these varieties differ from each other as natural groups. In order to distinguish clearly these differences, the following classification of varieties into races, strains and clons has been proposed

Races are groups of cultivated plants that have well-marked differentiating characters, and propagate true to seed except for simple fluctuating variations The different groups of beans, peas, wheat, oats, corn, cotton, and the like, referred to commonly as varieties, are thus in a more restricted sense races Boone County White, Leaming, Golden Bantam, and so on, would be recognized as races of corn, and Turkey Red, Fulcaster, Fultz, as races of wheat, and Early Paris, Dwarf Erfurt and Snowball as races of cauliflower.

Strains are groups of cultivated plants derived from a race, which do not differ from the original of the race in visible taxonomic characters When the breeder, by a careful selection of Blue Stem wheat, produces a sort of Blue Stem that differs from the original race only in the quality of yielding heavily, it would be called a strain of Blue Stem

Clons are groups of cultivated plants the different individuals of which are simply transplanted parts of the same individual, the reproduction being by the use of vegetative parts such as bulbs, tubers, buds, grafts, cuttings, runners, and the like The various sorts of apples, potatoes, strawberries, chrysanthemums, and so on, commonly denominated varieties, in a more restricted sense would be clons Clons of apples, pears, strawberries, potatoes, and the like, do not propagate true to seed, while this is one of the most important characters of races and strains of wheat, corn, and others. The term variety would thus be used in a general sense, and would include races, strains and clons.

Heredity.

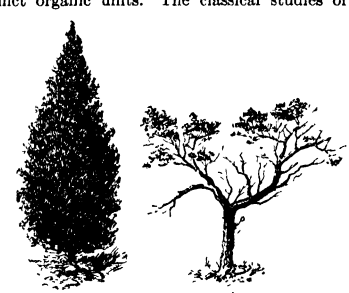
The laws of heredity are of primary importance to the breeder It is a general principle that like begets like, but it is also true that like frequently gives rise to unlike. In general, by heredity is meant the tendency which an organism manifests to develop in the form and likeness of its progenitors, and the study of heredity includes thus the inheritance of characters It is of the utmost importance that organisms in general reproduce their kind, as otherwise the breeder would be confronted with confusion, but it is of equal importance that the offspring does not always reproduce the parental characters There are thus apparently two conflicting principles in plant-breeding On the one hand, the breeder seeks to produce variations in order to get new types as the foundations for improvement. On the other hand, when such a variation from or improvement on the normal type is secured, he reverses the process and tries to establish heredity and reduce the amount of variation, so that the aphorism, "like begets like,' will hold true.

In pedigree- or grade-breeding, and in breeding to produce new varieties, the importance of hereditary strength cannot be overestimated, as it is only by rendering this power very great that any new form can be brought to what is called a fixed type

In recent years, the ideas of fixity of type have been greatly modified, and it is now held that fixity of type is secured by purifying a race from all admixtures so that any character represented in a race will be pure.

Unit-characters.

The modern studies of heredity have led to a new conception of organic characters that should be clearly understood by the breeder A careful study of species or varieties of plants or animals focuses the attention not on the generality of the differences existing but rather on the differences in certain characters, one observes whether a plant is smooth or hairy, cut-leaved or entire-leaved, much branched or simply branched, erect or procumbent, tall or short, and the like This leads to the conception that a plant is not of simple organization but is comprised of a combination of characters. These characters or the physiological units which cause them are now thought of as in considerable measure independent of each other and as representing distinct organic units. The classical studies of Grego



638 Red cedar: *a*, Columnar form; *b*, Spreading form.

Mendel on the hybridization of races of peas that exhibited different characters established the fact that at least certain characters are inherited separately and may form permanent new combinations.

A unit-character, then, may be defined as any characteristic quality or set of qualities or expression of character in an organism that is inherited as a whole and independent of any other quality or set of qualities They are the organic units of inheritance The units that are considered in hybridization are not the species or varieties themselves, but the unit-characters of which they are composed The origin of a new

variety would then consist in the acquirement of a new character by the organism or the loss of an old character or of the production through hybridization of new combinations of characters that already existed but in different combinations.

Nature of variation.

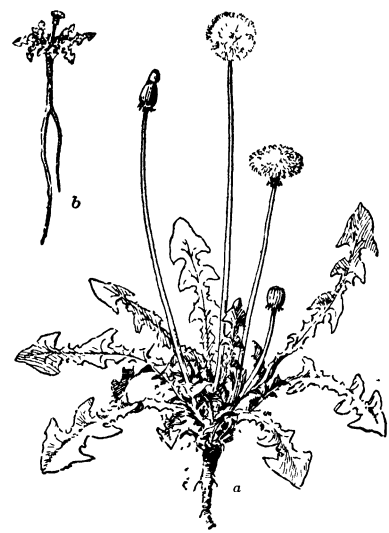
While, as indicated in the discussion of heredity, organisms are usually reproduced in the likeness of their parents, nevertheless it is well known that all plants vary Individual plants differ from one another just as do men The fact that plants can be improved by selection depends upon the occurrence of these so-called variations One is accustomed to think of plants as very stable and uniform Casually looking over a field of ox-eye daisies and admiring their beauty, one distinguishes no apparent variability, all seem to be alike Nevertheless, if the plants are examined carefully and the different individuals studied, it is found that each one possesses certain peculiarities Some have large flower-heads, others small flower-heads; some have very many rays or petals, others comparatively few, some have broad rays, others narrow rays Some plants are tall, others short. No two plants can be found which do not differ from each other in some noticeable character They present different facial expressions, the same as do people or cattle, so that different individuals may be recognized after one has studied them and made their acquaintance This is one of the interesting studies which the breeder pursues Careful gardeners learn to recognize the individual plants that they handle day after day as the shepherd recognizes the different members of his flock.

The inheritance of a character ordinarily does not mean its exact expression in the offspring as in the parent In considering variations from the standpoint of the conception of unit-characters, it must be remembered that only the determiners of a character are inherited and the expression of the character in the new individual is influenced by the environment under which the individual develops It must also be remembered that in the higher plants and animals with which the breeder ordinarily has to deal, an individual results from a fertilized egg-cell which contains the heritage determiners of two parents and, as there are a very large number of characters making up any individual and as different individuals possess different determiners which are brought together in fertilization, rarely or never can one individual be conceived to be an exact counterpart of another

Variations are of very great difference in magnitude and kind, and while many different names have been given to the different types of variation, the most generally accepted usage at present is to classify all variations either as fluctuations or mutations

Fluctuations are those variations that are supposed to be due to the direct action of environment and that are not inherited The variation in size as a result of richness of soil, is such a fluctuating variation and, as well recognized, is not a heritable character A similar illustration of such a variation is the difference in size of oat or wheat plants due to crowding in the field (Fig 637) It is known that if a pole bean be transferred to the North, it tends to produce a bush type, and if a cowpea be transferred to the North, it tends to shorten up its vine and assume a bush habit An interesting illustration of such modifications is shown in the ordinary red cedar, *Juniperus virginiana* (Fig. 638). In the rich, moist soils of Pennsylvania, Maryland and Virginia, this tree forms a beautiful tall columnar top with dense foliage (Fig 638 *a*). On the dry, sterile, limestone hills of Kansas, Nebraska, and Kentucky, and in the sandy soil of Florida, the same tree produces a spreading, scraggly top of entirely different character (Fig. 638 *b*). If one of these trees is transplanted while young, from sterile barren soil to moist rich land, it assumes the tall columnar habit as a result of the environment

Plant-breeders have sometimes assumed that such modifications, which are the result of environment (Fig 639), are of great importance to them This matter, however, is in grave doubt. The information at command indicates that these characters, which are physiological adaptations, are not hereditary, and are lost as soon as the plant is transferred again to its normal environment If, for example, it is desired to produce a bush cowpea and the selection is undertaken in the South with a vine variety, a search should be made among the plants for the individual that approaches most nearly to the bush type, and it is probable that this plant would be as likely to transmit this character to its progeny as a similar bushy type selected under northern conditions As a matter of fact, it may be that this tendency could be recognized much more



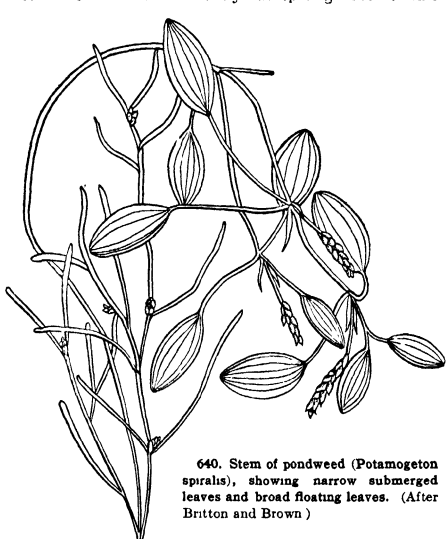
639. Variation in size of dandelion caused by growing at different altitudes. *a*, Plant grown in valley at low altitude, *b*, plant grown on mountain at high altitude (From Bonnier)

clearly in a southern location, where the plants normally produce vines, than in a northern location

Mutations, on the other hand, are changes that are more profound and effect the germinal cells of the organism in such a way that the changes are inherited The most typical illustrations of mutations are the striking large type-variations that are known to gardeners as sports, and which ordinarily reproduce true to seed. It must not be understood, however, that all mutations are large type-variations This, it is true, was in large measure the meaning given to mutations by DeVries in his development of the mutation theory of evolution, but the more general interpretation of biologists at present is to consider any type of variation that is inherited as a mutation. Many small variations, such as a slight difference in height of ear in corn, may be regularly inherited, and in some instances differences that are so slight as to be distinguished only by careful biometrical analysis are regularly inherited, generation after generation, even under very different conditions Recent scientific studies have emphasized

the great importance of such variations in the production of cultivated varieties and the evolution of species. As is well known to gardeners, these sports or mutations appear suddenly without warning or reason, so far as is known They cannot be produced, and one must simply wait until they appear and then be prepared to recognize and propagate them. Mutations usually reproduce their characters without much reversion to the parental type except such as is caused by cross-pollination. Mutations of self-fertilized plants thus usually come true to type, while in cross-fertilized plants the mutation must usually be cultivated in an isolated place and carefully selected to weed out the effect of such crossing as has occurred Many seedsmen examine their trial-grounds regularly for sports or mutations, and many of the best varieties have resulted from the selection of such sports. Livingston, of Ohio, who during his life was famous for the number of new varieties of tomatoes which he produced, made it a practice to search regularly the fields of tomatoes, which he grew for seed purposes, for such sports, and almost all of his numerous varieties were produced by the discovery of such striking variations.

A very interesting case of a variety that originated as a seedling sport or mutation is the now familiar case of the Cupid sweet pea Until about fifteen years ago the only sweet peas known were the ordinary tall twining sorts which grow to a height of 3 to 6 feet, depending upon the richness of the soil At this time there was found in California, a small dwarf sweet pea plant only about 6 or 8 inches high. This was growing in a row of the Emily Henderson variety, one of the ordinary tall sorts from which it evidently had sprung. Seed of this



640. Stem of pondweed (Potamogeton spiralis), showing narrow submerged leaves and broad floating leaves. (After Britton and Brown)

dwarf plant was saved and grown, and it was found to reproduce plants of the same dwarf character. The variety was designated the Cupid, under which name it was introduced to the seed trade and distributed over the world. The Cupid differed from other sweet peas not only in height but in its closely set leaves and general habit of growth. Indeed it is as distinct from other sweet peas as are distinct species of plants in nature. From the original Cupid, there have sprung many different sorts, until now there are varieties of Cupids representing almost all variations of color and shape of flower known in the sweet pea family.

Causes of variation.

Understanding of the causes of variation is as yet very imperfect. Fluctuations are in general interpreted as the direct physiological action of environment on the plant, or. in other words, environmental reactions. There would seem to be no doubt of the correctness of this view for the cause of ordinary fluctuations, and it may be accepted as the cause of such fluctuating variations as the breeder will commonly meet Such reactions as the changes in structure and form of the entire air-leaves and finely divided water-leaves of certain buttercups (Ranunculus) and the floating and submerged leaves of pondweeds or Potamogeton (Fig 640), and the loss of knees on the bald cypress when cultivated on high land where the soil is well aerated, may be interpreted merely as extreme environmental reactions Even these extreme changes are not inherited other than that the ability to react in this way under different environments is inherited

To account for mutations is, however, a much more difficult matter and no definite conclusion as to their cause has yet been reached Lamarck and his followers have strongly maintained the hypothesis that changed environment would stimulate the production of variations that would permanently effect the organism and its progeny in the direction of better adapting them to their environment Many scientists, even today, believe in the effectiveness of environment in developing adaptive changes Weisman and his followers, however, appear to have shown that characters acquired through external influences, the so-called acquired characters, do not affect the germ-cells, which are early differentiated in the development of the organism, and are thus not inherited

While, in general, it is certain that the ordinary environmental reactions are not inherited, it is known that plants long grown under a certain environment become modified to suit that environment, and that such adaptive changes have in some way so modified the organism that the adaptive changes are rendered heritable Thus the conclusion follows that in some way environment by its stimulation does occasionally affect the germ-cells and produce changes that are inherited. Plants that have long been cultivated under widely varying conditions almost invariably develop numerous heritable variations that would be classed as mutations The older breeders strongly held to the belief that such conditions as change of food-supply, change of altitude, artificial cultivation, budding, and grafting, indeed the ordinary manipulation of agricultural cultivation, lead plants to vary in directions of importance to the breeder Clearly, no problem is of more importance to the breeder than to be able to produce or cause such new characters to appear.

It is only very recently that the idea has developed that one can go farther than possibly to change the environment With the publication of MacDougal's researches in 1906, describing mutations that were apparently caused by injecting the capsules of plants with certain solutions, such as zinc sulfate and magnesium chloride, a possible new method of forcing variations was introduced MacDougal apparently obtained marked variations as a result of his treatment, that were inherited in succeeding generations

Tower, by subjecting potato beetles during the formation of the germ-cells to extremely hot and dry or hot and humid conditions with changes of atmospheric pressure, was able to cause the development of marked changes or mutations that were found to transmit their characters true through several generations and which segregated as unit-characters following hybridization. He concludes from his experiments "that heritable variations are produced as the direct response to external stimuli"

Gager has produced similar changes in plants by subjecting the developing ovaries to the action of radium rays, and a number of similar studies by Hertwig and others indicate that radium emanations have a very active effect on both plants and animals

While the evidence favoring the value of such external stimuli as the above in producing new heritable characters is apparently definite and positive, the extent to which the method can be used in

practical breeding has not been determined, and indeed further experience must be awaited before the evidence, or the interpretation of the evidence presented in these very valuable and suggestive researches, can finally be accepted Humbert has made experiments in which the capsules of a pure line of a wild plant (*Silene noctiflora*) were injected with the solutions used by MacDougal, and although the number of plants handled (about 15,000) was apparently as great or greater than was used in MacDougal's experiments, no mutations were found in the treated plants that were not also found in the untreated or check plants

Some observations and experiments are recorded in literature which indicate that mutilations or severe injury may induce the development of mutations Most noteworthy among such observations are those of Blaringhem, who by mutilating corn plants in various ways, such as splitting or twisting the stalks, apparently produced variations that bred true without regression and which he described as mutations Observations on the great frequency of striking bud-variations on recovering trunks of old citrus trees in Florida, following the severe freeze of 1894–5, also furnished evidence in support of this theory

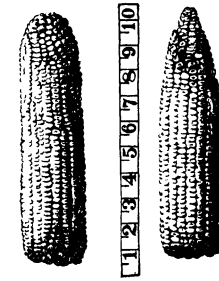
While the evidence at command regarding the artificial production of mutations is not yet sufficiently exact and trustworthy to enable one to draw definite conclusions and formulate recommendations for practical breeders, it may be stated that this is apparently one of the most profitable lines of experimentation for the immediate future

Principles of selection.

Selection is the principal factor of breeding, both in the improvement of races and in the production of new races and varieties (Fig 641). The keynote of selection is the choice of the best, and a factor of the highest importance in finding the best is the examination of very large numbers

In evolutionary studies, it has long been recognized that variation is the foundation of evolution and that no evolution is possible without variation, but, to selection has been assigned an all-important part as guiding and even stimulating the variation in a certain direction Darwin, and particularly some of his more radical followers, have assigned to selection a creative force, in that it has been assumed that when nature by a slight variation gave the hint of a possible change in a certain direction, natural or artificial selection, by choosing this variation and selecting from among its progeny the most markedly similar variants, could force the advance in the direction indicated Since Darwin's time, this cumulative action of selection had been emphasized so forcibly that selection had come to be recognized as an active force in creation rather than merely as a determinative agency

It is certain, of course, that, by careful observation and selection from any particular race, ultimately a new race may be produced The question is whether the individual or individuals selected in producing the new race have not varied by mutation or seed-sporting rather than being merely representative of the cumulative result of the selection of slight individual variations The sugar-beet furnishes an interesting illustration in this direction It will be remembered that Louis Vilmorin started the selection of sugar-beets for richness in sugar between 1830 and 1840, selecting first by means of specific gravity, the method being to throw the beets into solutions of brine strong enough so that the great majority of them would float, the few that sank being of greater specific gravity and presumably of greater sugar-content Considerable improvement was produced by this method. About 1851, the method of chemical analysis was introduced to determine the exact sugar-content. At this time, the sugar-content was found to vary from 7 to 14 per cent, and in the second generation of selection individuals with 21 per cent of sugar were found. The selection based on percentage of sugar, using the beets highest in sugar as mothers, has been continued regularly since that time, and the industry has come to rely entirely on careful selection for high sugar-content It would be expected that under these conditions, the percentage of sugar would have increased sufficiently so that the selected plants could be considered a different race or strain. Yet, after fifty years of selection, the highest sugar-content found is only about 26 per cent, and this in a very few instances, seldom over 21 per cent being found At the present time, many thousand analyses are made every year, so that abundant opportunity is afforded to find individuals producing a high sugar-content. On the contrary, when Vilmorin's work was started, the determination of sugar-content was made by very laborious methods, and was limited to comparatively few individuals. It is not improbable that if Vilmorin had been able to make analyses of the sugar-content in many thousands of roots, he would have found certain individuals producing as high as 26 per cent. The inference from this illustration would be that the limitations of the variation within the race have not been surpassed as a result of selection



641 Improvement of corn by selection Boone County White corn on left, and original type from which it was developed by selection on right.

Of recent studies favoring the active influence of selection in creating or strengthening characters, the most noteworthy are those of Castle and Smith

Castle and his assistants made an extensive series of experiments with hooded rats to increase the black-colored dorsal band on the one hand and to decrease or obliterate it, on the other He appears to have obtained very positive evidence favoring the gradual cumulative action of the selection, as he succeeded in markedly increasing the amount of black in one strain until the rats were almost wholly black and in the other strain almost wholly obliterating the black. Castle has also obtained similar results in producing a four-toed race, and a change of coloring in guinea-pigs His view may be summarized in the following quotation "In Johannsen's view, selection can do nothing but sort out variations already existing in a race I prefer to think with Darwin that selection can do more than this, that it can heap up quantitative variations until they reach a sum total otherwise unattainable, and that it thus becomes creative"

The experiments conducted by Smith and others at the Illinois Experiment Station on selecting high and low strains of corn with reference to oil- and protein-content, have resulted in markedly distinct strains possessing these qualities Experiments have also been made in cultivating these varieties without selection and the new characters have been maintained for several years without marked regression

The standard researches of DeVries, now familiar to all, challenged the correctness of the selection theory and sought to show that species originated by sudden jumps or mutations It may be admitted that DeVries proved that species or new characters were formed suddenly as mutations, but this would not prove that they might not also be formed or actually induced to mutate by a continuous process of selection Indeed, in his experiments on the production of a double-flowered variety of *Chrysanthemum segetum* ("Mutationstheorie," Vol I, p 523), a few generations of selection led to increasing markedly the number of ray-florets before the ligulate corollas appeared among the disk-florets, the change that he interpreted as the mutation that gave him the double variety

Tower's experiments with the potato beetle in attempting to create by selection large and small races, albinic and melanic races, and races with changed color-pattern, although conducted carefully from ten to twelve generations, failed to give any evidence of producing permanently changed types While strains of plus and minus varieties gave populations with a range of variation apparently markedly restricted to their respective sides of the normal variation range, still these selected strains did not greatly exceed the normal range of variation in either direction, and when the selection was discontinued, in two or three generations, again populations exhibiting the normal range of variation were produced Jennings, in a series of selection experiments with paramecium extending over twenty generations, and Pearl, in an extensive experiment in the selection of chickens in an attempt to produce a breed of high egg-laying capacity, failed to secure any evidence favoring an accumulative effect of selection

No series of experiments have had a more profound influence on the conception of selection than those of Johannsen, the Danish investigator In studying commercial varieties of beans, he found that such characters as weight and size of seed fluctuated around a certain average, and when large seed or small seed was chosen, the progeny showed the influence of the selection, being smaller or larger in accordance with the direction of the selection The progeny, however, did not exhibit the extreme sizes of the selected parents, there being a certain regression toward mediocrity In investigating this matter, Johannsen was led to use the ordinary pedigree method of cultivating the progeny of different individuals separately and inbreeding or selfing all seed used to prevent the

crossing of different strains By this method, he found that the progeny of each individual fluctuated around an average or typical size, as had the commercial varieties, but that while some strains were exactly the same in average size as the commercial variety, others fluctuated around a larger mean or a smaller mean than the commercial variety He tried the experiment of selecting from these large and small strains extreme variants, and found that no advance was made as a result of the selection He was thus led to conclude that in a pure self-fertilized strain from a single plant—what he called a pure line—no advance could be made by selection and that the commercial variety with which he first experimented was a mixed race In the course of his experiments with pure lines, several variations were obtained which reproduced true to type, but these were interpreted by him as changes of type by mutation.

While, before the publication of Johannsen's results, breeders clearly recognized the importance of determining individual performance and using pedigree methods, still his pure-line conception was a distinct advance and forcibly brought to attention the fact that most commercial varieties and races consist of a number of distinct types—biotypes, as he called them,—and that much of our work of selection consists merely in isolating and purifying these types

Is one, then, to conclude that the practice of breeders in continually selecting from the best for propagation is useless, and must one advise practical breeders to discontinue their selection? There can be no doubt that the practical breeders have made advances by selecting from the best individuals No scientific breeder will deny this It is simply the question of the interpretation of how the results were secured that is in doubt and whether these results can be considered as permanent new unit-characters

It appears that one is dealing in breeding with two markedly distinct types of selection, based on different principles and arriving at different results, both correct in principle and productive of equally valuable practical results, but of very different value when considered from a strictly evolutionary standpoint The first of these types would be that in which mutations are selected and new races established, while the second would be illustrated by that type of selection which is intended merely to maintain a maximum strain of the race

It would seem that such cases of improvement as are illustrated by the sugar-beet indicate that the continuous selection, generation after generation, of maximum fluctuations shown by a character, will result in maintaining a strain at nearly the maximum of efficiency, and that within a pure race the progeny of a maximum variate which would probably be classed as a fluctuation, does not regress entirely to the mean of the race in the first generation succeeding the selection, but that there is only a certain percentage of regression similar to the regression determined by Galton.

These races or selected strains maintain themselves as long as the selection is continued, and when the selection is discontinued rapidly regress to the mean of the species

The practical breeder should clearly recognize that the act of selection, the choice of the best, remains just as important whether it has a cumulative effect, thereby augmenting the character, or whether he is merely purifying an already existing superior race. The final result remains the same.

Methods of selection, or pedigree breeding.

By methods of selection is meant those practices that the breeder uses to find promising variations, determine their value, and purify or develop them into fixed races coming true to seed.

Choosing superior plants.

The first concern of the breeder is to find the valuable variations How he had best do this will depend largely upon the plant with which he is working. In all cases, it is of the greatest importance to find the best possible plants and this is likely to require the examination of a very large number of individuals. This factor cannot be too strongly emphasized. If, for example, one attempted to find a man 7 feet high, one would probably have to examine, or pass over, a million individuals to find him The superior individuals fitted to be the progenitors of a new or improved race are very few. Certain individuals far above the average may be found by examining a comparatively limited number, but the very best possible individual is but rarely produced

The plants from which selections are to be made should be grown under as uniform conditions as possible, so that the experimenter may have opportunity to examine and select the best Two methods of growing plants for selection are in general use, and may be termed the nursery method and the field method

The nursery method, which was first used by Hallett about 1868, consists in cultivating each plant under the most favorable conditions possible for its best development. By this method with wheat, for example, Hallett pursued the policy of planting the individuals in squares a foot apart, which would give each plant abundant opportunity for stooling, and also the investigator an opportunity clearly to distinguish each individual plant and determine its characteristics, total yield, and so on In recent years, this method of growing the individual plants at a standard distance from each other, in order to test their yielding capacities and the like, has been used very extensively

The field method was used by Rimpau about 1867, and probably by many others before that time By this method, the selections are made from plants grown under normal field conditions The advantages of this method are that it can be judged only what a plant will do in the field under ordinary conditions of field culture, by growing and selecting it under these conditions In the large majority of cases, the first selections are probably made from plants grown in the field in the regular course of crop-production, which thus were not specially grown for the purpose

If one is to use the nursery method, the plants must be especially planted While the nursery method certainly allows the breeder to distinguish the individual plants more clearly, in wheat, oats, and other crops that are sown broadcast or drilled, it entails very much extra work and is probably to be recommended only for the use of experimenters who are giving their entire time to the work In the greater number of horticultural crops, the individuals are normally cultivated one in a place, as in the case of tomatoes, cabbages, strawberries, currants and the like, and the examination of individuals in the field thus satisfies the requirements of both the above methods

The breeder may have in mind either of two purposes in his work (1) On the one hand, he may desire to secure an improved strain of a certain race, that is, by selection to keep his seed up to the maximum of efficiency This may be called strain breeding (2) On the other hand, he may desire to produce an entirely new race with different characters, and this may be called race-breeding

He should clearly recognize which of these types of breeding he is following As an illustration, suppose that the breeder is growing the Stone tomato and desires to maintain the best-yielding strain possible of this race He would then attempt to choose from a very large number of plants of the Stone variety, the best-yielding plants having the largest number of perfect fruits and typical of the variety in habit of growth, quality, character of fruit, and the like, and would hope by a process of continuous selection to maintain his selected strain in a state of high productivity. This is the type of selection pursued by the sugar-beet breeders described earlier in this article.

On the other hand, if he desires to produce an improved new race, he would search among large numbers of tomato plants of any or all varieties for the appearance of mutations or sports, or plants of new type differing from any known variety As a matter of experience,

it should be stated that it is very easy to find types of plants differing from the varieties or races ordinarily grown, but far the larger part of such variations are worthless types. Good new types, the superior or even the equal of the known varieties, are of very rare occurrence

If the general improvement of a variety is the breeder's purpose, he should choose a considerable number of apparently superior plants of good type, which will form the basis of his selection work. Breeders who are conducting careful experiments will find it necessary and desirable to use careful methods of judging their plants. While one is breeding possibly for one primary improvement, as, for example, increased yield, it is necessary, at the same time, that one should keep the product up to the standard in other characteristics, namely, quality, disease-resistance, drought-resistance, and the like, and that one sees that all of the good qualities of the variety are retained. To do this properly necessitates the use of a score-card, on which each character of the plant that is important is given its relative weight or grade. By the use of such a score-card, the breeder can judge each character separately, and by the adding up of the score-card get the rank of different plants in a comparative way

Inheritance test —When a number of plants have been chosen, the next important factor is to test each individual as to its inheritance It must be continuously remembered that a plant is valuable only as it produces good progeny To determine the inheritance, the usual method is to plant the seed from each individual selected in a row by itself, or in a marked part of a row. This is the so-called "plant-to-row" method, and brings the offspring of a single individual together so that they may be readily compared with each other and their qualities carefully judged. These progeny rows should be grown in a special breeding-patch in which the soil is as uniform as can be secured

It is frequently found that two select plants that are equally good so far as their yield is concerned will give progeny that, as a whole, differ greatly in this respect. In the progeny of one, almost every plant may have inherited the desired quality, while in the progeny of the other only a few of the plants may show, in any noticeable degree, the inheritance of the quality To determine the degree of inheritance, it is necessary to grade carefully the progeny of each individual

Finally, with the use of his best judgment, the breeder determines the superior progenies, and these would be the ones which have most nearly given the ideal type and produced the best yield of the highest quality This would end the work of the first generation of the selection as the breeder now has the data which shows him which of the original plants selected was the superior one It will be seen that this is a method of judging the individual by its progeny.

Continuation of the selection the second year.

Having determined the superior progeny or progenies at the end of the first year, the breeder then makes his selections of seed-plants from these best progenies for continuing the breeding While one progeny may be and usually is superior to all others, this may be due to the season or other accidental conditions and for a few generations it is usually the best policy to make selections from several of the best progenies. Select from each of the superior progenies several of the best plants, using the same care in selecting these plants as was used in choosing the first plants Preserve the seed from each of these plants separately and keep it carefully labeled so that its origin may be known

The further work with these plants consists in planting each individual by the plant-to-row method, testing the inheritance as described in the first generation, and finally selecting again the best progenies This would be followed by again selecting from the best progenies a number of superior individuals to continue the selections in the third year

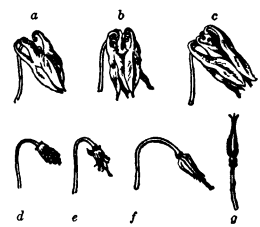
The third and succeeding years of the selection would be conducted in the same way as long as it was thought necessary or desirable to continue the work.

Securing general stock seed of the improved strain.

In carrying out selection work as outlined in the preceding section, it is ordinarily the object of the breeder to secure an improved strain of the race with which he is working, and usually he desires to utilize such improvements as he can make at the earliest possible time. With ordinary annual crops such as beans, peas, tomatoes, corn, and cotton, it will be found a good policy at the end of the second year of the selection, after taking the seed from the few special plants used in continuing the pedigree breeding, to harvest the seed from a number of the best plants remaining in the chosen progenies and using this seed to plant a multiplication plat from which stock seed may be secured to plant a fairly large crop Each year following this, seed may be taken in the same way from the best progenies in the breeding patch to plant a multiplication plat By this method, seed of a gradually improving grade may be secured for planting a general crop.

Control of parentage.

In plant-breeding, as in animal-breeding, the isolation of the parents is a very important consideration. It is necessary that the character of both parents should be known whenever this is possible In breeding plants, more attention is given ordinarily to the mother parent, and in very many instances the characters of the father parent are entirely neglected Animal-breeders, on the contrary, give more attention to the characters of the male parent, and much improvement in ordinary herds has been accomplished by the introduction of improved heritage through the male In plant-breeding, it is desirable that the seed of the select individuals be planted in a field by themselves. This insures that only progeny of carefully selected individuals will be planted near together, and thus no ordinary stock will enter as a contamination. One can be certain that each plant of the progeny is fertilized with pollen from another similarly good plant, or at least from a plant derived from good parentage. One difficulty, however, has been experienced by plant-breeders in planting continuously their selected stock in such isolated plats. If this method is continued year after year, it results in fairly close inbreeding, which, in the case of plants, frequently results in loss of vitality and vigor. In animals there is frequently no noticeable effect from close inbreeding, and many of the most famous animals have been produced as a result of the closest in-and-in-breeding. In plants, however, it is possible to secure much closer inbreeding than in animals, as in many cases a plant can be fertilized with its own pollen.



642. Aquilegia flowers, illustrating the process of emasculation.

a, mature bud showing stage which should be chosen for emasculation, *b*, similar bud with the tips of the corolla pried apart and the stamens removed, *c*, a bud opened naturally, too old to operate on, *d*, a bud of the stage shown in *a* and *b*, with corolla removed to show the internal organs, *e*, a bud the same as in *d*, but with the stamens removed, *f*, the same as *e*, but older, at the age when pollination normally takes place, *g*, pistil shortly after fecundation, the remnants of the stamens having fallen away.

Within recent years, much activity has been shown

in the careful breeding and improvement of corn. The corn plant has been shown, as a result of experiments made by various investigators, as, for example, the Illinois Experiment Station and the United States Department of Agriculture, to lose vitality very rapidly when self-fertilized. Within three or four generations, by the most careful inbreeding, it is possible to reduce corn almost to total sterility. The general practice of corn-breeders who have been giving attention to the production of pedigree strains is to plant the rows of corn from different select ears side by side, giving a row to each select ear, and each year selecting, from the progeny of those rows that give the largest yield, plants to continue further the selection Planting these select ears together every year, therefore, means that they are more or less inbred, as the closest relatives are planted together in the same row. While in following this practice at first no effect was visible, corn-breeders are now finding in some cases an apparent decrease in yield, which seems to be traceable to the effect of inbreeding. It seems necessary, therefore, in corn and in other plants that are affected by inbreeding, to use methods that will avoid close inbreeding. The detrimental effect of inbreeding is largely limited to those plants that are normally cross-fertilized, this fact being strikingly brought out in Darwin's "Effects of Cross and Self Fertilization in the Vegetable Kingdom" Tobacco, wheat, and some other plants that are normally self-fertilized do not show this decrease in vigor as a result of inbreeding



643 Plant of aquilegia with flowers covered with bags in hybridization work.

Considerable effort has been made within recent years, in the selection of certain crops, particularly corn, to follow both parents, choosing good males and good females of known parentage and crossing these by artificial means There can be no doubt but that by the use of such methods more rapid progress could be made, but in the greater number of cases the methods thus far devised require so much work as to be almost prohibitive

A method of breeding has recently been devised by J. B Norton in the improvement of asparagus, which is worthy of careful consideration and may be applicable, at least in modified form, to use in the improvement of various crops Asparagus is dioecious, the male and female flowers being borne on different plants The first part of the process consists in selecting a number of superior plants of both sexes, attention being given to all important characters such as yield, quality, rust-resistance, and the like This having been done, the next process consists in crossing each female with each selected male plant and testing the progeny produced by the cross. If, for example, ten superior females and ten superior males were chosen, a sufficient number of flowers on female No 1 would be crossed with pollen of each of the ten males to obtain sufficient seed to test the comparative value of the progeny of female No. 1 with each of the ten males. The ten lots of seed from the crosses on female No. 1 would be grown separately and the comparative value of the different progenies determined by careful observations on vigor, rust-resistance, quality of product, yield, and the like. In this way, it would ultimately be determined which of the ten male plants was the superior one to use in crossing with female No. 1. In like manner, female No. 2 would be crossed with each male and the progenies tested to determine the superior male in this combination. Finally the combination of each female with each male can be compared and if the work has been conducted with sufficient care and for a long enough period, it can be determined which combination has uniformly given the best results.

Asparagus is perennial and is easily propagated vegetatively by separation of the roots, so that when once the superior male and female combination has been determined, these may be propagated vegetatively as clons, in alternate rows in an isolated place so that all seeds developed will be of the desired combination. Asparagus produces numerous seeds and by such a method an indefinite quantity of seed of the desired combination can be produced It would doubtless be possible in a few years, if desired, to have all of the seed used commercially grown from a single superior combination

If experiments of this nature could be made on an extensive scale so that the males and females of the highest or maximum grade could be discovered, they would be of almost fabulous value The importance of this method of breeding may be better appreciated by imagining the value of the best bull and the best cow in the world if they would live indefinitely and if it were possible for them to reproduce rapidly enough to supply all of the individuals desired

The direct application of this method is possible only with perennial dioecious plants that can be propagated as clons and that develop numerous seeds The hop is another plant to which this method of improvement could be applied.

Hybridization.

Aside from selection, hybridization has played the most important rôle in the formation of the varieties and races of our cultivated plants, but the results obtained are in many cases closely connected with selection Ever since the time of Knight, hybridization has been used extensively in plant-breeding, and it seems that this is the only sure means that the breeder can use in producing new and desirable combinations of characters. In hybridization, as generally used, the breeder does not expect to cause or produce new unit-characters, although such changes may occasionally occur under the stimulus of hybridization. What he can do with certainty is to secure hybrids combining the different characters of two distinct sorts The extent to which such recombination of characters can be carried is almost unlimited. In many cases, two or three or even four distinct species and the characters represented in their various varieties have been recombined in hybrids

In older literature, the term hybrid was restricted to crosses resulting from the combination of distinct species, while combinations of different races of the same species were known as crosses or mongrels The term hybrid is here used as designating any product of a cross when the parents were noticeably distinct from each other, whether the parents belonged to different clons, races or species This broader use of the term hybrid has become almost universal in recent years. If, in discussion, it is necessary to refer to the degrees or grades of difference in the parents, the hybrids may be characterized as species hybrids, racial hybrids, clonal hybrids and the like.

Choosing varieties to hybridize.

In starting any work in hybridization, the first important step is the choice of the varieties to be hybridized. It is interesting to make crosses of any two plants with distinct characters and observe the recombinations of characters which result, but this haphazard work takes too much time and is not to be recom-

mended. The breeder, in general, should hybridize with some definite aim in view and use systematic methods in attempting to accomplish that aim One cannot ordinarily expect to obtain in hybrids of any two varieties any characters which are not present in the parents. The unit-character conception explained in the beginning of this article is of fundamental importance in understanding hybrids. The breeder, by a careful study of varieties, determines the good characters and the poor or weak characters of each variety He may, as an illustration, if working with tomatoes, find all of the varieties with yellow pear-shaped fruits to be large bushy plants, the so-called standards, and he may desire a dwarf type of plant and red fruits. By examining the different races of tomatoes, he would soon find a variety, such as the Quarter Century, which possesses the characters of dwarf plant and red fruit By crossing these two varieties, he would obtain new combinations of the characters of the two sorts, and if he grew a sufficient number of the second generation of these hybrids, he would be certain to find some plants in which the pear-shape had been combined with the red color and dwarf habit of the Quarter Century variety.

The study of the varieties of any crop thus gives the breeder an idea of the characters available, and he must then use his originality and judgment in determining what combinations of these characters would form the best commercial variety If this combination does not already exist, he may start out with considerable confidence that it is possible for him to obtain such a combination and thus a valuable new variety. Plants, however, are not simple in their organization and the reaction of different characters on one another in different combinations may not always be what one expects. Again, in no plant has a complete analysis been made of all characters, and it may be impossible for us ever to reduce all the characters of a plant to a unit-character basis, thus there is always an element of doubt as to the value of any new combination of characters until this combination has been produced and tested

Methods of crossing plants.

Plants, like animals, bear male and female organs, and an act of fecundation is necessary in all ordinary cases to insure the development of seeds In probably the larger number of plants, the male and female organs or the stamens and pistils are borne in the same flowers on one plant In some cases, as in the castor bean, corn, and the like, both sexes are borne on the same plant but in different flowers In still other cases, as in the date palm, asparagus, hop and hemp, the sexes are on different plants

In hybridizing plants, it is necessary to insure that the plants are not fertilized with their own pollen or with pollen from any other source than that desired If, therefore, the plant to be operated on has the stamens and pistils in the same flower, the stamens must be removed from the buds before they burst and discharge the pollen This act of removing the stamens, or emasculation, as the process is called, is necessary in order to prevent self-fertilization In some plants, it is necessary to emasculate the buds very early, as the pollen develops considerably in advance of the pistils In other cases, the pistils reach maturity or a receptive condition before the pollen is shed In this latter case, the emasculation may be delayed until a time just previous to the normal opening of the flower

The process of emasculation may be illustrated by the columbine Here large-sized buds are chosen just before they open normally (Fig 642) The tips of the petals can then be easily pried apart so that the stamens may be pulled off with small forceps. This process should be performed carefully to avoid crushing or injuring the pistil The bud should then be inclosed in a small light paper bag in order to prevent pollen from any foreign source being brought to the pistil by insects or wind (Fig 643) The bud should remain covered until sufficient time has elapsed to allow the pistil to reach normal maturity, when the bag should be removed and the pollen from the desired variety dusted over the pistil. After this act of pollination, the bud should again be covered with the paper bag, which should not be finally removed until several days later, after fecundation has taken place As soon as a flower is pollinated, it should be labeled with a small tag of some sort which may remain attached to the flower-stem until the fruit is ripe In some cases, the pollen may be placed on the immature pistil without injury, when the flower is emasculated, and this is a great saving of time when it can be done. However, in most cases, premature pollination is liable to injure the pistil and prevent the setting of seed One should ordinarily attempt to pollinate the pistil at as nearly the normal time as possible Many plants are difficult to hybridize and every process must be as natural as possible to insure results

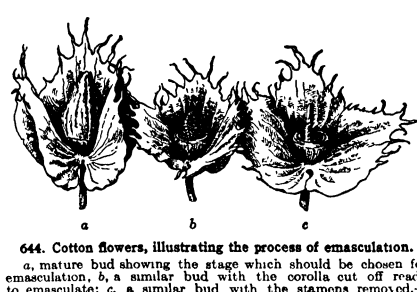
Many handy methods have been devised to use in pollination work and are described in breeding literature In all work fine copper wire is better to attach bags and labels than is string In emasculation work also, it will often be found convenient when some pollen has accidentally fallen on the pistil to wash it off with water by means of a small dental syringe In many cases, such as apples, pears and cotton, the best means of emasculation is to remove the outer floral envelopes by cutting them off, using a sharp scalpel. With a little practice this can be done quickly and with minimum injury to the essential organs (Fig 644)

Difficulty is frequently experienced when hybridizing different varieties, in getting plants of each variety to bloom at the same time. This difficulty may be overcome in many cases by keeping the pollen, which can be done for a limited period by slightly drying the pollen without allowing it to become desiccated, and preserving it in a tightly corked bottle

After the pollen has been placed on the stigma of the pistil by the act of pollination, each pollen-grain develops a small tube which grows down through the pistil to the ovary Through this tube, the male germ-cells pass down and finally a male germ-cell comes in contact with each egg-cell of the different ovules in the ovary (in most plants there are several ovules in each ovary) and fuses with them This constitutes the act of fecundation or fertilization This fecundated egg-cell is then the beginning of the hybrid and from the seed containing it, when grown, there develops the hybrid plant. The plant developed directly from this hybrid egg-cell is known as the first-generation hybrid (F_1) Seeds from this first-generation hybrid, when grown, give second-generation hybrids (F_2) The expressions F_1, F_2, and F_3, meaning first, second and third filial generations, are used very commonly to designate the first, second and third generations of hybrids

Laws of inheritance in hybrids

When plants of different pure races are crossed, as, for example, different races of wheat, corn or cotton, the hybrids are usually all very similar to each other in the first generation, exhibiting in general the same characters And this is the case also when different fixed species are crossed If, however, individuals belonging to unfixed races are crossed, there is usually a considerable variation in the first generation This is well illustrated by the crossing of different clons of apples, pears, oranges, and the like, when the different so-called varieties are merely transplanted parts of the same individual seedlings which have not been bred to a purity of type. It is well known that if seeds of an apple variety be planted, the resulting plants exhibit many different variations in the first generation The parents, themselves, therefore, not being of pure type, when they are hybridized produce progeny which in the first generation is variable. In the crossing of races which have been bred true to type, whether of the same or of different species, the first-generation hybrids, however,



644. Cotton flowers, illustrating the process of emasculation.

a, mature bud showing the stage which should be chosen for emasculation, *b*, a similar bud with the corolla cut off ready to emasculate; *c*, a similar bud with the stamens removed,—emasculated

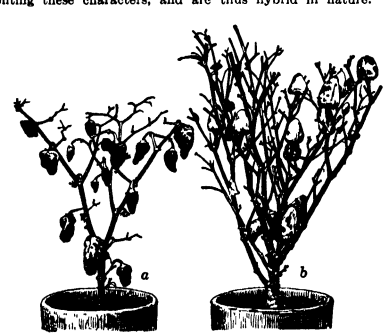
are nearly uniform in the characters presented, and in such instances it is necessary to secure a second generation of the hybrids in order to accomplish the segregation of the characters and the production of a large number of variations Ordinarily, therefore, desirable variations are looked for in the second generation. This, as has been explained above, is true only in the case of hybrids of species and races that are fixed in type

Mendel's law of hybrids

The preceding discussion represents fairly well the general understanding of hybrids until about 1900, when DeVries and Correns rediscovered what is now termed "Mendel's law of hybrids." These laws or principles are of great value from an economic standpoint, and are, furthermore, of the greatest scientific interest. They should thus be thoroughly understood by every practical breeder of plants It has been known for many years that a splitting-up and redistribution of parental characters occur in hybrids, and it is on this fact largely that the practical application of hybridization in plant-breeding depended. Until Mendel's law was discovered, however, there was no understanding of why or how such a recombination could be made, and it was necessary to experiment extensively in order to determine what could be accomplished

If one carefully studies a number of first-generation hybrids with special reference to the characters of the parents exhibited in the hybrids, it will be found that certain characters possessed by the male parent are plainly represented in the hybrid, while other characters possessed by the female parent are also represented in the hybrid Many characters of the parents are thus plainly represented in the hybrid, but it is probable that other characters will be blends of the similar parental characters, or possibly differ from any definite characters distinguishable in the parents Attention has already been called to the complexity of organisms in general and the difficulty of recognizing all of the unit-characters Thus far it has been possible only to follow carefully certain plainly marked characters This commingling of the different characters of each parent gives the hybrid a mosaic appearance, as if certain characters had been taken from each parent and thrown together to make up a hybrid individual.

Character-pairs —To understand this commingling of characters in the first-generation hybrids, it is necessary to know that the parents used in the hybridization differed from each other in certain characters. One parent may have had red fruits, hairy stems, and dwarf habit, while the other may have had yellow fruits, smooth stems, and tall habit Such characters are opposed to each other, and such opposed qualities or characters are termed "character-pairs" A plant may have red fruits and smooth stems, but it could not have red fruits and yellow fruits at the same time As an illustration of such character-pairs, may be cited, scarlet and yellow fruits of peppers, reversed or erect fruits of peppers (Fig 645), starchy and sweet kernels of corn, standard and dwarf size in tomatoes, stringy and stringless pods of beans, and the like Such pairs of characters have been termed by Bateson "allelomorphic pairs of characters," and this terminology is commonly used in the literature on hybrids When parents possessing opposed or contrasted characters are crossed the hybrid egg-cell receives, through the male and female germ-cells uniting in the fecundation, the determiners which represent the different contrasted pairs of characters, and all cells making up the first-generation hybrid will contain in like manner the determiners representing these characters, and are thus hybrid in nature. This being the case, it might be expected that all characters in the hybrid would show as blends of the parental characters or exhibit some stage of intermediacy between the characters of the parents. This is indeed frequently the case, but more commonly one of the characters is very strong, or "dominant," as Mendel expressed it, and only this character will show in the first-generation hybrid, the other character remaining recessive or masked, although present As an illustration, in the character-pairs mentioned above, scarlet fruits of pepper, reversed fruits of pepper (this is true only in certain varieties), starchy kernels of corn and standard size of tomato plants, are dominant over their corresponding contrasted characters Illustrations of blended or intermediate characters are found, for example, in first-generation hybrids of round with pear-shaped tomatoes, and large with small fruits of tomatoes or peppers



645 Pepper plants: *a*, with scarlet-colored reversed fruits, *b*, with yellow-colored erect fruits. The number and form of branches are also markedly different.

The law of segregation and purity of the germ-cells —The second important principle of Mendel's law is what is termed the law of segregation and purity of the germ-cells It seems certain from the researches that have been conducted that, when the germ-cells of the first-generation hybrids are formed, the determiners which represent the two different characters under consideration, and which were united by the hybridization, ordinarily segregate again in the cell-divisions, which lead to the formation of the germ-cells, so that certain germ-cells include the determiner of one only of the two characters There are thus two kinds of germ-cells formed with respect to this one character-pair Choosing as an illustration a hybrid of a pepper having scarlet fruits with one having yellow fruits (Fig 645), when the germ-cells were formed a segregation of the determiners representing the two opposed characters would take place and there would be germ-cells of one kind, both male and female, containing the scarlet fruit determiners and of a second kind, both male and female, containing the yellow fruit determiners This segregation takes place in the formation of both the egg-cells and the sperm-cells or pollen-grains. It is thus seen that the first-generation hybrid, when two such allelomorphic characters are combined, forms two kinds of egg-cells and two kinds of sperm-cells, so far as this one character-pair is concerned This segregation of characters, which has been termed the law of segregation, is one of the most important facts of inheritance and, in enabling us to get recombinations of characters, is of the highest importance in breeding

The law of probability in recombination of characters —The third important principle of Mendel's law is what is termed the law of probability, and explains what may be expected in plants of the second generation of such a hybrid Remembering that there are formed in the first-generation hybrid, as explained above, two kinds of egg-cells and two kinds of sperm-cells with reference to the opposed characters, what would happen if the hybrid were bred with its own pollen, or, in the case of an animal, if it were bred with another hybrid of the same parentage? For the purpose of illustration, suppose that a hybrid of a scarlet-fruited pepper with a yellow-fruited pepper be fertilized with its own pollen, and that 100 egg-cells be fertilized with 100 pollen-grains of the same hybrid There are two kinds of egg-cells produced, some carrying determiners of the scarlet fruit, and others determiners of the yellow fruit, and the same is true of the pollen-grains Taking the egg-cells and pollen-grains without choice, as equal numbers are produced of each kind, one would expect to have of the egg-cells fifty with scarlet determiners and fifty with yellow determiners In the pollen-grains, also, one would expect to have fifty with scarlet determiners and fifty with yellow determiners If, then, the 100 egg-cells and 100 pollen-grains are brought together in fertilization by chance, as would occur in nature, according to the law of probability, there would be twenty-five scarlet uniting with twenty-five scarlet, twenty-five scarlet uniting with twenty-five yellow; twenty-five yellow uniting with twenty-five scarlet and twenty-five yellow uniting with twenty-five yellow. Representing scarlet determiners by the capital letter S because scarlet is the dominant character, and the yellow determiners by the small letter y, as yellow is recessive, the unions may be represented as follows

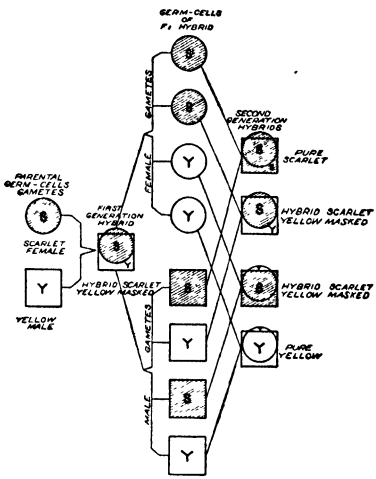
ONE HUNDRED EGG-CELLS BY 100 SPERM-CELLS.

Female Cells		Male Cells		Composition of hybrids	
25 S	×	25 S	=	25 SS	These do not contain determiners of y and will reproduce true.
25 S	×	25 y	=	25 Sy	These are hybrids so far as this character-pair is concerned,—exactly the same as in the first generation and contain determiners of both S and y These will not reproduce true to type and will break up like second-generation hybrids
25 y	×	25 S	=	25 yS	
25 y	×	25 y	=	25 yy	These do not contain the determiners of S, and will reproduce true.

The above illustration explains the law of segregation, and the probable ratio of recombination when hybrids are inbred with their own pollen, and when only one pair of characters is considered. When an egg-cell with scarlet determiners unites with a sperm-cell with scarlet determiners, this gives rise to a pure germ-cell, or zygote, containing only scarlet determiners, and the progeny in subsequent generations will breed true so far as this character is concerned Also, when an egg cell with yellow determiners unites with a sperm-cell with yellow determiners the result is a pure germ-cell, containing only yellow determiners and the progeny would reproduce true, so far as this character is concerned, in subsequent generations In the other two cases, when in fecundation

gametes with scarlet determiners unite with gametes with yellow determiners giving the combinations Sy and yS, which amount to the same thing, there result in reality, hybrids exactly the same as in the first generation and the progeny from these in the next generation behave exactly the same as did the first-generation hybrids in the second generation

In such a case as the one under consideration, in which the scarlet is a strong dominant character, all combinations that contain the determiners of this character, whether pure or of hybrid nature, show this character only Thus in the above 100 combinations the twenty-five yy would come with yellow fruits while the seventy-



646 Representing Mendelian inheritance of scarlet S, and yellow Y, color of fruits in pepper hybrids.

five other combinations would have scarlet fruits, although fifty of these would be of hybrid nature To determine which of these seventy-five scarlet-fruited plants are the combination Sy that is, scarlet with yellow, and which are SS, that is, scarlet with scarlet, requires the growing of self-fertilized progeny from them to determine which are reproduced true to type, as these would be the pure scarlet The progenies of any of these plants that produced both scarlet- and yellow-fruited plants would show that the parent of such progeny was a hybrid

In the hundred combinations there is thus produced a ratio of one pure scarlet to two hybrid scarlet and yellow to one pure yellow, 1 SS 2 Sy 1 yy or three scarlets to one yellow and this is the famous 3 1 Mendelian formula

This process of union of an allelomorphic pair of characters in hybridization, the formation of four kinds of germ-cells, both male and female, by the hybrid, and their four different unions, is graphically illustrated in Fig 646

While in certain hybrids of parents possessing two opposed parental characters, this ratio of probabilities is not produced if large numbers are used the ratio will be found in many cases with little deviation A sufficiently large number of cases have now been studied with various plants and animals to place this conclusion beyond question It is not known, however, how many characters follow Mendel's law, nor is it yet entirely certain whether those character-pairs that sometimes follow the law of segregation always follow it

The individuals of the second generation which contain the determiners of both characters of the pair, if self-fertilized or bred with similar individuals containing the determiners of both characters, exhibit in the third generation exactly the same nature that first-generation hybrids exhibit in the second generation The two determiners are commingled in their cells, and to all intents and purposes they are exactly the same as first-generation hybrids When such self-fertilized hybrids are grown they give again, in the third generation, the regular Mendelian proportion of 1 SS 2 Sy 1 yy Here the individuals containing only determiners of one character, that is, SS and yy, would come true to these characters in succeeding generations, while those individuals containing the determiners of both characters, S and y, would be expected to segregate again in the fourth generation in similar proportions

When dealing with more than one character-pair, ratios of segregation become complicated but are easily understood If the character of reversed fruits (R) and erect fruits (e), two plainly marked characters of ordinary garden peppers, caused by the pedicel of the fruit curving backward in one case and remaining straight in the other, are combined with the above allelomorphic characters, it can be foretold exactly what combinations will occur and the relative number of each This is a second allelomorphic pair of characters that behaves in inheritance the same way as did the two colors of fruit In this case, the reversed pedicel is the dominant character, as in the F_1 hybrids of reversed with erect sorts the peduncles are always or very generally recurved These characters would thus be represented by R for the recurved or dominant character and e for the erect or recessive character In this character-pair one would expect a splitting and segregation to have occurred in the formation of the germ-cells of the first generation so that the hybrid plants of the second generation would exhibit these characters in Mendelian proportions as in the character-pair first described The progeny in the second generation would thus exhibit these characters in the following combinations and proportions 1 RR 2 Re 1 ee This theoretical proportion should hold rather constantly, either in small or large numbers of hybrids, though in large numbers it would be more nearly realized The determiners of the four characters, or two character-pairs, are commingled in the cells of the first-generation hybrid. When the egg-cells and pollen-grains are formed, however, a segregation of the determiners of the two character-pairs occurs, but independent of each other Each egg-cell or pollen-grain will receive only the determiner of one character of a certain character-pair but will, at the same time, receive determiners of other characters belonging to other character-pairs Considering the two character-pairs described in peppers, an egg-cell receiving the determiner of the scarlet color of fruit S, might also receive the determiners for either R or e representing the characters of recurved or erect fruits These two character-pairs would thus give egg-cells of four combinations, SR, Se, yR, and ye

In the formation of the pollen-grains, the same combination occurs, so that with reference to the two character-pairs described, the pollen-grains that would be formed have the same combinations of determiners as the egg-cells, namely, SR, Se, yR, and ye There would thus be four kinds of egg-cells and four kinds of pollen grains so far as these two character-pairs are concerned If these are brought together, sixteen combinations are possible as follows:

SRSR	SeSR	yRSR	yeSR
SRSe	SeSe	yRSe	yeSe
SRyR	SeyR	yRyR	yeyR
SRye	Seye	yRye	yeye

Examining these combinations carefully, and placing together those combinations that contain the same character-determiners as indicated by the letters, and this can properly be done as it does not matter in the fecundated egg whether a certain determiner is furnished by the egg-cell or the pollen-grain, there result the following nine combinations, all of which are different in germinal constitution with reference to these two character-pairs

TABLE SHOWING NUMBER OF GERMINAL COMBINATIONS AND CHARACTER OF 1_2 PEPPER HYBRIDS WITH TWO ALLELOMORPHS

No of combinations	Germinal constitution	Visual characters of hybrid	Nature of hybrid
1	SRSR	Scarlet recurved	Pure scarlet and recurved
1	SeSe	Scarlet erect	Pure scarlet and erect
1	yRyR	Yellow recurved	Pure yellow and recurved
1	yeye	Yellow erect	Pure yellow and erect
2	SRSe	Scarlet recurved	Pure scarlet and hybrid recurved × erect
2	SRyR	Scarlet recurved	Hybrid scarlet × yellow and pure recurved
2	Seye	Scarlet erect	Hybrid scarlet × yellow and pure erect
2	yRye	Yellow recurved	Pure yellow and hybrid recurved × erect
4	SRye	Scarlet recurved	Hybrid scarlet × yellow and hybrid recurved × erect

An examination of the preceding table, in which are grouped the sixteen possible combinations when two allelomorphic pairs are concerned in the hybridization will show that among these sixteen there are nine groups with different germinal constitutions The visual character of the hybrid plants of these nine different groups is given in the third column and is easily understood by examining the germinal constitution and remembering that scarlet S, and reversed R, are the dominant characters in the two allelomorphs and that the presence of one determiner of either of these characters will cause the appearance of that character in the hybrid plant It will be observed that by grouping the hybrid plants according to the characters they show, there will be nine scarlet and reversed, three scarlet and erect, three yellow and reversed, and one yellow and erect This is the Mendelian formula 9 3 3 1 The nature of the nine different groups of hybrid plants with different germinal constitution is given in the fourth column of the table When a character is pure, it may be expected to reproduce true in succeeding generations but in those cases in which both determiners of a character-pair are present, the character is of hybrid nature and will segregate in succeeding generations

In the illustration of the character-pair, scarlet and yellow fruits and the probable ratio of number of unions in F_2 hybrids, it was shown that out of 100 unions one should expect 25 SS 50 Sy 25 yy. If now the second character-pair recurved and erect fruits is con-

sidered in connection with these same 100 unions, there would occur the following combinations, according to the law of chance:

25 SS	50 Sy	25 yy
6¼ SRSR	12½ SRyR	6¼ yRyR
12½ SRSe	25 SRye	12½ yRye
6¼ SeSe	12½ Seye	6¼ yeye

These nine combinations are the same as given above, but the percentage of each combination out of the 100 unions is shown

If a third character were considered, the proportions of the combinations can be determined in exactly the same way Each one of the above nine possible combinations would be again divided into three different unions in the same way as the three combinations of the one character-pair gave nine different combinations with the second character-pair. In the consideration of the three character-pairs, there would thus be twenty-seven different combinations of parental characters And again in each ovary fecundated, when only one determiner of each character-pair occurred, the opposing character-determiner being in each case eliminated, such a cell should give a plant that would reproduce its character true to type It is well known that almost any two different races or species that may be chosen for hybridization will ordinarily differ from each other in numerous characters. When there are a



647 Pepper hybrids distinct from parental types, formed by recombination of characters, *a*, dwarf type with few small horizontal branches, *b*, giant type with many large erect branches.

number of these opposing characters which form Mendelian character-pairs, the determination of the possible combinations by Mendel's formulæ becomes very complex and difficult to understand It is only by taking a few well-marked character-pairs and carefully studying them that the segregation and new combinations according to Mendelian proportions can be followed and understood

Any character-pairs following Mendel's law would segregate as indicated above, in the case of scarlet and yellow fruits and reversed or erect fruits of the pepper A very large number of characters of various plants and animals are now known to be Mendelian and while many modifications of the principles have been necessary to harmonize them with special cases, still it may be said that there is no other general law of heredity and Mendel's law has thus furnished us with a working basis of great value

The study of hybrids has been resolved into a study of unit-characters and their relation to each other By hybridizing related types having opposed characters and observing the segregations which occur in the later generations, the characters of each type are analyzed and it is determined when a character-pair occurs. The researches on this subject by Mendel, Bateson, Davenport, Castle, Punnett, Shull, Hurst, Correns, Tschermak, East and dozens of other now well-known investigators, have developed a science of heredity of which there was no conception a few years ago

The characters presented by the different varieties of a plant or of different species, which can be crossed with it, can now be studied, and one can definitely plan the combination of characters desired in an ideal type, and can with considerable confidence estimate the number of plants it will be necessary to grow to get this combination It is now known in general how characters behave in segregation and inheritance, so that one can go about the fixation of a desired type, when one is secured, in an orderly and intelligent way

The further the study of characters is carried, the more it is coming to be realized that the appearance of apparently new types following hybridization is due to recombinations of different units which in their reactions give apparently new characters As an illustration, in a study of pepper hybrids, which has been conducted during the past four years, it has become evident that the form of plant and branching is due to three pairs of characters or allelomorphs, namely, first, erect or horizontal branches, second, large or small branches, and third, many or few branches In crossing two medium-sized races, one with large horizontal and few branches, and the other with small erect and numerous branches, there result many new combinations of characters, among which appear some with small horizontal and few branches, which gives a dwarf plant, and others will have a combination of large erect and numerous branches, which gives a giant plant (Fig 647) These dwarfs on the one hand and giants on the other appear as distinct, new creations, though they are very evidently merely the recombinations of already existing unit characters, and dwarfness and giantness are the results of the reaction of the different units combined

When the large number of distinct characters that are presented by the very numerous varieties of any of our cultivated plants is remembered, an understanding is secured of the possibilities of improvement which the field of hybridization affords

The development of hybrids into pure races.

When hybrids have been produced between species or varieties possessing certain characters that it is desired to unite in a variety, the recombinations of characters as explained in the preceding section become visible in the second generation, and it is thus among the plants of this generation of the hybrid that one should expect to find the combination of characters desired The breeder would thus very carefully examine a large number of second-generation plants and choose for further experimentation those plants that were found to have inherited the characters which he desired to combine The entire batch of F_2 plants should be carefully examined to determine what characters behave as character-pairs and also the dominant or recessive nature of each character This knowledge is necessary in order to determine the practice to be pursued in choosing plants in which the characters desired will be pure with reference to these characters If, for example, the breeder is working to get a combination of two characters only, such for instance as a yellow- and erect-fruited pepper, from the combination of character-pairs discussed above in explaining Mendel's law he would discover that both of these characters are recessive, and thus when a hybrid was found in which these two characters were united, he could be sure that by self-fertilizing such an individual it would reproduce true with reference to both of these characters in the next and succeeding generations He would know furthermore in dealing with only two pairs of characters that he should, according to the law of chance, secure on an average about one such combination in sixteen hybrids

If, however, the combination desired was a scarlet reversed fruit, both dominant characters, the process would be much more difficult As shown in the preceding section describing the segregation and recombination of characters, nine plants out of the sixteen possible combinations would have red, reversed fruits, while only one of the nine would be pure with reference to both of these characters The breeder would thus be compelled to self-fertilize a number of the plants having red and reversed fruits and grow a number of plants from each in order to determine which one, if any, was pure with reference to both characters. If, then, the progeny from any one of the plants chosen and self-fertilized came true to type with reference to both characters, he would be certain of its purity and would again self-fertilize some of the best plants of this progeny, which should give him a pure type.

If a combination of a dominant and recessive character is desired, the examination of the F_2 hybrids would enable the breeder to choose a pure plant so far as the recessive character is concerned, but he could not determine the purity of the dominant character and would be compelled to self a number of plants exhibiting the two characters and grow progenies in the third

generation, when he should be able to select a pure type with reference to both characters

If, as frequently occurs, neither character of an allelomorphic pair is dominant, but gives in the hybrid an intermediate form, the fixation becomes simple, as in such cases those hybrids in which either character is pure can be recognized.

While these methods appear very complex at first, they will be easily understood with careful study, and are far simpler than the methods breeders were compelled to employ in fixing hybrids before they had an understanding of Mendel's law.

When more than two characters are concerned in the recombination, the process becomes more difficult, and indeed one cannot limit one's consideration to two characters in practical breeding unless one is combining standard varieties where all characters are good As in simple selection work, one must necessarily consider all important characters that go to make up a good variety, and usually one will be able to recognize Mendelian segregation only in a few prominent differential characters The breeder should use the knowledge of inheritance that he possesses with all characters which he can recognize, but at the same time the plants which he inbreeds to secure purity of type should be perfect plants of all-round good type, and in every generation of the hybrids grown he should exercise his best judgment in selecting the best plants for seed-bearers

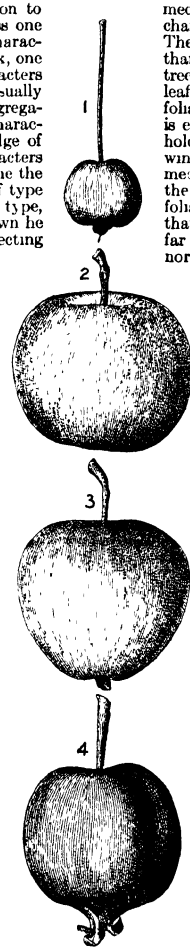
In the fixation of cotton hybrids, the policy was pursued of selecting for inbreeding the most fruitful and best-shaped plants of those hybrids having the desired characters, using very large numbers of hybrids from which to choose The self-fertilized seed of a certain type was then planted by the plant-to-row selection method in an isolated plat, in order to give an opportunity to select not only the pure combination of the desired characters but the best all-round plants As soon as the plants in such an isolated plat were sufficiently developed to show their characters and it could be recognized that certain ones had inherited the desired qualities, the fields were carefully searched and all plants not true to type were pulled up, leaving only a few good plants of the correct type This process of roguing, as the seedsmen call it, insures that at least the greater part of the seed developed would be fertilized with pollen of similar plants of good type. This sort of selection and purification of type will probably in most cases be found necessary even after such Mendelian characters as can be recognized have been secured in a pure state.

The inheritance of many fundamental characters will doubtless remain obscure for many years.

The use of impure first-generation hybrids.

In the case of very many of the most important horticultural crops, fortunately, it is possible to use hybrids without the necessity of purifying or fixing them as described in the last section. Plants such as apples, pears, oranges, grapes, roses and strawberries, which are grown as clonal varieties, being propagated by buds, grafts or slips, are merely parts of one individual and it does not matter whether they are germinally pure, as seeds are not needed This makes it possible to use F_1 hybrids and, as hybrids are notoriously vigorous, this is a factor of very great importance. Again, characters which blend and give intermediates in the F_1 generation may, in such cases, prove very valuable

The work that has been carried out by the Department of Agriculture in the breeding of citrus fruits very clearly indicates that valuable intermediates may sometimes be secured The writer, in conjunction with Walter T Swingle, hybridized the hardy cold-resistant trifoliate orange (*Poncirus trifoliata*) with several varieties of the tender sweet orange, and as a result at least five different varieties of hardy oranges or citranges have been produced These hybrids are nearly intermediate between the two parents, having the characters in the first generation nearly blended. The leaves are trifoliolate, but are much larger than the leaves of the ordinary trifoliate orange tree, and show a tendency to drop off, the lateral leaflets producing an unifoliolate leaf The trifoliate orange is deciduous, while the sweet orange is evergreen. The hybrids are semi-deciduous, holding a large share of their leaves through the winter In hardiness they also seem to be intermediate, being much more cold-resistant than the ordinary orange, but not so hardy as the trifoliate orange They are sufficiently hardy so that they doubtless may be grown with safety as far north as South Carolina, or 300 to 400 miles north of the present orange region. Some of the fruits produced are as large as the ordinary orange, but most of them are very nearly intermediate in size. They are very variable, however, in the first generation At least five of the fruits that have been produced are juicy and valuable It is not probable that they would be reproduced true to seed, but orange varieties are clons, and the different types will, of course, be normally reproduced by buds or grafts, so that from a practical standpoint it does not matter whether or not they would reproduce true through the seed. In the second generation it is probable that these different characters would split up, possibly according to Mendel's law, and it is likely that still more valuable varieties will be secured when a second generation has been grown See *Citrange*



648 Pyrus baccata above, and three named crosses with forms of P Malus,—Alberta, Columbia and Robin respectively from top to bottom. (×⅔)

Similar groups of valuable intermediate types of fruits have been produced by Wm Saunders, until recently the Director of the Canadian Experimental Farms, by crossing varieties of the ordinary apple, such as the Pewaukee and Wealthy, with a very hardy cold-resistant crab (*Pyrus baccata*). Saunders has produced already numerous hardy intermediate types which bid fair to be of very great economic value, particularly in the cold regions of Manitoba and Saskatchewan (Fig 648) Second generation seedlings of these valuable types may be expected to yield still more important improvements

The reproduction of such unfixed hybrids may be said to form the basis of fruit-culture, as all of the apple, peach, pear, plum, orange, lemon and grape varieties, as well as the varieties of small fruits, are of mixed parentage and do not reproduce true to seed. Most of the varieties of these fruits are either known to be hybrids or are superior seedlings that have been selected and propagated. These latter, doubtless, in the

greater number of cases were of hybrid nature as all of these fruits are normally cross-fertilized and natural hybridization is exceedingly common

The same may be said of most flowers, such as carnations and roses, that are cultivated extensively for the cut-flower trade. Practically all of the varieties are unfixed hybrids.

The selection of bud-variations.

No consideration of the methods of plant-breeding would be complete without a mention of the improvements that can be produced by what may be termed the selection of bud-variations While, in general, all buds of a plant are practically the same, as is shown by the fact that buds taken from the Baldwin apple almost uniformly produce Baldwin apples, yet there is considerable variation frequently in the product from different buds, and it is evident that bud-variations may be classified like seedling-variations, into fluctuations and mutations or the so-called bud-sports (Fig 649)



649. Bud sport of Cupressus to fastigiate type, with branch of similar fastigiate variety on right.

Hybrid plants also frequently, for some cause, show segregations of characters in different buds similar to the segregations shown in F_2 hybrid seedlings It would thus seem natural to suppose that these variations could be utilized in producing new varieties much as the similar types of seedling-variations are used

In violets, for example, the propagation is normally by slips that are developed from different buds These slips when grown into plants frequently show considerable difference, and B T. Galloway and P H. Dorsett, of the national Department of Agriculture, have demonstrated that by the selection of slips from plants which are very productive the yield in the number of flowers to the plant can be increased considerably In the case of the orange, seedling trees are almost always very thorny, yet certain branches may show a tendency to be more nearly thornless, and by the selection of buds from such branches the thorny character of almost all the standard varieties has been reduced By the systematic selection of vegetative parts, such as buds, slips, suckers, and the like, in many cases very important improvements could doubtless be secured, and the plant-breeder should have a thorough understanding of this method of improvement. In hybrids of mixed parentage, frequently a bud on one side of a plant will sport, showing different tendencies, and many of our new varieties of roses, chrysanthemums and carnations have been produced by the selection of such bud-sports. Many standard varieties of carnations have produced bud-variations that have proved valuable; the Lawson has given rise to the Red Lawson and White Lawson, the Enchantress has produced the Pink Enchantress and White Enchantress The practice of exercising care in choice of chrysanthemum or carnation cuttings and of cions for fruit trees is, therefore, seen to rest on rational reasons

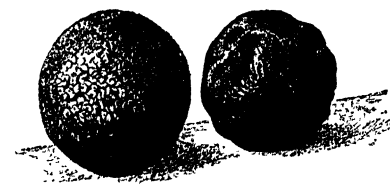
Variations in the character of the seed from different bolls, in the case of hybrid cottons, are frequently found and may be of value to the breeder even in cotton that is propagated by seed In the study of cotton, similar bud-variations have been found, showing in the lint characters of hybrids In a number of instances, certain bolls have been found which produced much longer lint than other bolls on the same plant, and similar variations in strength and uniformity of length have been observed Experiments indicate that such variations, which are doubtless to be classed as bud-variations, are inherited in considerable degree This being the case even in seed-propagated plants, it becomes desirable to observe and search for bud-variations

The importance of bud-selection in oranges and lemons has recently been called to attention by the investigations of A D Shamel, of the United States Department of Agriculture It has been found that groves planted with the Bahia or Washington Navel, which is grown extensively in California, frequently show a number of different types with reference to productiveness and form of fruit and that these conditions remain the same from year to year The same has been found to be the case also in lemon groves, several distinct types not infrequently being produced on the same tree (Fig 650) These barren trees, and trees producing poor fruit, greatly reduce the production of the grove and in many cases are a serious handicap Evidence has been collected showing that when buds are taken from productive trees of good type they may ordinarily be expected to produce good types

In experiments which have been conducted during the last six years in the selection of potatoes, it has been clearly demonstrated that, in a family of potatoes developed from a single tuber and thus positively known to be pure, low- and high-yielding strains can be produced by selecting from low- and high-yielding hills (Fig 651) Such low- and high-yielding strains have now maintained themselves for three years in over thirty different cases representing work with eighteen different varieties.

The importance of bud-selection is only beginning to be realized and further data is necessary before it can be determined how important this is in different cases The evidence now at hand, however, clearly indicates that this method of improving plants should be given careful consideration. H J WEBBER

BREVOÒRTIA (J Carson Brevoort, naturalist, Regent N Y State University) *Liliàceæ* Differs from Brodiæa in the long-tubular and 6-saccate corolla stamens 3, with 3 broad and truncate staminodia caps. stalked —One species



650 Two types of fruit, good and poor, borne on same tree of the Eureka lemon.

Ida-Màia, Wood (*B. coccínea*, Wats. *Brodiæa coccínea*, Gray). FLORAL FIRE-CRACKER Lvs. slender, grassy scapes slender, 1–3 ft. high, with 3–6 pendulous tubular-saccate fls 1–2 in long, which are brilliant crimson-red, tipped with pea-green. N Calif. to Ore in wooded foothills. B M 5857. G.C III 20 687. Gn 46, p. 503 —The fls. are very lasting and beautiful.

Half-hardy. Needs partial shade and a deep, loose soil, thoroughly drained, and with some leaf-mold. Corm the size of a nutmeg. CARL PURDY.

BREWÈRIA (Samuel Brewer was an English botanist of 18th century). *Convolvulàceæ* Perennial herbs, rarely somewhat woody: fls much like those of Convolvulus but the styles distinct or partly so, the corolla



651 Low- and high-yielding strains of Rural New Yorker potato developed by hill-selection within the progeny of a single tuber

pubescent outside in the bud lvs simple, entire.—Trailing plants of 30 or more species in warm climates.

grandiflòra, Gray Root tuberous st pubescent. lvs. broad-ovate or oblong-ovate and very short-stalked. peduncles 1-fld , fl very large (3 in long), bright blue and showy, funnel-shaped caps large and globose-ovoid or ovoid Fla —Intro by Reasoner Bros One species of Breweria (*B Pickeringii*, Gray) occurs from N J and Ill. south, and a few other species are also native farther south in the U. S N TAYLOR †

BREŸNIA (for J P Breyn, a German botanist of 17th century) *Euphorbiàceæ* Tropical shrubs or trees, rarely cult Lvs alternate, simple. fls small, in short axillary clusters, monœcious, apetalous, calyx imbricate, styles 2-parted fr a red berry Related to Phyllanthus about 15 species in Trop Asia and Pacific Isls *B turbinàta* (*Phyllanthus turbinatus*, Sims). B M 1862. L B C. 8 731, may be the same as *Andrachne fruticosa*. J B S NORTON

BRICKÉLLIA (Dr John Brickell, an early American naturalist) *Coleosanthus*, Cass *Compósitæ* About 40 species of herbs or small shrubs in the warmer parts of the U. S and Mex , only one of which seems to be in the trade. Somewhat allied to Eupatorium, from which it differs in having 10-ribbed achenes Lvs veiny, either opposite or alternate: fls white, cream-colored or flesh-colored, small, with pappus either scale-like or somewhat plumose, involucral bracts striate-nerved: achenes striate Prop by cuttings under a bell-jar.

grandiflòra, Nutt TASSEL FLOWER Nearly glabrous, 2–3 ft , branchy above lvs triangular-cordate or triangular-lanceolate above, coarsely toothed: heads about 40-fld , drooping, in large panicles, tassel-shaped and yellowish white. Rocky Mts.—Recommended for moist shady borders, and best grown in a mixture of leaf-mold, loam and sand. N. TAYLOR.†

BRIDAL WREATH: *Spiræa prunifolia*

BRIER. In America, commonly applied to brambles or thorny plants of the genus Rubus, especially blackberries In the Old World, it is applied to large wild-growing roses

BRITISH NORTH AMERICA, Horticulture in. The vast territory of British North America, as understood in this article, comprises the Colony of Newfoundland and the Dominion of Canada. Much of the territory is so little developed horticulturally, and most of the provinces are so very large, that rather extended attention is given here to the adaptabilities of the different political divisions The map (Fig 652, page 560) shows the outlines of the territory under consideration, and its relation to the northernmost part of the U S

Horticulture in Newfoundland has so far not developed to a great extent and the island is not thought of as a horticultural region, but the colony has great possibilities in this direction The winter temperatures are not so low as in some parts of Canada where apple trees grow well; and with care and protection from wind the hardiest summer and autumn varieties can be grown. The Canada plum (*Prunus nigra*) is a native of the southern part of the island and no doubt good varieties of this could be produced The European or domestic plums can also be grown successfully near the coast where protected from the high winds, but owing to the moist air they are very liable to become covered with moss and lichens Bush-fruits thrive, and strawberries and gooseberries succeed particularly well, and English varieties of both these fruits, which do so poorly in Canada on account of the hot, dry summers, are giving admirable results In winter the plants are well protected by a deep covering of snow The hardier vegetables flourish, and large quantities of potatoes are grown by the settlers

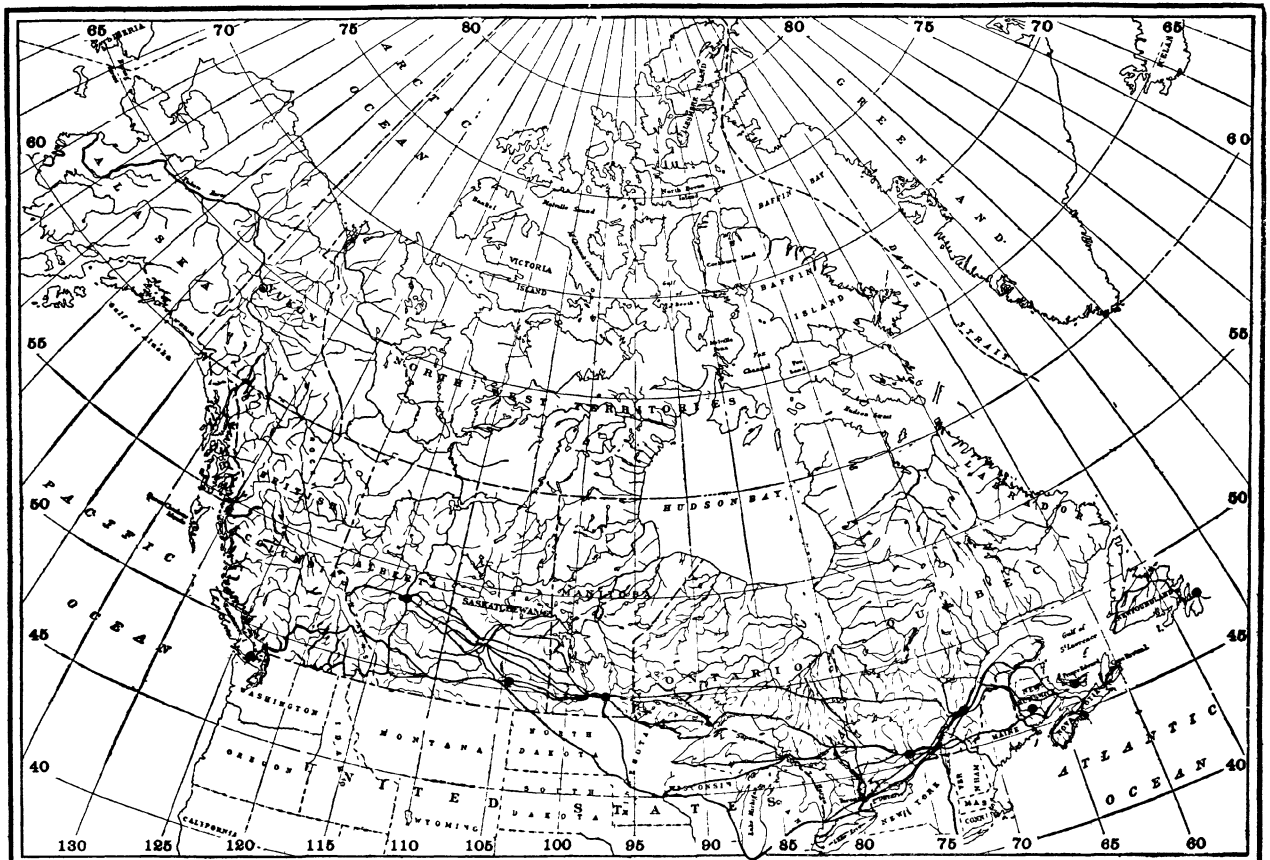
Owing to the relatively moist summer, annuals and herbaceous perennials do particularly well, it being possible to have almost or quite as beautiful a garden there as in eastern Canada

In the Dominion of Canada, horticulture has become one of the most important industries In fruit-growing, in floriculture, in vegetable-culture and in the beautifying of cities, towns, and private grounds, Canadians are fully alive to the possibilities of their country, and the rapid development of horticulture in all its branches is an indication of the success that has attended those engaged in its pursuits

The history of horticulture in Canada dates from the early settlement at Annapolis Royal in Acadia, now Nova Scotia, in 1605, and from the founding of the city of Quebec, now in the province of Quebec, in 1608 There is a definite statement as early as 1663 that apple trees were growing near the banks of some of the rivers in Acadia. There are also records of trees growing in the province of Quebec about that time In the province of Ontario, it was about the beginning of the eighteenth century before horticulture began appreciably to develop, while in British Columbia, which has made such rapid advances in recent years, fruit trees were not planted until about the middle of the nineteenth century Owing to inadequate means of transportation, the development of fruit-culture was not rapid in any part of Canada until within the past half-century, but now the extension of orchards, small fruit-plantations, glasshouses, and truck-farms is very marked every year

The census of Canada for 1911 gives the following figures Total number of fruit trees in Canada, 20,812,556, area occupied by fruit trees in Canada, 376,322 acres, estimated capital value of fruit trees in Canada, $127,000,000. The quantity of fruit grown in Canada is not known, but the Trade and Navigation Returns for the year ending March 31, 1912, show the exports of fruit from all ports to be:

	Value
Dried apples, 3,149,620 pounds	$248,035
Fresh apples. 1,664,165 barrels	5,104,107
Berries	106,486
All other fruits	159,293
Canned and preserved fruits	257,590



652. British North America, showing Newfoundland, the nine Canadian provinces, and the vast territory beyond.

The larger proportion of this fruit is produced in the provinces of Ontario and Nova Scotia, but rapidly increasing quantities are grown in British Columbia.

The fruit areas of Canada are large enough to supply Canada and a large part of the world with some kinds of fruit, and particularly with the apple, for many years to come In the great province of Ontario, 220,000 square miles in area, larger than the states of New York, Ohio, Illinois and Michigan together, there are large districts in which apples, pears, peaches, plums, cherries, grapes and the small fruits can be grown to perfection. The province of Quebec is considerably larger than Ontario, and while the tender fruits do not succeed except in the most favored parts, apples are grown in large quantities yearly From east to west in the provinces of Quebec and Ontario there is a belt of about 700 miles in length in which apples and other hardy fruits can be grown; while in the province of Ontario alone the best winter apples, pears, and plums can be grown successfully over an area about 350 miles long and 30 to 150 miles in width. The successful cultivation of peaches in Ontario is confined to the Niagara district and to points along Lake Erie and Lake Huron, but the area suitable for this fruit is extensive enough to supply a large population.

Nova Scotia has long been noted for its apples. The most favored districts are the Annapolis and Cornwallis valleys, where apples, pears, plums and cherries can be grown and where even peaches can be successfully raised These valleys have a total length of about 100 miles and vary in width from 6 to 11 miles Fruit-culture is not confined to this district, as over most of the province the hardier fruits can be grown successfully New Brunswick has not yet developed a fruit industry to any great extent, but in some of the valleys apples and other hardy fruits of the finest appearance and best quality can be produced In recent years there has been a marked awakening in this province and, owing to the cheapness of land and the beauty and quality of the fruits that can be produced, there would seem to be a good future for horticulture

Prince Edward Island, the smallest province of the Dominion, produces excellent tree fruits, and, owing to the late season, the apples keep better than in any other part of the Dominion Means of transportation are not yet good, but it is hoped that this will soon be much improved

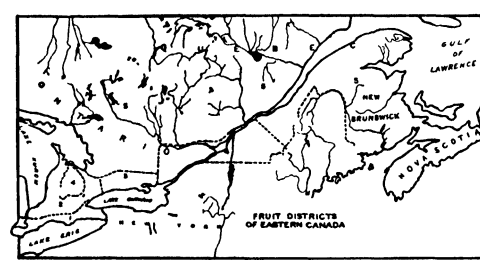
British Columbia, the area of which is about 370,000 square miles, or more than twice the size of California, has large sections admirably adapted to fruits Like the states of Oregon and Washington, with which its natural conditions may be compared, British Columbia has a number of districts with special conditions. Three of these are, (1) that in the damp coast climate of Vancouver Island and the Lower Mainland, (2) in the dry interior country where irrigation is, as a rule, necessary; (3) in the Kootenays, east and west, where irrigation is necessary only in places. In these districts all the best fruits, including peaches in some places, can be grown to great advantage. There are, however, many valleys that are being found suitable for fruit-culture, varying much in climate and extending from the American boundary far north.

British Columbia is expending its efforts mainly to supplying the prairie provinces of Canada; and it has been very successful in placing fruits on these markets in good condition. The trade abroad is growing also. Ontario is a close competitor of British Columbia for the prairie trade, but the increase in population is so rapid that it will require both provinces to supply the demands for a long time to come.

The prairie provinces of Manitoba, Saskatchewan and Alberta and the great territories to the north produce excellent bush fruits, but the tree fruits have for the most part not done well up to the present, although the hardiest varieties of apples succeed in some of the more favored localities and plums are native to Manitoba and the early varieties can be grown successfully over a wide area

Some of the influences affecting Canadian horticulture may be mentioned. The Dominion Experimental Farms, now sixteen in number, work upon which was begun twenty-five years ago, have played an important part. There are six Provincial Agricultural Colleges, all of which have Experiment Stations that disseminate information both through the students and by literature. The Provincial Experiment Stations and demonstration orchards are also doing much to explain the possibilities of fruit-culture in their several districts Seven Provincial Fruit Growers' Associations lend their aid in spreading a knowledge of the best methods of fruit-culture and of uniting the growers in cooperation and legislation The horticultural periodical literature of Canada, although represented by few papers, has done much to aid fruit-, flower- and vegetable-growers.

The Farmers' Institute and orchard meetings organized by the Provincial Governments and assisted by the Dominion Government, are very practical and helpful. In the province of Ontario, a large proportion of the



653. The fruit regions in eastern Canada.

counties have the District Representative, a Government official whose duty it is to instruct the people by word, by experiment and by demonstration

The horticultural societies assisted by the Provincial Government, of which there are seventy-five in Ontario, are doing excellent work in awakening a greater interest in horticulture and in spreading information, especially in regard to ornamental plants

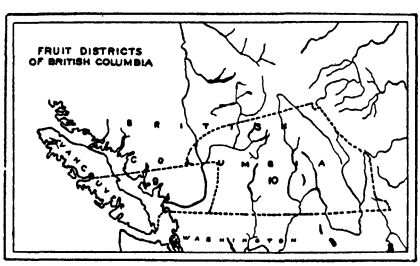
The apples originated by Wm Saunders in crossing the wild Siberian crab-apple, *Pyrus baccata*, and the varieties of the apple, have enabled the settlers in the prairie provinces to grow at least small apples where larger ones do not succeed; and the larger-fruited varieties obtained by Saunders, by introducing more of the blood of the apple into the first crosses, are now being tested for hardiness, and, if found worthy, will mark a step in advance.

All these factors affecting horticultural conditions and progress have been made still more effective by the cooperative movement that has in recent years made much progress in Canada. In the provinces of Ontario and Nova Scotia are many cooperative associations that now have central organizations where plans affecting the welfare of all the associations are discussed. These associations are doing much to make the fruit marketed of more uniform character and to bring better returns to the producer. One of the best influences in the improvement of horticultural products in Canada is the Fruit Marks Act (now the Inspection and Sales Act) passed in 1901, and operative over the whole of Canada. By this Act, growers are compelled to pack

their fruit according to certain standards and are liable to fine if they do not do so. Inspectors are stationed at packing-houses, on the markets, and at the ports of export, who examine the fruit to determine whether it is packed according to law A marked improvement has been noticed in the Canadian fruit exported since this law went into effect. There are also standard barrels, boxes and baskets for the whole of Canada

While floriculture is growing very rapidly, the area under glass in Canada is not very large yet, it being estimated at about 120 acres or 6,000,000 square feet in 1912 The estimated capital invested is $1,500,000 and the value of the output $1,800,000 The flowers most grown under glass in Canada are carnations and roses, although many other kinds are also raised Some of the Canadian growers have an international reputation for the quality of the flowers they produce The official organ of the florists in Canada is "The Canadian Florist," a trade paper published every two weeks

Many kinds of vegetables succeed admirably in Canada and there are a large number of skillful growers. Owing to the rapid development of the larger cities and the many new towns in the newly settled parts, there are many openings for market-gardeners Large quantities of vegetables, including particularly tomatoes and corn, are grown for the canning factories in southwestern Ontario where the season is earlier than in any other part of eastern Canada. Early vegetables are



654. The fruit region (within dotted lines) in British Columbia.

grown on a large scale, and have proved very profitable to those engaged in the business Perhaps the most noted vegetable grown in Canada is the Montreal muskmelon, which is well known for its high quality in many cities of the United States The production of such a high-class melon is a good indication of the summer climate of Canada, which in many parts is hot enough to mature melons well The market-gardeners are represented in Ontario by the Provincial Vegetable Growers' Association, branches of which are to be found in a number of the cities and towns. This organization has done much to assist market-gardeners and to make them feel that their calling is as important as any other branch of agriculture. W. T. Macoun.

Nova Scotia.

Nova Scotia (Fig 655) is a peninsula on the extreme eastern side of Canada. It extends in a northeasterly and southwesterly direction and is crossed by the forty-fifth parallel of north latitude. No part of the interior is more than 30 miles from the sea The surface is gently undulating, with no high mountain ranges The principal farming and fruit-growing sections are mainly in the valleys through which the rivers run and around the headwaters of the Bay of Fundy, where the high tides have left extensive deposits of rich alluvial soil The annual rainfall is about 42 inches.

The French Acadians early made plantings of the apple in this province When the New England settlers came, in 1761, to occupy the lands of the deported French, they found apple trees in bearing, many of which lived and continued to bear fruit well along into the last century. The leading horticultural industry is fruit-growing. Its most important division is apple-culture, although pears, plums, cherries and small fruits are successfully grown These soft fruits are necessarily sold in the local markets, which, though steadily growing in size, are as yet of too limited capacity to justify an extensive development of the culture of such perishable products Apples, on the other hand, are shipped to the British and other foreign markets where, in their season, they successfully compete with those from other parts of the northern hemisphere.

The strictly horticultural region of Nova Scotia is a small section of the western part of the province generally called the Annapolis Valley. This region, except in its extreme eastern part, is separated from the Bay of Fundy and protected from the direct force of the northerly and westerly winds by a range of hills, some 400 to 500 feet in height, known as the North Mountain It includes the valley of the Annapolis River, which flows southwesterly to the Annapolis Basin, and the valleys of the Pereaux, Habitant, Canard, Cornwallis, Gaspereau and Avon Rivers, which flow into Minas Basin on the east It is a narrow strip of country 6 to 10 miles wide and less than 100 miles long

Here apple-culture, from being a side line to general farming down to about forty years ago, has grown to be the leading branch of agriculture. The yield of apples in this district, packed and sold in 1911, was 1,734,000 barrels The yield for 1912 is estimated at 1,100,000 barrels These figures do not include, in either case, those that were used by the canneries, evaporators and vinegar factories, or that were consumed in the district in which grown About one-tenth of the output finds a market in the towns and the villages of the non-fruit-growing sections of the maritime provinces, the remainder being exported to Great Britain, Germany and other European countries, and to Newfoundland, the Canadian West, the West Indies and South Africa The varieties of apples grown have been selected chiefly with reference to the English market The leading commercial sorts are Gravenstein, Blenheim, Ribston, King, Yellow Bellflower, Cox Orange, Wagener, Baldwin, Stark, Spy, Golden Russet, Fallawater, Roxbury Russet and Ben Davis Some of these have long been known in England and were introduced from that country The Gravenstein, especially, reaches a high quality here The winter varieties also do well and mature just as the cool weather of autumn comes on

As a rule, orchards are carefully cultivated, fertilized, pruned and sprayed A large quantity of commercial fertilizer is used every year, as the area in orchards has outgrown the supply of stable manure Cover-crops are grown to furnish humus, the clovers, vetches and buckwheat being the crops chiefly used for this purpose The practice of thinning apples has lately been adopted by many of the best growers and is likely to become more general as competition in fruit-raising increases

A system of frost-proof apple warehouses, that has come into existence during the last sixteen years, is an important element in the carrying-on of the fruit business in Nova Scotia These—numbering one hundred in all—are found at the railway stations throughout the fruit district The usual width is about 40 feet, the length from 80 to 120 feet, affording room for packing and storage for 5,000 to 10,000 barrels. Formerly, the fruit-grower packed his apples at home, or in his barn Then, when a steamer was ready to load at Halifax, the apples had to be hauled to the railroad station, often several miles distant, and loaded into the waiting cars. Now the apples are generally taken in barrels directly from the orchard to the warehouse where they are stored until ready to be packed out for shipment.



XVIII. Canadian orchard development.—The tidewater country in Nova Scotia.

Under this system, it is possible with very little delay to pack and place on cars a steamer-load of apples. A railway haul of four or five hours brings the cars to the side of the steamer so that the danger from frost, even in zero weather, is largely avoided

A further advance was made in the business of packing and marketing apples when cooperative fruit companies were formed. The first company of this kind was organized in Berwick in 1907. During the next five years, more than thirty similar companies were formed Under provincial legislation enacted in 1912, these were organized into a central association known as the United Fruit Companies of Nova Scotia, Limited All the apples of the companies affiliated in this central association are sold through its agency It controls the sale of fully one-half of the apple crop of the province A uniform standard of grading is maintained, an official of the central association inspecting the packing in all the warehouses of the affiliated companies Cooperation in the marketing of apples was quickly followed by the cooperative manufacture of barrels and purchase of fertilizers, feeds and seeds, greatly to the convenience and financial advantage of the members of the companies In the near future, all farmers' supplies will probably be purchased cooperatively

The establishment of evaporators, canneries and vinegar factories throughout the fruit district, some of them owned by cooperative companies, furnishes a market for defective fruit and has also the effect of improving the grade of apples packed There are now eight evaporators, two canneries and four vinegar factories in operation.

Local nurseries, chiefly for the propagation of apple trees, are to be found at Annapolis, Berwick, Waterville and Wolfville While these have received good patronage in the past, the larger quantity of nursery stock in recent years has been imported, chiefly from Ontario With a view to avoiding the danger of introducing noxious insects and plant diseases, the provincial department of agriculture has lately passed strict regulations governing the importation of nursery stock The effect of this has been to stimulate the home nursery industry

Pears, plums and cherries are grown for home use and the local markets Bartlett and Clapp Favorite are the varieties of pears most largely grown Moore Arctic, Lombard, Yellow Egg, the Gages, Damsons and Burbank are the chief plums The cherries are the Morello and other varieties of the sour type Peaches are grown to some extent in the western part of the province, Alexander, Early Canada and Fitzgerald proving hardy

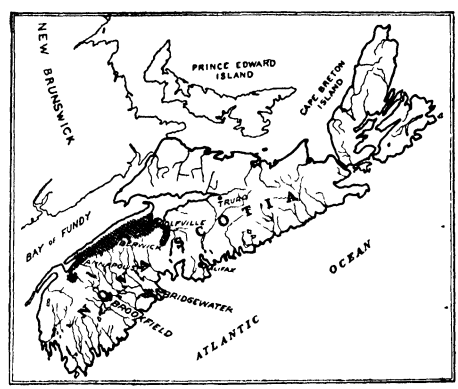
Cranberries constitute an important part of the fruit crop of Nova Scotia They are grown on reclaimed bog lands that would be unsuitable for any other farm crop There is much land of this kind in the province still unused In 1908, the cranberry crop in the vicinity of one railway station, Auburn, amounted to nearly 5,000 barrels and netted the growers $25,000 A good market for Nova Scotia berries is found in Montreal and the Canadian West

Truck-gardening is conducted to some extent on the light sandy soil of the central part of the Annapolis Valley In the vicinity of Berwick, Aylesford, and Kingston, such crops as strawberries, raspberries, tomatoes, green beans, asparagus and rhubarb, are grown for the local markets. Some of the tomatoes go to the cannery.

Only one important variety of apple originated in Nova Scotia, the Banks Red, a bud-sport of the Gravenstein. John Burbidge, who settled in the Cornwallis Valley in 1764 introduced the Nonpareil (Roxbury Russet) Charles Inglis, first Bishop of Nova Scotia, who received a grant of land in Aylesford Township, in 1790, introduced the Yellow Bellflower, which thence came to be known here as Bishop Pippin Charles R Prescott introduced Ribston in 1814, Blenheim in 1829, Gravenstein and Alexander in 1835, Baldwin and Greening in 1820 and Northern Spy shortly after 1852.

The Nova Scotia Fruit-Growers' Association, founded in 1863, is the oldest in the Dominion, and receives an annual grant from the provincial government For several years it assisted in maintaining a school of horticulture at Wolfville In 1905, this school was merged into the College of Agriculture at Truro.

In 1911, a fruit experiment station was established at Kentville This is maintained by the federal government at Ottawa The provincial government has established thirty-five demonstration orchards in parts of the province outside the fruit district proper The purpose of these orchards is to discover the fruit-growing possibilities of the different sections of the province, to find out the varieties best suited to these sections, and to give a demonstration of what orchard practice is considered most effective in such localities Horticulture is taught at the Agricultural College which was established at Truro in 1905. PERCY J. SHAW.



655 Nova Scotia, showing the present fruit district and two centers (Bridgewater and Brookfield), where the industry is beginning to develop.

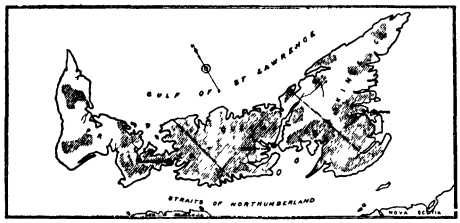
Prince Edward Island.

In the Gulf of St Lawrence, and separated from the continent by the Northumberland Strait, lies the province of Prince Edward Island (Fig. 656), the "low and beautiful land" that Cartier saw on the afternoon of June 30, 1534. It is situated between 46° and 47° 7′ north latitude and east of 64° 27′ west longitude, and is distant from New Brunswick 9 miles, from Nova Scotia 15 miles and from Cape Breton 30 miles. In form, it is an irregular crescent, concaved toward the north with such an exceedingly indented coastline that no part of the country is far distant from the sea. Sand-dunes extend along the north shore for a distance of 50 miles The surface is gently undulating Ranges of low hills traverse the island from New London to Hampton, from Brooklyn to Wood Islands, and from Red Point to Rollo Bay. The highest elevation is less than 300 feet. Small flat areas occur in the western part of Prince Co.

The climate is temperate and not subject to rapid changes For the past five years, the average temperature during the winter months was 36.6°, the lowest registered being −19 5°, and during the summer months 70°, with 86 5° the highest The yearly precipitation varies from 38 to 42 inches, a little less than half falling during the months May to October in light showers at more or less regular intervals

The whole population is engaged in agriculture and fishing and in the merchandise connected therewith Horticulture is yet in its infancy and only very few of the inhabitants have begun to realize its possibilities.

Nearly every farmer has a few trees producing sufficient apples for his own family. But few have seriously



656. Prince Edward Island The shaded parts are horticultural sections.

considered apple-growing as a revenue-producing branch of agriculture. The first trees were planted shortly after the English occupation in 1763 The stock was brought out from the Old Country and was nearly all of the cider varieties On this account it was generally believed that good apples could not be grown in this province. For over a century very little improvement was made.

The development of the apple industry in Nova Scotia stimulated the planting of more trees in Prince Edward Island and led to the setting out of nurseries in 1886 by William Taylor at Lower Freetown and by Condon at Kensington They received a great many orders for trees but the orders were so small (very few people wanting more than half a dozen) that there was not much profit in the business and it was not continued.

A few men, however, were enthusiastic over the possibilities of fruit-growing and at the call of Lieutenant-Governor Howlan met in Charlottetown on March 30, 1896, and formed the Fruit-Growers' Association of Prince Edward Island It received the encouragement of the Department of Agriculture and was given an annual grant of $100, for the purpose of holding a fruit show.

This again gave a further stimulus to tree-planting, and nurseries were set out by D A. Sharp at Summerside, Thomas Moyse at Central Bedeque and John Robertson at New Perth. Many trees were sold but the business does not seem to have been very profitable, and at the present time all the stock is imported. A few men, however, set out commercial orchards and between the years 1897 to 1900 some shipments of apples were made to the British market It was very difficult, however, to find more than a few barrels of one variety in a district This added very much to the expense of packing and shipping, and as the business was at best very uncertain, it was soon given up.

In 1909 the Cooperative Fruit Company was formed. The purpose was to provide proper packages and to get together sufficient quantities of apples of one variety to make a profitable shipment The Department of Agriculture provides the Company with a secretary and makes a small annual grant, sufficient to cover truckage expenses.

In 1909, eighty-four barrels were shipped, in 1910, some 350 barrels. The expenses of getting their apples together, graded, properly packed and marketed were too great and in 1911 each grower shipped his own This, however, proved even less satisfactory and the Company is preparing to pack again this autumn. They hope, however, to get a number of barrels of apples together at certain centers, and with this end in view, all the orchards in these vicinities are being sprayed

For a number of years the question of varieties has been taken up by the Fruit-Growers Association. The following are now recommended: For home orchard—Yellow Transparent, Crimson Beauty, Duchess of Oldenburg, Wealthy, Wagener, King, Northern Spy, McIntosh Red, and Stark For commercial orchard—Wealthy, Alexander or Wolf River, McIntosh Red, Ribston Pippin and Ben Davis

The feeling is general that the next few years will witness a great development of the apple industry in Prince Edward Island

Very few pear trees have been planted, but when given good cultivation and properly sprayed, they have done well The most popular varieties are Clapp Favorite, Bartlett, Vermont Beauty, Flemish Beauty, Howell and Anjou

The cool, moist climate of Prince Edward Island favors the growing of plums of the very finest quality, and of late years quite a number of trees have been set out Among the varieties best suited to Island conditions are Glass Seedling, Moore Arctic, Quackenboss, Yellow Egg, Victoria, Bradshaw, Prince Englebert and Blue Damson

Cherry trees were introduced by the early French settlers and, as they were able to take care of themselves, met with great success Nearly every farmstead has a few trees The crop is, however, very uncertain, as a late frost catches the blossoms about every third year They are nearly all sour cherries of the Richmond and Montmorency varieties. In a few orchards sweet cherries are being tried with indifferent success. They bloom too early and are caught by the frost

Grass lands that have not been manured with mussel mud invariably grow a crop of strawberries in every part of the province The increased cost of labor has made the picking of the wild ones unprofitable and for the last few years the cultivated varieties have taken their place on the market From 8,000 to 10,000 boxes to the acre is considered an average crop Some progressive farmers have had very large returns from strawberry-growing, with the result that prospects are very bright for a large industry The chief varieties grown at the present time are Splendid, Glen Mary, Senator Dunlap, Williams and Wilson

Among the bush fruits, raspberries and blackberries are being cultivated but not to the same extent as gooseberries and currants, which are in greater demand. All, however, are being grown very successfully Dewberries are not grown to any extent They have been introduced at the Experimental Farm and their cultivation will likely be extended

As wild strawberries are found in the higher grasslands, wild cranberries are found in the bog-lands and marshes In a few districts they are being cultivated and giving very large returns. When the plantation can be flooded, the crop is fairly sure, but when it cannot be flooded the frost frequently does much damage. The average crop is about eighty bushels to the acre.

There are several thousand acres of blueberry barrens in the province, from which about twenty carloads of berries are shipped annually They do not, however, seem to improve by cultivation and the increasing cost of labor will likely lessen the amount marketed Now and again the crop is a comparative failure, due to frost or to severe drought.

Prince Edward Island is peculiarly adapted to the growing of fruit The reason that more progress has not been made is the inadequate transportation facilities. Last year, however, arrangements were made for three calls of an ocean steamship at Charlottetown on the way from Montreal to Manchester The car ferry, also, that is about to be built between Carleton and Cape Tormentine will further help to overcome this difficulty, and it is expected that the next few years will witness a great development in horticulture in this

province. The census returns for 1911 give the following figures of the industry:

	No	Product
Apple trees	205,979	160,124 bushels
Peach trees	546	13 bushels
Pear trees	2,439	773 bushels
Plum trees	20,625	27,480 bushels
Cherry trees	53,094	7,576 bushels
Other fruit trees	9,998	1,479 bushels
Grapes		1,641 pounds
Strawberries		186,692 boxes
Currants and gooseberries		48,429 quarts
Other small fruits		1,860 boxes

THEODORE ROSS.

New Brunswick.

The province of New Brunswick (Fig 657) lies mainly between 45° and 48° north latitude, and 64° and 68° west longitude Its boundaries are. On the south the Bay of Fundy, on the east the Strait of Northumberland and the Gulf of St Lawrence, on the north the Bay of Chaleur and the province of Quebec, on the west the state of Maine The greatest length of the province from north to south is 230 miles, and its greatest breadth is 190 miles It has an area of 27,985 square miles and about 600 miles of seacoast It is a rolling country of no great elevations with the more hilly sections formed by an extension of the Appalachian Mountains in the northern and northwestern parts of the province Few countries are so well watered as New Brunswick Lakes and small streams are numerous all over the country. The St. John River, which flows into the Bay of Fundy, is 450 miles long. The Miramichi and Restigouche Rivers, both of which are over 200 miles long, drain into the Gulf of St. Lawrence The Petitcodiac and St Croix are important rivers situated respectively in the eastern and western ends of the province and flowing into the Bay of Fundy The yearly record for continuous sunshine is excelled by only one other province in the Dominion The average hours of sunshine recorded yearly at Fredericton is 1,983 The average annual precipitation for the last thirty-eight years at Fredericton is 45 6 inches

The province contains 17,393,000 acres, of which 7,750,000 are Crown land, 5,000,000 acres are settlement land and 4,643,000 acres are private timber land According to the report of the Agricultural Commission, which investigated farming conditions all over the province in 1908, there were at that time 32,480 farms, and 1,171,076 acres of cleared land

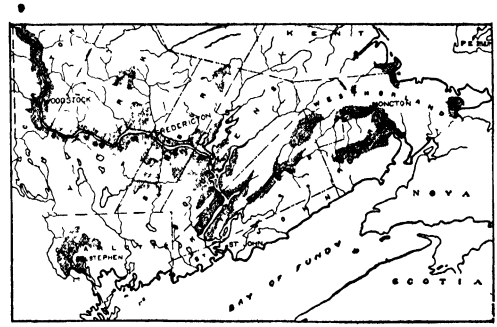
Potato-growing is the leading horticultural industry. The province is particularly adapted for the production of this crop, as the comparatively cool moist climate enables the potatoes to grow for a long period of time, and they are green and vigorous until the frost comes, hence their firmness, full starch content, good keeping quality and pleasant flavor An additional advantage is the ease and cheapness with which the potato can be shipped to tide-water, since the St John River and its tributaries water an area of 2,000 square miles Carried in scows, potatoes are delivered in St John from York County for 5 cents the barrel Carleton County on the western border, watered by the upper reaches of the St. John River, has long been the banner county for potato-growing. In 1910, it had 8,786 acres under cultivation, with a production of 1,127,680 bushels, or 128.3 bushels to the acre. In 1909, from 8,940 acres, it derived 1,800,676 bushels, or 201.4 bushels to the acre. The same year the province averaged 187.4 bushels to the acre. Victoria County, to the north of Carleton County and immediately adjoining Aroostook County, Maine, affords considerable excellent potato-raising land. In fact, the entire valley of the St John River is well suited for this purpose and potatoes are also grown extensively in the eastern counties of Kent and Westmoreland.

The entire acreage under potatoes in the province in 1910 was 47,744 and the yield 6,067,276 bushels In 1909 it was 47,853 acres and the yield was nearly 9,000,000 bushels In 1911, the acreage was 47,304 and the yield 8,493,212 bushels. Large quantities of potatoes are now being shipped annually to Ontario, the West Indies and Cuba. Experiments conducted during the past few years by experimental stations and practical farmers in Ontario show that potatoes produced in the maritime provinces gave a much larger yield than those from Ontario-grown seed. This has led to an increasing demand from Ontario for New Brunswick potatoes for seed purposes.

Apples were undoubtedly grown in the province in the early part of the nineteenth century, but it remained for Francis Peabody Sharp, New Brunswick's pioneer horticulturist, to demonstrate the possibilities of commercial apple-growing in this northern climate. His operations were conducted at Upper Woodstock on the St John River, and there, in 1844, he set out his first trees Sharp planted many large orchards, did extensive work in hybridizing and introduced many of the standard varieties into New Brunswick from the United States and elsewhere His death occurred at Upper Woodstock in December, 1903 From that time an impression that apple-growing could not be made a success seemed to gain ground, but of late years this has been swept away and the outlook for the future of the industry is now very bright

The list of apples recommended for New Brunswick covers the season and provides a class well suited for export shipment, as well as for supplying the local markets With cheap and rapid transportation by water, with an over-seas market close at hand, with plenty of suitable land at a moderate cost, with the knowledge that has been secured as to the proper varieties to plant, and with the active cooperation of the government, the success of New Brunswick as a fruit-producing area seems assured.

Many commercial orchards are now being planted, chiefly in the St John River valley and in the eastern part of the province, and apple-growing bids fair in the near future to take first place in the horticultural crops of the province. The provincial Department of Agriculture established a horticultural division in 1910 and there are now a provincial horticulturist and three assistants actively engaged in promoting the fruit-growing industry. Preparations for an export trade are being made by experimental shipments of apples

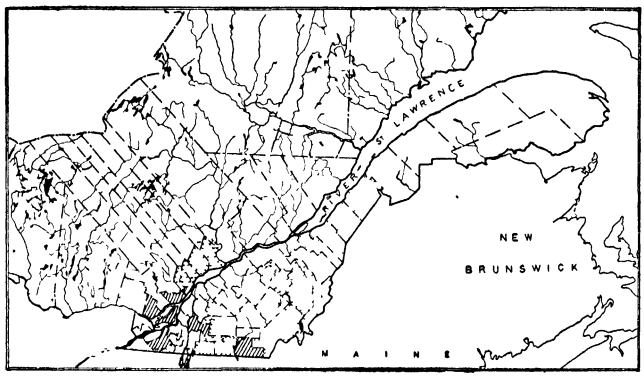


657. New Brunswick The shaded parts represent the chief fruit-growing and horticultural areas of the province.

to the European markets and the placing of exhibits in the principal cities of the United Kingdom and Canada The following varieties of apples are grown very successfully: Crimson Beauty, Red Astrachan, Duchess, Sharp New Brunswick, Yellow Transparent, Wealthy, Dudley, Alexander, Wolf River, Fameuse, McIntosh Red, Bishop Pippin, Golden Russet and Bethel Northern Spy, King of Tompkins and Rhode Island Greening are grown to a limited extent. The Moore Arctic, Lombard and Yellow Egg plums and Flemish Beauty and Clapp's Favorite pears are grown successfully.

Wild raspberries, strawberries, blueberries and cranberries grow in abundance. Strawberry-culture was first introduced into New Brunswick at Kingston, Kings County, about 1862, by the late D. P. Wetmore, Inspector of Schools. Large quantities are now produced, and as the season of maturity is comparatively late, many shipments are made to Boston and Montreal, where they are much in demand, as the strawberry crop is then finished in other sections Blueberries grow wild in enormous profusion and are canned in large quantities.

Truck-gardening is practised extensively on the



658. Horticultural regions of Old Quebec

northeastern bank of the St John River, in the vicinity of Maugerville and Sheffield. The soil there is a dark loam, several feet deep and exceedingly fertile, being the old river-bed, and large quantities of cabbages, cauliflowers, tomatoes, cucumbers, and the like, are grown and shipped to Fredericton and St John.

A. G. TURNEY.

Quebec.

Old Quebec (Fig 658) occupies a unique position in the Dominion of Canada because it is the oldest province, the largest province and the province in which the English-speaking people are in the great minority. Although not regarded as maritime, yet it possesses considerable coast, and the mighty St Lawrence takes on the character of an open sea. The St Lawrence and the numerous rivers and lakes that feed it are the principal physical features of the province, and these features have made of Montreal, Quebec's chief city, the importing, exporting and distributing center of Canada The Appalachian Mountains extend into Quebec under the name of Notre Dame, but in no place do they reach any great height. The greater part of the country is decidedly level, while some sections are gently undulating

South of the St Lawrence the climate is not severe; but in the extreme north arctic conditions prevail and the country is sparsely inhabited. The greater part of the province, however, is well suited to agriculture, and the returns per acre compare favorably with other agricultural areas of Canada The rainfall, although quite scanty at certain seasons, is usually sufficient. Irrigation is seldom or never practised and is usually unnecessary

When horticulture began in Quebec is not known, as it is older than the oldest records When the country was first explored by the French, the Indians knew the melon and cultivated it with some success, as well as a number of other crops of interest to horticulturists Father Charlevoix (S J), the historian, is very plain on this latter point In a letter dated Chambly, April 1, 1721, while referring to Montreal, he asserts that "The Indians, before our arrival in Canada, were familiar with both ordinary melons and watermelons." He said, "The former are as good as any in France, especially those raised on the island of Montreal, where they grow in rich profusion" (Vol III, Journ d'un Voyage, etc, p. 164).

That melons in ordinary seasons were common enough in Montreal may be gleaned from the appended quotations from a letter of Father Claude Chauchetiere (S F), dated Montreal, August 7, 1694. "We have had no melons to speak of this year, we shall barely have enough for seed This is something I have never yet seen before in Montreal, and every one is surprised at it"

The "Relation par lettres," 1709, attributed to Father Antoine Tiley (S.J), is authority for the statement, "The savage had the small squash, the watermelon, the gourd and the sunflower before the French came to the country." Although horticulture is old in Quebec, it has never been extensively practised, and the industry is expanding slowly In the vicinity of Montreal, vegetables are extensively cultivated for the home market, but the home market is not nearly supplied by native-grown produce and will not be for some time to come.

The present fruit areas are indicated on the map by parallel lines, while those partly in fruit are dotted The areas in which fruit might be grown are inclosed by a dark line surrounding the section. It will be seen that the total area is not large. Much of the province south of the St. Lawrence possesses great horticultural possibilities and expansion may there be looked for. Rouville, Chateauguay, Hochelaga, Jacques Cartier, Two Mountains, Stanstead, L'Assomption are regarded as fruit counties; Huntingdon, Argenteuil, Vaudreuil, Soulange, La Prairie, Napierville, Kamouraska, L'Islet, Montmagny and Bellechasse are partly in fruit; while Compton, Missisquoi, Brome, Beauce, Shefford, Bagot and counties on the St Lawrence to Champlain County may be regarded as possible fruit areas, but are not as yet extensively planted

The present status of horticulture may be gleaned by a study of the census of 1911 so far as the fruit industry is concerned It would seem that many of the old trees have fallen victims to the ravages of time, but that young trees are being set in larger numbers Better methods and a more thorough dissemination of knowledge are constantly crowding out the old, so that there

is no doubt that a few years hence the number of bearing trees will be much increased. The census figures are as follows:

	1901	1911	Increase or decrease		Per cent of Increase or decrease	
Orchard and nursery (acres)	34,289	34,376	Inc	87	Inc	0 2
Vineyard (acres)	119	641	Inc	522	Inc	438 6
Small fruits (acres)	not given	1,669				
Apple trees (no)	2,256,752	2,158,589	Dec	98,163	Dec	4 3
Bearing (no)	1,476,727	1,295,992	Dec	180,735	Dec	12 2
Non-bearing (no)	780,025	862,597	Inc	82,572	Inc.	10 5
Product (bus)	2,025,113	1,401,109				
Peach trees (no)	332	2,244	Inc	1,912	Inc	575 9
Bearing (no)	68	1,641	Inc	1,573	Inc.	2,313 2
Non-bearing (no)	264	603	Inc	339	Inc	128 4
Product (bus)	17	987				
Pear trees (no)	11,823	7,534	Dec	4,289	Dec	36 2
Bearing (no)	5,191	3,807	Dec	1,384	Dec	26 6
Non-bearing (no)	6,632	3,727	Dec	2,905	Dec	43 8
Product (bus)	3,275	4,967				
Plum trees (no)	304,280	260,076	Dec	104,204	Dec	28 6
Bearing (no)	245,370	133,567	Dec	111,803	Dec	45 5
Non-bearing (no)	118,910	126,509	Inc	7 599	Inc	6 3
Product (bus)	122,648	51,045				
Cherry trees(no)	394,090	167,275	Dec	226,815	Dec	57 5
Bearing (no)	317,762	111,267	Dec	206,495	Dec	64 9
Non-bearing (no)	76,328	56,008	Dec	20,320	Dec	26 6
Product (bus)	150,690	44,705				
Other fruit trees (no)	28,528	42,687	Inc	14,159	Inc	49 6
Bearing (no)	23,711	33,073	Inc	9,362	Inc	39 4
Non-bearing (no)	4,817	9,614	Inc	4,797	Inc	99 5
Product (bus)	21,380	10,764				
Total fruit trees (no)	3,055,805	2,638,405	Dec	417,400	Dec	13 6
Bearing (no)	2,068,829	1,579,347	Dec	489,482	Dec	23 6
Non-bearing (no)	986,976	1,059,058	Inc	72,082	Inc	7 3
Grapes (lbs)	995,849	310,826	Dec	685,023	Dec	68 7
Strawberries (qts)		1,955,749				
Currants and Gooseberries (qts)	842,968	661,101	Dec	181,867	Dec	21 5
Other small fruits		194,901				

The nursery business is popular in the province. Considering the size of the horticultural areas, the number of nursery firms doing business is large Under the name of "northern-grown stock" the sale has been pushed All nursery produce is carefully inspected by government officials, and all imported stock must be inspected before planting may be made

Many varieties have originated in Quebec The most of these are of minor importance, but the Montreal melon and the Fameuse apple have done more to advertise horticulture in Quebec than all other causes combined. The Montreal muskmelon is a melon of great size, often weighing nineteen and a half pounds There are many cases on record in which they became much heavier, but these exceptionally large ones are not sought after. It has been stated that early French Jesuits brought melon seed to Quebec and that the present Montreal melon evolved from this source, but there is no such record. If this ever happened, the event was deemed of so little importance as to be unworthy of record. There can be no doubt, however, that the Indians were cultivating the melon in Quebec when first explored by the French in 1645 to 1649. Father Bressani (S.F.) mentions a plant he had seen in the country of the Hurons, now Simcoe County, which he says was similar to the melon of India (Bresse Relation, Martin's translation, p. 68). The Journal of a "person of merit," name not given, 1663, who was sent out expressly to report on the resources of Canada, and who spent one year in the colony, has this to say on the matter in question "Thence we proceeded up the river to Montreal. Its latitude is that of Bordeaux, its climate most agreeable, its soil excellent; a gardener here has but to cast his melon seeds into a little patch of loosened earth among the stones and they do not fail to thrive without further care on the part of the man" (Relations 1663, quib, ed. p 28, 2 col , Chiv ed , Vol 48, p 169). He adds, "Squashes are raised there with still less labor, but differ much from ours [in France] for some have the flavor of apples and pears when cooked " The Montreal melon has not been an equal success in other sections The peculiar soil-formation and climatic conditions on the island of Montreal combine to give the fruit a flavor which is not equaled elsewhere. At the beginning of the melon season moderate-sized specimens bring on the Montreal market $18 per dozen and retail at $2 25 each The Fameuse apple is now commonly spoken of as the national apple of Quebec. No definite records exist concerning the exact origin of the Fameuse There can be no doubt, however, that the Fameuse is a seedling arising from seed brought from France by early French priests The Fameuse in Quebec is a very striking apple; in form, color and flavor it is par excellence No province to the west can compete with Quebec's Fameuse Specimens are produced here as nearly ideal as may be found, as comparative exhibitions have shown Fameuse apples from this province are easy winners

The local government grants $12,600 as an aid to horticulture From this sum $7 a month is allowed all students from Quebec attending the regular agricultural courses at the colleges, $1,500 is granted to three pomological societies And is also given to horticultural extension work, such as demonstration trains, demonstration orchards and various forms of institute work Horticulture is taught in three colleges, Macdonald College, Oka, and St Anne de la Pocatiere, which deserve special mention Macdonald College is unique in agricultural development along educational lines It sprang into being fully equipped and ready for efficient service at once This was made possible by the munificence of Sir William Macdonald, a public-spirited capitalist of Montreal It was Macdonald who financed the undertaking, but it was James W Robertson, a man of great vision, who, by means of lectures, literature and personal persuasion, aroused widespread interest in agriculture, and who, by his work and ideals was able to attract the attention of Sir William and to gain his financial support The college property comprises 561 acres, and boasts the largest horticultural department in similar institutions in America The courses run over four years, leading to the degree of B S A The agricultural school conducted by the Trappist fathers is of great interest to visitors These Trappist monks, by their industry and skill in agriculture, have changed the face of the countryside in the region of the Lake of the Two Mountains since 1880 The scientific and practical training at the college is given by twelve to fifteen fathers and lay teachers The average number of pupils at present is about one hundred, who come largely from the province of Quebec Students who have passed all examinations successfully obtain the degree of B S A from Laval University The agricultural school of St Anne de la Pocatiere teaches horticulture as well as allied agricultural subjects A limited number of students are in attendance, who secure diplomas upon completing the courses.

E. M. STRAIGHT.

Ontario.

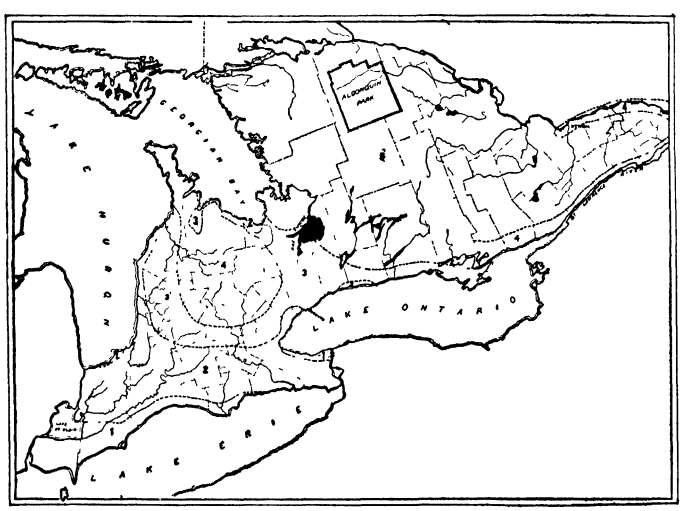
The horticulture of Ontario is undergoing very rapid evolution. The province is so situated geographically and topographically as to enjoy a climate much milder than that of most parts of Canada Within the prov-

ince, towns and cities are growing very rapidly, and markets are thus being provided for high-class products of all kinds. The Canadian Northwest, also, is rapidly becoming an important market and is attracting every year a large volume of trade that formerly went to Great Britain and western Europe

Ontario (Fig 659) includes a vast extent of country, being over 700 miles from extreme north to extreme south and approximately 1,000 miles from east to west. The outline of the province is very irregular. The most noticeable feature is the vast extent of boundary line which borders on the Great Lakes The altitude of the lakes varies from 250 to about 600 feet and inland Ontario ranges from lake-level to 1,700 or 1,800 feet. Practically all of the fruit-growing districts lie below 1,000 feet and all the important fruit districts border the Great Lakes

The early settlers paid less attention to horticulture than to other branches of rural activity, but of late years very rapid development has begun, especially in connection with fruit-growing, although commercial vegetable-growing and commercial floriculture are becoming increasingly important Landscape art is newer and less developed than are the commercial branches of horticulture, but many of the towns and cities possess active horticultural societies, part of the work of which is a propaganda looking toward the beautifying of home surroundings Ontario, as a province, possesses great natural beauty Few sections are entirely level and the general character is undulating or more or less rolling There are many beautiful homes in towns and cities and many also throughout the countryside

The many local horticultural societies and the provincial federation of them are exerting profound influence



659 Fruit-regions (numbered) in lower Ontario.

throughout the country on all kinds of amateur horticultural work, and floriculture especially is a feature of very many home gardens and of many school and public grounds as well. In commercial floriculture, the Dale greenhouses in Brampton were until recently said to be the largest range of houses in America, and there are many other up-to-date glasshouse plants in various parts of the province.

Old Ontario lies farther south than any other part of Canada, the most southerly part, as a matter of fact, lying in the same latitude as Boston, Mass., and on a level with the northern boundary of the State of California In this southern district, the production of early vegetables, both under glass and out-of-doors, has become an important industry. In the vicinity of many towns and of the large cities, such as Hamilton, Brantford, London, Toronto and Ottawa, there have also grown up important local industries in the production of vegetables The extensive production of such truck-crops as onions, cabbage, and celery is conducted in a few small districts only, but with the rapid development of markets this phase of vegetable-growing is taking on increased importance In certain sections, such as Prince Edward County, the vegetable industry takes the form of production for canning factories In that county, there are some sixteen large commercial canning plants, and many additional factories are located in other sections and devote themselves to the canning of full lines of vegetables and fruits The industry is growing

The apple is by far the most important fruit produced within the province, but certain sections have for years been producing peaches in a large way The Niagara Peninsula has long been famed as an important fruit center, and many fine commercial plantations of peach and other fruits are found there Peaches from this locality are being successfully shipped to Winnipeg and northwestern markets, and a few shipments have also been landed in Great Britain in excellent condition On the accompanying map, the three districts marked No 1 produce peaches successfully in a commercial way. The peach section bordering on Lake Huron is of comparatively recent development, but the climate and soil are perfectly adapted to this fruit, and a great extension of acreage has taken place in that locality within recent years. That part of district No 1 which lies to the north of Lake Erie does not produce peaches as extensively as its area would indicate, but there are numerous localities that can and do grow large quantities of this tender fruit. The section marked No 1 which lies south of the west end of Lake Ontario is the Niagara district of Canada, and is world-famous.

The sweet cherry as a commercial crop is found only in very few localities, and these are practically all in district No 1. This district is also the only part of the province that grows grapes extensively, as the more northerly sections have not sufficient length of season to ripen the crop. District No. 2 produces most of the plums and pears grown commercially in the province, but the Niagara section of district No 1 also grows these two fruits extensively. The part of district No 2 bordering on Georgian Bay was formerly one of the most important plum districts. The only district in the province that produces pears extensively is the Burlington section, lying at the west end of Lake Ontario.

The commercial cultivation of strawberries, raspberries, gooseberries, blackberries, and of sour cherries, is extensive in many districts of the province. Local conditions, such as the presence of urban markets or of canneries, together with the availability of labor, seem to determine the localities which can engage profitably in the production of these fruits. Large quantities of even the most tender fruits, such as strawberries, are shipped west to points in the prairie provinces, and eastward in some cases to Quebec, New Brunswick and Nova Scotia.

The most important apple districts of the province are all included in districts Nos 2 and 3 The northern, or, more correctly, the upper limit of district No 2, forms approximately the limit of the commercial cultivation of the Baldwin apple Other important varieties grown in district No 2 are Northern Spy, Greening and King. That part of district No 2 lying to the north of Lake Ontario produces few Baldwins and some Greenings, but the leading variety is probably Northern Spy District No 3 grows winter varieties for storage purposes and Northern Spy grown here keeps well until March or April The counties north of Lake Ontario also produce large quantities of Ben Davis, Gano and Stark These varieties have been exported in large quantities for many years to European markets

The area marked district No 4 in western Ontario lies at a much higher altitude than the surrounding districts and is consequently much colder There are few apples grown commercially, but the climate corresponds very closely to that of the St Lawrence River Valley, part of which on the map is also marked district No 4 The St Lawrence River Valley has long been noted for its McIntosh Red and Fameuse The McIntosh Red, by the way, had its origin in Dundas County, not far from the St Lawrence River, about 1790 (See page 317)

District No. 5 and the large extent of country lying to the north of Lake Huron and Lake Superior, and extending to James Bay, is comparatively new and untried with regard to its possibilities in fruit-growing In one or two districts of the great northland, apples are grown successfully in a commercial way This is true of St Joseph's Island, Algoma, and of the mainland of Algoma District bordering on the north shore of Lake Huron

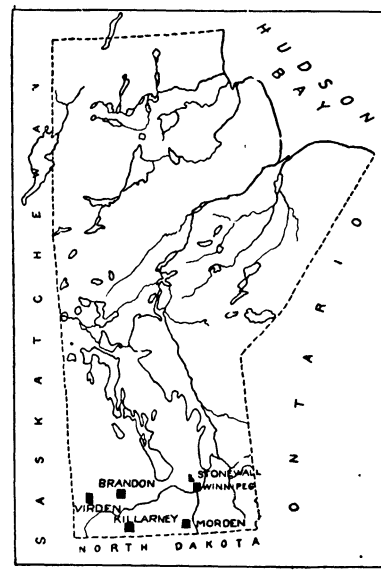
One of the most interesting features of Ontario horticulture is the existence within the province of a large number of very successful fruit-growers' selling organizations The story of the work done by some of these organizations in reviving the fruit industry in certain previously neglected counties reads like romance. In Norfolk County, on the north shore of Lake Erie, the production of apples increased in ten years from nothing to approximately 50,000 barrels, and this tremendous development came about simply through the care given to the old orchards, many of which had been standing uncared for and idle thirty or forty years previous to the organization of the fruit-growers' association There are some forty of these associations now doing business within the province, and by their aid Ontario expects in the future to be able to dispose of her fruit successfully in the face of all competition. J. W. CROW.

Manitoba.

In considering the agricultural possibilities of the province of Manitoba (Fig 660), the subject of horticulture is too frequently overlooked or given scant consideration The fact that cereals can be grown with great success has been very clearly demonstrated, but up to the present time comparatively few of the persons residing in western Canada have had sufficient confidence in the fruit-growing possibilities of the country to enter the industry on a very extensive scale. However, a few pioneers have opened the way, and to the results of their work one looks for encouragement and guidance.

Geographically, Manitoba lies just north of the international boundary line, extending from longitude 95° W. to 101½° W., or about 276 miles Since the extension of the boundary, the northern limits are on the shores of the Hudson Bay The altitude varies from 760 to 1,500 feet above sea-level.

The annual precipitation in the Red River Valley varies from 20 to 25 inches, and in the western part of



660 Manitoba.

the province from 15 to 20 inches The average rainfall for the growing season—May, June, July and August—varies from 8 to 11 inches

The annual sunshine is 47 per cent of the possible, and during the growing season is 56 per cent, making an average of 8 5 hours of bright sunshine a day, which accounts for the phenomenal growth which is made by most plants

The average monthly temperature in degrees Fahrenheit is as follows January, 1 9; February, 5; March, 14.4; April, 38 2; May, 50 4, June, 60 6, July, 64 6; Aug, 62 1; September, 52 8, October, 40.7, November, 20 7; December, 7 5 Average temperature for the growing season from the first of May to the first of September is 59 2° F.

In a country of such rich agricultural resources as Manitoba, in which excellent crops of cereals can be produced on an extensive scale with a minimum of labor, one would naturally expect that the people would turn rather slowly to the production of fruits, which require much greater care and a much more intensive and exact system of cultivation. The growing of this finer class of agricultural products is usually delayed until the country has become thickly populated and the land has been brought into a fairly good state of cultivation. Making an allowance for the difficulties that must be overcome in the production of fruits, some excellent work has been done and substantial progress made

Among the valuable introductions is the *Pyrus baccata*, or Siberian crab-apple, which was first planted on the experimental farm at Brandon, in the year 1890,

the trees having been grown at the Central Experimental Farm, Ottawa, from especially selected seed that had been imported from Russia. The introduction of this hardy Russian apple has done much for the advancement of apple-growing in Manitoba It furnishes a hardy stock on which the tenderer standard varieties may be grafted and their hardiness very much increased An effort has also been made to increase the hardiness of some of the standard varieties by hybridizing them with *Pyrus baccata*. Several promising hybrids have been produced in this way and are now being grown to some extent in the province. (See page 557)

Among the earliest attempts in fruit-growing in the district of Winnipeg, may be mentioned those of the late W. B. Hall, of Headingly. In the early sixties, some not unsuccessful experiments were conducted by him with currants, tomatoes, gooseberries, Siberian crab-apples and rhubarb The results were indeed so satisfactory that he and others in the neighborhood were induced to undertake fruit-growing on a limited scale Among other pioneers whose experiments on fruit-growing have been of value, may be mentioned the late Thomas Frankland, of Stonewall, A P Stevenson, of Dunstan, and D. W. Buchanan, of St Charles Mr. Stevenson has experimented with apples, plums, cherries, grapes, gooseberries, currants, raspberries and strawberries, and his untiring efforts have been a great incentive to others He has been very successful in growing apples, particularly the hardy Russian sorts He has at the present time a number of the better varieties of this class growing in his orchard, practically all of which are yielding good returns, his annual crop being usually over one hundred barrels The various hardy crab apples also yield good returns. Mr Stevenson is convinced that apples can be successfully grown in Manitoba if the proper varieties are chosen and the proper conditions provided

The experimental farm at Brandon has accomplished much for Manitoba horticulture Hundreds of varieties of the various classes of fruits from different parts of America and Europe have been tested there and the results published In the month of April, 1899, about 500 fruit trees, consisting of apples, crab-apples, plums and cherries, were placed under test at the experimental farm. These included many of the large standard varieties together with a number of hardy imported kinds. Numerous varieties of grapes, currants, gooseberries, raspberries, blackberries and strawberries were also tested. Many of these plants did not survive the first winter and in a few years only the hardiest sorts were found to be alive. Since the first planting, many other varieties of fruits have been introduced and experimented with and much valuable information has been gained Among the numerous introductions made was the Russian berry-crab, *Pyrus baccata*. Its extreme hardiness makes it eminently well suited to this country, where it is used as stock on which the less hardy sorts are grafted for the purpose of increasing their hardiness and thereby adapting them to an environment that would otherwise be uncongenial to them.

Small-fruit culture in the province of Manitoba has always been attended with a fair degree of success. Currants, gooseberries, red and black raspberries, and strawberries have been grown since the early settlement of the country. They yield profitable returns when intelligently cultivated They apparently possess an inherent hardiness not shared by many tree fruits, which renders them much more suitable for the severe climate. It is only a matter of a few years until these smaller fruits will be grown in all parts of the province, in sufficient quantities to supply the local demand.

Another phase of horticultural work to which considerable attention is being given, is the decoration of home- and school-grounds by the planting of ornamental trees, shrubs and flowers The prairie is bare and unattractive and around many prairie homes there has been a lack of trees and shrubs. The work of beautifying the surroundings of residences is one of the most necessary steps in the horticultural work of Manitoba Much has already been done in the cities, towns and rural districts by horticultural organizations to increase their attractiveness by ornamental planting.

Practically all garden vegetables, with the exception of a few that require a long season, may be grown to a high state of perfection The richness of the soil and the shortness of the seasons tend to give a flavor and tender crispness to the vegetables not attainable elsewhere The heavy yields that may be obtained from these gardens make vegetable-growing a very profitable branch of horticulture, as there is an abundant demand for vegetables in the home market

The work of fostering horticulture within the province is borne largely by the Agricultural College and certain societies, among the latter are the Manitoba Horticultural and Forestry Association, the Brandon Horticultural and Forestry Society, and others of a more or less local character The objects of these societies are to bring together those persons interested in horticulture, to assemble horticultural literature, and to stimulate in every possible way a greater interest in horticultural pursuits Much good work has been accomplished by these societies and to their efforts is largely due the increasing interest that is being taken in the various lines of horticultural work within the province

There are several directions in which progress may be made in Manitoba horticulture, for example, a better selection of varieties, an improvement by breeding and selection of wild and native fruits and varieties grown in the country, and improved systems of culture Much is being done in plant-improvement in other parts of the country, and Manitoba also offers an excellent field for the improvement of native fruits Various wild fruits grow very abundantly in many parts of the province, and if a combination could be effected whereby the hardiness and productiveness of these could be combined with the larger size and better quality of the cultivated fruit, a great step in advance would be achieved. F W Brodrick.

Saskatchewan.

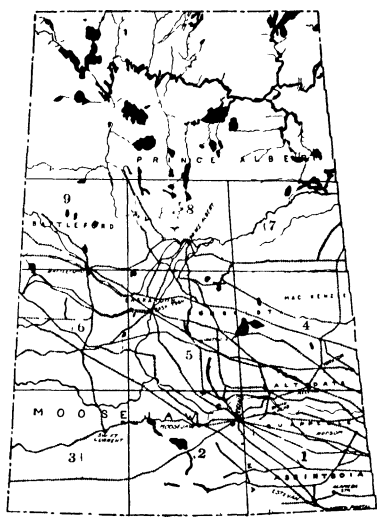
In the map (Fig 661), all that part of Saskatchewan that need be considered here is shown in the numbered districts, the remainder farther north being still beyond the reach of settlement, although many parts of it will no doubt be found, amidst its lakes and forests, eminently suited to the growing of farm and garden products, where now the lonely trapper and the mink and marten roam. Districts Nos. 2, 3, 5 and 6 are mostly bare prairie, being slightly wooded about some of the hills, river-banks and coulees; district No. 1 has also considerable prairie, but about the center is situated the Moose Mountain Forest Reserve, while mixed prairie and scattered groves of poplar extend over the northeastern part and through districts Nos 4, 5 and 9, with heavier timber towards the northeast in district No 7.

The average annual precipitation has been about 17 inches, but hardly more than 15 inches in districts Nos. 2, 3 and 6. Over 12 inches of this occurs from April to September. The elevation is also greater in this southwestern portion of the province, being 2,439 feet above sea-level at Swift Current, 1,884 feet at Moosomin near the eastern boundary, and 1,432 feet at Prince Albert on the Saskatchewan River in the north.

The average mean temperature of Saskatchewan for ten years has been: January, 2.9°; February, 3 8°, March, 14.5°; April, 37.4°; May, 50 2°, June, 57.5°; July, 63 3°; August, 60.5°; September, 50 1°, October, 40.9°; November, 25.0°; December, 10 4° F.

Horticultural industries have not yet been developed

to any extent, and consequently imports of canned fruits and vegetables, fresh fruits and flowers, have been very heavy in proportion to the population, and of exports there have been none. A rapidly increasing resident and floating population, combined with the attractions of grain-farming, to some extent account for this. There is no adequate reason why vegetables, small fruits and flowers should not be grown in quantity sufficient at least to meet the demand of the home market. There is ample evidence at any of the fairs held in the various parts of the province that the soil and climate are suitable for the production of a large variety of vegetables of unexcelled quality It has been proved that vegetables and flowers can be grown profitably under glass during the coldest winters The most important points to consider in locating such industries are access to market and cheap fuel. A glance at the map will show many favorably situated distributing points on the network of railway lines, while the lignite of the Souris Valley in the south and the wood of the northland, readily



661 Saskatchewan

solve the fuel problem without considering the possibilities that lie hidden in the straw piles that accumulate or are burned on the millions of acres of grain fields each season

Small conservatories and nurseries located at Prince Albert, Moose Jaw and possibly other points, are devoting their attention mostly to winter vegetables, while at Saskatoon 25,000 feet of glass is used in the production of pot- and cut-flowers. There is also a large demand for shrubs and ornamental trees for the beautifying of the homes so rapidly growing in numbers in village, town and city, but few nurseries are specializing in that line. The abundance of native small fruits such as the currant, gooseberry, raspberry, saskatoon, blueberry, cranberry, cherry and strawberry, has to some extent delayed the introduction of cultivated varieties into the gardens of the residents in those portions of the province most suitable for successful fruit-growing, and, on the other hand, those living on the open prairie have first to grow shelter-belts before they can hope for good gardens. When shelter is provided, the hardier varieties of small fruits and crab-apples may be grown without difficulty. There are, however, peculiar weather conditions that should be considered before anything of this kind be attempted on a commercial scale. Bright warm days and cold nights in April, and frosts in May, determine the extent of the fruit crop. It is true, however, that some of the evil effects of freezing and thawing can be avoided by protection of the stems from the direct rays of the sun

In isolated instances, in sheltered gardens, some of the hardiest varieties of standard apples, such as Hibernal, Anisette and Blushed Calville, are growing and some are producing fruit, but the day is yet distant when it can be said that apples are commonly grown here The late Director of the Dominion Experimental Farms, Wm Saunders, since the beginning of these farms, took a keen interest in the finding of suitable fruits for the prairie provinces and in the encouragement of horticulture, and has been ably assisted in this by Angus Mackay, Superintendent of the Indian Head Farm, where the Siberian crab has been found hardy enough to withstand the most severe climatic vicissitudes. This hardy crab has been used in the production of most promising hybrids and as stock on which to root-graft hardy cross-breeds At the same station varieties of the native Manitoba plum of good quality have been developed Work of this kind is also being undertaken at the more recently established experimental stations at Rosthern and Scott Another institution that, under the superintendence of Norman M Ross, has aided greatly in demonstrating to the people the possibilities in the way of landscape gardening and floral beautification of home surroundings, is the Dominion Forestry Farm at Indian Head, from which many millions of trees are distributed yearly to the farmers on the open plains to be planted, as windbreaks and shelter-belts, under expert supervision Much encouragement was given to the horticulture of the Northwest Territories, and Saskatchewan especially, by the interest displayed by A E. Forget, recently Lieutenant-Governor, and the skill and success of his popular gardener, George Watt, who was ever ready to advise and assist the inquiring amateur Probably no farm in the province could boast of so attractive a garden as that of Gerald Spring-Rice near Pense, where in typical Old Country fashion its labyrinth of walks and the choicest of flowers and shrubs, was centered by a sun-dial Another farm on which the possibilities in the way of garden and fruit-culture have been demonstrated is that of George Harvey in the Indian Head district, where shelter-belts, shade trees and hedges provide the protection so necessary for success in horticulture and nesting-places for the birds that are of so much assistance in controlling insect form. Personal mention should also be made of John Ashworth, a member of the legal fraternity, who, from love of flowers and the pleasure of overcoming obstacles, established the Saskatoon Nursery Company, which is now a profitable industry

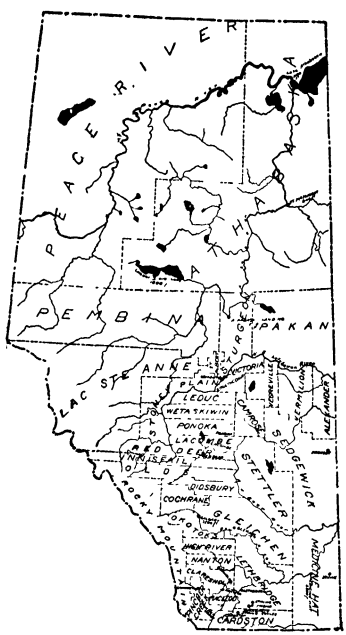
So closely is bee-keeping associated with successful fruit-growing, that it may not be out of place to say that very few in this province have yet turned their attention to the production of honey, although it has been amply demonstrated that bees make honey of excellent flavor from the abundance of wild flowers on the prairie; and bees may be safely wintered notwithstanding the severity of the frost at times

There are now only two horticultural societies in the province, one being located at Regina and in receipt of an annual civic grant, the other having been just started at Saskatoon No direct aid to horticulture is given by the provincial government, but through the Extension Department of the University of Saskatchewan, the agricultural societies and the homemakers' clubs may draw grants founded on their prize lists, in which horticultural competitions may assume a prominent place and expert judges are furnished when required. There is no

horticultural school at present in the province, but a department of horticulture is planned for the College of Agriculture and will no doubt be equipped in the near future, but at present the only instruction given is through qualified practical horticulturists sent out by the Extension Department to address meetings throughout the province T. N. WILLING.

Alberta.

Alberta (Fig. 662), is the farthest west of the three prairie provinces of Canada. Its eastern boundary is the 110th parallel of longitude, and its western boundary for about 500 miles north is the summit of the Rocky Mountains; and beyond this point, its western boundary is the 120th parallel.



662. Alberta.

From a climatic point of view, the province naturally divides itself into four principal regions,—southern Alberta, central Alberta, northern Alberta, and the foothills or highlands district. The latitude of the northern part of the province is offset to a great degree by its lesser elevation

Northern Alberta may be said to be that part of the province lying north of a line drawn east and west through Athabasca Landing. The whole of this district is still practically unsettled, although people are going in; a few small older settlements are scattered here and there about the fur-trading posts, and all the common garden vegetables, as well as farm crops, are grown at these places, as far north as 400 miles beyond Edmonton. Wild currants, gooseberries, strawberries, raspberries, and saskatoons or Juneberries are plentiful throughout the region. The country is more or less bush-covered or park-like, and is, in this way, protected from the winds that sweep over the open country in the south. In view of what has been accomplished in fruit-growing in the south, at a higher altitude and under wind-swept conditions, it is reasonable to expect that at least some of the hardier apples and crabs will in time be grown successfully in the far north The soil of northern Alberta is a deep black humous loam, and its very richness constitutes a danger from a horticultural point of view. There is usually an abundance of rainfall, and the difficulty with fruit trees under such conditions is to get them matured-up before winter No reports are at hand as to attempts at growing fruit in northern Alberta. The distance from the railways is so great that plants are usually dried out before reaching their destination, but as railways are now being pushed north, it will doubtless not be long before promising results will be secured.

Central Alberta may be said to comprise the region lying south of northern Alberta as far as a line drawn through Red Deer to Provost near the Saskatchewan border Its soil, climate, and other features are similar to those of northern Alberta, although the altitude in the central part of the district is greater, rising at Lacombe to over 2,900 feet It is the oldest settled part of Alberta, and is covered with well-handled farms, whose owners, having been some years in the country, have had time to make experiments in fruit-growing Apples have been produced near Edmonton, Ponoka and Red Deer, and crabs have been grown at the Dominion Experimental Farm at Lacombe and also at Calgary. Small fruits are grown successfully all over the district The influence of the difference in altitude is very marked in this territory, as ornamental trees, such as the soft maple (*Acer saccharinum*) and the American basswood (*Tilia americana*) are hardy in Edmonton, while they are a failure farther south at higher altitudes, and with similar soils, shelter, and rainfall

The Highlands of Alberta may be described as the country south of the Red Deer River, east as far as a line drawn north of Gleichen on the main line of the Canadian Pacific Railway, and thence running southwest to Stavely on the Calgary and Macleod line, and from that point south to a point north of Cardston, and thence east through Spring Coulee Its western boundary is the boundary of the province This is the highest part of the cultivable land of Alberta, rising to a height of over 4,000 feet A very small area of the northern part of this region is wooded, the remainder being open and often wind-swept prairie, with the additional harassment in the south of the warm chinook winds. In appearance, this southern section is not unlike the country east of it, while it is still in the "dry" belt, with a rainfall reaching in certain places at times over 20 inches It has a little more precipitation than southern Alberta to the east of it This increased precipitation causes longer and thicker grass, and this growing and dying down for generations has left a richer soil, which in turn encourages late growth in trees This, coupled with the often shorter season between frosts, incident to its higher altitude, will probably preclude the possibility of apple-growing becoming general in the higher districts unless in favored spots The hardier varieties of small fruits do well in this region, and at Cardston, 12 miles from the United States boundary line, at an altitude of approximately 4,000 feet, apples have been grown by a number of persons At Joe McFarlane's ranch about 6 miles from the Livingstone Range of the Rocky Mountains, at an altitude of over 4,000 feet, Hyslop crabs have been ripened These successes were in sheltered situations; and while this district may never become known as apple-producing, still these cases serve to show what may be done in isolated instances in which conditions are favorable, and may be accepted as an indication of what may become more general in years to come.

Southern Alberta proper is the district lying east of the foothills, and south of central Alberta It also has conditions peculiarly its own The prairie is bare of trees, and while the soil is of excellent quality, it is not the black, deep, vegetable mold of the other parts of the province It is what may be classified as a friable clay loam, that is, a rich clay loam containing enough sand to enable it to be worked easily It is in the dry belt, and the rainfall ranges from 12 to 15 inches per annum. Being bare, it is often windswept, and gardening without shelter-belts will never be successful It is the home of the warm chinook winds, and these may come at any time, and often in a few hours, or even minutes, a rise of temperature from 30° below zero to 8° or 10° above freezing will take place This is an extreme change in temperature, and if the warm wave is followed, after a few days or weeks, by a cold spell, it cannot fail to be a severe trial to growing trees These rapid changes in winter have been declared by many of the old settlers to be the cause of the scarcity of trees on the prairie This, however, is to a large extent a fallacy, as is being now proved constantly by the successful growth of shelter-belts of suitable species all over the country, and exposed in the fullest degree to the influences of the chinooks The lack of rainfall, however, does constitute a menace to successful fruit-growing, for if there is a scarcity of moisture in the soil in the fall, there is invariably greater risk of dead trees in the spring Snow cannot be depended on to preserve the moisture, or to supply it, as only about twice in thirty-eight years has it lain steadily the whole winter The dry winds drift the snow off, and the chinooks melt it, so that in winter for weeks at a time the ground may be bare of snow Cultivation to preserve the moisture is a necessity, though irrigation in the fall, in some districts in which it can be done, is of great assistance in carrying the trees over winter Notwithstanding all these untoward circumstances, a number of apple trees are growing and producing fruit in southern Alberta Settlement has been general only in the last ten years, and yet in that time many successful experiments in fruit-growing have been made, possibly more in the same time than in the history of any of the other prairie provinces Apples, crabs and plums have been growing in several gardens for the last seven or eight years in Medicine Hat, Irvine, Lethbridge, Magrath, Calgary and Macleod, and they also have been grown in several instances at Stirling and Raymond Thus, although southern Alberta would appear at first sight to have natural conditions unfavorable to large-fruit-growing, experience shows that, in spite of these, it is possible to do so It would seem as if the dryness of the country, intensified perhaps by the influence of the chinook, tends to ripen the annual growth before frost comes in the fall, so that the trees do not winterkill There is no doubt, also, that the nature of the soil has much to do with this early ripening, lacking as it does the stimulating effect of the more vegetable soils of the north Experience in grain crops and forest trees serves to bear this out However, it is still doubtful whether southern Alberta will ever become a fruit country The high winds that occur at any time in the spring and fall may interfere greatly with the setting or maturing of the fruit, and, as a consequence, the regularity of the supply There is no doubt, however, about the farmer in time being able to grow fruit enough for his own use, with the help of shelter-belts When fruit is grown under irrigation in Alberta, care must be taken to avoid irrigating after the last of June. If water is applied after that time, there is usually grave risk of winterkill, or rather fallkill, as the trees continue growing late into the fall and are not mature when the first frost comes. Even cultivation to preserve the moisture should not be carried on later than July 15

There is no provincial horticultural society, and no state aid devoted purely to horticulture, although much good work is being done by the experimental farms, maintained by the Dominion government These, however, have not been able to do much as yet, having been established only six years The chain of demonstration farms which is being established by the provincial government will probably be of some assistance in this direction There are two fairly strong local horticultural societies at Edmonton and Calgary

ARCH. MITCHELL.

British Columbia.

In the time since the Cyclopedia of American Horticulture was published, horticulture in British Columbia (Fig 663) has passed through the experimental stage Although the province is one of the largest in area in Canada, its population in 1891 was only 98,000, in ten years it had almost doubled, and in twenty years the census of 1911 shows a population of 362,000, of which over half is urban in character, and located on the coast. While practical experiment has shown that different forms of horticulture can be most successfully conducted commercially under the widely diversified conditions existing throughout southern British Columbia, development has been so recent that only the fringe of its possibilities has been touched Yet, even now the province has gained such a reputation as a fruit-growing country as to warrant a rather full description here.

Fruit-growing in British Columbia has been inspired by the success that the industry has attained in the states of Oregon and Washington directly to the south, in which conditions of climate and soil are not dissimilar, and by the rapidly increasing demand for fruit, not only by the growing population of the province, but by the phenomenal increase in demand from the Canadian prairie provinces, which cannot possibly produce all their own fruit Early dreams of possible markets for all the horticultural products of the province have been far surpassed by the actual development of the market. The population of western Canada was in 1911 over three times as great as in 1901 On the other hand, fruit-growing is now firmly established as one of the commercial industries of the province and though lumbering, manufacturing and mining surpass agriculture in the amount of wealth now being produced, fruit-growing will in a few years aid in bringing the returns from agriculture well to the front

In general physical features British Columbia is mountainous, the greater part of the area being covered by the Rocky, Selkirk, Cascade and Coast ranges, between which lie the valleys of the rivers and lakes in which agriculture is being practised It is probable that about one-twentieth or one-thirtieth of the entire land is cultivable The land is, therefore, usually fertile, and in many districts unusually so The climate is remarkably varied The greater part of the cultivated area of British Columbia lies within the upper austral and transition zones On the coast the atmosphere is humid, the rainfall copious and the annual temperature has a very limited range In the interior, continental temperature conditions prevail, and in most of the interior valleys it ranges from zero to 90° or 100° as the extremes Some of the interior valleys have a total precipitation of only 8 or 9 inches, while others run from 35 to 40 inches. Irrigation is essential in the first-mentioned, not in the latter A large percentage of British Columbia horticulture is conducted under irrigation The altitude of the horticultural districts on the coast varies from a few feet above sea-level to 400 or 500 feet above In the interior valleys the altitude runs from 800 to 2,800 feet, and even to 3,300 feet, above sea-level

Among the tree fruits grown in the province, the apple holds preëminence, and especially is this true in the arid and humid valleys of the interior, in which many varieties of apples reach a degree of perfection

not excelled elsewhere The interior valleys now ship about 600 carloads of apples to prairie and coast markets, and to Australia, China, Japan and England Pears are largely planted, not only in the interior, but also on the coast where they are relatively more successful than are apples, the principal varieties being Bartlett, Clairgeau, Anjou and Flemish Beauty. Plums and prunes are also of considerable commercial importance, the Pond Seedling or Hungarian being the principal plum, although the Italian prune is more largely grown commercially than any other variety of either plum or prune Peaches are practically confined to the Lower Okanagan valley, and the Triumph, Early Crawford, Yellow St John and Elberta are most largely grown commercially. The total shipments probably aggregate about 100 carloads Cherry trees are planted throughout the province on a commercial scale, the hardier sweet cherries, especially the Bing, Lambert and Royal Anne throughout the interior, while on the coast the Olivet and English Morello, both preserving cherries, meet with particular success, the growers obtaining an average of 11 cents a pound for a period of years Not the least important among the tree fruits are the crab-apples, particularly Transcendent and Hyslop, grown most largely in the Okanagan Valley The Transcendent is thought to be the most profitable apple for a period of years in the province. Prairie markets have recognized the superiority of the British Columbia crab-apple and are paying prices extremely satisfactory to the fruit-grower. The apricot is grown to some extent in the warmer interior valleys Nut trees are being experimented with throughout the province and indications are that some varieties of walnuts will prove commercially profitable on the coast

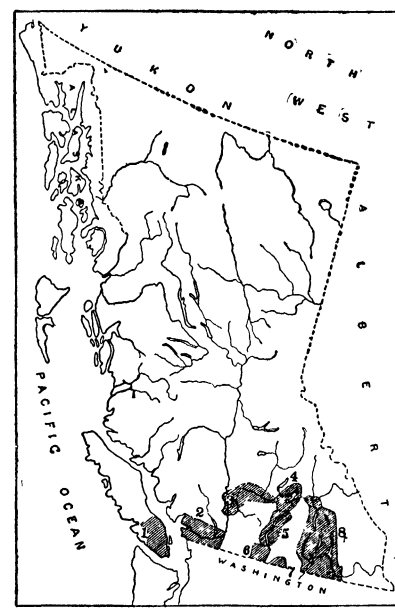
In small-fruits British Columbia has some areas, especially those contiguous to the delta of the Fraser River, that are preeminently adapted to the strawberry and raspberry; the loganberry also flourishes in the coast regions and is proving profitable Blackberries are grown to some extent on the coast, as are currants and gooseberries, although the latter are inclined to mildew, with the exception of the Oregon Champion, a western variety now grown almost exclusively The interior valleys, especially those having a more humid climate, are growing strawberries and raspberries commercially to an increased extent Taken as a whole, however, the acreage in small fruits is only a small fraction of that devoted to tree fruits, and this is quite likely to be the case indefinitely

Vegetable-growing is practised throughout the province, the white potato, onions, tomatoes, cabbage, and celery being the principal crops in the order named. The potato is grown as a field crop in practically all districts and the average yield an acre in 1911 was 230 bushels British Columbia potatoes won the Stillwell trophy at the National Land and Irrigation Exposition, New York, 1911, which proves the general excellence of the soil and climate of the province for the crop The potato-beetle is unknown and blight is not usually serious enough to warrant preventive measures Potatoes are shipped in commercial quantities to the Yukon, to northern British Columbia, to the coast cities, to the mining camps and to the prairie provinces The acreage in 1911 was about 13,000 acres and this was increased in 1912 The onions, of which the Yellow Globe Danvers is grown in the Okanagan Valley to the extent of about 100 carloads a year, are shipped to coast and prairie markets The summer nights are too cool for the tomato except in the arid interior valleys where they are grown in large quantities both for shipping fresh and for canning purposes Cabbage, celery and other vegetables are grown on an extensive scale commercially on suitable soils throughout the province, notably at Armstrong.

The greenhouse business surrounding the cities of the coast, has trebled in volume in three years, and openings still remain for its extension throughout the province. Bulb-culture is making progress in the district surrounding Victoria, and will become an important commercial industry when labor becomes cheaper.

The regions are shown on the map (Fig. 663). Horticulturally British Columbia is as yet almost confined to the southern part, and only the different areas so included are here discussed

Districts Nos 1 and 2 on the map are distinctly coastal in character The Japanese current tempers the climate throughout the entire year so that zero weather is very uncommon, and the summer temperature very rarely reaches over 80°. The humidity is high almost throughout the year, and the annual



663. Horticultural Regions of British Columbia

precipitation (which is nearly always in the form of rain) runs from 30 to 120 inches, the average in the horticultural areas being around 55 inches This falls largely in the winter months, and July and August are often so very dry as to cause a loss from drought This area has a remarkably long growing season Owing to the coolness of the nights, tomatoes, corn, and the like do not ripen Early apples do well, but winter apples cannot be matured successfully Fungous diseases also restrict apple-culture to a serious extent Pears, however, do well, small-fruits do exceptionally well, and preserving cherries are very profitable District No. 1, being the southeastern part of Vancouver Island, with an annual precipitation of about 40 inches, is rather drier than the lower mainland district No 2, but this difference has no great influence on the character of its products In these districts only a small proportion of the land suitable is being made to produce what it is capable of producing The local markets still import considerable quantities of produce from California, Oregon and Washington.



XIX. Canadian orchard development.—The **bench lands of British Columbia.**

The second great horticultural region of southern British Columbia is the dry-belt. It lies just east of the Cascade Mountains, is about 200 miles wide and extends northwest from the interior boundary about 250 miles. In it are districts Nos 3, 5, 6 and 7 as indicated on the map Its valleys lie at an elevation of 800 to 1,500 feet above sea-level. The annual precipitation totals from 9 to 15 inches, distributed fairly evenly throughout the months of the year The atmosphere is dry and bracing. Sunshine is plentiful and in the summer months almost constant. The winter extremes of temperature are lower than on the coast, and the summers are very much warmer. It is the great apple-, peach-, tomato- and potato-producing district of the province, all of its products being grown under irrigation, and mostly marketed in carloads on the coast and in the prairies Of its valleys, the Okanagan (No. 5) is the most advanced and the largest shipper; Thompson River (No 3) and the Kettle River (No 7) produce winter apples and potatoes as their staple crop, while the Similkameen Valley (No. 6) produces principally peaches and winter apples

The third great horticultural region in British Columbia may be called the semi-humid interior belt, embracing districts Nos 4 and 8 Here irrigation for most crops is not necessary, although for small fruits it is desirable. The annual precipitation runs from 18 to 45 inches, a considerable portion of which falls as snow, while June is a month of considerable rainfall The air is more humid than in the dry-belt and extremes of temperature of winter and summer are not so great The humidity makes fungous diseases a problem and spraying for apple-scab is necessary Unlike the dry-belt, it is a timbered country, and the cost of land-clearing offsets the cost of irrigation systems in the former District No 4, in the water-shed of Shuswap Lake, is as well advanced as the Okanagan Valley, the principal shipments from Armstrong and Salmon Arm being apples, potatoes, celery and cabbage District No 8, the West Kootenay, has not thus far been a shipping district, the local demand in the mining camps of Rossland, Slocan and the Crow's Nest consuming more than the locality produces

The following tabular statement indicates the adaptabilities of the different regions:

District	Present greatest production	Best commercial plantings
1 Island	Strawberries, King and Wealthy apples, pears, plums, and Italian prunes	Olivet and English Morello sour cherries, King apple, Bartlett, Clairgeau and Anjou pears
2. Lower mainland .	Strawberries, raspberries, plums and prunes	Strawberries, raspberries, King apple, also the above pears
3 Thompson Riv	Various winter apples.	Wealthy, McIntosh, Jonathan and Wagener apples
4. Shuswap Lake Section	Various winter apples	Jonathan, Wagener, Spy and Grimes apples
5. Okanagan Val	Various fall and winter apples, pears, plums, peaches and prunes.	Hyslop and Transcendent crabs, Duchess, Wealthy, McIntosh, Jonathan, Wagener, Y Newton, Spitzenberg, Northern Spy, and Rome Beauty apples
6. Similkameen ..	Peaches and winter apples.	Jonathan, Wagener, Y Newton, Spitzenberg, Winesap, and Rome Beauty apples
7. Kettle River...	Fall and winter apples.	Wealthy, McIntosh, Jonathan, Wagener, Rome Beauty and King apples
8. W. Kootenay..	Strawberries, fall and winter apples, plums, prunes and pears.	McIntosh, Gravenstein, Wagener, Jonathan and Northern Spy apples

The Dominion census of 1891 credited fruit with a total of 6,500 acres By 1901 this had been increased only to 7,500 acres, but in the decade just passed tree-fruit-planting has had a tremendous impetus and the acreage at the beginning of 1912 was thought to be around 40,000 acres, of which 93 per cent is apples, 4 per cent pears, the remainder, plums, prunes, cherries, apricots and peaches. The report of the provincial statistician shows that in 1911 there were 15,454 acres of vegetables, of which potatoes constitute some 13,000 acres, tomatoes and onions supplying the majority of the balance Potatoes average 6 9 tons or 230 bushels to the acre, while other truck crops average 11 4 tons to the acre The value of the fruit and vegetable products of 1911 was $5,084,241.

In floriculture and in landscape gardening, British Columbia is only making the first steps. In the cities, especially those of the coast, there are many fine gardens and estates, and the coast cities are developing admirable park systems.

The exact records of the first fruit trees imported, it has not been possible to obtain. It has been learned that the Hudson Bay Company was instrumental in bringing the seeds or seedling apples from California to its forts Camosum and Langley sometime previous to 1850 These old orchards are not now in existence. Orchard-planting on the coast during the period 1850 to 1885 was almost altogether of an experimental character, and nothing commercial was expected from it. From that time, and especially after the formation of the British Columbia Fruit-Growers' Association in 1890, experiments in commercial orcharding were begun Among the first orchards in the interior country might be mentioned those of Thomas G Earl of Lytton, that of Fred Gartrell at Trout Creek, and that of Frank Richter at Keremeos Later on came the planting of the Coldstream orchards owned by Lord Aberdeen, under the supervision of John Craig, and T W Stirling's orchard at Kelowna All of these orchards are still in bearing and have produced the wonderful fruit that has done so much to stimulate the large plantings that occurred between 1900 and 1912

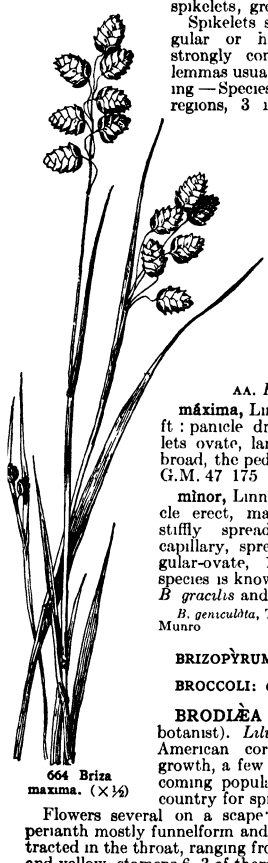
The British Columbia Fruit-Growers' Association, founded in 1890, has been in continuous activity since that time, and has done a great deal to stimulate and encourage the fruit industry and to secure governmental aid and recognition for it With the British Columbia Fruit-Growers' Association are affiliated all the fruit-shipping and educational fruit-growers' organizations of the province

The provincial Department of Agriculture has done very much to stimulate interest in the industry, and to protect it from the invasion of insect pests The Horticultural Board, organized under the auspices of the Department to study the problems connected with the industry, and especially the control of pests, has through its inspectors succeeded in keeping the province free of codlin-moth, San José scale, Colorado potato-beetle, plum curculio and many other insect pests which increase the cost of production in other districts

Four years ago the Department organized the Horticultural Branch, which is devoted to supplying information on horticultural subjects to the many new settlers embarking in the industry. The Horticultural Branch maintains sufficient assistant horticulturists to forward this work in the various districts It has inaugurated a series of schools to teach fruit-packing, publishes literature including a list of fruits recommended for planting, and is generally at the service of the fruit industry along these lines. The Department has done much to make the possibilities of the province known by means of advertising and inspection work, British Columbia having won the highest possible awards from the Royal Horticultural Society in London, England, against all the other colonies of the

Empire for six years in succession, fruit being every year exhibited. There are no horticultural schools in British Columbia, the nearest approach to these being the short courses conducted by the Horticultural Branch of the Department. Provision has, however, been made for an agricultural college, which is now being put under way, and in this institution ample provision will be made for investigation and experiment as well as education in horticulture. R. M. WINSLOW.

BRÌZA (ancient Greek name for a kind of grain, probably rye). *Gramineæ.* QUAKING GRASS Annual or perennial grasses, with open panicles of handsome spikelets, grown in gardens.



664 Briza maxima. (×½)

Spikelets several-fld, flat, triangular or heart-shaped, glumes strongly concave, these and the lemmas usually horizontally spreading — Species 12, in temperate regions, 3 intro into the U. S. These and one or two others also cult for ornament, the panicles being suitable for bouquets

A. *Plants perennial.*

mèdia, Linn COMMON QUAKING GRASS. Culms erect or decumbent at base, 1–2 ft; panicle pyramidal, many-fld, the branches stiffly spreading; spikelets nodding, 3 lines long, triangular-ovate.

AA. *Plants annual.*

máxima, Linn Fig. 664 One to 2 ft: panicle drooping, few-fld.; spikelets ovate, large, ½in long, 5 lines broad, the pedicels slender, drooping. G.M. 47 175 V 3.246.

minor, Linn. Four to 15 in. panicle erect, many-fld, the branches stiffly spreading, the branchlets capillary, spreading, spikelet triangular-ovate, 1½ lines long — This species is known to gardeners also as *B gracilis* and *B minima.*

B. geniculàta, Thurb = Eragrostis obtusa, Munro A. S HITCHCOCK.

BRIZOPÒRUM: *Desmazeria.*

BROCCOLI: *Cauliflower*

BRODIÆA (J J Brodie, a Scotch botanist). *Liliàceæ* BRODIÆA West American cormous plants of low growth, a few of which are now becoming popular in some parts of the country for spring bloom

Flowers several on a scape· pedicels jointed: the perianth mostly funnelform and non-saccate, not contracted in the throat, ranging from purple to red, white and yellow, stamens 6, 3 of them sometimes reduced to staminodia lvs all radical, narrow, usually few, sometimes evanescent. Monographers include under Brodiæa a number of genera erected by other authors, as Hookera, Triteleia, Milla, Calliprora, Hesperoscordum. (The oldest generic name of the group thus constituted is Hookera, but Brodiæa is one of the "nomina conservanda" of the Vienna code, retained because of its general use in the 50 years following its publication and since). For horticultural purposes, it is better and more convenient to merge all into Brodiæa. In this broad sense Brodiæa includes about 30 species, which must be divided into several groups. Monogr. by Baker, in G.C. III. 20, pp. 213, 238, 459; also Watson, Proc. Amer. Acad. Arts and Sci. 14.236. Closely related genera are Bloomeria, Brevoortia and Strophiurion

The brodiæas are valuable for naturalizing in California and the West, as they can be grown very easily. In colder climates they are worthy a trial for the same purposes but probably better for specimen-beds or the coldframe for cutting. They bloom during May, June and early July. *B. capitata* is the earliest to flower. The flowers are very lasting and beautiful for cutting. Unless planted in large numbers they are of little value for color-massing in beds, but most beautiful and dainty when planted in rockwork or with delicate plants such as ferns, heucheras, or columbines. While there is room for much variation in the treatment of the different species, several growing well in very wet soils while others can be grown even in rock fissures or grit, it will be found that the following general treatment will bring success

On the Pacific slope, brodiæas will grow well and can be naturalized in any soil or situation except in heavy shades or generally wet places or in heavily manured or much-watered soils When the soil is somewhat sandy or gritty, or has been lightened with road grit, spent tan-bark, leaf-mold or any light material, they will usually thrive best It is questionable whether they are quite hardy east of the Rockies and north of Virginia The soil should be well drained, and a winter covering of leaves should be given. Plant in the fall before the ground is frozen up, from 2 to 3 inches apart and not deeper than 2½ inches, water sparingly, and ripen well after flowering It is unnecessary to lift the bulbs in the summer on the Pacific slope but probably advisable east of the Rockies, unless they are kept dry in summer by placing glass over them

All brodiæas grow readily from seeds, but it requires several years to flower them. Many species produce offsets which, if detached, soon flower If potted early and placed in coldframes, they can be forced gently

In the following taxonomy, the species have been thrown into four more or less marked horticultural groups.

INDEX.

alba, 21	grandiflora, 11	multiflora, 20
Bridgesii, 8	Hendersonii, 9.	Orcuttii, 16
californica, 12.	Howellii, 23	Palmeri, 24
candida, 6	hyacanthina, 2, 3.	*paryflora,* 20.
capitata, 21	ixioides, 1	pedunculariis, 7.
congesta, 19	lactea, 3	Purdyi, 18
Douglasii, 22	laxa, 5	rosea, 15
erecta, 1	lilacina, 3, 23.	splendens, 1.
filifolia, 17.	major, 3	stellaris, 14
gracilis, 4	minor, 1, 13	terrestris, 10.

Group 1 —In this group, which contains some of the best species in cultivation, the plants have a fibrous-coated flattened corm, resembling that of the crocus; not usually bulbiferous The lvs are few, all radical and grass-like. scapes slender but stiffly erect, naked except for bracts below the many-fld umbel; fls usually broadly tubular, borne on slender pedicels, in purples, white and yellow; anther-bearing stamens 6 All are hardy, but a protection of straw or lvs is advisable in the colder regions A light, loose, well-drained, sandy or loamy soil best meets their needs, and an excess of moisture and very rich soils are to be avoided.

A *Segms. equaling or exceeding the perianth-tube.*

1 **ixioides,** Wats. Dwarf, 3 in to 2 ft.: lvs. linear, fleshy: fls. few to many, on pedicels 1–4 in. long, in shades of yellow and often purple-tinged, 1 in. or less long; filaments winged, 2-toothed above S. Calif. to Ore. B.R 1590. B.M 3588 (as *Calliprora lutea*). G C. III. 20·459 —Many handsome varieties The best is var. **splèndens,** Hort., with large, bright yellow fls.

the limb wheel-shaped. Var. **minor,** Hort. Dwarf: fls. yellow, with dark band and blue anthers. Var. **erécta,** Hort. Dwarf

2. **hyacinthina,** Bailey (*Triteleia hyacinthina,* Greene) From 1–2 ft.. lvs linear. fls. 10–30, 1 in. or less long, milky white or purplish. Calif.—Perhaps this and *B lactea* are forms of one species.

3. **láctea,** Wats. (*B hyacinthina* var. *láctea,* Baker). In the type, has the habit of *B laxa,* but the fls have a short tube with a rotate corolla, and are white, with green midvein, filaments deltoid. Calif. to Brit. Col., in many forms Watson combines the *Hesperoscordum lacteum* and *H hyacinthinum* of Lindley, B R 1639, into this species *B. lactea,* thereby not recognizing a *B. hyacinthina* Baker, however, unites the *B lactea* form with *B hyacinthina,* describing var *lactea* as "more slender than the type, with white fls. and longer pedicels" G C III 20 459 —Var **lilácina,** Wats., is much stronger, very bulbiferous, grows in wet, heavy soils, and has a larger fl., which is usually lilac-colored. Var. **májor,** Purdy. Like var *lilacina,* but fls white

4 **grácilis,** Wats A tiny species, with small yellow fls scape 2–4 in and purplish lf 1 fls ½in long, on pedicels of equal or greater length; filaments elongated and very slender S Ore

AA *Segms shorter than the tube.*

5 **láxa,** Wats Strong plant, 1–2 ft lvs linear fls many, broadly tubular, purple, tube very narrow, and exceeding the segms., filaments very slender, stamens in 2 rows N Calif B R 1685 (as *Triteleia laxa*). G C III 20 241 —Showy, and one of the best There are many variations

6 **cándida,** Baker (*Triteleia cánduda,* Greene) Much like *B laxa* in character of bloom, but fls only 6–10, and segms white or bluish with a green vein, and the fls set at an angle on the pedicel, so that they all face one way: further distinguished by early flowering and the very broad and glossy, scarcely carinate lvs Calif

7 **pedunculáris,** Wats (*Triteleia pedunculáris,* Lindl.) Still stouter (1–2 ft.), with smaller and fewer white fls on pedicels a few inches to a foot long; filaments short or none N Calif. G C III 20 243 — This species grows in wet, heavy ground close to water, and is very cormiferous

8 **Bridgesii,** Wats Fig 665. Similar to *B laxa,* but stamens in one row, corolla with a spreading limb and sub-cylindrical tube, and color reddish purple, filaments deltoid Cent Calif G F 1 126 (adapted in Fig 665).—Grows a foot or more high.

9 **Hendersonii,** Wats. Resembles *B Bridgesii* yellow, banded purple filaments somewhat winged, but not deltoid small-fld S W. Ore.

Group 2 —Corm not flattened, bearing many strong offsets, the coating hairy and reddish lvs linear and grassy scapes stiff, few-fld., fls large, of a thick, waxy opaque texture, funnelform (except *B Purdyi*), very lasting, usually purple, in an open umbel, perfect anthers 3 These brodiæas are native to a heavy soil, in rather moist situations, and are hardy. They will thrive under conditions recommended for Group 1. (*Hookera*).

A. *Fls. funnelform, with a prominent tube.*

B. *Scape not rising above ground.*

10 **terréstris,** Kellogg (*H terréstris,* Brit & Greene). Scape short or practically none, the umbel sitting on the earth· lvs nearly terete. fls. ¾–1 in long, staminodia emarginate, yellowish, anthers sagittate-oblong. Cent. Calif., along the coast.

BB. *Scape evident.*

C. *Staminodia as long as anthers, or longer.*

11. **grandiflóra,** Smith (*H. coronária,* Salisb.). Scape 4–10 in. high: lvs. nearly terete, dying before the fl.-st. appears: fls 3–10, bright blue, of good size (1 in or more long), segms. longer than tube, very lasting, staminodia obtuse; anthers linear Calif. to Brit. Col B.R. 1183. B.M 2877. G C III 20.213.

12 **californica,** Lindl (*H californica,* Greene). Much like *B. grandiflora* scape longer (12–30 in.); fls. 10–25, 1½–2 in long, rose to deep purple, staminodia linear and cuspidate N Calif G C III 20 215.— "The finest species for garden purposes," according to Baker.

13 **minor,** Wats (*H minor,* Greene). Much like a small *B grandiflora* scape very slender, 3–6 in ; fls. 2 6 and only ½–1 in long, staminodia broad and usually emarginate, anthers oblong Calif to Ore.

14 **stellàris,** Wats. (*H. stellàris,* Greene). Low: scape with long pedicels and 3–6 bright purple fls, with white centers lvs nearly terete anthers winged behind· staminodia white, longer than the stamens, emarginate. N Calif G C III 20 : 213 —Very pretty.



665. Brodiæa Bridgesii. (plant×½)

15. **rósea,** Baker (*H rósea,* Greene). About 3–6 in lvs nearly terete· fls. 5–8, under 1 in long, rose-red, filaments dilated, staminodia white, obtuse and entire, longer than the anthers N Calif G C III 20 213 — A pretty species

CC *Staminodia markedly shorter than anthers*

16. **Órcuttii,** Bailey (*H Orcuttii,* Greene). Plant rather stout, a foot or more high: lvs linear, flat or nearly so. fls. 5–15, less than an inch long, short-tubed, lilac, staminodia a small triangular scale, or none S. Calif G C III 20 215

17 **filifólia,** Wats (*H filifólia,* Greene) From 6–12 in · lvs. slightly flattened. fls. 3–6, ¾in or less long, dark-colored; staminodia triangular, twice shorter than the anthers S Calif

AA *Fls short and flaring.*

18 **Púrdyi,** Eastw Different from others in having a short-tubed fl with broadly spreading, declinate segms., the throat constricted. Cent Calif., in Sierras.

Group 3 —Corm long and cormiferous lvs grassy: scape tall, slender and flexuous, fls small, in close, head-like umbels, the separate fls waxy and narrowly tubular; perfect anthers 3, except in *B capitata.* These species thrive in a loose, perfectly drained, loamy soil, with some humus Hardy The species are not readily distinguished All are from Cent. Calif. to Wash. Known as California hyacinths.

A. *Anthers 3.*

19 **congésta,** Smith Tall (2–3 ft.), with a globular head of purple fls : lvs. somewhat terete. perishing: fls 6–12, sessile or nearly so, ¾in. long; filaments 0;

staminodia purple, 2-toothed. Calif. to Wash. G.C. III. 20.213 —Blooms late

20 **multiflòra,** Benth. (*B. parviflòra,* Torr. & Gray). Similar to *B. congesta* fls. 6–20 sessile or short-stalked, umbellate, ¾in. long, blue; staminodia lanceolate, entire. Calif., Ore , Utah. B M. 5989.

AA *Anthers 6.*

21. **capitàta,** Benth. (*Milla capitàta,* Baker. *Dichelostémma capitàta,* Wood). Lower (1–2 ft) lvs narrow-linear, perishing: fls many, in a capitate umbel, ¾in or less long, lilac (a var *alba*), three inner anthers winged. Calif , Utah, New Mex B.M. 5912. G C III. 20.238 —Early blooming.

Group 4 —Corm as in Group 1. fls many, in a dense, or at least a close, umbel, the tube about as long as the segms.; good anthers 6.



666. Brodiæa Palmeri (plant ×½)

A *Fils essentially capitate.*

22 **Douglasii,** Wats (*Triteleia grandiflòra,* Lindl. *Milla grandiflòra,* Baker). Lvs linear: scape 1½–2 ft ; fls. few, in a close umbel, saccate as in *Brevoortia coccinea,* blue; segms. as long as the tube, the inner ones wavy; filaments winged. Ore and Wash. B. M. 6907.

23. **Hòwellii,** Wats. (*Triteleia Hòwellii,* Greene). Fls. bell-shaped, white. differs from *B. Douglasii* in smaller fls , and segms. not more than half so long as tube Wash B M. 6989.

Var. **lilácina,** Hort One of the handsomest of all brodieas, and a good grower. fls. porcelain-blue, suggestive of *Brevoortia coccinea* Wash. G. C III 19 767; 20: 239 Gn 46 502 — Large and strong.

AA *Fils. in a close but rather free umbel, the pedicels usually larger than the perianth.*

24 **Pálmeri,** Wats. Fig 666 Lvs firm and linear: fls. many, ½in long, the segms about as long as tube, blue. S. Calif. G F. 2.245 (adapted in Fig 666).

B coccínea, Wats =Brevoortia —*B crócea,* Wats 1 ft or more: fls 6–15, yellow N Calif —*B insularis,* Greene Like B capitata, but more robust and larger-fld Islands off Calif —*B Lémmonæ,* Wats 1 ft fls. small, deep orange N Ariz.—*B leptándra,* Baker. 1 ft or less fls 2, purple Calif —*B lilácina* Baker 1 ft or less. fls 10–15, lilac-purple Calif —*B lugens,* Baker Like B ixioides, but fls saffron-color within and brown-black on tube and ribs. Calif —*B pulchella,* Greene Probably the same as B congesta — *B. scabra,* Baker Like B ixioides, but scabrous fls bright yellow. Calif —*B volúbilis,* Baker=Strophohrion

CARL PURDY and L. H. B.

BROMÈLIA (Bromel, a Swedish botanist) *Bromeliàceæ.* Hothouse plants. grown for the stiff form and clusters of flowers.

About two dozen species of Trop. American herbs, with stiff, pineapple-like lvs , and fls in heads or panicles, corolla 3-parted; calyx of 3 ovate-oblong sepals. Differs from Billbergia and Ananas in technical characters, particularly in the deeper-cut calyx Less popular as stove plants than Æchmea and Billbergia *B. bracteata* and *B. macrodontes* of trade-lists belong to Ananas. Culture as for Billbergia, which see. Monogr. by Mez, in De Candolle's Monogr. Phaner. 9.

Pínguin, Linn PINGUIN of Jamaica. WILD PINE Three to 4 ft high: lvs broad-toothed and spiny, bright green, but becoming pink and red with age fls reddish, pubescent, in a dense panicle, with a mealy rachis, the sepals acute fr as large as plums, acid W. Indies —Makes a good hedge in tropical countries, and the fr yields a cooling juice

Binòtii, Morr Panicle lax, sepals rounded at the top: habit open and spreading Brazil

B longifòlia, Rudge=Streptocalyx —*B tricolor,* Sanders Lvs 1½–2 ft long, 1½–3 in wide, the wavy margins creamy yellow except at the rose-red base, the central portion a glossy green G.C III 43 261

L H. B
GEORGE V. NASH †

BROMHEÀDIA (Sir Edward F. Bromhead, English naturalist). *Orchidàceæ* Stove orchids, terrestrial or epiphytic, non-bulbous, little known in cult , comprising two species from the East Indian-Malayan region.

Leaves distichous, rigid, often fleshy fls showy, white and orange, the parts narrow and pointed, lip 3-lobed, narrow. Prop by division or offsets after flowering **B. Finlaysoniàna,** Reichb (*B palústris,* Lindl *Grammatophyllum Finlaysoniànum,* Lindl). Root of stout and fleshy fibers st 3–8 ft , with sheathing scales below and a few oblong thick or fleshy lvs. at the middle and elongated scaly peduncle at the top: fls white, fragrant, the parts 1½ in long, oblong-acuminate and nearly equal, spreading, lip oblong, 3-lobed, white outside and purple-lined inside, the middle lobe rounded and yellow at center B.M. 4001.

BROMPTON STOCK: *Matthiola*

BRÒMUS (ancient Greek name for the oat). *Gramineæ* BROME-GRASS. Annual or perennial grasses with large, usually awned spikelets in panicles.

Spikelets several-fld ; lemmas convex or keeled, 5–9-nerved, usually 2-toothed at apex and awned from between the teeth, sometimes awnless, the awn usually straight.—Species about 100, mostly in the north temperate zone

The genus contains a few forage grasses and several annual species that have been intro into the U. S , especially on the Pacific coast, where they have become troublesome weeds. Among the weedy annual species may be mentioned *B secalinus,* Linn , chess or cheat, with smooth sheaths, drooping panicles of ovate short-awned spikelets, the lemmas convex and smooth, *B. commutatus,* Schrad , resembling the preceding but the sheaths hairy; *B. mollis,* Linn. Resembles chess, from which it differs by its hairiness and more erect panicle; *B. villosus,* Forsk., with large few-fld. spikelets, the awns about 2 in. long; *B. tectorum,* Linn , delicate, slender spikelets in drooping panicles the awns 6–7 lines long; *B rubens,* Linn., with erect compact panicles of purple spikelets, the awn 9–11 lines long The last 3 are especially abundant in Calif. Cheat is used for hay in Ore.

A. *Plants perennial, producing rootstocks.*

inérmis, Leyss AWNLESS BROME-GRASS Erect, 2–4 ft. panicle narrow, the branches ascending or spreading in fl ; spikelets about 1 in , the lemmas mucronate or short-awned Intro. from Eu Gn 25, p. 429 Dept. of Agric , Div. of Agrost , 7 298 —Used as a pasture and meadow grass in the northwestern states. Especially valuable in semi-arid regions

AA. *Plants annual or biennial.*

B. *Spikelets awnless or nearly so.*

brizæfórmis, Fisch. & Mey. One to 2 ft.: panicle 2–6 in., one-sided, nodding; spikelets oblong-ovate, strongly flattened, as much as 1 in. long, 5 lines wide. Eu. Dept. of Agric., Div. of Agrost., 7 298.—A handsome ornamental.

unioloides, H B K. (*B. Schráderi*, Kunth) Fig. 667. Rescue-Grass Schrader's Brome-Grass. Two to 3 ft.; sheaths pilose, blades narrow, scabrous; panicle erect, open or narrow, the branches ascending, spikelets 1 in. long, compressed, the lemmas keeled, strongly nerved, acuminate, glabrous or scabrous. Andes. Dept. of Agric., Div. of Agrost., 7 299, ibid, Circ. 26.1.—Grown in the southern states as a forage grass.



667 Bromus unioloides. (×½)

BB. *Spikelets long-awned.*

macróstachys, Linn. One to 2 ft.; panicle narrow, compact, consisting of a few large spikes ¾–1 in. long, awns spreading or recurved, ½–¾ in. long. Eu.—Sometimes cult. for ornament.

madritènsis, Linn. Fig. 668. One to 2 ft., tufted; panicle erect, 2–4 in., oblong-ovoid, contracted, glumes and lemmas narrow, the latter 7–9 lines long, awn straight or somewhat curved, 8–11 lines long. Eu.—Sometimes cult. for ornament.

B. prateńsis=Festuca elatior. A. S. Hitchcock.

BROOM: *Cytisus* and *Genista.*

BROOM-CORN. Brooms are made of the rays or peduncles of the flower-cluster of *Andropogon Sorghum* (*Sorghum vulgare*), the species which in other forms is known as sorghum, kafir, and Guinea corn. For cultivation of broom-corn, see Cyclo. Amer. Agric., II, 216.

BRÓSIMUM (Greek, *edible*). *Moràceæ.* A genus of 8 species of large trees of Trop. Amer., yielding edible fr. fls. monœcious, or rarely dœcious, inside or on the outside of a fig-like receptacle. *B. Alicástrum*, Swartz, is the bread-nut of Jamaica, but it is not grown within the U. S., except in most of the botanic gardens. It bears round yellow fr., about an inch in diam., containing a single large seed, which is edible after roasting. The tree has shining lance-elliptic entire lvs. Prop. by cuttings of young wood in a bell-jar with bottom heat.

BROUGHTÒNIA (named in honor of an English botanist, Arthur Broughton). *Orchidàceæ.* Epiphytic orchids, requiring stove conditions.

Pseudobulbs, 1- or 2-lvd., ovoid or globose; infl. terminal, simple or somewhat branched, sepals and petals similar, somewhat spreading, the latter a little the broader, lip sessile on the base of the column or sometimes a little adnate, lateral lobes inclosing the column, middle lobe spreading, ovary extended into a long cavity, pollina 4, waxy.—A West Indian genus of 2 or 3 species. Sometimes united with Epidendrum.

sanguínea, R. Br. Pseudobulbs up to 2 in. long, 2-lvd. lvs. 2–4 in. long, leathery, linear-oblong; racemes of 5–10 fls. about 1½ in. across and of a crimson-purple, sepals lanceolate, acute, petals oval-oblong, lip nearly orbicular, denticulate on the margin. Jamaica. B M 3076, 3536 (as *B. coccinea*). George V. Nash.

BROUSSONÈTIA (after T. N. V. Broussonet, a French naturalist). *Moràceæ.* Ornamental trees or shrubs, grown chiefly for their large handsome foliage.

Leaves alternate, petioled, serrate, undivided or lobed: fls. dœcious, apetalous, the staminate in cylindrical, nodding catkins, with 4-parted calyx and 4 stamens, the pistillate in globular heads with a tubular perianth including the stalked ovary, stigma filiform, collective fr., a dense globose head consisting of the persistent perianths and bracts with numerous small 1-seeded drupelets protruding at maturity and orange red.—Three species in E. Asia, and there often cult., the bark being used for paper-making.

These are deciduous trees with wide-spreading branches, under culture often shrubby, with rather inconspicuous greenish white flowers. *B. papyrífera*, the hardier of the two species in cultivation, is fairly hardy as far as north New York. It is usually a small tree with a rather low wide-spreading head and may be used in cities in situations in which small shade trees are wanted, as it stands heat and dust well. It is not particular as to the soil.

Propagation is by seeds, sown after maturity or in spring, by greenwood cuttings under glass, or by cuttings of ripened wood, kept in colder climates during the winter in the greenhouse, also by root-cuttings with slight bottom heat and layers. The varieties are also sometimes budded in summer or grafted in early spring on the roots of the type in the greenhouse. Known as paper mulberries.

papyrífera, Vent. (*Mórus papyrífera*, Linn.) Tree, 30–50 ft., with thick, pubescent branches; lvs. long-petioled, usually cordate-ovate, acuminate, coarsely dentate, often deeply lobed, especially on younger plants, rough above, pubescent beneath, 3–8 in. long; fr.-heads ¾ in. across, red. May. China, Japan. B M 2358. S I F. 1 38. Var **cucullàta,** Ser. (*B. naviculàris*, Lodd.) Lvs. small, concave and curled upward. G W 6 601. Var **laciniàta,** Ser. (var. *dissécta*, Hort., var. *Bullàta*, Hemsl.) Lvs. finely dissected into very narrow lobes, often reduced to the nerves and only at the end with a small lanceolate or ovate-lanceolate lft. R H 1878, pp. 374, 375. Gn. 15, p. 53.—Very distinct form, low and shrubby, more tender than the type. Var **macrophýlla,** Ser. Lvs. large, usually undivided. Var **leucocárpa,** Audib. Fr. white.



668. Bromus madritensis. (×¼)

Kazinòki, Sieb. (*B. Siebóldii*, Blume. *B. Kaempféri*, Hort.). Branches slender, glabrous at length; lvs. short-petioled, ovate or ovate-oblong, nearly glabrous, only somewhat rough above, entire or 2–3-lobed, 2–8 in. long; fr.-head less than ½ in. diam.

China, Japan. I. T 2:45 —This species is more tender than the former. It is cult. sometimes as *B. Kaempferi*, while the true *B. Kaempferi*, Sieb , with the lvs. resembling in shape those of *B. Kazinoki*, but much smaller and pubescent, and with very small fr.-heads, seems not be in cult. ALFRED REHDER.

BROWÁLLIA (after John Browall, Bishop of Abo, Sweden). *Solanàceæ* Mostly blue-flowered greenhouse and garden herbs.

A genus of about 6 S. American annuals, with abundant blue, violet or white fls. which are solitary and axillary, or in more or less 1-sided racemes; corolla-tube 15-nerved, straight, which distinguishes it from Streptosolen, in which the corolla is twisted

The seeds may be sown in the open border, but for the sake of the earlier bloom it is better to start them indoors in early spring and transplant into the open about May 15, where they will bloom profusely all through our hot, dry summers, and until frost They can be grown in poorer soil than most half-hardy annuals, and make excellent bedding-plants They are also used for winter decoration, the seeds being sown in midsummer, earlier or later according to the size of the specimens desired They should be placed near the glass and frequently stopped, in order to produce compact plants Large specimens are excellent for cutting, and small potted plants should be grown more commonly by florists for home decoration at Christmas It is even possible to lift flowering plants from the open before the first frost of autumn and pot them for conservatory decoration, although the flowers are likely to become successively smaller Blue flowers are rare in winter, and browallias are especially desirable for their profuse bloom all through winter and early spring The flowers are, however, likely to fade, especially the purple ones. In pots under trees, *B speciosa* makes an excellent summer plant.



669 Browallia speciosa, and a flower (at e) of B. demissa. (×½)

In the names of the early species, Linnæus commemorated the course of his acquaintanceship with Browall· *elata*, reflecting the exalted character of their early intimacy; *demissa*, its rupture; and *alienata*, the permanent estrangement of the two men.

A. *Corolla-segms. long, acute or acuminate: corolla-tube at least 1 in. long.*

speciòsa, Hook. Fig 669 Lvs sometimes opposite, sometimes alternate· fls much larger than in *B grandiflora*, all solitary, axillary, peduncle shorter than the lvs.; corolla-tube thrice as long as the calyx, and abruptly swollen at the top beneath the limb, limb of 5 ovate, striated, dark purple segms , pale lilac beneath. Colombia B M 4339 P M 16 290 —There are blue-, violet- and white-fld varieties. Var **màjor,** Hort , has violet fls 2 in. across R B 20.240 **B. gigantèa,** Hort , is a florists' variety, with very deep blue fls and long-blooming habit. Intro. into American trade in 1899

AA. *Corolla-segms. short, 2-lobed or notched. corolla ¾in. long or less.*

B. *Upper lvs. not stalked fls all in loose racemes, calyx not hairy.*

grandiflòra, Graham (*B Roézlii*, Hort). St. and lvs. glabrous, or in the upper part of the plant minutely clammy-puberulent lvs ovate, the lower petioled: calyx-teeth oblong, somewhat obtuse, equal, scarcely shorter than the tube, spreading corolla white or pale blue, the limb wider than in *B demissa* Peru B M. 3069 —In *B Roezlii*, said to be from the Rocky Mts , some fls. are white, some pale blue The name is unknown in N. American botanical literature No dark blue or violet-colored forms are advertised

BB. *Upper lvs stalked fls solitary and axillary below, racemose above.*

c. *Calyx hairy.*

demíssa, Linn (*B elàta*, Linn) Fig 669. St and lvs. pubescent or glabrous lvs ovate, with longer stalks than in *B grandiflora* calyx-teeth acute, unequal, much shorter than the corolla-tube The lvs are variable, cuneate, rotund, or rarely cordate S Amer. B.M. 34, 1136. The following are now referred to the above: *B americana, B. elata, B elongata, B. nervosa* This species is the commonest, and is usually known as *B. elata*. Blue, violet, white and dwarf forms are cult.

cc. *Calyx sticky or clammy.*

viscòsa, HBK (*B pulchélla* and *B Czerniakowskiàna*, Hort). Plant viscous-pubescent. lvs short-petioled, ovate, rough-hairy on both sides· pedicels a little shorter than the calyx calyx-teeth very clammy, oblong, shorter than the corolla-tube. The lvs are similar to *B demissa*, but the habit is stiffer and the fls more numerous The calyx-teeth spread less than in *B grandiflora* S Amer

B americàna, Linn , is considered by some a separate species from the above, but in Germany, where most seeds of annual fls are grown, it is used by Siebert & Voss (in Vilmorin's Blumengartnerei) to include B demissa, B elata and other forms —*B Jàmesonii*, Benth =Streptosolen Jamesonii —*B pulchélla*, Hort , is likely to be either B grandiflora or B viscosa WILHELM MILLER. N TAYLOR †

BROWNEA (Patrick Browne wrote a history of Jamaica) Sometimes written *Brownæa*. (*Hermesias*, Loefl). *Leguminòsæ* A group of 10 small evergreen trees of Trop Amer., allied to Amherstia and Bauhinia but little known in the American trade. Lvs. alternate and pinnate fls showy, red, in dense terminal or axillary clusters Cult. in hothouses **B. Ariza,** Benth. (*B. princeps*, Lind.) has drooping heads of scarlet fls. I.H. 42:38. **B. grándiceps,** Jacq Fig 670. Fls. red, in capitate spikes lfts about 12 pairs, lance-oblong. S Amer. B.M. 4859. G M. 31:115. **B. Rósa-de-Mónte,** Berger. Fls scarlet, in dense heads. lfts. 2–3 pairs, oval, acuminate. S. Amer. N. TAYLOR.†

BRUCKENTHÁLIA (after S. von Bruckenthal, an Austrian nobleman). *Ericàceæ.* Ornamental shrub, chiefly grown for its profusely produced small spikes of pink flowers

Leaves linear, whorled· fls. in short racemes; calyx campanulate, 4-lobed; corolla campanulate with 4 triangular lobes; stamens 8, included, connate at the base, disk rudimentary, caps subglobose, 4-celled, loculicid, many-seeded —One species in S. E Eu. and Asia Minor. Very closely related to Erica, but differs chiefly in the calyx being lobed only to the middle, not 4-parted, in the rudimentary disk and the connate stamens.



670 Brownea grandiceps (×1-12)

This is a low evergreen, heath-like shrub forming large tufts, with needle-shaped small leaves and small rosy pink nodding flowers in short terminal racemes, produced in great profusion Perfectly hardy North and requiring the same treatment as hardy ericas, a pretty little plant for rockeries Propagation is usually by seeds which are freely produced in cultivation and treated like those of erica, also by cuttings

spiculifòlia, Reichb (*Erica spiculifòlia,* Salisb *B. spiculifòlia,* Benth) Tufted shrub, 5–8 in high lvs. about ⅛in long fls ⅓in long, anthers obtuse, 2-lobed at the apex, style exserted. June, July B M 8148.

ALFRED REHDER.

BRUGMÁNSIA *Datura*

BRUNÉLLA (probably from old German *breune* or *braune,* quinsy, which it was thought to cure) Often written *Prunella,* which was the spelling used by Linnæus *Brunella* is pre-Linnæan. *Labiàtæ* Low-growing hardy herbaceous perennials

Flowers usually violet or purple, produced all summer on heads an inch or more high or in bracted spikes; calyx reticulate about 10-nerved and 2-lipped, which distinguishes it from the closely related Physostegia, in which the calyx is almost regular

They are best suited for the rockery and slightly shaded parts of the border, succeeding in almost any soil that is not excessively dry.

vulgàris, Linn SELF-HEAL HEAL-ALL. Lvs. ovate-oblong, entire or toothed, usually pubescent: corolla violet or purple, rarely white, ½–¾in. long, not twice as long as the purplish calyx Amer , Eu , Asia.—One of the most cosmopolitan of all plants, being too common in the wild to be cult A form with variegated lvs. is rarely found wild Herb considered astringent and vulnerary. Var. **laciniàta,** Hort., not Linn. Lvs. much cut and torn: fls. as in the type.

grandiflòra, Jacq (*B. pyrenàica,* Phillipe) Lvs. often toothed, especially at the base· corolla over 1 in. long, more than twice as long as the calyx. Eu. B M. 337.—Perhaps the best of the garden kinds. Var. **álba, Hort.** Fls pure white.

Webbiàna, Hort. Lvs shorter than in *B. grandiflora,* and not so pointed: fls. very freely produced, more than twice as long as the calyx, bright purple. June–Sept.

N. TAYLOR †

BRUNFÉLSIA (Otto Brunfels, physician and botanist of the sixteenth century) *Francisceæ Solanàceæ.* Trees and shrubs, a few of which are grown in warm glasshouses.

Leaves entire, oblong, often shining· fls in terminal cymes or clusters, or solitary, large and showy, sometimes fragrant; corolla with 5 rounded and nearly equal spreading lobes (or 2 of them a little more united), stamens 4, in the throat of the corolla, the anthers all alike: fr. berry-like —Species above 20, in Cent and S Amer and W. Indies

Brunfelsias are usually winter-flowering plants. The wood must be well ripened before flowering begins. Grow in a rich open compost, and feed liberally when well rooted They need a night temperature of 50° They bloom best when pot-bound Propagated by cuttings from the new growth in spring, or from pieces of the ripe wood in autumn inserted in very sandy soil and peat and kept close and shaded until rooted The plants are of easy culture when the simple requirements are understood Under glass, the bloom begins usually in October and November They are showy open-air plants in Florida and southern California

A *Fls violet or blush, sometimes fading to white*

calycina, Benth (*Franciscea calycina,* Hook *F. pauciflòra,* Benth *F confertiflòra,* Moore *Besleria inodòra,* Vellozi) Habit erect or spreading, branching freely from the base upwards lvs shortly petiolate, numerous, glabrous or nearly so, 3–4 in long, elliptic or elliptic-ovate, acute, rich dark livid green above, pale green below fls rich dark purple in dense terminal or axillary cymes, pedicels an inch long, limb salver-shaped, with slightly wavy margins, calyx ¾–1 in. long, tubular, light green Brazil B M 4583 —Extremely variable in the size of the fls and lvs Some of the most distinct forms have been described as species by various botanists All have fls of some shade of purple and are here included as varieties The following are well-marked forms in cult .

Var. **eximia** (*Franciscea eximia,* Scheidw). A fine tree-flowering variety intermediate in size between the type and var *macrantha* and characterized by the long slender slightly curved and hairy calyx, which is about 1¼ in long. fls rich purple on first-opening, but soon fading to almost pure white, about 1½ in diam ; calyx rather long for the genus, tube extending to three-fourths its length whole plant slightly downy. B M. 4790 F.S. 10·1037.

Var. **floribúnda** (*B floribúnda,* Hort.). A dwarf floriferous shrub of free-branching habit and glabrous in all parts. lvs 2–4 in. long, elliptic, rich dark livid green color, glabrous, and prominently veined on the under sides· fls rich violet, with small white eye, limb flat or nearly so, calyx ⅝in long, elliptic in outline; pedicels stout, ½in long —Largely grown by European nurserymen in recent years. A pretty and desirable form, as it flowers rather early in the year without any extra heat.

Var. **macrántha** (*B. macrántha,* Lem. *B. grandiflòra,* Don. *B Landeniàna,* Nichols). Fig 671 A magnificent form of strong and vigorous habit, with rich dark green lvs often as much as 8 in long and 2½ in broad, glabrous or nearly so in all parts, except the upper part of the corolla-tube fls in dense axillary or terminal cymes in the axils of all the upper lvs., rich deep purple in color, with prominent ring of lavender-blue color surrounding the white eye at the mouth of the tube calyx, 1 in long, bright green, corolla 2½–3 in diam.—One of the finest and most floriferous shrubs for a warm greenhouse or subtropical country, of

extremely easy cult., and readily trained into fine specimens. Readily conforms to pot culture. Should be kept slightly on the dry side during the winter, but not enough to cause it to lose the lvs

ramosíssima, Benth Lvs. oblong to nearly lanceolate, acuminate or obtuse, glabrous or rarely slightly hairy above and hairy or villous beneath. fls large, in lax cymes, deep violet-purple, the corolla-tube twice longer than the calyx —One of the best, with luxuriant foliage; may be grown cooler in winter than the other species. Probably a form of *B calycina.*

Hopeàna, Benth (*Franciscea Hopeàna*, Hook. *F. uniflòra*, Pohl) A slender twiggy free-branching shrub: lvs lanceolate-oblong, thin in texture, rich dark green, paler beneath· fls. small but freely produced, solitary or in pairs all along the leafy growths; limb light violet-blue on first opening, fading to almost pure white with age, tube very slender, curved upwards, nearly white, 1 in. long, calyx ¾in long, teeth obtuse. Brazil W. Indies. B.M. 2829 L B C 14.1332.

latifòlia, Benth. (*Franciscea latifòlia*, Hook) Habit dwarf with slender spreading branches lvs. elliptic, 2–4 in. long, acute or obtuse, glabrous above, slightly pubescent beneath· fls. in terminal clusters or short axillary, few-fld cymes, corolla 1½ in diam , pale violet, with white center, changing in a day or so to white, sweetly scented; tube 1½ in long, slender, slightly curved; calyx erect, campanulate, ½in. long, teeth acute. Trop. Amer. B.M 3907.

AA *Fls. white or yellow.*

americàna, Linn Habit dwarf, branches slender: lvs glabrous or nearly so; lamina elliptic-ovate, acute; petiole ½–1 in long, stout fls solitary and axillary, or in terminal few-fld clusters, pure white shading with age to pure yellow and sweetly scented, especially at night, petals obtuse; calyx green, campanulate teeth spreading, nearly equaling the length of the tube. Trop. Amer B.M. 393.—Of very easy cult , and thriving and seeding freely under the conditions of an ordinary greenhouse In Fla , grows 4–6 ft high, the very fragrant fls are much prized

Var. **pubéscens** (*A fàllax*, Hort.). Resembles the type, but hairy in all its parts, and rather more floriferous.

undulàta, Swartz. A strong-growing evergreen shrub or small tree, reaching to 20 ft in its native habitat and flowering freely when quite small lvs ovate-lanceolate, margins slightly wavy, light green in color, acute, variable in size up to 7 in long and 2 in wide when vigorous, apex acute or obtuse, petiole ¼–½ in. long fls on the upper parts of the sts solitary or in pairs in the axils of most of the terminal lvs. forming terminal clusters; calyx cyme green ½–¾in long, campanulate ; corolla white changing to creamy white with age; lobes broadly ovate or orbicular in outline and with beautiful wavy margins. Jamaica. B. M 8422 — A magnificent free-flowering species and a great acquisition to any garden. Requires subtropical conditions.



671 **Brunfelsia calycina var. macrantha.** (×⅓)

jamaicénsis, Griseb. (*B. nítida* var. *jamaicénsis*, Hook) An erect shrub or small tree, sparsely branched in the young state: sts. woody, with the lvs more or less tufted at the ends of each year's growths lvs. elliptic or lanceolate, up to 7 in long, but often small and borne on short lateral tufted growths, glabrous or nearly so, petiole very short fls crowded on the apex of the current year's growth, solitary (occasionally in pairs) and axillary; pedicels ¼–½in. long, slender, erect or spreading; calyx erect, ½in long, campanulate teeth spreading, acute, corolla erect, white, changing with age to primrose-yellow. W. Indies B M 4287 — A very fine species for the warmer parts of the S , but a somewhat shy-flowering plant unless the growth is thoroughly well ripened up There is a general resemblance between this species and *B nítida* and *B undulata* and it is possible that they are forms of one polymorphic species.

L H B
C P Raffill

BRUNSDÓNNA. A cross between *Brunsvigia* and *Amaryllis Belladonna* has recently been given the garden name *Brunsdonna Sanderæ alba*, it has the umbel resembling typical *A Belladonna*, and one-sided rather than globular fls white See *Amaryllis Belladonna* var. *Parkeri*, which is a similar cross

BRUNSVÍGIA (after the Duke of Brunswick) *Amaryllidàceæ.* Tender summer- or autumn-flowering bulbs

Umbels of large numerous brick-red fls ; corolla funnelformed, 6-parted, deciduous, its segms nearly equal, recurved at the tip —Species 9 S Afr

The bulbs must be thoroughly rested from the time the leaves fade until the scape appears Brunsvigias are hard to flower They require rich, sandy soil, plenty of heat and sunlight When growing, give water and liquid manure freely They propagate by offsets. For fuller instructions, see *Amaryllis*

A *Lvs strap-shaped*

Josephinæ, Ker Bulb 5–6 in thick lvs 8–10, strap-shaped, glaucous or greenish, thick, closely ribbed, 2–3 ft long, 1½–2 in broad scape 1 in thick, 1½ ft long; fls 20–30, rarely 50–60, in an umbel, pedicels ½–1 ft long caps smaller than in *B gigantea*, less conical and less strongly angled B M 2578 F S 4 322 —Named after the Empress Josephine, who purchased the original bulb after it flowered at Malmaison.

AA *Lvs tongue-shaped.*

gigantèa, Heist. (*Amaryllis gigantèa*, Van Marum. *A orientàlis*, Ecklon) Bulb very large lvs about 4, tongue-shaped, closely ribbed, 3–5 in broad, usually under 1 ft long scape red or green, a finger's thickness, fls. 20–30 in an umbel, paler than in *B gigantea*, and less numerous; pedicels stout, strongly ribbed, 4–6 in. long. B.M 1619 (as *B multiflora*).

B falcàta, Ker=Ammocharis falcata —*B magnífica*, Land Fls 20–25 in a cluster, corolla short, the segms white, with medium stripe of red or purplish red lvs 1–2 ft long, 3–3½ in wide, recumbent —Thought by Baker to be Crinum Forbesianum or near that species

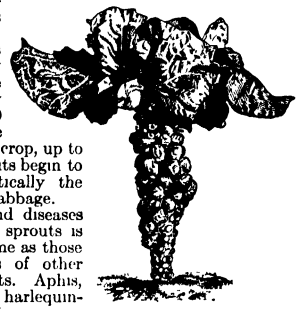
N Taylor.†

BRUSSELS SPROUTS. Fig 672 A form of the cabbage tribe, grown for the globular buds or "sprouts" produced along the stout upright stem

The garden varieties of brussels sprouts represent one of the many interesting variations that have taken place in the cabbage family. This plant, while in its seedling stage and during its early life, closely resembles the ordinary cabbage, but later in its development the axillary buds, instead of remaining dormant as is the case with the common cabbage, develop into miniature heads similar in their make-up to an ordinary head of cabbage but very small

The soil to which the sprout is adapted is, in general, the same as that for late cabbage; in fact, the plant is

always grown in conditions similar to those chosen for late cauliflower or late cabbage, and its range of adaptation is much the same as that of autumn cabbage. The fertilizing of the crop should be the same, in general, as for autumn cabbage. The plants should be set so as to allow them sufficient room for full development, preferably in checkrows 30 to 36 inches apart each way. Young seedlings should be ready for planting in the latitude of New York from June 20 to July 10 The cultivation of the crop, up to the time the sprouts begin to develop, is practically the same as that for cabbage.



672 Brussels Sprouts.

The enemies and diseases to which brussels sprouts is subject are the same as those of the fall crops of other cabbage-like plants. Aphis, green-worm, the harlequin-bug and the cutworm are probably the most annoying of the insect pests, while the rots, damping-off fungus and the mildew are more or less troublesome

Before the sprouts are ready for harvest, the lower leaves of the plants are broken away in order to facilitate the cutting of the miniature heads or sprouts, this is done by means of a sharp short-bladed knife, used to separate them from the stalk of the plant In sections in which the plant can remain in the open during the winter, two or three cuttings are made The first sprouts develop in the axils of the leaves nearest the ground, and as the stalk of the plant elongates and more leaves are added, a succession of sprouts develop The first cutting is confined, therefore, to the older and more fully developed sprouts When the miniature heads have attained the size of ½ to 1 inch in diameter, the cutting begins and is repeated at intervals depending upon the development of the sprouts In regions in which it is not safe to allow the plants to remain in the open during the winter, a small supply for home use or for local market may be stored in a vegetable-cellar or storage-pit, the plants being lifted with earth adhering to the roots and planted in sand that is kept somewhat moist during the storage period Under these conditions, the sprouts will remain in good condition for several weeks and successive harvests can be made the same as when the plants are standing in the open

The hand labor involved in gathering the sprouts and preparing them for market is the chief deterrent to the extensive cultivation of this crop It is only in regions in which mild winter conditions prevail and in which labor is available to harvest and assort the sprouts that the industry thrives on a commercial scale After the sprouts have been cut and placed in suitable receptacles, they are carried to a packing-house where each head is trimmed by removing the outer leaves The trimmed heads are then placed in berry boxes holding one quart, those for the top layer being selected for uniformity in size and arranged so as to give a finished appearance to the receptacle

Several varieties of brussels sprouts are offered by the trade, but there is only one general type, the chief difference being in the length of the stalk of the plant itself and the manner in which the sprouts are distributed along the stalk This plant, although a popular vegetable in England and on the Continent, is sparingly cultivated in the United States, a few centers only giving attention to it as a commercial crop. Parts of Long Island, in New York, are well known for brussels sprouts production

L. C. Corbett.

BRYÁNTHUS (Greek, *bryon*, moss, and *anthos*, flower growing among mosses) *Ericàceæ*. Heath-like low shrub with pretty pink flowers, suitable for rockeries, but not yet in cultivation

Leaves evergreen, linear, remotely denticulate: calyx 4-parted; corolla rotate, 4-parted; stamens 8 caps. subglobose, 4-valved —One species on Kamtchatka and Behrings Isls. The genus Phyllodoce has been referred by several botanists to Bryanthus, but it differs considerably in its urceolate or campanulate 5-lobed corolla, 10 stamens, 5-valved caps. and solitary or umbellate fls

This prostrate evergreen shrub has small needle-shaped leaves and small rosy pink flowers in peduncled, slender, 3–10-flowered racemes. Bryanthus will probably require the same treatment as Chiogenes, Loiseleuria and Phyllodoce The only species is **B. Gmelinii,** Don. For illustration, see Pallas, Fl. Ross. 2.74 (as *Andromeda Bryanthus*).

B. Brèweri, Gray=Phyllodoce Brewer *—B. empetriformis*, Gray =Phyllodoce empetriformis *—B. erectus*, Lindl =Phyllodoce erecta *—B. glanduliflorus*, Gray=Phyllodoce glandulifloru *—B. taxifolius*, Gray =Phyllodoce taxifolia

Alfred Rehder.

BRYÒNIA (Greek, *to sprout*, referring to the annual growth from the tuber). *Cucurbitàceæ* Herbaceous perennial climbers.

A genus of 12 species of perennial cucurbits, native of Eu and W Asia They are herbaceous from a tuberous root, with staminate fls in racemes, while Bryonopsis is an annual plant, with the staminate fls in fascicles All species of Bryonia are dœcious except *B. alba* Bryonopsis is monœcious See Cogniaux, in DC Mon. Phan 2.469

A. *Fls. dœcious, stigmas rough fr. red.*

dióica, Jacq. Bryony Height 6–12 ft: root long, fleshy, branching, white, a finger's thickness lvs ovate or roundish in outline, 5-lobed, margin wavy-toothed, rough with callous points, paler beneath: pistillate fls greenish white, corymbose, short-peduncled —Common in England and in Cent and S Eu, rarer in W Asia and N Afr Not usually sold in Amer, but a common plant along English highways and cult in American botanic gardens It grows rapidly over hedges and fences Root of this and of *B. alba* are employed principally as a hydragogue-cathartic The fresh, bruised root applied to the skin causes vesication.

AA *Fls monœcious, stigmas smooth: fr. black.*

álba, Linn. Height 6–12 ft.. roots thick, tuberculate, yellowish outside, white within: lvs. long-petioled pistillate fls in long-peduncled racemose corymbs Eu, Caucasus, Persia

B. lacinìosa, Linn =Bryonopsis laciniosa

Wilhelm Miller.

BRYONÓPSIS (Greek, *Bryony-like*). *Cucurbitàceæ*. A genus of two species of annual climbers. Consult *Bryonia* for generic differences.

lacinìosa, Naudin (*Bryònia lacinìosa*, Linn.) Lvs. deeply 5-lobed, rough, light green above, paler beneath; segms. oblong-lanceolate, acuminate. serrate: fls. monœcious, fascicled or solitary, yellow: fr. about the size of a cherry, spherical, green, with pretty white markings Asia, Afr, Austral F S. 12:1202. Var **erythrocárpa,** Naudin (*B. erythrocàrpa*, Naudin) Has red fr. with white marks I H. 12:431. F.S. 21 2237 Gn 6, p 193.—A warmhouse plant, rarely grown in pots and trained to rafters Prop. by seeds.

Wilhelm Miller.

BRYOPHÝLLUM (Greek, *sprouting leaf*). *Crassulàceæ* A small genus of succulent plants in the same order with stonecrops, hen-and-chickens, cotyledon and echeveria, grown to some extent as flowering plants but more especially as a foliage novelty.

Root-system fibrous and very abundant. sts. upright,

simple or sometimes branching toward the base, of a thick soft tissue over a woody cylindrical core. lvs. opposite, petioled, simple or pinnately compound, succulent infl cymose or paniculate, fls nodding; sepals 4, united into an inflated calyx which incloses the lower half or more of the corolla, corolla cylindrical, ending in 4 petal tips, stamens 8, ovaries 4, separate or more or less united below.

The members of this genus may readily be distinguished from related genera by the "sprouting" habit of their leaves as indicated by the generic name. If a leaf is removed from a plant and placed in a warm moist place, young plants will very soon appear in the notches around its border This is the simplest method of propagation and is usually accomplished by placing the leaf flat on the wet sand of a growing-bench, in a warm, sunny exposure Tiny buds will soon appear in the notches and these are followed by numerous fine roots See Fig 673. When the small plants have attained a size sufficiently large to be handled, they may be removed from the parent leaf and potted This method may be employed in growing-houses at any season. Plants are also readily produced from stem-cuttings rooted in sand, or from seed. Seeds retain their vitality more than a year when kept dry. The best plants are to be grown by using rather rich loose, well-drained soil, with plenty of light, heat and moisture. However, they are very tenacious of life and will survive with a minimum of water and a low, but not freezing, temperature. They grow luxuriantly out-of-doors during the summer months but must be housed during the frost period. Useful in various botanical demonstrations.

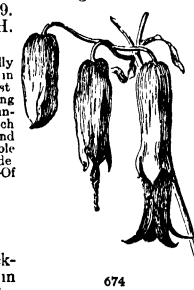
pinnàtum, Kurz (*B calycìnum,* Salisb). Figs. 673–4. Height 2–4 ft lvs opposite, fleshy, becoming leathery with age, earlier ones simple, ovate, with cordate or rounded base, later ones pinnate and then of 3–5 short-stalked lfts , the rachis and petiole with a narrow groove on the upper side, margin crenately doubly-serrate, light green becoming purplish along the veins toward maturity, margin purple as are also the petioles and young st -growths. fls pendulous, in terminal panicles; calyx much inflated, purplish green with lighter dots, 1½ in long; corolla greenish white with purple-tinted, spreading acute tips Tropics of both hemispheres B M. 1409. L.B C. 9 877. G C III 41:422. J H III 46 205.



673 Sprouting leaf of Bryophyllum.

R.B 24.125 R H. 1900, p. 362 V. 3.117; 4:113; 7.340.—Said to be used in India as a diuretic.

crenàtum, Baker Less robust in habit of growth than the preceding: height 2–3 ft.: lvs. very fleshy, simple, 1–3 in long, becoming smaller upward on the st , ovate with rounded or cordate base, in the latter case strongly crested auriculate, margin coarsely crenate to dentate, bright green with purplish pink margin and strongly bluish glaucous when young as are also the petioles and sts.; petioles not grooved on the upper side· fls. nodding, in terminal, open, corymbose cymes, calyx membranaceous, inflated, ⅜in long, pink, corolla ¾in long, ending in 4 rounded segms , red. Madagascar. B.M. 7856. G C III. 33.59, 41:419. G W. 10, p 396; 6, p. 495. R H. 1900, pp 175, 176, 362.



674 Flowers of Bryophyllum pinnatum. (×½)

B prolìferum, Bowie Occasionally met with, is much more robust in growth, reaching 12 ft in height· st 4-angled in new growth, becoming cylindrical later lvs pinnatifid to pinnate, the base of the pinnæ very much thickened, blade much contorted and margin finely crenate, rachis and petiole prominently grooved on the upper side S Afr B M 5147 F S 23 2446.—Of little value more than a novelty.

C. H. THOMPSON.

BUCKEYE. *Æsculus*

BUCKLEŸA (after S B Buckley, American botanist, died in 1884 at Austin, Texas) *Santalàceæ.* Shrubs rarely introduced in botanical collections, without particular ornamental qualities, but interesting as one of the few parasitic shrubs successfully introduced into cultivation.

Leaves opposite, sessile, entire: fls. dicœcious, apetalous; staminate in umbels, with 4 short ovate sepals and 4 short stamens; pistillate solitary, terminal, with 4 short deciduous sepals and below with 4 elongated linear-lanceolate persistent bracts, calyx-tube clavate, style short with 2–4-parted stigma; ovules 3–4 fr a furrowed drupe —Three species in China and Japan and 2 in N. Amer

Only the American species, **B. distichophýlla,** Torr , is in cult A slender-branched upright shrub, to 12 ft lvs 2-ranked, ovate-lanceolate or ovate, 1–2½ in long, acuminate, ciliate fls small, greenish· fr an ovoid or oblong-ovoid yellowish green drupe, about 1 in long, crowned by the 4 persistent bracts N C and Tenn G F 3·237 —Parasitic on the roots of Tsuga Has proved perfectly hardy in Mass there is a plant about 70 years old in the botanic garden at Cambridge It has also been successfully cult. at the Arnold Arboretum and in a few European botanic gardens Prop by seeds, best sown with a potted Tsuga in the greenhouse and planted out with its host when the young plants are strong enough, preferably within the reach of the roots of a large Tsuga, in order that the original host may be removed later when it crowds the young buckleya too much.

ALFRED REHDER.

BUCKTHORN: *Rhamnus,* particularly *R. catharticus,* also *Bumelia*

BUCKWHEAT (*Fagopŷrum esculéntum,* Moench) *Polygonàceæ* A tender annual grain plant, flour being made of the large 3-cornered fr. It is much grown in the N. U. S., usually being sown about the first of July. It is also a favorite for bee forage Buckwheat is native to Cent Siberia and Manchuria, and is now widely cult , although it is a grain of secondary importance. The Tartarian buckwheat (*F. tatáricum,* Gaertn) is occasionally seen It has smaller and yellowish fls , and a smaller roughish, wavy-angled fr. This species is often confounded with forms of *F esculentum,* from which it is really easily distinguished Buckwheat is a good cleaning crop for weedy and hard lands. For general discussion of buckwheat, consult Cyclo. Amer. Agric.. Vol. II. See *Fagopyrum*

BUDDLÈIA (after Adam Buddle, an English botanist) Syn , *Buddlea Loganiàceæ* Ornamental shrubs or trees, chiefly grown for their handsome flowers profusely produced in showy panicles or globular heads

Woody plants or rarely herbs, more or less covered with a stellate, glandular or scaly pubescence· lvs opposite, short-petioled, entire or serrate. fls in racemes, panicles or clusters, corolla tubular or campanulate, 4-lobed: stamens included, 4: fr. a 2-celled caps. with numerous minute seeds —About 70 species in tropical and temperate regions of Amer , Asia and S Afr , of which only a small number of hardier species is cult

The buddleias are deciduous or sometimes half-evergreen trees or shrubs with usually quadrangular branches, narrow rather large leaves and small lilac, violet, white or yellow flowers in showy panicles or clusters None of the species is hardy North, but some, as *B. japonica, B Davidii, B Lindleyana* and *B intermedia* will live through the winter, if protected with dry leaves around the base, even if the stems are killed nearly to the ground, they will freely push forth young shoots in spring, which usually flower the same year The handsomest in flower are *B Colvillei, B. Davidii, B asiatica, B globosa* and *B officinalis*

They grow best in a rich, well-drained soil, in a sunny position, they are rather coarse plants and need much space Propagation is readily effected by seeds sown in spring in gentle bottom heat, by greenwood cuttings under glass, or by hardwood cuttings taken off in fall and kept during the winter in a frost-proof room

INDEX.

asiatica, 7	intermedia, 2	officinalis, 5
capitata, 9	japonica, 1	*salicifolia*, 3
Colvillei, 10	Lindleyana, 3	sinuato-dentata, 3
curviflora, 1	*macrostachya*, 6	superba, 4
Davidii, 4	mad igascariensis, 8.	*variabilis*, 4
globosa, 9	insignis, 4	Veitchiana, 4
heterophylla, 8	*nemda*, 7	Wilsonii, 4
insignis, 2	nivea 6	yunnanensis, 6.

A. *Corolla small, with long, narrow tube, ½–¾in long*

B *Fls in panicles.*

C *Color violet or lilac*

D *Lvs glabrous or only slightly grayish tomentose beneath stamens inserted below the middle of the tube*

1 **japónica,** Hemsl (*B curviflòra*, André, not Hook & Arn) Three to 6 ft , with spreading quadrangular, winged branches lvs ovate-lanceolate, acuminate, remotely denticulate or coarsely dentate, slightly tomentose or nearly glabrous beneath, 3–6 in long fls in dense, terminal, pendulous racemes, 4–8 in long, corolla slightly curved, lilac with grayish tomentum outside Japan I H 17 25. R H 1870, p. 337; 1878, p 330

2. **intermèdia,** Carr. (*B japónica* × *B Landleyàna*) Hybrid of garden origin, similar in habit to *B japonica* Lvs ovate-oblong, dark green above, 4–5 in long fls. violet, in slender, arching or pendulous racemes, 10–20 in. long R H 1873.151 Var **insígnis,** Rehd (*B insígnis*, Carr), has the upright habit of *B Landleyana* Branches distinctly winged: lvs. oblong-lanceolate, often in 3's racemes erect, rather dense, 4–6 in long, usually paniculed at the end of the branches, with rosy violet fls R H. 1878:330

3. **Lindleyàna,** Fort (*B salicifòlia*, Hort , not Jacq) Three to 6 ft lvs ovate or oblong-lanceolate, acuminate, remotely denticulate, pale green beneath, and slightly pubescent or glabrous, 2–4 in long racemes dense, erect, 3–5 in long; corolla purplish violet, slightly curved, pubescent outside China B R 32 4 F S 2:112. P.M. 14.5. R H 1846.201. Var **sinuàto-dentàta,** Hemsl Lvs. sinuately-dentate. China

DD. *Lvs. densely white or yellowish tomentose beneath: stamens inserted slightly above the middle.*

E *Tomentum close.*

4. **Davídii,** Franch (*B variábilis*, Hemsl). Fig. 675. Three to 8 ft · lvs nearly sessile, ovate-lanceolate or lanceolate, acuminate, coarsely serrate, whitish-tomentose beneath, 4–10 in long fls in dense, terminal, erect or nodding panicles, 4–6 in long or in some varieties longer, corolla lilac, with orange-yellow mouth, glabrous outside Aug , Sept China B M. 7609 R H. 1898 132, 1902, p 383 G C III. 24 139. Gn 55 428; 64, p 153. M D G 1908 136 —A very handsome species with showy and fragrant fls appearing in great profusion in late summer, several varieties differing from the type which has rather lax panicles of lilac-purple fls with an orange eye not very marked, by larger and denser panicles and brighter color Var **Veitchiàna,** Rehd. (*B variábilis* var *Veitchiàna*, Hort) More robust, erect at first, later gracefully arching, with denser and larger clusters of bright mauve-colored fls with a bright orange eye, begins to bloom early in Aug J H S 27 182 J H. III 45 381. G M 51 45 G W 16, p 538 Var **magnífica,** Rehd. & Wilson (*B variábilis* var *magnífica*, Wilson) Similar to the preceding has larger deep rose-purple fls. with deep orange eye and the margin of the petals reflexed, panicles very dense, begins to bloom about the middle of Aug Gn 68, p 161; 69 288 R B 33 281 F S R 3, p 339 G M 52 668 Var **supérba,** Rehd & Wilson (*B. variábilis* var *supérba*, DeCorte) Color of fls like the preceding variety but petals not reflexed at the margin and panicles larger R B 35 12 Var. **Wilsonii,** Rehd & Wilson (*B variábilis* var *Wilsonii*, Hort) Tall and arching, with longer and narrower lvs panicles drooping rather loose, sometimes attaining 30 in. length, corolla smaller, bright rose-lilac with bright orange eye, corolla-lobes half upright and reflexed at the margin in full bloom through Sept , the latest of all There are also other named varieties



675
Buddleia Davidii (×⅛)

5. **officinàlis,** Maxim Shrub, to 8 ft branchlets nearly terete, grayish tomentose· lvs oblong to linear-lanceolate, 2–6 in long, entire or serrulate, grayish pubescent above, whitish or fulvous tomentose beneath fls lilac with orange eye, fragrant, in terminal panicles usually 4–6 in long, consisting of short-peduncled dense clusters, corolla over ½in long with a slender tube pubescent outside and within and twice as long as the oval obtuse lobes W. China. B M 8401 G C III 49·200 —Tender; flowers during the winter in the greenhouse like *B asiatica* Page 3566.

EE. *Tomentum fluffy, white or yellowish: stamens inserted just below the mouth.*

6 **nívea,** Duthie Shrub, to 8 ft · branchlets, the under side of the lvs and infl densely covered with a pure white woolly tomentum lvs ovate-lanceolate, 4–9 in long, acuminate, coarsely serrate, glabrous above fls lilac or purple, small, in long terminal panicles; corolla with the tube tomentose outside, glabrous within except at the mouth Aug., Sept W. China. G C. III. 38.275.— Very distinct on account of its white fluffy tomentum, but fls less showy than in most other species, nearly embedded in the fluffy tomentum of the infl. Tender. Var **yunnanénsis,** Rehd. & Wilson (*B. macrostàchya* var *yunnanénsis*, Dop) Tomentum less fluffy, yellowish. lvs pubescent above fls larger; panicles usually solitary. W. China

cc. Color white: stamens inserted just above the middle of the corolla.

7. asiática, Lour (*B. nec̆mda,* Roxbg.) Shrub or small tree. branchlets terete with white or buff-colored tomentum when young lvs. lanceolate, 4–8 in long, acuminate, entire or serrulate, glabrous above, white or buff tomentose beneath: fls white, very fragrant, in slender drooping panicles, 3–6 in. long and usually several at the end of the branchlets; corolla with the tube villous outside and spreading suborbicular erose lobes or in a less desirable form with ovate, erect and entire lobes Jan., Feb China, India, Java B.M. 6323 G.C. III 39 106 Gn 69, p. 89, 76, p 80 J.H. III 52 180 G.W 10, p 502 —A very desirable greenhouse shrub on account of its slender spikes of deliciously fragrant white fls in winter. If prop early in spring, transplanted several times or planted out during the summer, the plants will be of sufficient size in autumn to flower the following winter.

ccc. Color yellow.

8. madagascariénsis, Lam. (*B. heterophýlla,* Lindl.). Straggling shrub, 6–20 ft., with densely tomentose branchlets· lvs ovate-oblong, rounded or slightly cordate at the base, acuminate, entire, dark green and lustrous above, whitish or yellowish tomentose beneath: fls tomentose outside, in large terminal panicles, appearing during the winter Madagascar. B.R. 15:1259. B.M. 2824 —Hardy only in subtropical regions. Sometimes cult. in Calif. and used as a half-climbing plant to cover unsightly objects.

BB. *Fls in globular heads.*

9. globòsa, Lam (*B capitàta,* Jacq.). Three to 10 ft. with the branches and lvs. beneath yellowish tomentose: lvs. ovate or ovate-lanceolate, acuminate, crenate, rugose above, 3–7 in. long· fls. orange-yellow, in dense, long-peduncled, axillary heads at the ends of the branches, fragrant Chile. B.M. 174. Gn. 33, p. 369. G. 28 505 G.M 53 979. F.S.R. 3 335 (habit) —A graceful and very distinct shrub, standing some degrees of frost.

AA. *Corolla with broad cylindrical tube, limb over 1 in. broad.*

10 Cólvillei, Hook & Thoms Shrub, occasionally tree, to 30 ft. lvs. elliptic-lanceolate or lanceolate, serrate, pubescent, and pale or grayish green beneath, 5–7 in long panicles broad, pendulous, 12–18 in long; corolla purple or crimson, with white mouth B.M. 7449. R.H 1893·520. I.H. 41:10 F.S 14 1487. J.H. III. 31 85 —The most beautiful of all buddleias, and a very desirable shrub for warmer temperate regions; only older plants flower freely.

B albiflòra, Hemsl (B. Hemsleyana, Koehne) Allied to B. variabilis Shrub or small tree, to 30 ft lvs lanceolate, 5–9 in. long, glabrous above, white or yellowish tomentose beneath fls. small, lilac, in elongated spikes, sometimes to 20 in long W China. G. 27 501 —Less handsome than B. variabilis fls not white, as the name implies, given under the impression that the fls were white. —*B. americàna,* Linn Shrub, 8–12 ft lvs. ovate to oblong-lanceolate, cuneate at the base, glabrous above, yellowish tomentose beneath, 4–10 in : fls in terminal densely tomentose panicles consisting of sessile subglobose clusters Mex. to Peru —*B auriculàta,* Benth. Straggling shrub petioles auriculate, lvs oblong-lanceolate, entire or denticulate, grayish white tomentose below, 1½–3 in long fls cream-colored, fragrant, tomentose outside, in terminal compact panicles, stamens above the middle S. Afr G.C. II. 16 633, III 6 529 I.T 1 20 Tender —*B brasiliénsis,* Jacq f. Upright shrub sts quadrangular lvs ovate to oblong-deltoid, crenate-serrate, white-tomentose below, 4–8 in long, decurrent into the winged auriculate petiole fls orange-yellow, pubescent outside, in axillary clusters, forming terminal narrow panicles; stamens just below the mouth Mex. to Brazil B.M. 2713 Tender.—*B columbæ,* André Upright shrub, similar to B. Lindleyana Lvs narrow-lanceolate, entire, 4–6 in long, glabrous fls. white in terminal slender panicles, corolla with spreading lobes slightly shorter than the corolla-tube Spring Of unknown origin R.H 1901, p 37 Tender —*B crispa,* Benth =B. paniculata —*B. Hemsleyàna,* Koehne=B albiflora —*B paniculàta,* Wall. (B. crispa, Benth.). 6–15 ft fls. lilac, in rather dense panicles branches and lvs tomentose B.M 479.i F.S. 9 958 —*B pulchélla,* N.E. Br Shrub, 2 ft., branchlets terete, tomentose lvs hastate, irregularly lobed, or rhomboid to lanceolate, 1–2 in long, pubescent: fls white with orange eye, fragrant, in terminal panicles, 2–2½ in. long, corolla with slender tube, pubescent outside S. Afr (?) —*B. salicifòlia,* Jacq =Chilianthus arboreus —*B saligna,* Willd =Chilianthus arboreus —*B stenostàchya,* Rehd & Wilson Allied to B. nivea Less fluffy lvs oblong-lanceolate panicles usually 3, long and slender; fls larger, anthers inserted above the middle of the tube W. China.

ALFRED REHDER.

BUDS. A bud is an incipient shoot or short growth-axis concealed by the closely investing leaves, or leaf-parts, that it bears. The foliage-shoots and flower-shoots of all seed plants arise from buds. The leaves converge over the true stem-apex or growing-point. The essential thing is that this growing-point continues the terminal growth and gives rise laterally, behind the point, to new leaves, in the axils of which buds may be formed ultimately. In the plumule of the seed the first bud activity is manifest, and thenceforth a bud marks every growing stem-apex



676. Apple buds—fruit-bud on the left, leaf-bud on the right.

Normally the leaves arise back of the stem-apex, first as small protuberances, which soon flatten laterally. They grow faster than the stem-apex, and by more rapid growth on the under surface they bend over, forming for the time a part of the bud or bud-cluster of leaves which effectively protects the delicate tip In many herbaceous plants the shoot elongates throughout the growing period, so that each leaf or whorl of leaves in turn has a more or less equal work as a part of the bud As the apex elongates and each leaf develops, greater growth on the inner (upper) surface effects its complete exfoliation Using favorable material, one may completely dissect the bud, laying bare the growing-point, which may be readily examined with a hand-lens. Either of the little pondweeds commonly cultivated, Elodea or Hippuris, may be used for this purpose.

The buds which are commonly most conspicuous and at the same time most highly specialized are the "resting" buds of temperate shrubs and trees Such buds are often scaly buds, and they are characteristic of all climates in which there is an interruption to growth, either through cold or dryness In this case the stem-apex and younger leaves are normally inclosed by persistent more or less indurated leaf-parts modified as bud-scales Resinous secretions may accompany the scales and the younger leaves may be covered with hairs The size, form and minute characters of such buds vary widely, but obviously they are, in general, wondrously efficient in the resistance exhibited towards rigorous climatic conditions The important point is that the bud-structures quite effectually prevent drying out of the young shoot which is there tucked away.



677. Pear twigs — fruit-buds on the left, leaf-buds on the right.

Particularly interesting is the fact that the resting-bud of many trees includes in miniature the entire vegetative or flowering shoot of the next season In such case the rapid elongation of the axis and unfolding of leaves in the spring is soon followed by the formation of a new resting-bud wherein the shoot of another year is gradually differentiated Every gradation occurs between this type and the typical active bud of annuals.

Interest in buds centers in their spring activity, properly in the awakening and growth resulting when the conditions have remained favorable sufficiently long Leaves and axes enlarge and elongate rapidly, bursting asunder the dead scales and often carrying forward the expanding younger ones The growth of the younger scales exhibits the true nature of these structures, some of which are found to be leaf petioles, some petioles with minute blades, and various other modifications occur. Many resting-buds are awakened from their comparative inactivity by a few days of favorable weather. These are "early" flowers, and of this type are the lilac and the golden bell Other buds require a longer period, such as the oak and the hickory It is not strange, therefore, that some plants lend themselves readily to early forcing by etherization, the hot water treatment, and the like, while others are with great difficulty forced



678 Sections of pear buds—fruit-bud on the left, leaf-bud on the right

In the preceding, more specific mention has been made of buds which develop leafy shoots, that is of leaf-buds It is clear, however, that the resting-bud, as well as an herbaceous bud, may develop a single flower, as in the peach, a cluster of flowers, as in the red maple, or a shoot with leaves and flowers, as in the apple and Norway maple The occurrence of leaf- and flower-buds with respect to the age of the twig and the relation of pruning to bud disposition are questions of special horticultural interest, but cannot receive consideration in this brief account Illustrations of flower-buds and leaf-buds are shown in Figs 676–679

Buds are normally produced terminally and in the axes of leaves, the latter arrangement therefore corresponding to leaves, but under exceptional circumstances they may arise from the growing tissue of any member. Buds from the roots of the sweet potato and dahlia are important in propagation, likewise are those produced by the leaves of certain species of Begonia As a matter of fact, buds originating from internodes, roots and leaves—so-called regenerative-buds—are not uncommon, but the development in such situations occurs as a rule only when normal buds are not present

Buds with the leaves and leaf-parts surrounding them are sometimes organs of food-accumulation The typical bulb is little more than a fleshy bud, and there are all gradations between the typical bulb and the typical tuber—the latter with many buds Small bulb-like buds occur in *Lilium bulbiferum* and a few other plants, and they are always important in propagation It requires no stretch of the imagination to classify the edible shoots of brussels sprouts among unusual buds, and from this it is no great leap to the monstrous "bud" of the cabbage

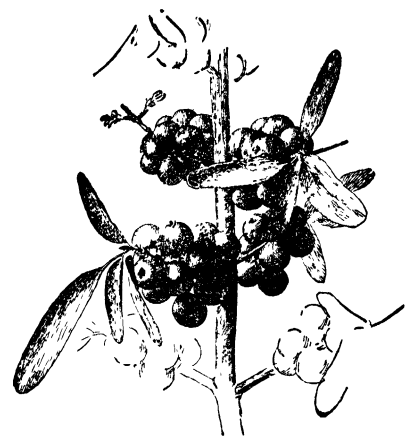
Literature Bailey, Lessons with Plants, The Macmillan Company; Strasburger (*et al*), A Text-Book of Botany, The Macmillan Company, Percival, Agricultural Botany, Duckworth & Co B M DUGGAR



679. Buds of the peach The middle bud is a leaf-bud and the large side buds are fruit-buds.

BUETTNÈRIA (D S Aug Buettner, 1724–1768, German botanist) *Byttneria Sterculiàceæ* About 50 herbs, shrubs or trees of diverse habit, native to eastern and western tropics, scarcely known in cult Some are prickly climbers or scramblers. Fls. small, usually dark purple or greenish, in umbels or cymes, petals 5, long-clawed, hooded and oddly appendaged at the top fr a 5-celled, globose spiny woody caps One species is catalogued in S Calif · **B. urticifòlia,** Schum , from S Brazil, Argentina· Climbing shrub; branches grooved, spiny, nearly glabrous: lvs long-petioled, cordate-ovate, acuminate, coarsely serrate, appressed-hairy on both sides: fls. ⅓–½ in. across, 3–5 in a stalked umbel

BUFFALO BERRY (*Shephérdia argéntea,* Nutt *Lepargyræa argéntea,* Greene). *Elæagnàceæ* Fig. 680. A shrub 6 to 18 feet in height, native from Manitoba and Saskatchewan south to Colorado, Nevada and New Mexico, now grown in the upper Mississippi Valley and northward for its abundant acid fruits



680 Buffalo berry (×⅔)

The buffalo berry was brought into use early, mention being made in Hovey's Magazine of Horticulture for 1841, page 251, of its being frequently cultivated It is a handsome ornamental shrub, with silvery foliage and red berries Occasional plants are found with yellow fruit The plant is dioecious, therefore, care should be taken, if fruit is desired, to plant both staminate and pistillate plants Western nurserymen are beginning to offer these two kinds of plants separately in the ratio of one staminate to four pistillate plants, but the best proportion is not yet known Many persons who plant the buffalo berry are disappointed by securing only one sex The staminate or male plants may be known in their winter condition by the dense clusters of rounded flower-buds, the pistillate or female plants by the smaller, flattened, fewer, more slender flower-buds.

The fruit varies greatly in size, quality and season, and is gathered in large quantities for culinary use It makes a delicious jelly Some berries are of sprightly flavor, good for eating out of hand They can also be dried for winter use The fruit is generally considered better when touched by frost, less sugar being required. The name is said to have come from the custom of eating the berries as a sauce with buffalo meat in the early days The buffalo berry makes a fine thorny hedge, that is both useful and ornamental

It is found that sprouts received as dug up in the native thickets from various parts of the Northwest do not always transplant satisfactorily, a year in a nursery row gives them better roots and secures an

even stand when set in their permanent place. Seedlings are better rooted. Seedlings are easily raised from seed washed free from the pulp in the fall and stratified for winter, keeping in sand in a box buried just beneath the surface in a well-drained spot in the garden. There should be holes in the box for free drainage and the planting should be done very early in the spring In Bulletin No 88, June, 1904, of the South Dakota Experiment Station, Plate 19 shows a field of 7,500 buffalo berry plants of the first generation under cultivation. These plants were raised from seed gathered along the Missouri River of South Dakota, where buffalo berries are especially abundant. However, under cultivation the plant does not respond, as regards early bearing, as quickly as its near relative the Siberian sandthorn (*Hippophae rhamnoides*) It was found that the buffalo berries can be worked on the Russian form of oleaster (*Elæagnus angustifolia*). The fault of the buffalo berry is its small-sized fruit and the difficulty of gathering it, owing to its numerous thorns, but it has been and is an abundant source of pleasant fruit to thousands of settlers in the newer regions of the West The fruit varies greatly in size and degree of acidity, affording opportunity for selection work in its native home along the Missouri River and tributaries. N. E HANSEN.

BUGBANE *Cimicifuga*

BULB, BULBS. A bulb is a thickened, fleshy, and commonly subterranean bud, usually emitting roots from its under side. The office of the bulb is to carry the plant over an unpropitious season, as over winter or a dry period

True bulbs are either tunicated, formed in rings or layers, like those of hyacinths and onions (Fig 681), or scaly, like those of some lilums (Fig 682), but as popularly understood and in commercial parlance, the term bulbs applies to a large class of flowering and ornamental bulbous-like plants in their dormant condition, during which period they are collected, dug, stored, shipped, sold and planted, like so many potatoes This class includes, in addition to the true bulbs, many that are botanically known as corms, which are solid, as crocus and gladiolus (Fig 683), tubers which are succulent and have the buds or eyes near the surface, as the dahlia and potato (Fig 684); rhizomes, fleshy, creeping underground stems like certain iris, ginger, and many wild plants (Fig 685), pips, the flowering crowns of lily-of-the-valley; and certain other dormant fasciculated fleshy roots like those of peonies, ranunculus, and the like A variety of bulbs is shown in Fig 686. The true or feeding roots grow generally from the base of the bulb, the stems, flowers and foliage from the crown of the bulb, or the eyes. There is an exception to this in certain lilies, which throw out roots above the bulb also (Fig. 687). The bulb is a storehouse for the plant, wherein is formed, after flowering, new stems, leaves and flowers. In fact, the bulb contains a new plant, which is protected and sustained within the bulb by the reserve food and energy collected therein during one season for the plant's successor. After the flowering period, the plant above the bulb and the roots beneath it ripen off and die away The bulb is then in a dormant condition. It is during this state of rest, lasting approximately from three to six months, that bulbs are taken out of the ground and transported easily and safely from continent to continent, if required, after which the incipient roots, stems, foliage and flowers may develop with as much luxuriance and perfection as if the bulb had remained in its original environment.



681. Onion bulbs.

Bulbous flowering plants (bulbs) are very popular with flower-loving people There is a particular charm and interest in growing them As a rule, they produce flowers of remarkable beauty, unsurpassed by any other class of plants, and many of them are deliciously fragrant They comprise an endless variety in habit, form, size and color, are adaptable for many purposes, and many of them flower equally well under either garden or house culture Soon after their beauty fades they die away, or may be removed; and in the interval, their places may be occupied by other seasonable flowering plants. Not the least among the merits of bulbs is their ease of culture, and the great certainty and perfection with which their flowers are produced, under suitable conditions

Among bulbous plants are many that are sufficiently hardy to withstand the severity of our northern winters The kinds that are suitable are nearly all dormant in the fall, which is the proper time for planting them, and they will flower the coming season In March or earlier, spring is ushered in with the blooming of snowdrops, chionodoxas, anemones, scillas, crocus, winter aconites, bulbocodiums and so on, followed in April with brilliant hyacinths, tulips, narcissus and hosts of others In April appear the unapproachable late tulips, poet's daffodils, dicentras and the like, followed in succession until frost, notably with peonies, irises, hemerocallis, lilies, montbretias, tritomas and others

Gardeners usually think of bulbs as divided into two classes,—hardy and tender, or those that stand freezing and those that do not There is a class from South Africa known as Cape bulbs, which usually bloom in the fall There are now so many improved hybrids and breeds that are crowding out the types, that the term "Cape bulb" has lost its significance in this country. In the present article, bulbs are treated under the following general heads Hardy spring bulbs for design bedding, hardy bulbs in the herbaceous garden, mixed flower-border or lawn, subsequent treatment of outdoor bulbs, summer- and autumn-flowering tender bulbs for spring planting, bulbs for flowering in the house and greenhouse; the forcing of bulbs, other indoor methods; subsequent treatment of forced bulbs; keeping dormant bulbs, tubers, and the like, propagation of bulbous plants; hints on buying and selecting bulbs, catalogue of bulbs.

Hardy spring-flowering bulbs for design bedding.

The only bulbs adapted to geometrical beds are Dutch hyacinths and tulips It is not best to use both in the same bed for really fine effects For display bedding in parks, public squares, and like places, only solid bright contrasting colors as a rule are used, since brilliancy of coloring is advisable when the taste of large crowds must be considered This limits the selection in hyacinths to dark crimson, rose-red, pink, purple, blue, lavender, white and yellow (the latter is seldom satisfactory), and in tulips to dark blood-red, scarlet, rose, blush-pink, yellow, white, and a blush claret, which last is seldom used On private grounds many beautiful effects can be obtained by the use of the softer colors, particularly in beds that are situated in partial shade In ordering the bulbs for this style of bedding, it is important to select kinds that bloom at the same time and are of uniform height; and in the case of hyacinths to choose varieties with a strong stem,

for many sorts are liable to fall over from the weight of the spike and are quickly soiled when they lie on the ground If the item of expense is to be taken into account, it is possible to use second-size bulbs of hyacinths, often listed as bedding sizes, with satisfactory results, although only fine bulbs give fine bloom

In planting bulbs in "design beds," it pays for the extra trouble first to remove the soil to a depth of 6 inches, spade up the lower soil, using well-rotted manure and plenty of bone dust worked in Then level off, smooth, and cover with an inch of sand This prevents the manure from touching the bulbs, and allows the water to drain away from immediate contact with them, thus removing causes which may lead to their decay Bulbs set in this manner on the sand may be placed in their exact position, after which the top soil is carefully replaced It is a difficult matter to set bulbs just 4 inches deep and 4 to 6 inches apart with an ordinary trowel The planter is almost sure occasionally to chop off a piece of a neighboring bulb or displace it Bulbs planted in the manner advised, being all of an even depth, will flower uniformly, often, when planted with a trowel, some bulbs will be an inch too high and some an inch too low, which in early spring makes considerable difference in the time of blooming Besides, when bulbs are planted with a trowel or dibble, there is danger of "hanging" a bulb occasionally, where it may perish on account of not touching bottom



682 Scaly bulb of Lilium pardalinum

Hardy bulbs in the herbaceous garden, mixed flower-border, or lawn

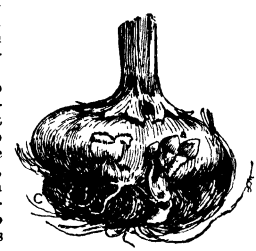
The mixed border is a favorite place for most hardy bulbs They should be planted in little colonies here and there among the hardy plants and shrubs, and it is here that bulbs seem to thrive and give the most pleasure As spring approaches, the somber winter browns and dull greens of the deciduous and evergreen plants are suddenly transformed into an unrivaled setting, studded with brilliantly colored and fragrant flowers, the contrasts being exceedingly effective and cheery; and besides, from the border one does not hesitate to cut a few flowers for the house for fear of spoiling the effect, as would be the case in formal bedding Furthermore, bulbs seem to do better and last longer in a border because the flowers are cut freely in bud or when just approaching their prime, which is the best possible time for the benefit of the bulb, for the efforts of any bulb to form seeds weakens the bulb A hyacinth bulb that matures seed is virtually destroyed Then again, in an herbaceous border the bulbs are not disturbed through the necessity for replacing them with other flowering plants, as such a mixed border when properly planted should do much itself to hide the withering leaves The foliage then remains unmjured until ripe, thus fulfilling its duty of recharging the bulb with new energy for the next season's display Of course, after three or four years, the bulbs should be divided if they have grown and spread, and judgment must be used to determine when the lifting should be done with the least injury to the other permanent subjects in the border It is best, perhaps, to associate with the bulbs plants that are not seriously injured by being moved

Bold clumps of the taller bulbous plants are very effective on the lawn, where beds of one kind should be isolated, and be given a position not too prominent nor too near. The object desired is a mass of one color, which at a little distance is more striking on account of the contrast with the surrounding green grass and trees. Among the best hardy bulbous plants for this purpose are: hemerocallis, such lilies as candidum, Henryi, tigrinum, speciosum and auratum, also dicentra, crown imperials, montbretias, tritomas, peonies, and Kaempferi and germanica irises.

Bulbs planted right in the sod on the lawn make a very pleasing picture when in bloom in the early spring Make patches here and there of golden, white and purple crocus, the little chionodoxas, snowdrops, *Scilla amœna*, winter aconite, snowflakes, bulbocodium and triteleia. These grow, increase, bloom and ripen the foliage mostly before it is necessary to use the lawn-mower, so that the surface of the lawn in summer is not marred. The bulbs may be dibbled in when the ground is moist and soft during the fall rains, but it is better to cut and turn back the sod here and there, plant the bulbs under it, then press the sod back again

For parks, groves and wild outlying grounds beyond the closely clipped lawn, a very happy style of "naturalizing" bulbous and other plants is coming much into vogue Such bulbs should be used as can be planted in quantity, twenty-five to a hundred or more of a kind in a patch, and only those should be used which are hardy, and will flower and thrive and increase under neglect. Fortunately, there are many bulbous plants that succeed even better in such rough places than in the prim garden Among them are hardy anemones, camassia, convallaria, dicentras, erythroniums, funkias, certain iris, lilums, poet's narcissus, Von Sion and many other narcissi, trilliums, and numerous others

In regard to the preparation of beds for hardy bulbs, planting and treatment, one can only generalize Detailed directions suited to the different species, and also varieties where treatment varies, will be found under their respective headings in this Cyclopedia As a rule, well-rotted manure (mind that it is well-rotted, not fresh and heating) should be liberally applied and dug into the ground deeply It must be where the long, feeding roots can get at it, and yet not touch the bulbs, nor be too near their base This is easily accomplished by removing a few inches of the top soil first, as described under "Design Bedding" above If it is impracticable to do this, then it is not advisable to use manure at all, for the bulbs are liable to come in contact with it and become diseased Bone meal alone is then the safest fertilizer to use, and it should be applied lavishly. Most bulbs like rich food if properly applied Although the embryo flowers were formed within the bulb the season before, yet their size, luxuriance and brilliancy this season depend largely upon the nutrition the roots receive Liberal applications of manure water, when the bulbs are in bud, often produce excellent results



683. Corm or solid bulb of gladiolus.

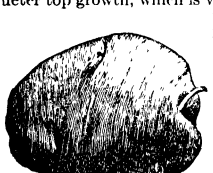
The proper depth to plant bulbs varies according to the kinds. It is a common fault to plant them too near the surface. Some kinds, notably the Californian Humboldtii and Washingtonianum lilies, do best when 10 to 12 inches deep, hyacinths, tulips, narcissi, and similar large bulbs from 4 to 6 inches deep, smaller bulbs somewhat shallower. A good rule to follow is to make the depth three times the average diameter of the bulbs. Hardy bulbs root during the fall and early winter, and if planted too near the surface the freezing, thawing and heaving of the upper crust of soil in mild winters often causes the bulbs to break from their roots, and, in consequence, only inferior flowers are produced. When good cold

weather has set in and a light crust has been frozen on the soil, then cover the bed with leaves, straw, marsh hay or reeds to a depth of about 4 to 6 inches This protects not only from severe freezing, but from equally injurious unseasonable thaws Do not put the covering on too early, for it might warm the soil so that the bulbs would begin to grow and afterward be injured from freezing. Gradually remove the covering in the spring

The general run of bulbous plants thrive in a loamy soil, inclining to sand. This soil attracts moisture, allows free drainage, and admits air If the soil is cold and stiff, a liberal admixture of leaf-mold and sand, with the addition of manure applied as previously described, will be beneficial The texture of the soil should be such that stagnant water will not remain around the bulbs, as it tends to rot them, particularly when dormant. An excess of humus is, therefore, to be guarded against for most bulbs

While most bulbous plants thrive under the soil conditions advised above, yet there are many exceptions. Happy should be the man on whose grounds is found a variety of soils and exposures, shade and sun A small wooded valley or ravine, with a brook flowing through it into an open, moist meadow, affords conditions suitable for growing to perfection the greatest variety of bulbous and other plants, many of which cannot be enjoyed in the average garden The hyacinth is a notable exception in regard to soil conditions In Holland this bulb is grown in pure sand, and soon becomes diseased in heavier soil This should indicate that in this country plenty of sand should be added to the natural soil, and that the bulbs should not be left in the ground during the summer

The sooner bulbs can be put in the ground after they are ripe, the better for the bulbs, for, no matter how long they will keep, they do not improve when out of the ground, but tend to dry out and lose vitality. This is particularly true of the narcissi, which give very noticeably larger flowers when the bulbs are planted early. All of the sorts having a strain of poeticus blood begin the new root-growth almost as soon as they have ripened, and are far better off if they can be in the ground early There are, however, many reasons why bulbs cannot be planted as soon as ripe, and when they are to be kept for certain purposes, they should be stored as advised below Hardy spring-flowering bulbs should be planted in the open ground in the fall, not earlier than six weeks before regular frosty and freezing nights are expected. Plant as much later as necessary, providing the bulbs are keeping sound, but it is not advisable to plant them earlier Cool weather is necessary to deter top growth, which is very liable to start after four to six weeks of root development; and young, succulent top growth is apt to be injured by the succeeding freezing In Maine, Ontario, Wisconsin, and other northern parts (about 45 degrees north latitude), such hardy bulbs as hyacinths, tulips and narcissi, may be planted in September. In New Jersey, Pennsylvania, Ohio, and so on (about 40°), plant about the middle of October. In the latitude of Richmond, Louisville, and St. Louis, the middle of November is early enough In the latitude of Raleigh, Nashville, and south, do not plant until middle of December; and for the latter section let the selection of bulbs run to late-flowering varieties, such as Bizarre, Darwin, and late double tulips, late hyacinths, late narcissi, and the like, for they are not so likely to be caught by the occasional freezing weather in January and February In this southern latitude, however, very early-flowering bulbs, such as Roman hyacinths, Duc Van Tholl tulips, Early Polyanthus narcissi, and so on if planted in September, are usually through blooming before freezing weather begins South of the freezing belt, hardy spring-flowering bulbs are not very successful, as a rule, there being no sufficiently cool weather to deter top-growth and force root-action first, without which the flowers and foliage will not develop beyond such sustenance as the bulb can supply, and this sustenance is usually exhausted by the time the flower-spikes are half grown But there are many half-hardy and tender bulbs that are more easily grown and flowered in the South than in the North.



684 Potato —Example of a tuber.

Subsequent treatment of outdoor bulbs

The treatment of bulbs after flowering is important when the bulbs are to be used again, for it must never be forgotten that the flowers and resources for the next season are garnered within the bulb after blooming, through the agency of the roots and foliage Imperfectly developed and matured foliage this year means poor flowers or none at all next year, so it is best to leave the bulbs alone until the leaves have died down. The further treatment depends upon the kind of bulbs under consideration Generally speaking, one class may be left in the ground for a number of years, while another thrives better if lifted annually and given a short period of rest out of the ground Among this latter class must, of course, be included tender bulbs which will not survive the winter if left in the beds or borders and which should be taken up in the fall when matured Of the hardy bulbs, hyacinths and tulips succeed best if lifted annually Late tulips in borders may be left undisturbed for two or three years with fairly good results, but the single early kinds ought to be taken up each year

Lifting of any bulbs should never be done before the foliage assumes a decidedly limp and brown appearance From that time on until the root-growth begins, they may be taken up, cleaned, and stored away, or divided and replanted at once The former method is advisable for hyacinths and tulips, the latter for most of the bulbs on the list appended hereto When bulbs are grown commercially, this yearly lifting is essential in order to make provision for propagation by division or by offsets, as the young bulbs mature more rapidly and perfectly when separated from the parent bulb When summer bedding-plants are to be substituted, it is sometimes necessary to remove bulbs before ripe In such cases, the bulbs should be carefully taken up with a spade Disturb the roots as little as possible, and do not cut or crush the leaves Heel-in the plants in a shallow trench in some half-shady out-of-the-way place until ripe, taking pains to avoid setting them too close in the trench to secure some air-space about the tops If the soil adheres to the roots when taken from the beds, the bulbs will be less affected by being disturbed before maturing As soon as ripe, they should be dug up, cleaned, and stored away A point to be kept in mind is that it is safer to lift tulips too early than too late; these bulbs should be taken up just before the stems are quite dry By doing so the protective skin about the bulb is more likely to be retained during the time the bulbs are out of the ground Darwin tulips have especially thin skins which frequently loosen and come off entirely if the bulbs are left too long, and then the bulbs tend to become soft and flabby during the resting period Narcissi should be taken up with whatever foliage has not quite withered away. Indeed, it is always wisest never to cut a leaf from choice kinds, but to make plantings of cheap kinds if leaves are wanted for cutting.

Summer- and autumn-flowering tender bulbs for spring planting.

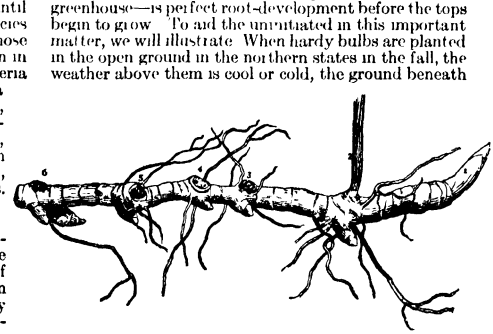
This class (tender) includes some of our showiest garden flowers, which are almost indispensable They are of the easiest possible culture. Planted in the spring,

after danger from frost is over, in a sunny position in good rich soil, they will flower with great certainty the same season After flowering and ripening of the foliage, they should be taken up and stored for the winter as advised under "Keeping dormant bulbs" (p 593) until wanted next spring Among the more important species of this class of bulbs are the undermentioned (those marked F must be kept in a semi-dormant condition in a coldframe or greenhouse) Agapanthus (F), alstremeria (F), amorphophallus, anomatheca (F), antholyza (F), tuberous begonia, bessera, colocasia (caladium), cooperia, crinum, cypella, gladiolus, galtonia (*Hyacinthus candicans*), boussingaultia (madeira vine), montbretia, nemastylis, border oxalis, ornithogalum (F), pancratium, richardia (calla), schizostylis (F), sprekelia, tigridia, tuberose, watsonia, zephyranthes.

Bulbs for flowering in the house and greenhouse

There is no class of plants that gives more satisfaction for this purpose, with so little skill, than the various bulbs Perhaps the most important class of all bulbs for winter-flowering and forcing are certain hardy and half-hardy kinds They are the most easily managed of all, and need occupy no space in the window or greenhouse, excepting when in bud and bloom Under suitable treatment, they flower with great certainty, and their flowering period may be hastened (forced) or retarded at pleasure, so as to "bring them in" for certain occasions, or to give a continuous succession of bloom There is a great variety of kinds of bulbs to select from for this purpose (see list of species at end of this article), yet the great demand, at this writing, has centered on the following leaders, especially for forcing purposes *Allium neapolitanum, A Hermattii grandiflorum, Anemone fulgens*, convallaria (lily-of-the-valley), *Freesia refracta alba*, gladiolus "The Bride," early single-flowering Dutch hyacinths and Romans, Campernelle jonquil, *Lilium candidum, L Harrisii* and *L longiflorum* Several narcissi are in demand, notably among the large trumpet varieties Emperor, Empress, Golden Spur, Horsfieldii, and Spurius major, among the medium and small trumpets Sir Watkin, Barrii conspicuus and Poeticus ornatus, of the doubles are Von Sion and Orange Phœnix, of the Polyanthus narcissi Paper White grandiflora (Totus albus), and double Roman (Constantinople) Of other species of bulbs, *Ornithogalum arabicum*, spirea Gladstone, and single and double tulips of the early varieties are in demand In the classes of bulbs there is often a great diversity in the fitness of the varieties for forcing Certain sorts will be found best adapted to early forcing, others to midseason or late work, and in selecting bulbs for forcing these characteristics must be taken into consideration Besides this general division into early and late forcing kinds, the skilled grower recognizes that each variety has its own peculiar period when it is at its best, if forced Many tulips and narcissi are very fine if forced early and only moderately good if forced late; the converse is equally true, for often an early variety will do only indifferently well when it is used for late work This characteristic is well studied by one of the largest forcers for the English market, who devotes whole separate houses to particular varieties of tulips, and puts in charge of each one man who knows the whims of the variety he tends This should not, however, deter anyone from attempting to force bulbs, as success is sure to be gained if standard forcing kinds are used, and the few important rules are followed The principles of culture for hardy bulbs for winter-flowering are the same, whether only a few are grown in pots for the window-garden, or whether they are to be forced by the thousand by the florist. The first essential is to secure the strongest bulbs Remember that the flowers were formed within the bulbs the previous season. If one buys bulbs of narcissi containing only one flower, or hyacinths with only ten bells on a spike, the best culture possible cannot make them produce more; but good culture will develop such flowers larger and better

The next most important essential—one might say the secret of success in flowering bulbs in house or greenhouse—is perfect root-development before the tops begin to grow To aid the uninitiated in this important matter, we will illustrate When hardy bulbs are planted in the open ground in the northern states in the fall, the weather above them is cool or cold, the ground beneath



685. Example of a rhizome—Smilacina racemosa. The figures show the different years' growths.

them is warmer, and the conditions are congenial for root-action but deterrent to top-growth This results in the perfect development of such flowers as the bulbs contain On the other hand, when hyacinths, tulips, narcissi, and most other hardy spring-flowering bulbs are planted in fall in our extreme southern states, they may prove disappointing, because the weather is warm, causing the flowers and foliage to begin to grow before the roots, and as soon as such sustenance as the bulb could supply has been exhausted, the plant stops growing and dwindles. When one grows bulbs under artificial conditions, one must make them produce roots first Failure to do this is responsible for nine-tenths of the disappointments.

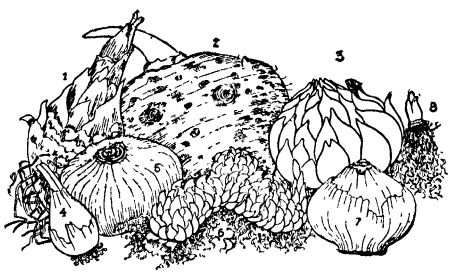
When hardy bulbs are to be grown in pots for winter blooming in the house or conservatory, the bulbs should be potted as soon as they are procurable, between August and November. Some writers recommend that bulbs be planted in successional lots to give later and continuous flowers, but such advice is at fault, as the bulbs tend to dry out and lose vitality when kept dry too long. It is no trouble to retard the flowering of hardy bulbs in winter, as hereafter described, without keeping them out of the ground.

The soil should be rich loam Fresh manure cannot be used Of thoroughly rotted manure, some may be pulverized and worked into the soil, but it is safer to use pure bone meal, one part to fifty of soil If the soil is stiff and heavy, mix with it sand and leaf-mold or peat The size of pots depends upon the kinds of bulbs. A 5-inch pot is best for a first-sized hyacinth, or large-bulbing narcissus, particularly the polyanthus type. Tulips, small narcissi, and bulbs of a similar size, while they can go individually into a 4-inch pot, are better when put three or more of one variety together in a larger pot, as the soil retains a more even temperature and moisture, and for this reason some prefer earthen bulb-pans, which come in various sizes, from 8 to 18 inches in diameter In potting, place a little broken pottery or lumps of charcoal in the bottom for drainage, then fill the pot with soil and shake it down, but do not pack it Neither must the bulb be pressed or screwed into the soil, else the soil will be packed under it so that when the roots start they often raise the bulb out of the pot Plant the bulb just deep enough that its top will not show. Large and soft bulbs, which are liable to rot, may be set in a cushion of sand, and the bulb not covered with soil until it has taken root and become established (Fig 688).

When planting mixed bulbs in the same pot, pan or box, care should be used in selecting different varieties that will flower at the same time. An early-flowering Duc Van Tholl and a double Tournesol tulip would flower a month apart under the same treatment. Some varieties of hyacinths, of narcissi, and of most species of bulbs vary greatly in time of blooming, which, of course, would spoil the effect.

The forcing of bulbs

When florists force bulbs in quantity for cut-flowers, they seldom use pots, but shallow boxes, or flats, of a size to economize bench-room. Usually these boxes are cut down from soap-boxes to a depth of 3 or 4 inches. The bulbs are planted closely in these, from an inch to 2 inches apart, according to the kind. The tops of the bulbs (excepting lilies) are kept about even with the top of the soil. Give a thorough watering to help settle the earth about the bulbs, but give no more water until growth begins, for bulbs in a dormant condition resent an excess of moisture. After the bulbs are potted, or boxed, as described, they should be placed in a cold-frame or cold-pit to root. This is the most important detail in flowering bulbs under artificial conditions.



686 Various types of bulbs and tubers

1 Tuberose. 2 Colocasia antiquorum (*Caladium esculentum*). 3 Easter Lily. 4 Jonquil 5 Gladiolus 6 Lilium pardalinum. 7 Hyacinth. 8 Lily-of-the-Valley

Cover the pots, boxes or pans with 4 inches of sand, ashes, rotted leaves, tanbark or similar substance, and do not put the sash on until freezing weather, and even then remove the sash on pleasant days. When no coldframe or pits are available, the pots may be covered as advised in a cool cellar, provided close attention is given to be sure that the soil is maintained in a uniformly moist, but not wet condition. It is preferable however, to sink them in the open ground Very fine flowers were obtained from hardy bulbs when treated as follows: A trench a foot deep is dug in the garden where water will not settle in it, and it is protected from the north and west cold Three inches of coal-ashes is first placed in the trench, to allow drainage and keep the worms out. The pots are then placed on the ashes, the earth is filled in about the pots, filling the trench rounding over When the weather gets cold enough to freeze a crust on the soil, an additional covering of about 4 inches of rough stable manure, leaves or straw, is put over. This cover must be heavy enough to keep the pots from freezing, not that this will injure the bulbs, but that it will be almost impossible to remove the pots if the covering of earth freezes solid Care should be taken that the sides of the trench do not fall in, depositing a layer of earth over the leaves or other cover, which will freeze hard enough to make removal difficult. Often a simple cover of 8 to 10 inches of leaves directly over the pots will be most advantageous if earth has been worked in about the sides of the pots to retain moisture No further attention is required, as everything is congenial to perfect root-development, while the weather is cool enough to check top-growth. Some early bulbs, such as Roman hyacinths, Paper White narcissi, Duc Van Tholl tulips, and the like, will root sufficiently in five or six weeks to be taken up for first flowers, which should be out by Christmas or earlier, but it is safer to allow all bulbs not less than eight weeks for rooting. A fairly sure indication that the bulbs are ready to be brought into heat is the appearance of about an inch of top growth, and of an abundance of roots through the bottom of the boxes or through the holes in the bottom of the pots Every two weeks after the first removal of pots, or as needed, further relays of rooted bulbs may be taken out for a continuous display of bloom When the pots of hardy bulbs have been taken up, place them in a cool greenhouse or cool, light storeroom, with temperature not over 50° This temperature will allow the flower-stems and foliage to grow, and at the same time prevent the opening of the flowers until the stems have attained their proper height. The pots should be kept shaded for several days until the top-growth has taken on its natural green color, after which the pots may be taken to a sunny, warm window, or wherever they are wanted to flower. Bulbs treated in this manner will produce perfect spikes of flowers.

A practice often followed by florists early in the season is keeping the bulbs in the dark and in heat in order to draw out the flower stems to a proper height This can often be accomplished by placing an inverted pot over the tops, the light coming through the hole in the bottom being sufficient to draw out the stems If this is done, the bulbs must be watched to see that the tops are all growing evenly, should some of the bulbs get a start of the others, the pots must be put in the light at once to avoid irregularity in flowering For early work, this darkening, together with strong bottom heat, will give longer foliage and stem than if the bulbs are subjected to strong light when first brought under glass But plenty of fresh air must be afforded, and as the buds begin to show color the pots must be removed to a cooler temperature to harden the growth, and enough light given to put color in the foliage and the buds

A good rule to keep in mind in flowering hardy bulbs is Temperature, 40° for roots, 50° for foliage and stems, 60° for best flowers, 70° for quick development, 80° to rush bloom with loss of substance and risk of "going blind" (producing no flowers)

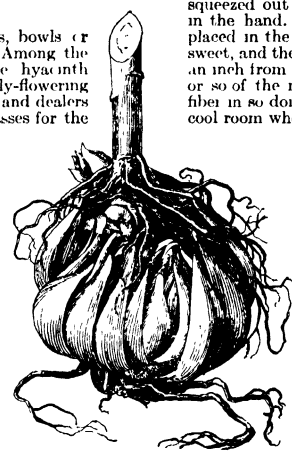
The exceptions to the above advice are lilium and lily-of-the-valley. The bulbs of *Lilium Harrisii*, *L. longiflorum* and the various sorts of *L. speciosum*, in addition to throwing out roots from the base of the bulbs, usually form roots from the new stem just above the bulb, and the plants and flowers derive much strength from these top-roots So in potting lily bulbs, it is best to put them down so deep that there will be sufficient soil above the bulbs to entice and sustain the stem-roots This may be done when the bulbs are potted, or 2 or 3 inches of soil may be added after growth is under way and the stem-roots have begun to work into the soil An advantage in the latter method is that some fertilizer may be mixed with the new soil, and sustenance provided when it is most timely. In other respects treat the bulbs after potting as just advised. Winter-flowering lily-of-the-valley forms no new roots The thick, fleshy, fibrous old roots should be trimmed at the bottom, leaving them from 2 to 3 inches long. This allows them to absorb the abundant moisture with which they should be supplied while the flowers and foliage are developing. They flower just as well in sand or moss, or anything that retains an even moisture and temperature, as they do in soil, but lily-of-the-valley for flowering in the house or greenhouse requires freezing before it can be successfully brought into flower. Without freezing, many pips will "come blind," or pro-

duce malformed spikes So it is just as well for amateurs to plant their pips an inch or two apart in pots or bulb-pans, and plunge them in the garden, as recommended for other hardy bulbs Florists generally freeze their pips in refrigerators, or have them placed, just as they arrive from Germany, 2,500 pips in a case, in cold storage, in a temperature of 28° to 30°.

Half-hardy bulbs for winter-flowering and forcing should be treated the same as hardy bulbs, except that after potting they should be placed for rooting where they will not freeze Yet they can go fairly close to it and be all the better for it In northern states, a coldframe or pit or cold greenhouse to root them in is, therefore, almost indispensable For tender winter- and summer-flowering greenhouse bulbs, the culture varies with almost every species, and as no general instructions would suit all kinds, the reader may refer to their individual cultures given under their respective headings in this Cyclopedia. (See list of species at the end of this article)

Other indoor methods.

The flowering of bulbs in glasses, bowls or unique pots, is always interesting Among the most successful and interesting are hyacinth bulbs in glasses of water Use early-flowering single varieties only The seedsmen and dealers in bulbs supply special hyacinth glasses for the purpose They come in various shapes, colors and decorations, and vary in price from 20 cents to $1.50 each These are simply filled with fresh, pure water A lump of charcoal thrown in absorbs impurities, but it is not absolutely necessary The bulb rests in a cup-shaped receptacle on top of the glass In filling, the water should not quite touch the bottom of the bulb Put in a cool, dark, airy place until the roots have reached the bottom of the glass, which should be in about six weeks Do not place them in a close, warm closet They must have fresh air As the water evaporates, fill the glasses, and change the water entirely when needed to keep it sweet and clear After rooting, place the glasses in a light store-room where the temperature averages about 50°, until the stems and foliage have developed, then remove to a warm, sunny window for flowers to open There are other kinds that do equally well when rooted in water, providing the largest healthy bulbs are chosen Among them are sprekelia (Jacobæan lily), Trumpet narcissi Horsfieldii and Golden Spur, polyanthus narcissi Grand Monarque and Gloriosa, large bulbs of Roman hyacinths, early single tulips, and Mammoth Yellow crocus Hyacinths have been flowered on a piece of virgin cork floating in an aquarium, a hole being cut through the cork for the roots to reach the water The so-called "Chinese sacred lily," a variety of Polyanthus narcissus, grows and flowers luxuriantly in bowls of water, provided they are not placed in a dry, furnace-heated room, which will cause the buds to blast before opening Sufficient pebbles or shells should surround the bulbs to prevent them from toppling over.



687 The Easter lily throws out feeding-roots both below and above the bulb

Crocuses, Roman hyacinths, and lilies-of-the-valley are very pretty when nicely flowered in columnar, hedge-hog- or beehive-shaped hollow pots with holes for the reception of the bulbs. A bulb is placed in front of each hole from the inside, with the crown of the bulb looking outward The pot is then filled with soil through the large opening in the bottom, moss being pressed in last to hold the contents in place, after which the pots are put outside for the bulbs to root, as explained for other hardy bulbs for the house.

The growing of bulbs in moss fiber, a method introduced by Robert Sydenham, of Birmingham, England, is well deserving of attention by the amateur. The great advantage of this method is that the bulbs can be grown in decorative china bowls, without drainage, while the compost is clean to handle and, as the bowls are not porous, they may be set about a room without danger of spotting the most highly polished woodwork. The compost is made up of moss or peat fiber and ground oyster-shell in the proportion of three parts dry moss to two parts of the shell; a little pulverized charcoal added tends to keep the material sweet The moss must be rubbed between the hands thoroughly to break even small lumps and then mix the shell with it very carefully, after which water should be slowly added in the proportion of four quarts to each half-bushel of the mixture When properly moistened the compost should feel quite damp but no water will be squeezed out if a small quantity is pressed tightly in the hand. A few pieces of charcoal should be placed in the bottom of the bowl to keep the fiber sweet, and the bowls should be filled to within about an inch from the rim Cover the bulbs with an inch or so of the mixture, taking care not to pack the fiber in so doing, and place the bowls in a cellar or cool room where they can have plenty of fresh air For about three weeks the mixture will itself provide sufficient moisture, but after that time they must be examined frequently, nothing is so essential as keeping the fiber uniformly damp to the very bottom of the bowls but there must be no water standing If dry for but a day there is great risk of the bulbs going blind The treatment from this point on is identical with that given for bulbs grown in ordinary potting soil

Subsequent treatment of forced bulbs.

After being forced or flowered in the greenhouse or window, hardy bulbs are of little value, for most bulbs suitable for the purpose have attained their maximum size, and, in consequence, are ready to break up Florists usually throw these bulbs away However, if space can be spared for the bulbs to complete their growth after flowering, and watering and temperatures are watched, many of them can be matured to be utilized afterwards. The ripening of the foliage is as necessary to forced bulbs as it is to those grown in the open, and to promote this the potted bulbs should receive enough care and nourishment to counteract the artificial conditions under which they are grown When it is desired to keep forced bulbs, the compost should be made somewhat richer at potting time After flowering, the pots may be plunged out-of-doors, if freezing weather is over, until the foliage has ripened Then the bulbs can be shaken out and planted in the mixed border or about the kitchen-garden, where some of them will recuperate and give flowers for cutting within a year or two, and eventually they will regain their vigor sufficiently to be transferred to the bulb-garden. Yet with most of the bulbs the labor involved is scarcely commensurate with the returns, and the bulbs might just as well be discarded at the beginning.

Keeping dormant bulbs, tubers, and the like.

Bulbs and tubers of the various species, as well as their varieties, vary greatly in size Some, like oxalis, snowdrops, and chionodoxas, often do not exceed half

an inch in diameter, while other bulbs, such as those of *Caladium esculentum*, certain arums and crinums, attain great size, frequently weighing several pounds each. Such solid bulbs as those of tulips, hyacinths and narcissi, will remain out of the ground solid and plump, in a suitable place, for three or four months. The larger the bulb the longer it will keep, as a rule. Large crinum bulbs have been kept for fifteen months Still, it is always better to plant the bulbs as soon as possible, for, although they keep, they do not improve, and their tendency is always toward drying out and loss of vitality.

Never keep bulbs packed air-tight. They are liable to generate heat or sweat, mold or rot, or to start. When solid bulbs are to be kept dormant for any length of time, they should be stored away from bright light in baskets, shallow boxes or slatted trays, protected from rats or mice, in a room or cellar in which there is a circulation of fresh air and the temperature is as cool as possible. Forty degrees is the desideratum for all excepting tender bulbs Scale-like bulbs, as lilums, soon dry out and shrivel, if exposed to the air for any length of time; therefore, they are best kept in open boxes packed with some substance that will retain a slight and even moisture, such as sphagnum moss, rotted leafmold, coconut fiber refuse, or moist sand, but they must be kept cold to check any efforts to start. Fleshy roots, like those of peonies, and so on, should be treated like the lily bulbs When a cold-storage room, with an average temperature of 36° to 40°, is available, it is the safest place to carry over hardy bulbs and roots for spring planting

Lily-of-the-valley pips are carried in cold storage rooms of about 28° to 30°. The pips and packing freeze solid; and here they are kept for months until wanted for forcing When they are removed, they must be thawed out gradually and as soon as possible, by plunging in cold water, before they are subjected to any heat; otherwise, they are likely to rot For this reason, "cold-storage pips" cannot be safely shipped any distance in warm weather, this often being the cause of the country florists' disappointment in results



688 Bulb with a cushion of sand beneath it to prevent decay.

Tender dormant bulbs, as begonias, gloxinias, amaryllis, pancratiums, tigridias, tuberoses, must be kept in a warm, dry atmosphere, not below 50°. The cause of tuberoses not flowering is often that the bulbs have been kept below 40°, which destroys the flower germ, although the foliage grows just as vigorously. Tender tubers, such as dahlias and cannas, should be stored in dry sand in a warm, dry cellar or under the greenhouse bench.

Propagation of bulbous plants.

Bulbous plants increase usually in either of two natural ways—from division or from seed. Increase by division, with true bulbs and corms, is due, in the first place, to the tendency these plants have after reaching a certain age to break up into a number of smaller parts, each part making a new start for itself and developing with time into a bulb of flowering size In addition to this breaking up, all bulbs, even those of young growth, form tiny bulbels or offsets, throughout their time of maturing These bulbels appear in many ways, some forming outside of the protecting skin of the mother bulb, as in the case of the tulip and hyacinth, others developing about the base of a newly-formed corm like the gladiolus In this connection it is proper to note that the formation of bulbs during the growing season varies in that some kinds form an entirely new bulb, as the tulip and gladiolus, and others merely add new tissues to the old bulb and increase in size, as the narcissus and hyacinth. As a rule, small bulbs obtained by this process of breaking up do not have the vigor of those from offsets, the younger a bulb is, the greater vigor it always has, although the flower may not show its true size.

Whereas bulbs secured by division always come true, —that is, the flowers resemble that of the parent bulb, allowing for the occasional variation due to "sporting"— propagation by seed is likely to give new varieties, differing in character from the original. Certain kinds of bulbs, such as the scilla, chionodoxa, or freesia, can be propagated by seed and come true, unless cross-fertilized Bulbs grown from seed take longer to mature than do those from offsets, and for commercial purposes the seed method is seldom employed except when the raising of novelties is an object

Of the other so-called bulbous plants which are under consideration here, the tuberous kinds increase naturally by the development of new eyes which grow into young plants as the old tuber decays, while the rhizomatous sorts form new plants through the elongation and branching of the running underground stems accompanied by the dying back of the older parts Artificial propagation of these kinds is an easier affair than with true bulbs, as the separation of the new growth is readily effected by division with a knife, or even with the rougher use of a spade Such tubers as potatoes, begonias and gloxinias can be cut into small parts wherever an eye has started, and these planted out separately grow into new plants With certain kinds it is a frequent practice to dust over the tubers where the cut has been made with sulfur or soot to prevent decay Caution must be used in following this method, as too frequent division of this sort results in weakening the vigor of the stock to be grown Several tubers, such as the dahlia and begonia, can be propagated either by stem or leaf cuttings taken from the young growth

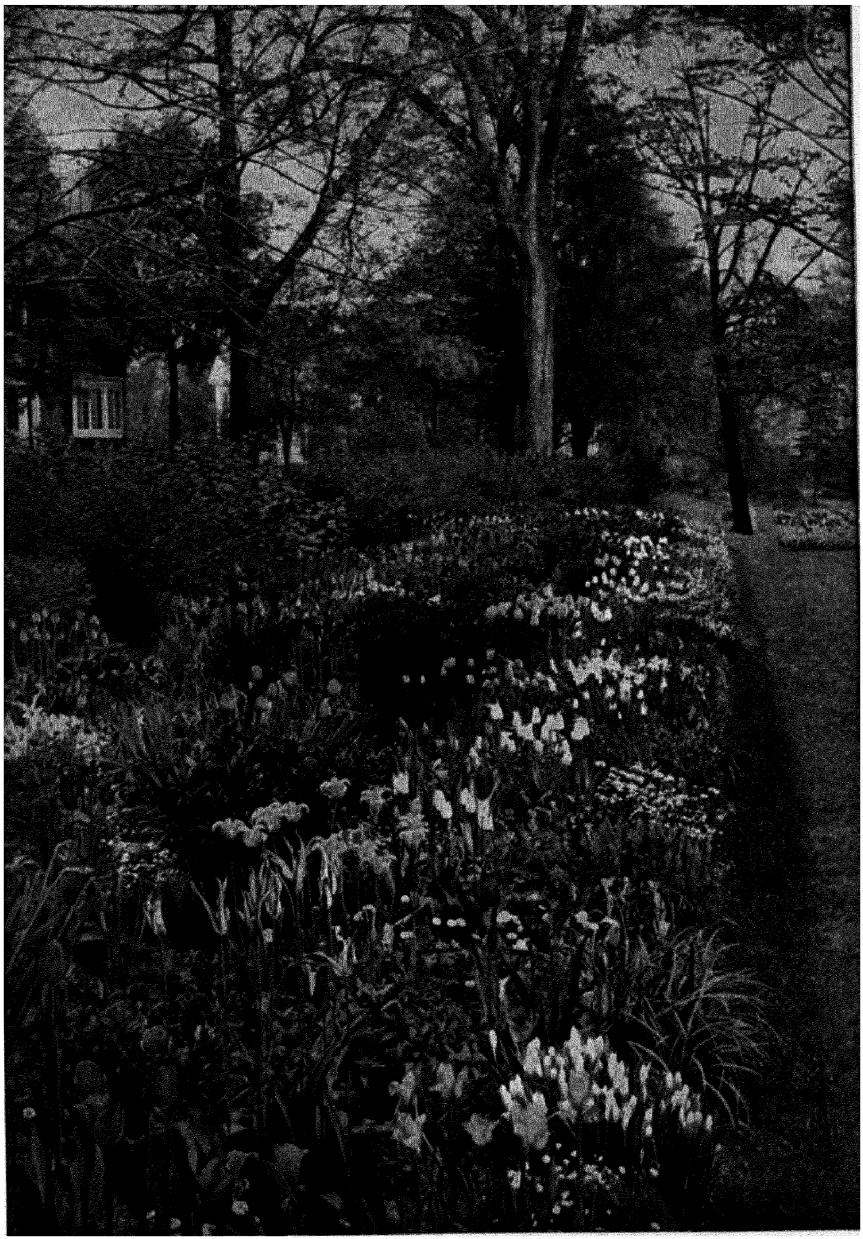
Artificial propagation of the hyacinth by cutting the old bulb is the method employed in Holland, while many lilums are increased by loosening the outer bulb scales and inserting them in sand after the manner of cuttings Certain bulbs like the tulip, as grown in Holland, are subjected to heat after lifting, to ripen the bulbs more thoroughly. Bulbs to be used for propagating are given a higher temperature, which arrests the flowering and tends to increase the breaking up of the mother bulbs. For special methods of propagating, the reader should consult the articles on the various bulbs throughout this Cyclopedia

The cultural treatment for the young bulbs is in general the same as that prescribed for the older, larger ones. The offsets need not, of course, be planted so far apart, the very smallest being simply scattered in drills as peas or beans are sown At first the soil should be somewhat lighter than later on, and must always be kept free from weeds and well cultivated The young bulbs should be planted early, and when annual lifting is practised they should be the first to come out of the ground.

From an economic point of view it is doubtful whether the so-called Dutch bulbs can be successfully propagated and grown in America. The extremely low cost of labor, and the rapid increase of stocks in the soil and climate of Holland, together with the fact that the secret of ripening the bulbs to perfection is known thoroughly only by the Dutch, makes it improbable that bulbs can be grown as well, or with a reasonable profit, here in America.

Hints on buying and selecting bulbs.

As already said, bulbs can develop only the flowers which were formed within them before they were ripened. A bulb may be poor because not full-grown or too young, or because grown in impoverished soil or under



XX. A border of hardy bulbs

uncongenial conditions, or because it may not have been matured when dug; or it may be injured from heating, sweating, rotting or moldiness in storage or transit, caused by improper curing or packing, or it may be dried out from having been out of the ground too long. In the majority of cases in which poor bulbs are planted, however, it is the buyer's fault in procuring cheap bulbs, which in many cases are second grades, lacking age and proper size The commoner varieties of a species usually propagate the fastest, and it is generally these less salable varieties and inferior seedlings and cullings from the named bulbs that go to make up most "mixed colors" and "mixed varieties." Therefore, for best results, it is advisable to expend a given amount of money for the first-size named varieties, rather than for a larger quantity of cheaper seconds and mixtures, unless, of course, the bulbs are wanted for large permanent plantings, as in promiscuous borders for naturalizing, in which best flowers the first season are of secondary consideration.

The best named hyacinths—"top roots," as they are called in Holland—require from four to six years to attain full size and give best flowers Such bulbs, according to the variety, should measure from 20 to 24 centimeters (8 to 10 inches) in circumference These naturally cost more to grow than the younger second or "bedding" grade of bulbs, measuring from 18 to 20 centimeters (6 to 8 inches) There is a third size, ranging from 16 to 18 centimeters (4 to 6 inches), that goes in mixtures, and a fourth size (12 to 14 centimeters) that goes out as "Dutch Romans," "Pan Hyacinths," "Miniatures," and so on Some growers even scale their sizes a centimeter or two less than mentioned, to enable them to quote lower prices Crocus, narcissi, tulips and many other bulbs are also sorted into sizes, enabling the growers to catch all classes of buyers

A first-size crocus bulb should measure 10 centimeters (4 inches) in circumference, and such bulbs produce from six to twelve flowers each A small, cheap bulb produces only two or three flowers A narcissus bulb of maximum size will produce from three to five flowers (sometimes more), and an inferior size usually but a single flower A white Roman hyacinth bulb 14- to 16-centimeter size (5 to 6 inches in circumference) will produce three and often four spikes of firsts and several seconds, while an 11- to 12-centimeter size will average only one first-grade spike and a couple of seconds, or perhaps nothing but seconds The best lily-of-the-valley pips bear from twelve to sixteen bells on a spike, usually all firsts Cheaper inferior grades of pips have seldom more than seven to ten bells If the florist or planter wants the best bulbs, he must pay more money for them, but they are cheapest in the end, for second-grade stock takes up just as much room and requires as much care, fire, and other expenses It is the grade of flowers called firsts that sell and pay a profit. The supply of seconds is often so abundant that the market price for them does not pay the cost of the bulbs.

Mere size alone should never be taken as the standard in judging bulbs, however, as in this respect there is always a great difference among varieties of the same kind of bulb A plump, solid bulb, without any suspicion of flabbiness, will give far better blooms than one without these qualities, but if size goes with them the purchaser will be just so much better satisfied Furthermore, the selection of varieties is of importance since in recent years a great many vastly improved varieties in all classes of bulbs have been introduced The growers, nevertheless, because of the demand for the older sorts, of which they have large stocks, continue to list many kinds no longer worth growing, unless cheap bulbs are wanted. Attention ought also to be paid to the fact that a number of varieties appear in the lists under different names, a feature of the bulb trade which often leads to great confusion although the reliable dealers usually note synonymous names in such cases. Cheap bulbs may often be secured through the auction sales in fairly good quality, but it is utterly impossible to count upon these being true to name, or even to color. The surest way to obtain first-class bulbs



689 A good pot of narcissi

is always to purchase from a trustworthy source, and to state clearly, when buying, the exact purposes for which the bulbs are intended and the amount which the buyer desires to spend.

Catalogue of bulbs

To aid in the selection of bulbs for particular purposes, is appended a list of the leading species that are procurable while dormant (between the months specified) from seedsmen and bulb dealers, and a sign is affixed to each to indicate the purpose for which the species—or certain varieties in it—are adapted Some kinds are useful for more than one purpose, and such have a corresponding number of signs For example: If a selection of bulbs is to be made for winter-flowering in the house, make a note of those to which an asterisk (*) is affixed, then turn to their respective headings in this Cyclopedia, where will be found other advice and descriptions, read all cultural instructions carefully, and consult good growers and reliable dealers for the most recent varieties in any species, remembering that new varieties frequently appear.

*For winter-flowering bulbs for greenhouse or window, select from species marked **

For summer- and fall-flowering bulbs for pots for greenhouse and other decoration, select from species marked †

For spring-flowering hardy bulbs for gardens, lawns, and the like, select from species marked ‡

For summer- and fall-flowering hardy bulbs for gardens, lawns, and the like, select from species marked §

For summer- and fall-flowering (not hardy) bulbs for spring planting in garden, and the like, select from species marked ‖.

For climbing bulbous plants, select from species marked ¶

Those marked H are hardy, HH, *half-hardy,* T, *tender.*

GENERA, ETC	HARDINESS	DORMANT.
Abobra ¶ ‖	HH	Oct to Apr.
Achimenes†	T	Oct to Apr.
Agapanthus † ‖	HH	Oct to Apr.
Albuca †	T	Oct to Apr.
Allium * ‡	H & HH	Aug to Dec.
Alstroemeria † ‖	HH	Sept to Nov.
Amaryllis * †	T	Oct to Apr
Amorphophallus §	T	Oct to Apr
Anemone * ‡	H & HH	Aug to Nov.
Anomatheca ‖	HH	Oct to Apr.
Antholyza §	HH	Oct to Apr.
Apios ¶ ‖	H	Oct to Apr.
Arisæma †	HH	Oct to Apr.
Arum * †	T	Aug to Apr.

GENERA, ETC.	HARDINESS.	DORMANT.
Babiana *	HH	Aug. to Nov.
Begonia, Tuberous † ♃	T	Oct to Apr.
Bessera ♃	HH	Oct to Apr.
Blandfordia *	T	Aug to Nov.
Bloomeria ‡	H	Aug to Nov.
Bomarea ¶ †	HH	Aug to Oct.
Boussingaultia ¶ ♃	T	Oct to Apr
Bowiea ¶ †	HH	Oct to March
Bravoa †	HH	Oct to Apr
Brodiæa * ‡	HH	Aug to Oct.
Bulbocodium ‡	H	Aug to Oct
Caladium † ♂	T	Oct to Apr
Calochortus * ‡	HH	Aug to Nov.
Camassia ‖	H	Aug to Nov
Canna ♃	T	Oct. to Apr
Chionodoxa * ‡	H	Aug to Oct.
Chlidanthus ♃	HH	Oct to Apr
Colchicum ‖	H	Aug to Sept.
Commelina ♃	HH	Oct to Apr
Convallaria * ‡	H	Oct to Apr
Cooperia ♃	HH	Oct to Apr
Corydalis ‖	H	Aug to Apr
Crinum † ♃	T	Nov to Apr
Crocosmia ♃	HH	Oct to Apr
Crocus * ‡	H	Aug to Oct.
Crown Imperial ‡	H	Aug to Oct.
Cummingia †	T	Aug to Oct.
Cyanella †	HH	Aug to Oct.
Cyclamen persicum *	T	Aug to Nov.
Cyclobothra ♃	HH	Aug to Nov.
Cypella ♃	T	Oct to Dec.
Cyrtanthus †	T	Oct to Apr.
Dahlia ♃	T	Oct to Apr
Dicentra ‡	H	Oct to March
Dioscorea ¶ ‖	H	Oct to Apr
Eranthis ‡	H	Aug to Oct.
Eremurus ‖	HH	Oct to Apr.
Erythronium ‡	H	Aug to Nov.
Eucharis †	T	Sept to Dec
Eurycles †	T	Oct to March
Freesia *	HH	Aug to Nov.
Fritillaria * †	H & HH	Aug to Oct
Galanthus * ‡	H	Aug to Nov.
Galtonia ♃	HH	Oct to Apr
Geissorhiza †	HH	Aug to Nov.
Gesneria * †	T	Oct to Apr
Gladiolus ♃	HH	Sept to Apr
Gloriosa ¶ †	T	Oct to Apr
Gloxinia †	T	Oct to Apr.
Griffinia †	T	Oct to Apr
Hæmanthus †	T	Aug to Nov.
Helleborus ‡	H	Oct to Apr
Hemerocallis ‖	H	Oct to Apr
Homeria ♃	HH	Aug to Nov
Hyacinth * ‡	H	Aug. to Nov.
Hymenocallis ♃ †	T	Oct to Apr
Imantophyllum †	T	Oct to Apr
Iris, Bulbous * ‡	H & HH	Aug to Nov.
Iris, Rhizomatous, etc ‡ ‖	H	Oct to Apr
Ismene ♃ †	T	Oct to Apr
Ixia *	HH	Aug to Nov
Ixiolirion ‡	H	Aug to Nov
Jonquil * ‡	H	Aug to Oct
Lachenalia *	HH	Aug to Oct.
Leucojum ‡ ‖	H	Aug to Oct
Lilium * ‖	H	Sept to Apr.
Lycoris ♃ †	HH	Oct to Apr
Milla ♃	HH	Oct to Apr
Montbretia ‖	HH	Oct to Apr
Muscaria ‡	H	Aug to Nov
Nerine †	T	Oct to Apr
Narcissus * ‡	H	Aug to Oct.
Nemastylus ♃	T	Oct to Apr
Nerine †	T	Aug Nov
Ornithogalum * ♃	H & HH	Aug to Nov
Oxalis, for borders ♃	HH	Sept to Apr.
Oxalis, Winter-flowering * †	HH	Aug to Nov.
Peony ‖	H	Oct to Apr
Pancratium † ♃	T	Oct to Apr
Phædranassa *	T	Oct to Apr
Polygonatum ‖	H	Oct to Apr
Puschkinia †	H	Aug to Oct
Ranunculus *	HH	Aug to Nov
Richardia * † ♃	T	Sept to Dec.
Rigidella ♃	T	Oct to Apr
Sanguinaria ‡	H	Oct to Apr
Schizostylis * ♃	HH	Oct to Apr
Scilla ‡ *	H & HH	Aug to Nov.
Sparaxis *	HH	Aug to Nov.
Spiræa (Astilbe) *	H	Oct to Apr
Sprekelia * ♃	T	Sept to Apr
Sternbergia ‖	H	Aug to Oct.
Tecophilæa *	HH	Aug to Oct.
Tigridia ♃	T	Oct. to Apr.
Trillium ¶	H	Oct to March
Triteleia ‡	HH	Oct to Apr
Tritoma ‖	H	Oct to Apr
Tritonia *	HH	Aug to Nov.
Tropæolum, Tuberous * ¶	HH	Aug to Dec
Tuberose ♃	T	Nov. to May
Tulip * ‡	H	Aug to Nov.
Tydæa * †	T	Oct to Apr
Ureeolina †	T	Oct to Apr.
Vallota †	T	Oct. to Apr
Watsonia * ♃	HH	Sept to Dec.
Zephyranthes * ♃	HH	Aug. to Apr.

PETER HENDERSON & Co.

BULBÎNE (Greek, *bolbos*, a bulb). *Liliàceæ*. More than 20 species of half-hardy African and Australian plants, allied to Anthericum, but practically not cultivated in this country

Flowers showy, the petals distinct, 1-nerved, spreading and often recurving in age, stamens shorter than the perianth. Some of the species are bulbous, and require the general treatment given Cape bulbs (see *Bulbs*), but none of the bulbous species is known here.



690. Bulbine annua.

ánnua, Willd Fig 690 Annual, acaulescent, without any rootstock or bulb. lvs. 12–20, erect but weak· fls. bright yellow, racemose S Afr. B M. 1451 (as Anthericum). D C. Pl. Grasses, pl. 8.—Can be grown as an annual S.

N. TAYLOR.

BULBINÉLLA: *Chrysobactron.*

BULBOCÒDIUM (Greek, *woolly bulb*) *Liliàceæ* Crocus-like bulbous plants of mts of Eu and Russian Asia, spring-flowering or autumn-flowering

Leaves appearing after (or before) the fls, usually 3, narrow, sheathed at base· fls close to the ground, 2–3 from each bulb, the perianth funnelform, segms distinct to the base but conniving in a tube; stamens 6; style 3-fld at the top.—One variable species, treated in general as crocuses are cult. Allied to Merendera, to which some of the former species are referred.

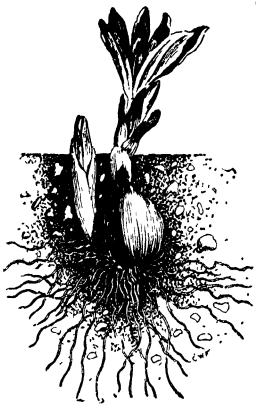
vérnum, Linn Fig 691. Blooms in gardens in earliest spring before the lvs. appear, the fls resting nearly on the ground. fls. rosy purple, white-spotted on the interior, 1–3 from each bulb· lvs broad and channelled B M. 153 (cf. Fig 691). F S 11·1149 Gn 75, p. 409.—Bulbs should be taken up and divided every 2 or 3 years. Plant in the fall Usually blooms in advance of the crocus. *B. versicolor*, Spreng (*B. ruthénicum*, Bunge), is a small handsome form

L H. B.

BULBOPHÝLLUM (Greek, *bulb-leaf*). *Orchidàceæ*. Epiphytic plants, creeping upon rocks or trees; cult in the warmhouse

Pseudobulbs 1–2-lvd in the axils of the sheaths, and with the infl. arising from the base of the pseudobulb: fls. small and numerous in a raceme, or larger and few

or solitary; dorsal sepal erect or spreading, free, equaling or shorter than the lateral, which are obliquely broadened at the base and adnate to the foot of the column; petals shorter than or nearly equaling the sepals, lip articulated to the foot of the column, incumbent upon the column; pollinia 4.—A genus of about 125 species, mostly natives of Trop Asia and Afr.—Bulbophyllum needs a moist atmosphere and should not become dry. Grown on pieces of wood or tree-fern stems.



691. Bulbocodium vernum.

A. *Fls large, solitary.*

B. *Petals and lip minute; sepals tessellated with pale brown and yellow.*

grandiflòrum, Blume. Pseudobulbs 2–3 in. long, 1-lvd: lf up to 10 in long and 2 in broad, emarginate at the apex: peduncle usually not exceeding the lf. with 2–4 bracts and a solitary large fl about 8 in long, sepals tessellated with pale brown and yellow spots, the dorsal sepal arcuate and incurved, the sides reflexed, the lateral sepals deflexed, petals minute, triangular, lip minute, 3-lobed New Guinea. B M 7787. G C. III 17 429.

BB *Petals and lip large, the former as long as the sepals.*

C *Lip cordate-triangular; petals reflexed.*

Dèarei, Reichb (*B. Godseffiànum,* Hort.). Pseudobulbs 1-lvd up to 1½ in long lf up to 6 in long, acute: peduncle as long as or exceeding the lf, bearing a solitary large fl, sepals and petals tawny yellow, the dorsal sepal ovate-lanceolate, red-spotted, the lateral sepals lanceolate, falcate, purple-marked on both sides, petals linear-lanceolate, with the veins deeper, and some purple spots, lip triangular-cordate Origin uncertain. G C II 20 108 (as Sarcopodium).

CC *Lip cordate-ovate; petals merely spreading.*

Lóbbii, Lindl Fig 692 Pseudobulbs 1-lvd, up to 1½ in long lf about 6 in long, narrowed into a petiole peduncle shorter than the lf, bearing a solitary large fl 3–4 in across, sepals and petals buff-yellow, the dorsal sepal with lines of purple spots on the back, ovate-lanceolate, the lateral sepals falcate, marked with rose in the center, petals lanceolate; lip yellow, purple-spotted, cordate-ovate, acute Java. B M 4532 G C III 38 184 (var *colosseum*).

AA *Fls less than ½in long, in a raceme.*

Careyànum, Spreng. Pseudobulbs ovoid or oblong, 1-lvd. lf up to 10 in long and 2 in. broad. scape with many bracts, bearing a dense raceme, 2–4 in. long, of numerous fls which are orange-yellow or greenish, spotted with reddish brown or purple; sepals oblong-ovate, acute; petals broadly ovate, minutely awned; lip nearly entire Himalayas.

B. auriculàtum, Lindl Burma B M 7938.—*B. barbigerum,* Lindl Lip long, narrow with a tuft of long purple hairs at the apex Trop Afr Gt 48, p 491 B R 1942. B M 5288 R B. 30 253.—*B. Bunnendàlii,* J J Smith Java B M 8187 G C. III 47 84.—*B. birmànse,* Schlecht Fls orange-yellow, very small Burma O. 1910 107, desc.—*B. Buttnerànum,* Schlecht Fls golden yellow bracts leafy, greenish white, rose-dotted Siam O 1910 108, desc.—*B. calabàricum,* Rolfe Fls small, light yellowish green, with a dull reddish purple lip W Trop Afr.—*B. campanulàtum,* Rolfe. Sumatra. B M 8281.—*B. capituliflòrum,* Rolfe Fls. very small; sepals and petals whitish green, lip deep purple. W. Trop Afr.—*B. chrysocéphalum,* Schlecht Dwarf plant fls yellow S E Asia.—*B. combsum,* C. and M Burma B M 7283.—*B. crenulatum,* Rolfe. Madagascar B.M. 8090.—*B. cylindràceum,* Lindl Himalayas. G C III 49 3.—*B. Dayànum,* Reichb Burma F S 21 2236. G C III 45 194.—*B. dichròmum,* Rolfe Annam B M 8160.—*B. Dixònii,* Rolfe Fls small, greenish yellow with numerous dark brown spots, petals with bristle-like tails at the apex Siam.—*B. Ericssònii,* Kränzl Fls umbellate, the sepals and petals green, spotted with purple-brown, the lip triangular, broadly cordate at base, acute, marked with red-brown Malay Archipelago B M. 8088 G C III 21 61, 32 483 O R 15 243.—*B. exaltàtum,* Lindl Sepals light green, dotted with brown, lip blackish purple, much fringed Brazil, British Guiana.—*B. fascinàtor,* Rolfe Annam B M 8199.—*B. fuscopurpureum,* Wight. Fls dull reddish brown, about 1 in across S India.—*B. galbànum,* Riddell Malay Penn B M 8216 G C III. 42 42.—*B. Gentìlii,* Rolfe Scape 1 2ft long, bearing a densely fld spike, fls scarcely ½in long, sepals and petals straw-colored and purple Trop Afr G C III 36 266, desc.—*B. ghuinènse,* Cogn Fls arranged in 2 rows in short spikes, sepals greenish, spotted inside with red, petals minute, white, lip red Brazil O 1910 108, desc.—*B. nanetum,* J J Smith Fls larger than in B. Lobbii, sepals densely dotted with purple, petals long and drooping Borneo.—*B. Kèrii,* Rolfe Lvs oblong, deciduous fls dull yellow, pubescent Siam.—*B. kindthianum,* Wildem similar to B. barbigerum, but the hairs on the lip are not club-shaped Congo Free State.—*B. lemniscatondes,* Rolfe Java(?) G C III 45 68.—*B. lemniscatum.* Pax Burma F S 23 2476 Gn 35, p 610.—*B. lepidum,* J J Smith =Cirrhopetalum.—*B. lilacinum,* Rolfe Fls in dense racemes or spikes, lilac spotted with purple Siam.—*B. longisèpalum* Rolfe. New Guinea G C III 42 211.—*B. macrànthum* Lindl Burma and Malay Archipelago B M 7208.—*B. mandibulare,* Reichb f. Borneo.—*B. Medusæ,* Reichb f Malay.—*B. micropetalum* Rodrig A small plant with spikes of tiny transparent green fls with prominent blackish purple stripes Brazil.—*B. minutum,* Rolfe Resembles B barbigerum but has a broader labellum with white feathered processes Congo Free State.—*B. mirum* J J Smith Remarkable for its curious fls, lateral sepals united, petals consisting of a small round disk with motor filaments Malaya.—*B. morphologòrum,* Hort Fls curious in having a small triangular plate between the dorsal and lateral sepals, Siam.—*B. nigrèscens,* Rolfe Sepals yellow dotted with blackish purple, petals and lip blackish purple Siam.—*B. nudiscapum,* Rolfe Allied to B barbigerum Congo.—*B. orthoglossum,* Kranzl Malaya G C III. 43 406.—*B. Pahudii,* Reichb f Malaya F S 22 2268.—*B. papillòsum,* Finet Raceme twice as long as lvs, rachis and bracts green, lip dark purple French Congo.—*B. Pèchei,* Bull Burma B M 7286.—*B. polyblépharon,* Schlecht Fls solitary, dark purple New Guinea.—*B. propinquum,* Hort Fls green with dense purple reticulation Siam.—*B. quadrifarium,* Rolfe Fls inconspicuous Madagascar.—*B. radiatum,* Lindl Fls yellowish white, with narrow lanceolate petals and sepals lf linear India.—*B. tremulum,* Wight E Indies G C. III 49 291 O R 9 361.—*B. trientàtum,* Rolfe Allied to B. mandibulare British New Guinea.—*B. trifarium,* Rolfe Fls. arranged like the bracts in 3 rows, dull, lurid purple, with numerous minute darker spots on the sepals Madagascar.—*B. virétcens,* Thouars Fls umbellate, sepals and petals 4–5 in. long, pale green, the veins and nerves brown, lip rather fleshy, about ¾in. long, cordate-ovate, pale green, purple at the base. Java. B M. 8327. G C III 40 260.—*B. Weddèlii,* Reichb. f. Brazil. B.M. 7958. G.C III. 36 382.



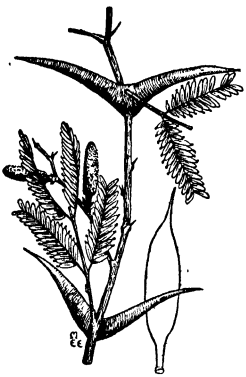
692. Bulbophyllum Lobbii. (×½)

GEORGE V. NASH.

BULLACE. A name used in England for half-wild, half-domesticated plums very similar in character to the Damsons. In America there exist no plums for which another name can not be preferred. The bullace, or bullaces (for there are several varieties sometimes

spoken of as bullaces) are usually referred to the botanical name of *Prunus insitita* (e g, Hedrick, Plums of New York, p 40), but they are also classified with the Damsons, thus taking the botanical name of *Prunus domestica* var *damascena* (See Bot. Gaz. 27:481.)

F. A. WAUGH.



693. Acacia cornigera.

BULL-HORN. A name applied to several species of tropical American acacias remarkable for their large stipular inflated spines which closely resemble the horns of an ox or buffalo These are utilized by certain stinging ants of the genus Pseudomyrma as nesting-places for rearing their young. The thorns, which are connate at the base, are hollowed out by the insects, which perforate one of the spines near the tip, usually on the under side, so that no water can enter All the species of true bull-horns have a four-lobed involucel on the peduncle of the flower-spike near the base The bipinnate leaves have nectar-glands on the rachis and petiole, as in many other acacias, and they are still further provided with peculiar processes on the tips of the leaflets, minute wax-like bodies rich in oil and protoplasm, which Thomas Belt, in his "Naturalist in Nicaragua" (1874), discovered to be used as food by the ants inhabiting the spines, and which in his honor were named Beltian bodies These apical bodies had long been known, and Linnæus called attention to the nectaries on the leaf-rachis, but Belt was the first to suggest that in return for quarters and subsistence the little ants serve their host as a body-guard of soldiers, and Darwin in his work on the "Effects of Cross- and Self-Fertilization in the Vegetable Kingdom," called attention to Belt's interesting observations and deductions

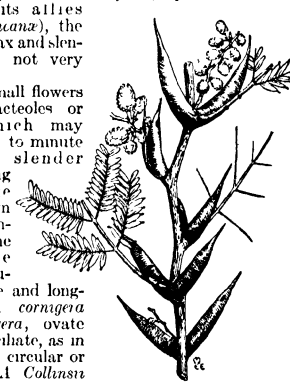
Francisco Hernandez, the *protomedico* of Philip II of Spain, sent in 1570 to study the resources of Mexico, figured the peculiar spines and the leaves of one species growing in the Huasteca region of Mexico, in the Tierra-caliente, not far from the Gulf coast This author speaks of the intense pain caused by the stings of the ants and describes their larvæ engendered in the hollow spines Jacquin, in describing a bull-horn acacia growing near Cartagena (Colombia) in 1763, tells how the little insects rush from the thorns when the tree is struck however lightly, falling upon the unwary intruder and inflicting upon him myriads of burning stings Long before this (1696) Plukenet had figured the bodies on the apices of the leaflets, and Linnæus himself expressed his wonder as to the function of the extra-floral nectar glands



694. Acacia cornigera.

In all bull-horn acacias, there are two kinds of leaves with accompanying spines vegetative leaves in which the stipular spines usually become greatly inflated; and bract-like smaller leaves subtending the flower-heads or flower-spikes on the axillary raceme-like flowering branchlets, with stipular spines usually small and subulate. The extra-floral glands on the leaf-rachis and petiole are either crater-like and more or less elongated, or round and bead-like, often several in a series at the base of the petiole and sometimes one between each pair of pinnæ

The flower-spikes or flower-heads are solitary, geminate, or fascicled in clusters of several in the axils of the small bipinnate leaves on the axillary, raceme-like flowering branchlets. In one species, *Acacia Cookii*, there is apparently no specialized flowering branchlet, but the globose heads are borne in dense clusters in the axils of the large slender-pronged equitant spines In all true bull-horns the four-toothed involucel is at or near the base of the peduncle In *A cochliacantha* the involucel is at the apex of the peduncle, very much as in *A Farnesiana* In *A cornigera*, *A spadicigera*, and *A Collinsii*, the spikes are dense, cylindrical and more or less like the spadix of an aroid In *A sphærocephala* they are spheroid-ovate or ovate-oblong, with the flowers closely crowded on a fusiform receptacle. In *A Cookii*, the heads are perfectly globose with the receptacle also globose In *A Hindsii*, which Bentham put in a section (*Americanæ laxifloræ*) apart from *A. spadicigera* and its allies (*Pycnanthæ americanæ*), the flower-spikes are lax and slender with flowers not very closely crowded



695 Acacia sphærocephala.

Between the small flowers are stipitate bracteoles or umbracula which may readily be likened to minute umbrellas with slender handles protecting the flowers before anthesis from moisture and fungus spores The laminæ of these may be ovate-acuminate or hastate and long-pointed, as in *A cornigera* and *A spadicigera*, ovate with the margin ciliate, as in *A sphærocephala*, circular or nearly so, as in *A Collinsii* and *A Hindsii*, or very broadly ovate, as in *A Cookii*

The flowers themselves consist of a tubular calyx, four- or five-toothed or almost entire, a corolla of four or five lobes, in *A cornigera* and its allies only slightly longer than the calyx but in *A Hindsii* about twice as long They are polygamous; that is, some of the flowers are entirely staminate, others are both staminate and pistillate. The stamens are numerous, with a single pistil in the hermaphrodite flowers rising from the center of the mass; ovary several-ovuled; style filiform, stigma minute, terminal.

In one division, to which *A cornigera* and its allies belong, the pods are indehiscent, inflated, thin, chartaceous, terminating in a sharp beak (Fig 693) In another division, to which *A Hindsii* and *A Collinsii* belong, the pods are dehiscent (Fig 696) In *A Cookii* they are very long and slender and two-valved In all cases the hard smooth compressed seeds are surrounded by sweetish yellow or orange-colored pulp, somewhat like that found in the pods of the algarroba, or St John's bread, which causes the fallen pods to be eagerly sought by pigs and other animals This peculiarity at once distinguishes the bull-horn acacias from *A arabica*, the type of the genus, which has dehiscent pods devoid of pulp.

Following are the leading species of bull-horn acacias.

A. *Involucels at the base of the peduncle (Bambracteatæ, Benth.); pedicelled bracteoles of the fl heads peltate* TRUE BULL-HORNS.

B. *Pods indehiscent thin and fragile, terminating in a sharp, spine-like beak*

C. *Laminæ of pedicelled bracteoles (umbracula) ovate-acuminate or hastate fl-spikes dense, cylindrical, inflated spines broadly spreading or incurved, closely resembling the horns of an ox*

D *Peduncles of fl-heads puberulent laminæ of the bracteoles long-acuminate, more or less scabrous above, inflated spines usually brown or chestnut-colored at length*

A cornigera, Linn (Arbor cornigera, Hernandez) HUITZ-MAMAXALLI BULL-HORN CUERNITOS ARBOL DE LAS HORMIGAS ANT-TREE Figs 693, 694 A shrub or small tree with 1–3 erect sts and a few lateral branches bearing numerous large inflated spines remarkable for their close resemblance to the horns of an ox or buffalo The pods are eaten by pigs and other animals E Trop. Mex

DD *Peduncles of fl-heads glabrous laminæ of bracteoles short-acuminate not scabrous above inflated spines usually ivory-white or yellowish*

A nicoyensis, Schenck NICOYA BULL-HORN ESPINO BLANCO WHITE-SPINED BULL-HORN A shrub or small tree resembling the former Occurs in Costa Rica, Guatemala and the adjacent regions of Mex and Salvador

CC *Laminæ of pedicelled bracteoles ovate, ciliate, not acuminate fl-spikes spheroid-ovate or ovate-oblong inflated spines not broadly spreading, often V-shaped or U-shaped*

A sphærocephala, Cham & Schl BULL-HORN CUERNITOS DE VERACRUZ CORNIZUELO ARBOL DE LAS HORMIGAS ARBOL HORMIGUERO Fig 695 A shrub or small tree resembling A cornigera, from the state of Vera Cruz

BB *Pods dehiscent, coriaceous or woody*

C *Fls in globose heads on long thick peduncles clustered in the axils of long fork-like spines pods very long*

A Cookii, Safford BULL-HORN ACACIA OF ALTA VERAPAZ A small tree or shrub with slender fork-like inflated thorns inhabited by stinging ants Guatemala

CC *Fls in elongated spikes, borne on special flowering branchlets, in clusters of several, subtended by small bipinnate lvs with subulate stipular spines or by a pair of spines only laminæ of pedicelled bracteoles circular or nearly so*

D *Spikes dense rigid oblong-cylindrical pods thick and woody, straight or slightly curved, obtuse or shortly acuminate larger spines swollen at base, usually U-shaped and equitant*

A Collinsii, Safford A shrub or small tree with inflated U-shaped, olive-greenish or brownish stipular spines curving upward and sometimes twisted around the branch S Mex

DD *Spike lax, flexible, linear pods coriaceous, slender, falcate usually long-acuminate larger spines very broad and flat, terminating in widely diverging, very sharp points, like an inverted bicorn chapeau*

A Hindsii, Benth BROAD-THORN ACACIA BULL-THORN OF MAZANILLO BUFFALO HORN Fig 696 A small glabrous tree remarkable for its broad flat stipular thorns, which resemble in form an inverted military chapeau W coast of Mex

AA *Involucel at the apex or above the middle of the slender peduncle laminæ of the bracteoles ovate-ciliate (not peltate) larger spines stout and straight widely diverging Fls in globose heads, solitary or geminate, on flowering branchlets, subtended by a small bipinnate lf with subulate stipular spines or by a pair of small spines only larger inflated spines at length split longitudinally*

A cochliacantha, H & B (Mimosa campeachiana, Miller). SPLIT-THORN ACACIA SPOON-THORN ACACIA This species is not a true bull-horn since its peduncles have not a basal involucel and its stipular spines instead of being hollow and subject to the perforations of ants become split longitudinally

W E SAFFORD.



696. Acacia Hindsii.

BUMÈLIA (ancient Greek name for an ash-tree). *Sapotàceæ*. BUCKTHORN, also IRONWOOD. Woody plants sometimes cultivated in botanical collections, but without particular ornamental qualities

Small trees or shrubs with milky or gummy sap and very hard wood: branches usually spiny: lvs alternate, entire, short-petioled: fls. mostly perfect in axillary clusters, long-pedicelled; calyx 5-lobed, persistent; corolla campanulate, 5-lobed, lobes longer than tube with a small appendage on each side; stamens 5, adnate to the corolla, and 5 petal-like staminodes, ovary 5-celled, pubescent. fr a 1-seeded drupe —About 20 species from the southern states to Brazil

These are evergreen or deciduous small trees or shrubs, usually spiny, with generally obovate to oblong leaves and inconspicuous white flowers on axillary clusters followed by black subglobose to oblong-ovoid drupes None of the species is of much horticultural value, but as most of them grow naturally on dry, rocky or sandy soil, they may be used sometimes with advantage for planting in similar situations The hardiest are *B lanuginosa* and *B lycioides*, which have proved hardy in sheltered positions at the Arnold Arboretum. Propagation is by seeds

lanuginòsa, Pers CHITTIM WOOD Tree, sometimes 50 ft lvs oblong-obovate or cuneate-obovate, rounded and often apiculate at the apex, dark green and lustrous above, tomentose beneath, sometimes nearly glabrous at length, 1–2½ in long clusters many-fld, pedicels slender, hairy fr oblong-ovoid or obovoid, ½in long S S 5 247 H T 376 Southern states north to S Ill, west to Texas —This is the species most often met with in collections

B angustifòlia, Nutt Shrub or small tree, to 25 ft lvs persistent, obovate to oblanceolate, glabrous, 1–1½ in long, fr oblong Fla S S 5 249 —*B lycioìdes*, Gaertn Shrub or small tree, to 25 ft lvs deciduous, elliptic to oblong or oblanceolate, acute, glabrous, 1½–4 in long fr ovoid Va to Ill, Fla and Texas S S 5 248 —*B tènax*, Willd Shrub or small tree, to 30 ft lvs obovate to oblanceolate, pubescent beneath, 1–3 in long fr oblong N C. to Fla S S 5 246

ALFRED REHDER

BÙPHANE (Greek, *cattle-destroyer*, alluding to poisonous properties) *Amaryllidàceæ* Amaryllis-like bulbs, very little known in this country, culture as for Brunsvigia.

The buphanes are large plants, with many red fls in an umbel with 2 involucral bracts lvs appearing late, strap-shaped, thick perianth tubular, segms equal and narrow, spreading, stamens 6, exserted, attached on the throat, style thread-like, the stigma small —Two species in Trop and S Afr The fls appear before the lvs, being as many as 200 together in a single head-like umbel, on a stout peduncle 1 ft or less high

dìstticha, Herb (*B toxicària*, Herb *Hæmánthus toxicàrius*, Thunb *Brunsvigia toxicària*, Ker-Gawl). Bulb, 6–9 in diam, tunicate lvs several, distichous, 1–2 ft long peduncle or scape stout (6–12 in high) and solid, compressed, glaucous, bearing a dense umbel. B M 1217 —Sparingly offered Lvs said to be very poisonous to cattle in S. Afr; bulb furnishes arrow poison for the natives

ciliàris, Herb (*Amaryllis ciliàris*, Linn. *Brunsvigia ciliàris*, Ker-Gawl *Crossyne ciliàris*, Salisb *Hæmánthus ciliàris*, Linn) Fewer shorter lvs, and shorter peduncle, bearing 50–100 dull purple fls; may occur in choice collections B R. 1153

L H B.

BUPHTHÁLMUM (Greek for *ox-eye*). *Compósitæ* A genus of 7 species of European and W Asian perennial herbs, sometimes grown in the hardy border Heads large, with long yellow rays and imbricated involucral bracts lvs alternate, entire or dentate pappus short, often connate into a corona: achenes glabrous Showy plants of easy cult.

speciosíssimum, Ard (*Telèkia speciosíssima*). Two to 5 ft lvs cordate and clasping, the upper ones oval and acuminate: heads solitary on the ends of the sts, flowering in July and later.

salicifòlium, Linn (*B grandiflòrum*, Linn.) Lower lvs oblong-lanceolate, 3-nerved, somewhat pubescent and slightly serrate: fls solitary and terminal, large.

speciòsum, Schreb. (*B cordifòlium*, Waldst & Kit.). Lvs. very large, cordate, coarse-serrate. fls. very large

and showy, on an upward-thickened peduncle 3–4 ft, blooming in June and later. J.H. III. 53.187. B M 3466 (as *Telekia speciosa*).—The best of all, a bold free and showy perennial growing very close and making good mass-effects

L H B
N Taylor †

BUPLEÙRUM (Greek, *ox* and *rib*; of no obvious application) *Umbellíferæ* A genus of 75 species of weedy plants of the Old World, of which one (*B rotundifólium*, Linn), is naturalized in the eastern states, and another (*B. falcàtum*, Linn), is cult. in Japan for greens (A G 13·9). Lvs simple, entire, often perfoliate fls umbellate mostly without an involucre except in the species below; calyx-teeth mostly none.



697 Bupleurum fruticosum.

fruticòsum, Linn Fig 697 Shrubby, 3–5 ft lvs oblong, leathery, mucronate, sometimes persistent, usually quite sessile fls. with a reflexed involucre, the umbels also with a set of bracts, also recurved fr oblong S Eu —Suitable for dry, almost sterile, places

B. crèceum, Fenzl A showy perennial with fls and involucral bracts bright yellow Asia Minor

N Taylor

BURBÍDGEA (after F W. Burbidge, who discovered it in Borneo). *Zingiberàceæ* Allied to Hedychium, but with no lateral perianth segms. and the lip reduced to a small blade The showy orange-scarlet fls rival cannas in brilliancy. For cult, see *Alpinia* and *Hedychium*.

nítida, Hook f Tender herbaceous perennial height 2–3 ft rootstock creeping, matted sts tufted, slender lf-blades glossy, 4–6 in long, eared at junction with the sheath panicle terminal, 4–6 in long, many-fld, inner perianth-tube 1–1½ in long, outer segms. 1½–2 in long, orange-scarlet, the dorsal one shorter and more roundish than the 2 lateral ones. B.M 6403. G C II 12 401

B schizochila, Hort Dwarfer and more compact in habit than B nitida Lvs dull green above, brown-red beneath fls orange-yellow Malaya

BURCHÉLLIA (W Burchell, botanical traveler) *Rubiàceæ*. One species from S Afr, an evergreen shrub, with opposite short-petioled lvs and dense terminal clusters of sessile scarlet fls. corolla tubular, bell-shaped; stamens 5, inserted in the tube. fr. a 2-celled, many-seeded berry **B. capénsis,** R Br, has been in the American trade, being cult for its rich, dark foliage and brilliant fls It is very variable, and has received several names Three to 10 ft Prop by cuttings. Grown under glass B M 2339 (as *B. bubalina*). R.H. 1886·420. J.H. III 34·81. L B.C 7.664. B. R. 466.

BURDOCK. *Arctium.*

BURLINGTÒNIA: *Rodriguezia.*

BURNET (*Potèrium Sanguisòrba*, Linn). A hardy rosaceous perennial, the piquant lvs of which are sometimes used in flavoring soups and salads The dried roots are occasionally used as a family remedy Burnet is little known in this country as a condimental herb. It is worthy a place in the hardy border for the ornamental character of its odd-pinnate lvs and its little heads of fls with drooping stamens The lfts are very dark green, ovate and notched sts 1–2 ft high, bearing oblong or globular monœcious heads Of easiest cult, either from seeds or by division of the clumps. Native of Eu.

L. H. B.

BURNING-BUSH. *Euonymus*

BURRIÈLIA *Baeria*

BURSÀRIA (*Bursa*, a pouch, alluding to the shape of the pods) *Pittosporàceæ*. Two species of shrubs with white fls in clusters; sepals, petals and stamens each 5, the petals soon withering fr a 2-loculed caps, in shape like that of the shepherd's purse

spinòsa, Cav An elegant spiny shrub or small tree, with drooping branches and pretty white fls, produced in summer lvs small, oblong-cuneate, alternate and nearly sessile 1½–1 in long fls small, lateral or terminal, mostly terminal in broad pyramidal panicles Austral Tasmania B M 1767 Andr Bot. Rep 314 —Cult. in S Calif.

BURSÈRA (Joachim Burser, a disciple of Caspar Bauhin) *Burseràceæ* Usually tall trees, with simple or pinnately compound lvs.: fls small, in clusters, 4–5-parted, with twice as many stamens as petals or sepals, and a 3-parted ovary containing 6 ovules fr a 3-parted drupe with usually only 1 seed —About 40 species of trees in Trop Amer For *B serrata*, see *Protium*

Simarùba, Sarg (*B gummifera*, Jacq) Gumbo-limbo or West Indian Birch Lvs odd-pinnate, with 3–5 pairs of lfts, lfts ovate, acute, membranous, smooth on both sides, entire, the netted veins prominent on the under side fls staminate and pistillate, appearing before the lvs or as they unfold, in knotty racemes somewhat resembling those of the choke cherry fr a drupe, with a 3-valved succulent rind and 3–5 nuts —A tall tree with a straight trunk and spreading head, found in Fla, Mex, and Cent Amer and the W Indies Wood very light, specific gravity when dry 30, useless even for fuel; decays very rapidly It yields a sweet, aromatic balsam, which is used in Trop Amer as a medicine for internal and external application, dried, it is known in the trade as Chibou, or Cachibou resin, or Gomart resin It is known as a hardy greenhouse plant, and thrives in a compost of loam and peat. Prop. by cuttings under glass, with bottom heat.

G. T. Hastings

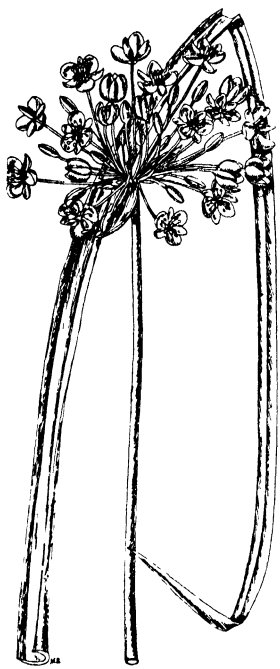
BUSH-FRUITS. A term used to designate those small-fruits that grow on woody bushes. It includes all small-fruits—as that term is used in America—excepting strawberries and cranberries. Bush-fruits is an English term, but it has been adopted in this country, notably in Card's book on "Bush-Fruits" The common bush-fruits are currants, gooseberries, raspberries, blackberries, and dewberries.

BUTCHER'S BROOM. *Sarcococca*

BÙTEA (Earl of Bute) *Legumìnòsæ* Three or 4 species of trees or woody vines of India and China, with deep scarlet papilionaceous fls in racemes, and pinnate lvs In the Old World rarely grown in stoves In this country 1 is cult. in S. Calif.

frondòsa, Roxbg A leafy tree, yielding gum or lac: lfts. 3, roundish, pubescent beneath, the lateral ones

unsymmetrical fls. 2 in. long, orange-crimson, very showy; stamens 9 together and 1 free. E India and Burma. Rheede Hort. Mal. 6. 16, 17.—Reaches a height of 50 ft. Inspissated juice is known as Bengal or Palas kino, or butea gum, which has astringent properties, resembling true kino. Seeds used in India as a vermifuge. The tree yields also stick-lac. The coarse, fibrous material obtained from the inner bark is used for caulking the seams of boats. Dried fls. yield a yellow or orange dye.



698. Butomus umbellatus. (×¼)

BUTNÈRIA: *Calycanthus*

BÙTOMUS (Greek, *bous*, ox, and *temno*, to cut; the leaves too sharp for the mouths of cattle) *Butomàceæ*. Hardy perennial aquatic of easy culture in ponds.

The Butomaceæ comprises 3 genera. Butomus is allied to Alisma, but with several ovules in each carpel; perianth-segms. all prominent and colored, stamens 9, carpels 6, tapering above; lvs. sedge-like. All the species are referred by DC., in Mon. Phan., Vol. III, to *B. umbellatus*, and to the Australian Butomopsis, which is also a monotypic genus (by some, however, included in Tenagocharis).

umbellàtus, Linn. FLOWERING RUSH. Fig. 698. Rhizome thick. lvs. 2–3 ft. long, iris-like, sheathing at the base, 3-cornered. fls. rose-colored, 25–30 in an umbel, on a long scape; sepals 3, petals 3. Summer. Eu., Asia, in still water. Prop. by division.

BUTTERCUP: Species of *Ranunculus*

BUTTERFLY WEED: *Asclepias tuberosa.*

BUTTERNUT *Juglans.*

BUTTERWORT *Pinguicula.*

BUTTON-BUSH. *Cephalanthus.*

BUTTONWOOD: *Platanus*

BÚXUS (ancient Latin name). *Buxàceæ*. BOX TREE. Ornamental small trees or shrubs grown chiefly for their handsome evergreen foliage.

Leaves opposite, short-petioled, penninerved, entire, glabrous or nearly so, coriaceous. fls. monœcious, apetalous, in axillary or terminal clusters, consisting usually of 1 terminal pistillate fl., with usually 6 sepals and with a 3-celled superior ovary with 3 short styles and several lateral staminate fls. with 4 sepals and 4 stamens. fr. an obovate or nearly globular 3-pointed caps., separating into 3 valves, each containing 2 shining black seeds.—About 30 species in the mts. of Cent. and E Asia, N. Afr., and S Eu., also in W. India and Cent. Amer.

These are evergreen shrubs of rather slow growth, with shining, small foliage and inconspicuous flowers and fruits. *Buxus japonica* seems to be the hardiest species, and it has proved quite hardy at the Arnold Arboretum; and *B. microphylla* is of about the same hardiness, while *B. sempervirens* is somewhat tenderer, *B. balearica* and *B. Wallichiana* are still more tender. *B. sempervirens* stands pruning very well, and in the old formal gardens of Europe was formerly much used for hedges, and sometimes trimmed into the most fantastic shapes, the dwarf variety is still often planted for bordering flower-beds. The very hard and close-grained wood is in great demand for engraving and finer turnery work.

The box tree thrives in almost any well-drained soil, and best in a partially shaded position.

Propagation is by cuttings from mature wood early in fall, kept during the winter in the cool greenhouse or under handlights in the open, in more temperate regions they may be inserted in a shady place in the open air, 4 to 6 inches is the best size for outdoor cuttings. Layers will also make good plants. The dwarf variety is usually propagated by division. In planting borders, it is essential to insert the divided plants deeply and as firmly as possible, and to give plenty of water in the beginning. Seeds are sown soon after maturity, but it requires a long time to raise plants of good size from them.

A. *Width of lvs. less than ½in.*

B. *Lvs. oval to oblong-lanceolate, broadest about or below the middle; branchlets usually slightly pubescent*

sempérvirens, Linn. COMMON BOX TREE. Fig. 699. Shrub or small tree, to 25 ft.; branches quadrangular. lvs. oval-oblong or oval, rarely roundish oval or lanceolate, usually obtuse, ½–1½ in. long, petioles usually pubescent. fls. in axillary clusters, staminate fls. sessile, with a central gland half as long as the calyx. S Eu., N Afr., Orient, China. H W 3, p. 29. F E 18, pl. 81. Gn. 55, p. 62.—Wood much used for engraving. Lvs. employed in medicine. Very variable in size, color and shape of the lvs., some of the most commonly cult. forms are the following. Var. **arboréscens,** Linn. Fig. 700. Tall shrub or small tree. lvs. usually oval. The typical form. Var. **argéntea,** Loud. (Var. *argénteo-marginàta*, Hort.). Lvs. irregularly edged with silvery white. Var. **aùrea,** Loud. (var. *aùrea maculàta*, Baill.). Lvs. variegated with yellow or entirely yellow. Var. **marginàta,** Loud. (var. *aùrea marginàta*, Baill. and Hort.). Lvs. edged yellow. Var. **glaùca,** Koch (var. *macrophylla glaùca*, Hort.). Lvs. oval, glaucous. Var. **rotundifòlia,** Baill. (var. *latifòlia*, Hort.). Lvs. broadly oval. Var. **Händsworthii,** Koch. Of upright habit, with rather large dark green lvs. Var. **oleæfòlia,** Hort. Of upright habit, with oblong lvs., resembling those of the olive. Var. **élegans,** Hort. (var. *oleæfòlia élegans*, Hort.). A variegated form of the preceding variety. Var. **bullàta,** Koch. With large bullate lvs. Var. **angustifòlia,** Loud. (var. *longifòlia*. Hort., var. *salicifòlia*,



699. Buxus sempervirens (×½). The lower spray shows the under surface

Hort) Shrubby: lvs oblong-lanceolate Var **myrtifólia,** Loud Usually low lvs small, elliptic-oblong Var. **rosmarinifólia,** Baill Low· lvs small, linear-oblong, revolute at the margin Var **suffruticósa,** Linn (var. *nána,* Hort) Dwarf: lvs. small, oval or sometimes obovate; flowering clusters usually only terminal

BB. *Lvs. usually obovate, broadest above the middle: branchlets glabrous.*

japónica, Muell Arg (*B. obcordàta,* Hort. *B. Fórtunei,* Hort) Shrub, 6 ft , with spreading branches lvs. cuneate, obovate or roundish obovate, obtuse or emarginate at the apex, ½–1¼ in long, light green with glabrous petioles· clusters axillary; staminate fls. sessile, with a central gland as long as the calyx. China, Japan S I F 2 38 —Very distinct with its spreading slender branches and light green, lustrous foliage.

microphýlla, Sieb & Zucc (*B japónica* var *microphýlla,* Muell Arg) Dwarf, often prostrate shrub, quite glabrous: lvs obovate or obovate-lanceolate, ⅓–1 in long· clusters mostly terminal; staminate fls sessile, with a central gland like the former Japan.

AA. *Width of lvs. ½in. or more.*

balearica, Willd Shrub, 6–15 ft : lvs. elliptic or oblong, acute or obtuse at the apex, 1–2 in long, light green. clusters axillary; staminate fls. pedicelled. S. Spain, Balear —Handsome shrub, but less hardy than the former.

B. californica, Lk =Simmondsia californica —*B Fórtunei,* Carr. =B longifolia —*B Fórtunei,* Hort =B japonica —*B. Hárlandii,* Hance Branches pubescent lvs narrow obovate, emarginate, ¾–1¼ in long China —*B longifólia,* Boiss (B Fortunei, Carr). Lvs narrow-elliptic or lanceolate, 1–1¼ in long Orient, China —*B. longifólia,* Hort =B sempervirens var angustifolia —*B Wallichiana* Baill Branches pubescent lvs linear-elliptic, 1-2½ in. long Himalayas

ALFRED REHDER.

BYRSÓNIMA (name refers to use of some species in tanning, in Brazil) *Malpighiàceæ.* Perhaps 100 Trop. American trees and shrubs, frequently climbing, rarely known in cult. Lvs. opposite, thick, simple, entire, the stipules often connate fls white, yellow or pink, in terminal simple or branched racemes, sepals and petals 5, the former bearing a pair of glands, the latter clawed and the blades concave, stamens 10, the filaments united at base and bearded fr a 3-celled fleshy drupe, with bony seeds, often edible *B lùcida,* HBK, occurs in Fla and W Indies, a much-branched evergreen shrub, with fls white turning yellowish or rose, apparently not in the trade. **B. crassifólia,** HBK Mex. and S , is offered in S Calif Shrub or small tree lvs ovate, tapering each way· fls. yellow in pubescent erect racemes Said to bear the "nanche," a popular fruit of the Mexicans This has a sour fermented taste, it is offered for sale in the markets of the west coast Mexican towns, and is eaten raw with salt, or in soups, or in stuffing for meats The astringent bark, rich in tannin, is used medicinally.



700. Buxus sempervirens var. arborescens.

C

CABBAGE. The more or less compact leaf-formed head of *Brassica oleracea;* also applied, with designations, to related forms of the same species, as Welsh cabbage, tree cabbage Closely related plants are the kales (Fig 706), collards, Brussels sprouts, cauliflower See *Brassica*

The Chinese cabbage of this country is a wholly different species from the common cabbages It does not form a compact and rounded head, but a more or less open and soft mass of leaves, after the manner of Cos lettuce It is of easy culture, but must be grown in the cool season, for it runs quickly to seed in hot and dry weather

The culture of the cabbage antedates reliable historical record. Writers of Pliny's time or before refer to variations in growth and character which must have resulted from selections and cultivation for many generations, under conditions very different from those which seem to be the natural habitat of the plant on the comparatively barren chalk cliffs of England, and in similar locations in Europe

It is indeed hard to realize that the scrawny and somewhat starved-looking plant shown in Fig 628 (Vol I) could be the ancestral origin of such corpulent, overfed individuals as are shown in Figs. 701 to 704 Such a change in habit of growth can be accounted for only by the plant's possession of exceptional capacity for using the more abundant food-supply furnished by cultivation for many generations, and the storing of it in a way that makes it available for man's use rather than for the mere perpetuation and multiplication of the parent plants

Characteristics of the plant and requisites for best development.

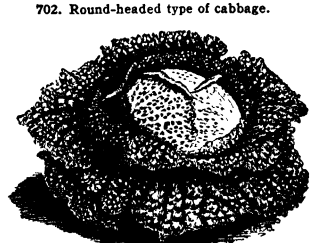
The cabbage is classed by botanists as a slow-growing bi-annual, and has three distinct periods of life First, the more or less rapid growth of leaf and plant Second, a more or less distinct resting period during which the formation of embryonic blossoms is started. Third, the growth and development of the flower and seed The cultivated cabbages retain very persistently these distinct growing periods, but have added what might be classed as another, that of head-formation, which is in reality simply a distinct division of the first This additional head-forming period, although essential to the plant's value as a cultivated vegetable, is not at all necessary for the growth and perpetuation of the plant, which, when it has been held in check by long-continued severe frost or drought, will often revert to the original order of growth and pass directly from the growing to the seeding stages with no attempt at head-formation



701. Conical form of cabbage—Jersey Wakefield.



702. Round-headed type of cabbage.



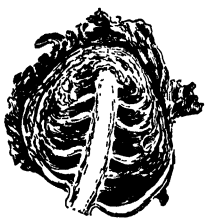
703. Savoy cabbage.



704. A modern cabbage plant in head—Early Flat Dutch.

Cultivated cabbage thrives best in a moist and comparatively cool climate, and will not reach its best and rarely a satisfactory or profitable development in a hot dry one, nor where there are likely to be even occasional days of high temperature or hot dry winds Even if there is abundant moisture in the soil, a few hot dry days, such as corn and tomato plants would delight in, will often not only check but permanently prevent any vigorous or profitable growth This sensitiveness to over-heat is most pronounced during the second or unnatural period of growth, and the least so during the first Young plants will often thrive in temperatures in which it would be quite impossible to induce older ones to form a solid head Excessive heat is quite as injurious, and often more so, than freezing, but the latter is especially injurious to the younger plants, particularly if they are growing rapidly, the older ones being little injured by frost which would kill rapid-growing seedlings One notable effect of exposure of young plants to severe or long-continued low temperature is that it takes the place of the resting period, and thus cuts out the second or head-forming period, so that the plant, as soon as established in the field, begins to shoot to seed without forming any head The degree to which the plant suffers from unfavorable temperature seems to vary not only with different varieties but in different locations In the Puget Sound country, cabbage plants are often killed by exposure to low temperatures, which those of the same variety and age growing in similar soil and exposure on Long Island would endure with little apparent injury In the United States, favorable climatic conditions are most likely to occur in succession during the winter, spring and fall months, as one moves northeast along the Gulf and Atlantic coasts, or in the West along the coast north from Portland, Oregon, and in isolated sections south of that point. Some of the finest cabbages ever produced in America have been grown at points on the Pacific coast as far south as Los Angeles, California. There are also locations,

especially in New York, Ohio, Indiana, Michigan and Wisconsin, near the Great Lakes, or where smaller but deep inland lakes abound, in which cabbage does exceptionally well, but generally, in common with most cruciferous plants, they do better near the sea, in such locations as the Eastern Shore of Maryland, Long Island and Puget Sound regions, than in the interior or on the borders of even very large bodies of fresh water.



705. Section of cabbage head, showing the thickened rachis and leaf-stalks, and the buds in the axils.

As the plant is a native of the temperate zone, and thrives best in it, and cannot long endure high temperatures, one does not think of it as particularly sun-loving; but there are few garden plants to which abundant sunlight is more essential and shade more detrimental than the cabbage. In its native habitat, the plants are found growing alone or in small open groups where they are fully exposed to the sun Similar conditions are essential to its best development under cultivation so that it can rarely be profitably grown in the shade or in crowded groups or rows, and "shooting to seed" or other failure to form a head is often due to the crowding of the seedlings in the seed-row.

The cabbage is one of the grossest and least fastidious feeders of cultivated plants, and while an abundance of easily accessible food is essential for its profitable culture, it is less particular than most plants as to its proportions and physical condition, if only it has an abundance. Large crops of the best quality are often produced by the use of fresh green and uncomposted manures in almost limitless quantities. Some growers object to the use of manure from hog-pens, yet some of the largest, healthiest and best crops ever seen have been grown by the liberal use of hog manure. Strange as it may seem, abundant fertilization hastens rather than retards the plant reaching marketable condition.

The plant is more particular as to its water-supply than its food-supply, and suffers even more quickly than most vegetables from a lack of sufficient moisture in the air or soil On the other hand, it cannot long endure an excess, particularly in the soil, and soon succumbs to wet feet A well-drained soil which at the same time is fairly retentive of moisture is essential to profitable cabbage-culture.

Even more than with most garden vegetables, the physical condition of the soil is a most important factor in determining the development of the cabbage. Large and often very profitable crops may be grown on soils which would be classed as clay, loam, gravel, sand or muck, provided they are rich and friable, but seldom a large, or profitable crop can be grown on even a very fertile soil which after rains quickly hardens and bakes so as to be impervious to air. Permanent friability rather than superior fertility makes some soils exceedingly profitable for cabbage, while it is difficult and often impossible to grow a paying crop on others which are even richer and better watered, but which are liable to cake after every rain. This is especially true of some soils that are generally classed as a very rich clay or muck Permanent friability is the most essential quality for profitable cabbage-culture, and the want of it the most common cause of failure to grow a profitable crop.

Varieties of cabbage. Figs. 701–704, 707.

Few vegetables show a wider range of variation. There are sorts that can be grown to edible maturity on a square foot and in 90 to 120 days from the seed, while others can hardly be crowded into a square yard or reach prime edible maturity in less than 200 days; sorts so short-stemmed that the flat head seems to rest on the ground, others in which the globular head crowns a stalk 16 to 20 inches long, kinds in which the leaves are long, round, or broad, smooth, or savoyed, light yellowish green, dark green or so dark red as to seem black, with surfaces which are glazed, smooth, or covered with thick bloom There are many early-maturing kinds, each having characteristics adapting them for different cultural conditions and uses, that will, in fertile soil and a temperature between 60° and 80° by day, and never below 40° at night, form salable heads in 90 to 110 or 120 days from the germination of the seed; others that mature in mid-season, still others that grow the entire season and increase in solidity even while stored for winter

American seedsmen offer cabbage seed under over 500 more or less distinct varietal names, a large proportion of which stand for different stocks rather than for distinct varietal forms. here only the most distinct types and the most commonly used names are mentioned

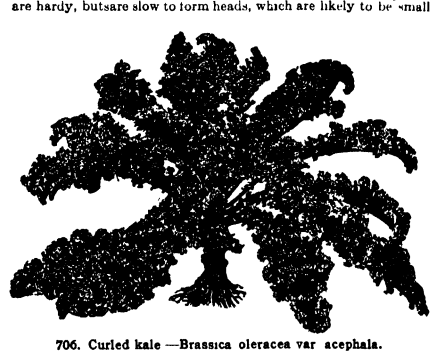
Early York, Etampes, Large York, etc.—Very compact, upright-growing smooth-leaved sorts which are comparatively tender to both heat and cold, and form vertically oval comparatively soft heads of excellent quality, but better suited to European than American climatic conditions and market requirements

Early Jersey, Large Wakefield, Winnigstadt, etc —Compact-growing, very sure-heading sorts which are very hardy to both heat and cold and form comparatively small, but closely wrapped hard sharply conical heads which are of attractive appearance, but not of the best quality Well suited to the general soil and climatic conditions and very popular in America

Enkhuizen Glory, Early Summer, Fottler's Drumhead, etc — Second-early sorts, forming small compact to large spreading short-stemmed plants, and nearly round to distinctly flat heads which mature quickly, are of good quality but not well adapted for distant shipment or winter storage

Flat Dutch, Drumhead, Ballhead or *Hollander,* etc —Large spreading comparatively slow-growing plants, forming round to oval hard heads, having the leaves very closely wrapped and overlapping in the center They are generally good keepers, often improving not only in solidity but in quality during storage

Savoys —A class in which the leaves of both plant and head are crumpled or savoyed instead of smooth as in the preceding There are varieties of all the forms of smooth-leaved sorts The plants are hardy, but are slow to form heads, which are likely to be small and more or less open or loose-centered, but they are of superior flavor, and this class is worthy of more general cultivation in the home-garden and for local market



706. Curled kale —Brassica oleracea var acephala.

Red cabbage —A class of which there are many varietal forms, and in which the plants and heads vary from purple shaded green to deep red The heads are generally small, but very solid and are especially suited for use as "cold slaw "

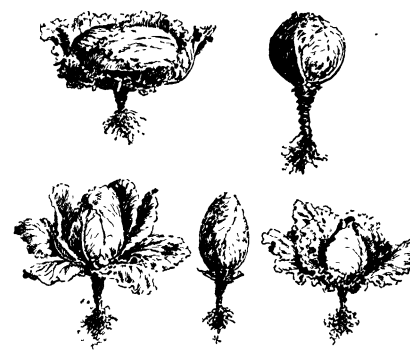
Portugal Sea-Kale, Tronchuda or *Chinese cabbage.* — These are distinct classes and species of cabbage, intermediate in character between the more common sorts and the more distant kales They have never become generally popular in America, though they are rather largely grown and used by the Asiatics, particularly on the Pacific coast The sea-kale cabbage is not to be confounded with sea-kale, which is a very different plant.

These are but a few of the almost limitless, more or less distinct variations offered by seedsmen, yet each of them was thought by someone to be superior in some location, under some conditions, or for some purpose The general recognition of the value of each variation, and the consequent popularity of the sorts in which the variation is best developed, are constantly changing, partly because of local conditions of climate, but more largely because of changes in transportation and market facilities and conditions.

Cultural methods

Ideal climatic conditions are found only in very limited areas, and the common cultural practice in each locality is largely shaped by the degree to which local conditions approach them In the country north of Washington in which a well-lighted and heated greenhouse and experienced help are available, the simplest method, and one by which the very best of early cabbage can be grown, is to plant the seed in flats some sixty to ninety days before danger of killing by frost is past, and as soon as the central bud or leaves appear (which should be in ten to fourteen days) to "prick out" the plants, setting them 2 to 4 inches apart in other flats, according to the relative importance in that particular culture of earliness and cost of production The house should be given abundant ventilation, and temperatures exceeding 70° or 85° by day and 50° or 60° at night carefully avoided Often it will be found very advantageous, as soon as the plants are well established, to remove them to well-lighted coldframes These should be carefully tended in order to give all the air possible, and to avoid over-heating by the sun or falling below 35° at night, and the plants transferred to the open ground as early as this can be done without danger from killing frosts Some very successful growers plant seed in well-protected coldframes so as to secure a thin, even stand, and by careful attention secure a slow but steady growth through the winter, and the seedlings are first transplanted to the open ground as soon as danger from killing frosts is over A common practice from Philadelphia or Baltimore southward is to sow the seed in the fall in carefully prepared beds in sheltered locations, and, as soon as the plants are large enough, to transplant them to flat-topped ridges about 30 to 36 inches from center to center and as high as can be formed by two or three back-furrows These ridges usually are run east to west and the plants are set on the south, the north or the top, or sometimes in the furrow between them, depending upon the judgment of the planter as to which location will give the best result on that particular farm and exposure and in that particular season, as sometimes one and sometimes another location gives the best results In some sections and often only on certain farms of a section this method gives large very early-maturing and profitable crops, while in different fields, even on the same farm, a large proportion of the plants so handled will be killed by frost or will shoot to seed without heading In certain locations, notably in the vicinity of Charleston, South Carolina, cabbage-plant farms have been established, from which plants in prime condition for setting in the field can be secured by the million The location and exposure, and the character of the soil of the most successful of these farms is such that the plants are rarely killed or seriously checked by frost, but make a constant but slow growth all winter and can be pulled at any time so as to retain abundant root and vigor and be safely shipped long distances. The seed is sown and the plant-beds treated much as one would treat a bed of onions for sets or pickles, except that in many cases the rows are as close as 3 inches and the bed receives little or no cultivation after the seed is planted.

Objections that are sometimes well founded to plants from such farms are, that they are slow "taking hold" and a large proportion of them "shoot to seed" without heading, or the heads are small and of poor quality, but such failures often come from the use by the plant-raiser of cheap and inferior seed, or from the crowded rows and careless handling, or from the farmer sending for and setting the plants too early, or from holding them too long before setting Some plant-raisers take pains to advertise that they do not guarantee plants shipped by them before December 1 to give satisfactory results (though they often do), but that they are willing to guarantee that plants shipped by them from December 1 to April 1 will, in suitable soil and exposure and with good cultivation, produce full crops of marketable cabbage. Most farmers who use 20,000 to 30,000 plants could grow on their own farms as good plants or better than they could buy from even the best and most reliable growers, and often at materially less cost, but it is



707. Cabbage shapes: Flat; round or ball; egg-shaped; oval, conical

questionable whether many of them would do so, and it is not surprising that the practice of buying plants, particularly when earliness in market maturity is desirable, is rapidly extending

The best distance between plants will depend not only upon the variety used but upon the character of the soil, kind of labor available and the condition and way in which the crop is to be marketed. Such small upright-growing sorts as Early York, Etampes, or true Jersey Wakefield, which are to be marketed when still quite soft, can be well grown set as close as 6 or 8 by 18 to 24 inches, requiring 20,000 to 30,000 plants to the acre, but in America such close planting necessitates so much hand labor that it is seldom profitable, and 8 to 12 by 28 to 30 or 36 inches, requiring from 8,000 to 15,000 or 20,000 plants to the acre, is usually found the more profitable distance.

The best method of setting, whether by hand, hand-planters, or machine, will be determined by local conditions. The plants should "take hold" in two to four days and start into vigorous growth in ten days to three weeks, the time depending upon the condition of the plants, and the way they are handled, quite as much as upon the weather. After active growth has commenced, it should continue at a constantly accelerated rate until the head begins to harden, and although toward the last the plants may not seem to increase in size, the heads will gain in weight. The cabbage suffers less than most vegetables from mutilation of the root, yet deep cultivation is undesirable because unnecessary. The essential thing is to prevent any crusting over, and the keeping of the surface in such good tilth as to permit of the free aëration of the soil.

One of the best crops of early cabbage on record was secured from what was regarded as naturally a rather unfavorable soil that was not very heavily fertilized, but received a shallow cultivation with a harrow tooth cultivator every day (except Sundays and on four days when the surface was so wet from rain that it would puddle) after the plants were set until the crop was in market condition

The time of planting for fall and winter cabbage and the general cultural methods most likely to give good results in any particular location are the same for both seasons, the time of maturity being determined more by the varietal character of the seed than by method of culture The cultural practice usually followed by neighboring and equally successful growers is often radically different. One planter may always, on some fixed day in May or June, sow seed in flats and as soon as the seedlings are well started pick them out into other flats, and then again into a plant-bed and wait for a favorable day, if necessary until August, before putting them in the field. An equally successful neighboring grower may wait until as late as the last of June and sow thinly in well-prepared seed-beds and transplant from them to the field, while still another may wait for favorable weather even until the last of July and then plant seed in place as is the usual practice of some most successful growers In New England, growers often drill the seed in place, and when the plants are well established chop out the superfluous ones



708. An outdoor method of storing cabbage

The weight or quantity of seed used for a given area varies greatly, as the size of the individual seeds vary, not only with different varieties but with different lots of the same sort. Some growers expect to get plants enough for an acre from less than an ounce, while others require two to five times as much, and those who sow in place often will use four to eight ounces to the acre. Superlative crops have been known to be grown by radically different methods, and very often successful growers have some peculiarity of practice which they deem essential to the best results, but which a neighboring and equally successful grower regards as a foolish waste of labor; but, however the practice of successful growers may differ, there are some points in which they all agree Among these are, the use of the best obtainable seed of some particular variety which they have found by experience, or which they believe is best adapted to their conditions and is uniform in time of maturity, so that all the heads are in prime condition and may be gathered at the same time, which is an important factor in determining cost of production, while uniformity in shape, form and color are equally important in determining salability. The quality of the seed used, while not the only factor, is generally the most important one in determining the uniformity of product of any particular culture Unchecked and constantly accelerated rate of growth are most important factors in securing the best possible development of any particular culture. Every check, whether it come from overcrowding of the seedlings, careless transplanting, or the caking and want of friability in the surface soil, tends to divert the energy of the plant from the unnatural and excessive leaf-formation upon which its value as a cultivated vegetable depends to the more natural but less useful formation of blossoms and seed Just how on any particular farm the most favorable conditions can be secured cannot be told in general cultural directions, but must be decided by the grower from his knowledge of the character and wants of the plant, the condition of the soil, and last, but by no means least, his facilities for controlling the conditions upon which the growth of the crop depends.

Harvesting.

This is the simplest and easiest part of cabbage-growing With an easily acquired dexterity, each head in five or six rows can be cut, trimmed and tossed into a central windrow by a single well-directed stroke of a well-sharpened spade or heavy hoe Occasionally, because of some unnatural growth of the plant, or want of attention, a head will need retrimming, but by the exercise of a little care, practically all of them can be kept in marketable shape From the windrows, the heads are gathered and loaded loose into cars, delivered to factories or placed in storage Yields secured vary greatly, being influenced by the sort, the quality of the seed, the character of the soil, loss from insects and disease; they generally range from five to twenty tons to the acre The crop is usually readily salable in the fall, delivered at factory or on board cars at prices ranging from $4, or even less, to $10 to $20 a ton

Marketing

Cabbage greens — In some sections, notably southern Mississippi and Louisiana, considerable acreage is grown and marketed as cabbage greens The seed is sown in place or the plants are set quite close in the row, and as soon as they have commenced active growth and long before they have formed a distinct head, they are cut and marketed much in the same manner as spinach or kale, but this method of culture and use is very limited.

Early cabbage is generally considered marketable as soon as the leaves have closed into a head, even if this is still so soft and loose that it would be quite unmarketable later in the season If cabbages are cut when soft and immature, they soon wilt and lose all crispness and palatability, to avoid this, the earlier shipments are made in small open crates containing less than a score of heads, or sometimes in larger closed ones carrying ice, and often in refrigerator cars Later in the season, as the heads become larger and harder, they are shipped in slat crates about 12 by 18 by 38 inches, or in ventilated burlap-covered barrels holding about two and three-fourths bushels

Fall and winter cabbages are usually sold by the ton, of much more closely trimmed heads than are considered marketable earlier in the season, and are commonly shipped in open and well-ventilated cars without special container or packing, except as may be necessary to protect from hard freezing Many acres are grown on contracts with shippers, packers of sauerkraut, and the like, who contract for the delivery direct from the field to factory or on board cars, of the usable product of a certain acreage at an agreed price per ton. While this is sometimes a very satisfactory arrangement, many careless and incompetent growers are induced to contract, and their neglected crops become infected with disease and insects which spread to the fields of even the most careful growers, and the crop in the vicinity of such factories and shipping-points soon becomes unprofitable.

Storing.

Formerly the most common practice was to let the plants stand until danger of hard freezing, then pulling, allowing the roots to retain what earth they would, but breaking off some of the most spreading leaves and crowding the plants together (with heads all up or all



709 Cabbage in winter storage in cabbage-house

down and at a uniform height), with earth packed between them, in long shallow trenches that were gradually covered with sufficient coarse straw or litter to protect from severe freezing A variation of this method is to pull, leaving what roots and earth adheres, and set as closely and level as possible in a shallow cellar not over 3 feet deep, which after filling is covered with a roof of boards, tarred paper and litter sufficient to keep out rain and frost, and high enough in the center to allow of handling the cabbage It is essential to success with either trench or cellar that they be located where there is the least possible danger from standing water, rats and other vermin, and as well protected as possible from severe winds and cold Advantages of this method are that heads quite too soft to be salable become hard and firm, and that cabbages so stored retain to a remarkable degree their crispness and flavor, and are thought by some to be even better than when fresh from the field, but when taken from the trench or cellar, they soon lose their crispness and will not stand shipment so well as heads which were trimmed before storing A very common method is to cut and partially trim the heads and place in piles 4 to 6 feet high and broad, and of convenient length, built over a board-covered trench which is ventilated by open ends and tiles up through the cabbage, the piles being gradually covered and the openings closed so as to prevent hard freezing (Fig 708).

In certain sections a large proportion of the cabbages grown for late winter and early spring market are trimmed and stored in bins or on shelves in frostproof storehouses (Fig. 709).

Diseases

Clubroot (*Plasmodiophora brassicæ*) —A soil parasite affecting cabbage and other cruciferous plants It thrives best in acid soils and in some cases can be checked by a liberal use of lime, but its presence in any field in destructive abundance is seldom suspected until too late to save the crop Planting cabbage or other cruciferous crops on such a field should not be repeated for several years, during which it should have continued dressings of lime and ashes Care should be taken to secure uncontaminated soil for seed-beds, and to destroy all affected plants before cattle have access to them, as the disease may be carried by such refuse in the manure from cattle who have eaten it.

Wilt or *Yellows, Black-rot, Stem-rot, Fusarium, Phoma* —Infectious diseases which sometimes become so abundant in certain sections as to prevent the profitable culture of cabbage They are all distributed by means of contaminated seed, by manure from cattle fed on diseased refuse, by soil carried on tools from affected fields, distribution in this way should be carefully avoided. All diseased plants should be destroyed by fire as soon as noticed The soil used in the seed-beds should be sterilized by live steam or soaked in a weak solution of formaldehyde (one part to 260 of water). The seed should be soaked fifteen minutes in the weak solution of formaldehyde, then rinsed in clear water and immediately planted.

Animal pests.

Flea beetles —The securing of vigorous plants is sometimes prevented by the attacks of innumerable flea beetles, *Phyllotreta vittata* This may be prevented by surrounding the beds with frames made of 10- to 12-inch boards connected across the top with 2-inch strips and then covered with 20- to 40-thread to the inch cheesecloth This should be put on as soon as the seed is planted and be removed, in order to harden the plants, four to six days before they go to the field

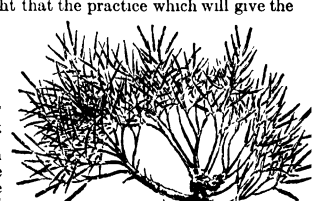
Cut-worms —These are best guarded against by keeping the field perfectly clear of all vegetation for six to ten days before setting, then mix four quarts of bran meal or flour, one cup of molasses or sugar, and two tablespoonfuls of paris green, with water enough to make about the consistency of milk, and sprinkle on twenty to fifty times its bulk of fresh-cut grass and scatter over the field the night before setting the plants.

Cabbage worm —Keep careful watch of the plants and if the green worms appear in abundance and seem to reach full size, sprinkle or spray the plants with kerosene and whale-oil soap emulsion, or paris green and water in the proportion of four gallons of emulsion and one pound of paris green to fifty gallons of water. After the heads are two-thirds grown, powdered hellebore, one ounce to two gallons of water, should be substituted for the poisonous paris green mixture

Root-knot (*Nematodes*) —Although seldom very destructive north of Philadelphia, this is often the unsuspected cause of failure in the South, particularly of fall crops in light lands The only practical remedy is the avoidance of affected fields or sterilizing the soil by freezing or live steam.

Seed-breeding and -growing. Figs. 710, 711.

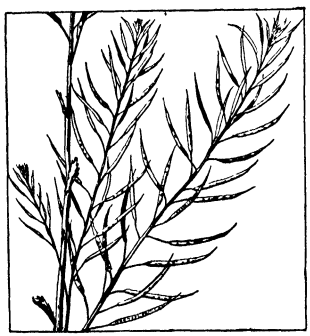
It is only through careful study of the practical value and correlation of varietal differences, the exercise of great care in selection and growing of the plants, and in the saving of the seed, that this or any vegetable can be improved or even its present good qualities maintained Under favorable conditions the plant is capable of producing abundant seed, a single plant having been known to yield thirty-five ounces, enough to plant 25 to 40 acres, but such yields are very exceptional, and one-half to four ounces a plant is much more common Although botanically the plant is self-fertile, when isolated it seldom yields much and often no viable seed It transmits very persistently through many generations any distinct variation, but often without expression, although such hitherto unexpressed variations are apt to appear in the seed of self-fertilized plants, so that such seed is frequently less uniform than that from a field of plants of the same ancestry At least one of our popular varieties is made up of the descendents of a single isolated plant, but it is a curious fact that in the second and subsequent generations 90 per cent of the plants, although quite uniform, were very different in character from that of the selected individual from which they were descended. The originator of one of our best varieties maintains that it is essential to the production of the best seed of that sort that seed-plants of very different types should be set together, and by crossing they will produce seed giving plants of the desired type. In spite of these facts, it is thought that the practice which will give the best results with other plants is equally desirable for the cabbage, and that first a distinct and well-defined conception of the varietal form desired must be formed and the stock started from the plant or plants whose seed most uniformly developed into plants of the desired



710. Wild cabbage plant in seed. Chalk cliffs of England.

character, rather than from those in which it was exceptionally well developed. Often even professional seed-growers have but a very vague and constantly changing conception of what a given variety should be.

The greatest profit is not from the field that produces even a good many of the most perfect specimens, but from that in which the largest proportion of the plants are most uniformly of the desired character. In order to produce seed which will give such results, one must first form a very clear conception of just what one wants in plant and head, and learn the relation between easily noted but economically unimportant qualities, and others not so easily seen but more important in determining value. Having selected a number of ideal plants, one should grow these either singly, or in groups of three or four that are nearest alike. Save and number the seed of each plant separately and plant a small sample of each number, carefully noting the numbers in which the product was most uniformly of the desired character. From the reserved seed of the numbers which most uniformly developed the desired form, one can start a stock for field planting. It is not safe, however, to rest there; one must start a new selection of the desired character so as to continually renew one's stock. In raising seed, plantings should be made a little later than one would for fall market cabbage. As the plants develop, each lot should be repeatedly looked over and not only those which show no disposition to form a head, or one in which the inclosing leaves do not pass over the center, but also those which show any departure (even if it be of itself a desirable one) from the desired form, should be removed. The plants should be left in place until there is danger of the ground being closed by frost and should then be pulled, a few of the larger leaves removed and then packed into narrow trenches in sheltered and well-drained localities, taking pains to pack the earth closely about the roots and stems. Gradually, as necessary to prevent hard freezing, they should be covered with earth and with coarse litter, the aim being to keep them as cold as possible without actually freezing, and to prevent them starting into growth. As early in the spring as possible, they should be set for seeding, giving each plant about twice the space needed for market cabbage. In setting, the plants, should be more or less inclined, so that while the top of the head is but little above the surface, the roots are not buried in hard and cold subsoil. As they are set, the heads should be scarred across the top, not deep enough to injure the sprouting center, but so as to facilitate its pushing its way through the head. The seedstalks should not be cut until they begin to shed the seed, which turns black and seems ripe before it is fully mature.



711. Cultivated cabbage in seed.

The entire plant should be cut and stored until quite dry, when the seed can be easily threshed, cleaned, and spread not over ½ inch deep in full sunlight for a few days and then stored.

Commercial seed-growing.—Although one occasionally sees heavily seeded plants in all parts of the United States, cabbage seed rarely proves a profitable crop, except in very limited areas along Long Island Sound, the eastern shores of New Jersey, Maryland and Virginia, and in the Puget Sound region, where the yield commonly secured varies from 300 to 700 pounds to the acre, although exceptional crops sometimes reach 1,500 to 2,000 pounds. The common method of growing does not vary materially from that described, except that very often too little care is exercised in securing stock seed, and it is sowed or the plants set so late that they fail to develop sufficiently to enable one to do very effective rogueing out of inferior stock. In Holland, seed is often raised from much better matured heads than are commonly used in America and which are cut from the root, but leaving more stem than for market use, and planted so that the top is level with or slightly below the surface. Treated in this way, they root like a great cutting and form loose, well-branched plants which are not so liable to injury from wind, and are said to yield more seed than would be produced if the entire plant was used. It is possible that this method might give good results in the Puget Sound region, but it would not in the East. W. W. TRACY.

CABÓMBA (aboriginal name). *Nymphæàceæ.* FANWORT. Submersed aquatics of the western hemisphere, used in ponds and aquaria.

Flowers small, sepals and petals 3, persistent; stamens 3–6; carpels 3–18, separate: submerged lvs. finely dissected, mostly opposite.—Six species.

caroliniàna, Gray (*C. aquática,* DC., not Aubl. *C. viridifólia,* Hort.). WASHINGTON PLANT FISH-GRASS. Floating lvs. green, oblong-linear: fls. axillary, ½in. broad, white, with 2 yellow spots at base of each petal, stamens 6. Ponds and slow streams, S. Ill. to N. C., Fla. and Texas. A.G. 15.157.—Hardy as far north as Phila. if not frozen. The commonest plant for fish-globes and aquaria; roots easily in earth, grows well, is dense and bushy, and a good oxygenator, prefers water free from lime. Prop. by cuttings set in earth in 1–2 ft. of water at 55–70° F. Commonly sold for aquaria in bunches of 6–12 shoots 8 in. long, wrapped with lead at base, without earth the bunch lasts 4–8 weeks, when it drops most of its lvs. and must be replaced. Var. **rosæfólia,** Hort., is a form with reddish lvs., less durable, and more difficult to prop. A. G. 15.157. Var. **pulchérrima,** Harper, has sts. reddish purple, lvs. darker with narrower segms. and petals bright purple. Ga. The true *C. aquática,* Aubl., of Trop. Amer., with yellow fls. and nearly orbicular floating lvs., is shown in B. M. 7090.

H. S. CONARD.

CACÀLIA (ancient Greek name). *Compósitæ.* Perennial herbs of wide distribution, some of which are planted in the open for ornament.

Flowers paniculate or corymbose, the florets all hermaphrodite, with white, flesh-colored, or orange, exclusively tubular corollas, each of the 5 lobes with a midnerve. achenes glabrous: lvs. petioled, alternate. The genus is by some considered as a section of Senecio, differing in never having ray-fls.—Species about 40, about one-fourth Asian and the remainder mostly American. They need protection in the North.

lùtea, Mill. A slender rather attractive perennial, with alternate, widely separated lvs. half clasping the st.: fls. orange-yellow, in heads about ½in. diam., corymbose. St. Helena; perhaps not a true cacalia.

C. aùrea and *C. lùtea* of gardens may be Emilia.—*C. coccínea,* Sims=Emilia.

N. TAYLOR.†

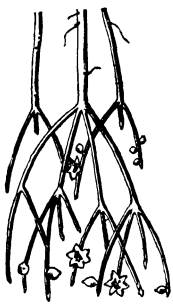
CACALIÓPSIS (*Cacalia-like*). *Compósitæ.* Perennial, for garden planting.

Heads discoid, very many-fld. of perfect yellow florets; corolla rather deeply 5-cleft, the lobes lanceolate: lvs. palmate.—One species, little known in cult.

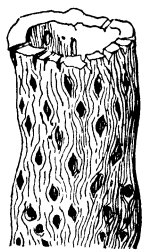
Nardósmia, Gray Stout, 1–2 ft high, loose, woolly, but becoming nearly glabrous. lvs. nearly all radical, not unlike those of *Petasites palmata,* long-stalked, 5–9-cleft or very rarely parted, the lobes dentate or cut: heads an inch high, in a loose cluster at the summit of the nearly naked st., fragrant Pine woods, Calif. to Wash.—Intro. by Gillett in 1881 as a border plant.

CACAO, COCOA: *Theobroma.*

CACTUS, CACTI. The plants correctly designated by this name constitute the family *Cactàceæ* Scarcely any group in the whole vegetable kingdom is more remarkable for its strange and varied forms, the beauty of its flowers, and wonderful adaptation to desert life It is not, however, confined to desert regions, for in the moist forests of the tropics of the New World it is represented by a number of interesting forms often epiphytal or scrambling in their habit of growth, with beautiful flowers and sometimes with delicious edible fruit.



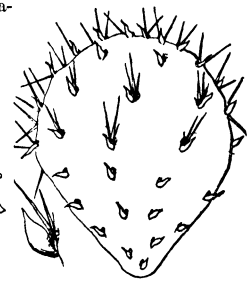
712 Tips of Rhipsalis cassytha.



713 Skeleton of Opuntia stem.



714 Pereskia aculeata.



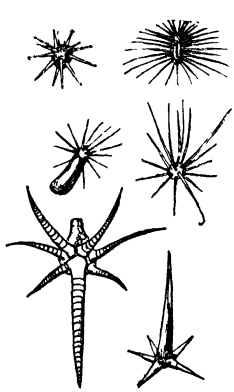
715 Opuntia joint with leaves.

The Cactaceæ are confined to America, the only apparent exception being the genus Rhipsalis, composed of plants with the habits of the mistletoe, growing on the trunks and branches of trees, and bearing small pellucid glutinous berries (Fig 712) This genus, endemic in tropical America, has found its way to Africa, the island of Mauritius and even to Ceylon, and several opuntias, or prickly pears, occur on the shores of the Mediterranean, in South Africa, and Australia, where they have made themselves so thoroughly at home as to be regarded by many writers as indigenous The Cactaceæ are not confined to tropical or even semi-tropical regions At least two species of Opuntia extend northward into British Columbia, and species of Echinocereus, Echinocactus, and Mamillaria are found in the state of Colorado The xerophytic forms flourish especially in the southwestern United States, the Mexican plateau, the peninsula of Lower California, where there are great cactus forests, and the vicinity of Tehuacan, in the southern part of the Mexican state of Puebla, a region celebrated for its remarkable and gigantic tree-like forms related to the genus Cereus For an account of the vegetation of the deserts of the southwestern states and of Mexico, the reader is referred to Frederick V Coville's "Botany of the Death Valley Expedition," published as Vol. IV of the "Contributions from the United States National Herbarium, 1893," Coville and MacDougal's "Desert Botanical Laboratory of the Carnegie Institution —1903"; and to D. T. MacDougal's "Botanical Features of North American Deserts, publication No 99 of the Carnegie Institution of Washington, 1908.

To the southward, the family extends to Chile and Argentina Giant torch thistles and echinocacti are scattered over the pampas of Uruguay, and melon-shaped echinopses amid the snows of the lofty plateau of Bolivia

The genus Mamillaria, so well represented in the southwestern United States and Mexico, is almost absent from Central America, the representative genera of that region as well as of the warm Huasteca region of eastern Mexico being Cereus, Pereskia, Pereskiopsis, Nopalea, and Opuntia, while the "turk's-head" or "melon cacti" are chiefly West Indian

The peculiar structure of columnar, opuntioid, and melon-shaped cacti is undoubtedly the result of excessive dryness of the climates in which they occur, to protect themselves from which they have been obliged to store up water and to reduce their transpiration as low as possible They have a more or less pronounced woody axis surrounded by pulpy cellular tissue (parenchyma) in which the water-supply is stored The stomata are usually situated in depressions or grooves in the leathery cuticle, and as an additional means for checking transpiration, the cell-sap is nearly always mucilaginous, while in some forms latex cells are present, filled with milky or gummy fluid which hardens on exposure to the air and effectively heals wounds in the soft fleshy plant Certain species of Echinocactus (viznagas) are like great barrels studded with spines and filled with pulp of the consistency of watermelon rind, which is sometimes made into conserves like citron (dulces de viznaga) Other forms, like species of Pereskia, Pereskiopsis, and arboreous opuntias have hard, woody stems and branches The reticulated skeletons of certain species of opuntia (Fig 713) are manufactured into walking-sticks, legs of furniture, napkin rings, and even into veneering for woodwork In Lower California and some parts of South America, where other vegetation is lacking, the stems of columnar cerei, or "cardones," are used for constructing habitations, inclosures, and for timbering mines Columnar cacti are also planted for living fences, or hedges, especially the "organ cactus" (*Myrtillocactus geometrizans*) of tropical Mexico. Leaves are present in nearly all cacti, but in some species they are mere vestiges and can scarcely be seen with the naked eye In other species they are large and perfectly developed, either with distinct petiole and feather



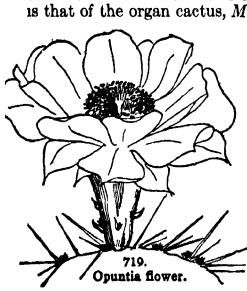
716. Cactus spines.



717. Opuntia leptocaulis, showing sheathed spines.

veins, as in *Pereskia aculeata* (Fig 714), or sessile and fleshy with only the midrib and several parallel nerves apparent as in the genus Pereskiopsis. They are sometimes caducous, fleshy, cylindrical or awl-shaped, as in the genus Opuntia (Fig. 715). In the axils of the leaves are peculiar cushion-like areoles (corresponding in all probability to aborted branches) clothed with down or felt-like wool, from which spines, and, in some genera, also flowers, issue. In the genera Opuntia and Pereskiopsis, the areoles also bear minute short barbed bristles called glochidia, which will penetrate the skin and become detached at the slightest contact and are the source of annoying irritation which often persists for many hours.

The spines (Fig 716) are not connected with the axis of the stem or branches, but emerge from the areoles. In some forms they are simple and straight, bristle-like, awl-shaped, or short and conical In others they are bent like fishhooks or are curved and horn-like, with transverse ribs Sometimes they are minutely downy or hairy and sometimes even plumose or feathery. They may be either naked or enveloped in a membranous barbed sheath (Fig 717) They may be grouped in star-like clusters, with straight or curved rays spreading from a common center, or in comb-like fascicles, with the radial spines arranged in two rows on each side of a longitudinal axis (pectinate). In addition to the radial spines, there are usually erect central spines either straight and rigid, or more or less curved. One of the most striking forms is that of the organ cactus, *Myrtillocactus geometrizans*, in which the stout erect central spine resembles the blade of a dagger and the radials a guard for the hilt. In contrast with this may be mentioned the spines of *Pelecyphora aselliformis*, which resemble minature sow-bugs, or aselli (Fig. 718).



719. Opuntia flower.

The flowers in most cases issue from the upper portion of the areoles, but in certain mamillarias and allied forms they come forth from between the tubercles or from their base at the end of a dorsal groove. Usually the flowers are solitary and sessile, but in the genus Pereskia (Fig 714) they are peduncled and often clustered They may be tinted with rose-color, crimson, purple, yellow or orange, or rarely with copper-color or scarlet, but they are never blue. Often they are pure white at first, gradually becoming suffused with rose-color in age. In a few species they are inconspicuous, as in the epiphytal Rhipsalis (Fig 712) Some are diurnal, others nocturnal, some open at sunrise and close at night or when the sky becomes clouded, others open at a certain hour and close at another fixed hour of the day or night, some last for only a few hours, others for a day, and some persist for several days Some, like the "night-blooming cereus" are delightfully fragrant, while others are ill-smelling or have no perceptible odor.



720. Leuchtenbergia principis, showing transformation from scales to petals.

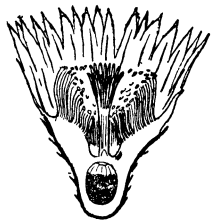


718. Extreme condensation of the plant body.—Pelecyphora aselliformis (Nat Size)

The perianth is not divided sharply into calyx and corolla, although the outer floral leaves are usually sepal-like and the inner ones are true petals. In one great division of the family including Opuntia, which has been named *Rotatifloræ*, the perianth is more or less wheel-shaped or widely spreading (Fig 719), in the other division, *Tubulifloræ*, to which Cereus belongs, the floral leaves form a tube, often remarkably long and slender, and crowned with a spreading limb. The floral leaves are not arranged in definite series but somewhat like those of a water-lily, the scale-like lower or outer leaves gradually becoming broad and petaloid as they approach the center (Fig 720) In all cases the perianth crowns the ovary, and sometimes persists after withering on the apex of the fruit (Fig 721). The stamens are very numerous and are inserted on the petals or perianth-tube (Fig. 722). The single style is longer and stouter than the slender filaments, and usually terminates into a radially divided stigma (Fig 723) Sometimes the stigma is conspicuously colored and issues star-like from the center of the



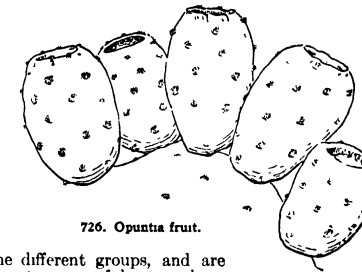
721. Cephalocereus fruit.



722. Echinocactus flower, showing insertion of stamens.



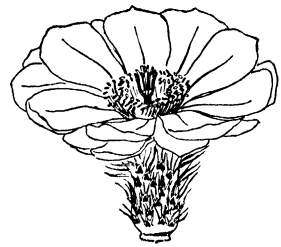
723. Opuntia flower, showing styles and ovary.



726. Opuntia fruit.

mass of stamens, as in the genus Echinocereus, in which the emerald-green star contrasts prettily with the golden-yellow or orange-colored stamens, rising from a rosette of rose-purple petals (Fig 724). The ovary (Fig 723), although formed of several carpels, is 1-celled The placentæ are parietal, bearing an indefinite number of ovules, the stalks of which (funiculi) become fleshy as the seeds develop and form a sugary pulp around the seeds

The fruits of the Cactaceæ are variable in form That of the leafy Pereskia is apple-shaped and bears a number of leaf-like bracts on the skin (Fig 725), on which account the fruit of *P aculeata* is called blad-appel, or leaf-apple, in the Dutch colonies, while in the British West Indies it is known as Barbados gooseberry and is made into tarts and sauces like real gooseberries In some of the pereskiopses, the fruit is elongated and shaped like a prickly pear, with watery rind and seeds covered with cottony hairs In Opuntia and Nopalea the fruit is commonly called prickly pear, or tuna (by the ancient Aztecs, nochtli). These fruits bear small fleshy leaves at first, like the flattened pads of the plants, and when the leaves fall off the areoles persist armed with the irritating sharp-barbed glochidia described above (Figs 717 and 726) Many species allied to the genus Cereus bear edible fruits, usually called pitahayas Those of the tall columnar cardones (Lemaireocereus) are covered with easily detachable tufts of wool and spines but never bear glochidia Those of Cephalocereus (Fig 721) are spineless The triangular climbing forms which are often trained over garden walls in tropical countries, sometimes bear enormous juicy fruits of fine flavor (Fig 727) Those of Echinocactus (Fig 728) are more or less scaly The fruits of certain species of Echinocereus, called alicoches by the Mexicans, are known to Americans as strawberry cacti, on account of the fine flavor of their juicy pulp Those of *Echinocactus longihamatus* are known in northern Mexican markets as limas de viznaga, or cactus limes, on account of their acid taste; and the small smooth crimson fruits of many mamillarias are called chilitos, on account of their resemblance to small chili peppers. Very much like them are the fruits of melon cacti (Fig. 729) which issue from the dense crown of bristles like scarlet radishes or firecrackers tipped with a fuse.



724. Echinocereus flower, showing radiate stigma

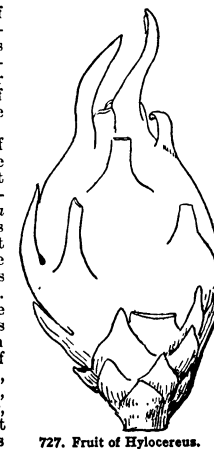


725. Pereskia fruit.

The seeds of the Cactaceæ vary considerably in the different groups, and are sometimes useful in making generic determinations Thus the woolly seeds of Pereskiopsis are sharply distinct from the black glossy seeds of the genus Pereskia, with which the first-named genus was at one time confused In Opuntia and Nopalea they are flat, hard and bony, somewhat ear-shaped in the flat-jointed opuntias (Figs 730, 733,) and usually discoid and marginless in cylindrical opuntias (Figs 730, 735). In Cereus they are glossy black, with the testa either quite smooth or minutely pitted (Figs 730, 732); in Echinocereus they are covered with minute tubercles or granules (Figs 730, 734) In Echinocactus, which is not a very homogeneous group, the seeds are pitted in some species and tuberculate in others In one section of Mamillaria (Eumamillaria) they are glossy and marked with sunken rounded pits (Figs 730, 731), while in another section, which should probably be made a distinct genus (Coryphantha) they are frequently smooth In the closely allied Ariocarpus they are relatively large and tuberculate In the genus Pelecyphora, they are sometimes kidney-shaped, as in *P. aselliformis*, and sometimes of a peculiar boat-like form with a very large umbilicus, as in *P pectinata* In the epiphytal *Rhipsalis cassytha* they are kidney-shaped and finely granular.

The seeds of many of the species of Pachycereus ("cardones") are used by the Indians of Lower California and Mexico for food In southern Puebla the fruit of *Pachycereus columna-trajani*, called tetezo figs (higos de tetetzo) are a regular food staple, offered for sale in the markets of Tehuacan during the month of May.

Other cactus fruits of great economic importance are those of the giant Cereus of our arid southwestern region, *Carnegiea gigantea*, locally known as pitahayas de sahuara, first brought to notice in the year 1540 by the members of Coronado's expedition. They are not spiny like the fruits of Pachycereus and they burst open when quite ripe. The fruit of *Lemaireocereus Thurberi*, known as pitahaya dulce, although much sweeter, bears clusters of stout spines issuing from tufts



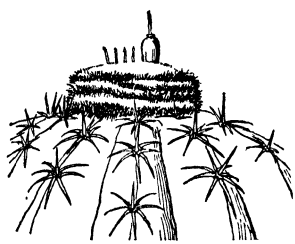
727. Fruit of Hylocereus.

of wool. Closely allied to it is *Lemaireocereus griseus* of central and southern Mexico, which yields much nutritious fruit. The fruit of the organ cactus, *Myrtillocactus geometrizans*, sold in the markets as garambullas, either fresh or dried, must also be mentioned as of economic importance

Of medicinal importance is the narcotic peyote or "mezcal button" (*Lophophora Williamsii*), used as an intoxicant and febrifuge by certain tribes of Indians, and regarded by some of them with superstitious reverence. This little plant was regarded by some of the early Spanish writers as a fungus and was used by the Mexican Indians to produce marvelous visions



728. Fruit of Echinocactus.



729. Melon cactus bearing fruits.

For an account of the methods of propagation and culture of cacti and their application to ornamental gardening the reader is referred to a paper by Charles Henry Thompson, on "Ornamental Cacti. Their Culture and Decorative Value" issued by the United States Department of Agriculture as Bulletin No 262 of the Bureau of Plant Industry, December 17, 1912. See also *Succulents*, vol. VI. W. E. SAFFORD.

CÁCTUS (shortened from Melocactus by Linnæus). *Cactàceæ*. A single small species, sometimes grown in under-glass collections and in open succulent gardens South.

Stems globose or ovoid, with vertical ribs, crowned at maturity with a "cephalium"—a prolongation of the axis densely covered with small tubercles imbedded in wool and bearing in their axils small fls. and berries. The plant has the appearance of an Echinocactus, but the fls. and berries resemble those of Mamillaria.



730. Seeds of Cacti. 1. Mamillaria. 2. Cereus; 3. Flat-jointed opuntias; 4 Echinocereus; 5. Cylindrical opuntias.

Melocáctus, Linn. (*Melocáctus commùnis*, Link & Otto). Fig. 731 Ribs 10–20, acute; areoles nearly 1 in. apart; radial spines 8–11, straight or curved, subulate; centrals 1–4; cephalium at first low, hemispherical, becoming cylindrical in time, reaching a height of 8 in ; the dense wool of the cephalium is pierced by many red or brown bristles. fls. red, slender. fr. ⅔in. long, crowned by the persistent remains of the fl., red. W. Indies; called there "Turk's head." B.M. 3090. J. N. ROSE.

CADÁLVENA: *Kaempferia*.

CÀDIA (Arabic name, *Kadi*). *Legumindsæ*, tribe *Sophòreæ*. Small evergeen shrubs of Arabia and Africa, remarkable for their regular mallow-like flowers.

Leaves pinnate: fls. axillary, mostly solitary, drooping; stamens 10, free, shorter than the petals: pod linear, acuminate, flattened, leathery.—Four species. Can be grown outdoors in Calif. or S. Fla ; in the N. in the temperate house. Prop. by seeds and cuttings.

purpùrea, Forsk. (*C. vària*, L'Her.). A small shrub, the branches woody. lfts. 20–40 pairs, very narrow, almost sessile: fls. bell-shaped, pedunculate, rose-red, the corolla about 1–1½ in. long and very veiny, not spiny. Arabia.

C Ellisiàna, Baker, has few large lfts. and rose-colored fls Madagascar. B M 6685 —*C. pubéscens*, Bojer. Lfts. 8–10 pairs, broad-oblong. Madagascar N. TAYLOR †

CÆSALPÌNIA (Andreas Cæsalpinus, 1519–1603, Italian botanist). *Legumindsæ*. BRASILETTO. Including *Guilandina*, and *Poinciana* in part Ornamental tropical or subtropical trees or shrubs chiefly grown for their showy flowers and also for their attractive finely divided foliage; some species yield tanning materials and dye-stuff.

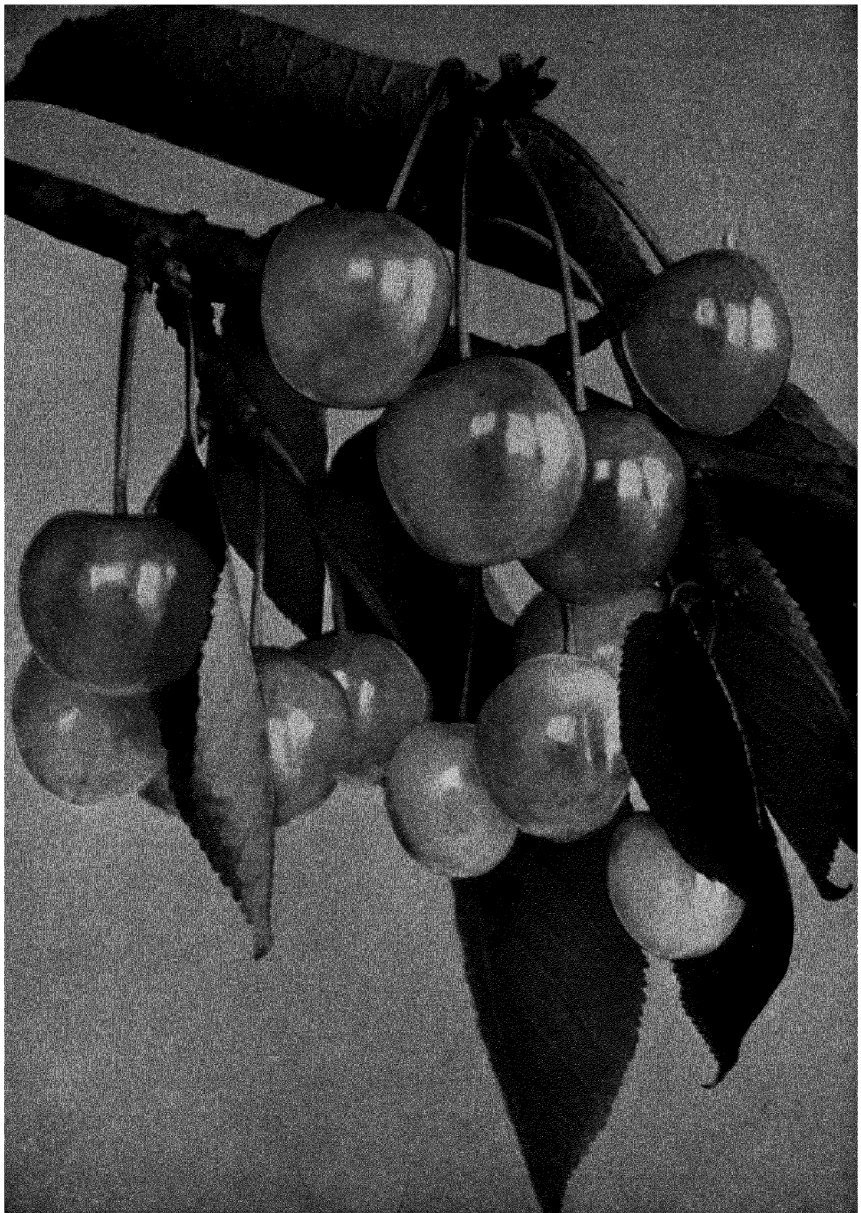
Calyx with short tube and 5 imbricated lobes, the lowest concave and larger; petals 5, clawed, usually orbicular or obovate and nearly equal; stamens 10, curved, ovary sessile with few ovules and a slender elongated style. pod ovate to lanceolate, usually compressed, often indehiscent —About 30 species in tropical and semi-tropical regions The genus belongs to the subfamily Cæsalpinioideæ, in which the fls are not papilionaceous, and is allied to Gleditsia

Cæsalpinias are armed or unarmed trees or shrubs, rarely climbers, with finely divided bipinnate leaves and conspicuous yellow or sometimes partly red flowers in racemes, often forming terminal panicles Many species are very showy in flower and are favorites in tropical and subtropical countries; in this country they can be grown only in Florida and southern California except *C japonica*, which is the hardiest species and will probably stand the winter in sheltered locations as far north as Washington, D C. They are also grown sometimes in warm glasshouses.

Propagation is readily effected by seeds, which should be well soaked in warm water for some hours before sowing A sandy soil should be chosen for the seedbed, and lightly shaded After the plants show the first true leaf, they should be potted off into small pots of ordinary garden soil, not too rich, made light by the addition of sand, if of a clayey nature The plants grow very rapidly, and must be shifted into larger pots as their size requires for greenhouse culture, but in tropical climates may be transplanted into permanent positions outdoors after they reach a fair size in pots. The dwarf species are elegant subjects for subtropical gardening during the summer months in temperate climates, provided a sunny location is given them, as they revel in rather dry very warm soil, and do not require artificial watering after being established A rocky, sunny situation may be given *C pulcherrima* and its variety *flava*, where they will bloom during many weeks of summer, until frost checks them, if strong plants about a foot high are selected in early summer Care should be taken to harden off plants gradually in the house, so that they may not be chilled when transplanted outdoors. While they will do well in a poor soil, an application of manure or chemical fertilizer may be given them to advantage, causing them to make a more vigorous growth and give better and larger heads of flowers. In the tropics, and also in subtropical climates, these shrubs and trees are always admired and are commonly planted for ornament. The royal poinciana (*C. regia*, but properly *Poinciana regia*, which see), and also the dwarf poinciana, or flower-fence (*C. pulcherrima*), will thrive in close proximity to the sea, and are valuable for planting in exposed coast situations. (E. N. Reasoner.)

A. *Stamens long-exserted: fls. very showy: trees, unarmed or nearly so.*

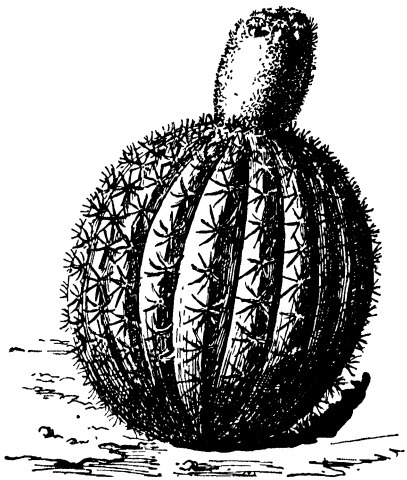
Gilliesii, Wall. Shrub or small tree, with very many small lfts., scarcely ½in. long, oblong, obtuse, glabrous:



XXI. Cherry.—Specimen fruits of one of the heart cherries

fls. light yellow, with brilliant red stamens protruding 3–5 in., in terminal racemes; sepals hairy-fringed. S. Amer. B M. 4006 (as *Poinciana Gilliesii*, Hook.). F.S. 1:61. R H. 1893·400. G C. III 15.73. Gn 76, p 4.—A very showy and worthy plant which bears in Calif. the popular name of "Bird of Paradise" like *Strelitzia Reginæ*. It will stand a temperature as low as 20° F.

pulchérrima, Swartz. Barbados Pride Barbados Flower-Fence. Dwarf Poinciana. Shrub, with few scattered prickles, delicate, evergeen, mimosa-like lvs with 12–18 pinnæ, each with 20–24 oblique-oblong lfts less than 1 in long, and very gaudy red-and-yellow crisped fls. on the ends of the new growth: stamens and style red, and long-exserted Generally distributed in the tropics. B M. 995. P.M. 3:3. Gn 75, p 594.—One of the most popular shrubs in warm climates, as S. Fla. There is a var. **flàva,** with yellow fls.



731. Cactus Melocactus. (×⅓)

AA *Stamens not much exceeding the petals, or shorter*

B. *Lfts. very obtuse*

C *Branches unarmed.*

pannòsa, Brandeg. Medium-sized tree with slender branches spreading horizontally and clothed with white, deciduous bark· lvs decompound; pinnæ 2–4, each with 4–6 oblong and retuse lfts.· fls. yellow, showy: pod glandular, 1-2-seeded. Lower Calif —A rapid-growing species which can be used for fences and is therefore called "palo estaca" in Lower Calif.

CC *Branches prickly.*

D. *Pod smooth shrubs.*

sepiària, Roxbg Scrambling pubescent shrub: lvs. glaucous, slightly pubescent beneath; pinnæ 12–20, each with 16–24 oblong lfts , rounded at both ends, ½–1 in long fls yellow in simple stalked racemes. India. —Furnishes dye-wood, also used as a hedge plant.

japónica, Sieb & Zucc Loose, spreading shrub, armed with stout, recurved prickles: lvs with 6–16 pinnæ, each with 10–20 lfts , oblong, very obtuse: fls. in large, panicle-like clusters, canary-yellow, the stamens bright red. Japan. B M. 8207. G C. III. 42:43. R.H. 1912·60 Gn. 40:588; 61, p. 81; 76, p. 411. J.H. III. 34·531; 51 181.—Endures the winters in some parts of England. The hardiest species of the genus, probably hardy as far north as Washington, D. C.

Nûga, Ait. Vigorous climber: branches flexuose with copious hooked prickles· lvs glabrous; pinnæ 4–6, each with 4–6 ovate-obtuse lfts 1½–2 in. long: fls. bright yellow in large panicles; calyx glabrous: pods ovoid-oblong, 2 in long, indehiscent, 1-seeded. Himalayas and Philippine Isls to N. Austral. and Polynesia. Blanco, Fl. Filip 150.

DD *Pod prickly· tree.*

echinàta, Lam Tree, with prickly rusty pubescent branches· lvs. unarmed, glabrous, pinnæ 5–9, each with 15–20 rhombic-oblong obtuse lfts ½–¾in long· fls. yellow in axillary and terminal racemes; calyx pubescent; stamens shorter than petals: pod oblong, 3 in. long Brazil. Fl. Brasil 15, 2:22.—Yields dye-wood.

BB. *Lfts. acute or mucronulate: pod prickly.*

minax, Hance. Diffuse shrub, thorny: pinnæ 10, with 12–20 ovate-lanceolate glabrous lfts. 1–1½ in long: racemes panicled, many-fld , with very large bracts; fls. white and purple: pods 7-seeded (seeds large and black), prickly. China.

Bónduc, Roxbg. Climbing shrub, with prickly, pubescent bipinnate lvs , oblong-ovate mucronate lfts. 1½–3 in. long, yellow fls , and a few large yellow seeds in a short, prickly pod. Tropics; S. Fla

C bijuga, Swartz (Acacia Bancroftiana, Bert) Spiny shrub with ultimate lfts in 2 pairs· fls paniculate Jamaica —*C kauaiensis*, Mann=Mezoneuron kauaiense.—*C regia*, Dietr =Poinciana regia.—*C vernàlis*, Champ Tall climbing prickly shrub: fls in racemes China. B M 8132

L. H. B. and Alfred Rehder.

CAHOUN: *Attalea Cohune.*

CAILLÌEA: *Dichrostachys*

CAJÀNUS (aboriginal name) *Leguminòsæ.* A tropical shrub, grown for the nutritious peas One variable species, probably originally from Africa

índicus, Spreng (*Cytisus Càjan*, Linn) Grandul. Congo Pea Pigeon Pea Dhal Toor Urhur. Erect, 3–10 ft , villous or often tomentose lfts elliptic-oblong, exstipellate, resinous-punctate beneath: fls. yellow and maroon, pea-like, continuing all through the year, in axillary racemes· pod pea-like, hairy, constricted between the many seeds Much cult in the tropics for the seeds or pulse, being treated usually as an annual It varies greatly in stature and in character of seeds: *C flàvus*, DC , has yellow fls and 2–3-seeded pods which are not spotted; *C bicolor*, DC , a smaller plant, has red-striped fls , and 4–5-seeded pods which are spotted See B M 6440 and R H 1874·190. The pigeon pea is much grown in the W Indies, some varieties being preferred for human food and some for live-stock; run wild. L. H. B.

CAJÓPHORA: *Blumenbachia.*

CALABASH: *Crescentia*

CALABASH GOURD: *Lagenaria.*

CALÀDIUM (origin of name obscure) *Aràceæ.* Warmhouse large-leaved plants, grown for the foliage; also employed in summer bedding

Herbaceous perennials, arising from large rhizomes or tubers, acaulescent, with usually beautifully marked, long-petioled lvs ; the secondary nerves oblique to the few spreading primary nerves· peduncles usually solitary; spathe with the tube convolute, constricted at the throat, the blade boat-shaped; spadix erect, a little shorter than the spathe, the lower part naked, stipe-like, the staminate part longer than the pistillate; fls. unisexual· fr. a berry, white —A dozen or less species in Trop. S. Amer. Two of the species are immensely variable, and many named horticultural varieties are in the trade. Engler in DC Monog Phan. 2:45² (1879); also F. S 13.

As soon as Caladium plants begin to lose their leaves in the fall, water should gradually be withheld until the leaves are all gone. The pots should then be removed to a position under a bench, and laid on their sides, or taken from the soil and placed in sand During the resting period they should not be subjected to a lower temperature than 60° F., and kept neither too wet nor too dry. About the beginning of March the tubers should be started for the earliest batch to be grown in pots Arrange the tubers in their sizes, and keep each size by itself The largest-sized tubers will start quickest, and it is desirable to begin with these for pot-plants. Start them in chopped moss in boxes. The tubers may be arranged rather close together in the box, and merely covered over with the moss to the depth of about an inch. The new roots are made from the top part of the tuber, so it is important that this part should be covered to encourage the roots For starting, a heat varying between 70° and 85° will suffice. As soon as a healthy lot of roots makes its appearance, the plants should be potted, using as small-sized pots as possible. The soil for this potting should be principally leaf-mold, with a little sand. In a short



732. Caladium bicolor var Chantinii. (No. 17).

time they will need another shift; the soil should on this occasion be a little stronger; give a position near the glass, and shade from strong sunshine —New forms are raised from seed, this operation being an exceedingly easy one with the caladium, as they cross-fertilize very readily. The flowers, unlike those of the Anthurium, are monœcious, the females ripening first To pollinate them, part of the spathe must be cut away Seedlings at first have the foliage green, and it is not until the fifth or sixth leaf has been developed that they show their gaudy colorings Propagation of the kinds is effected by dividing the old tubers, the cut surfaces of which should be well dusted with powdered charcoal to prevent decay —As bedding plants, the fancy-leaved caladiums are gradually becoming more popular. To have them at their best for this purpose, the ground should be worked for some time previous to planting out, with a goodly quantity of bone meal incorporated with the soil The tubers are best put out in a dormant state, as then they make very rapid progress, and eventually make finer plants than when they are first started in the greenhouse, as by this system they are too likely to sustain a check in the hardening-off process, and lose their leaves. The fine, highly colored kinds are not so well suited for outdoor work as those having green predominating in the foliage, but some of the kinds, such as Dr Lindley and Rosini, do remarkably well Frequent watering with manure-water is absolutely necessary to the development of the foliage, both outdoors and in. (G. W. Oliver.)

INDEX.

albinervium, 55.
albomaculatum, 16.
albostriatulum, 51.
Alfred Bleu, 16
amœnum, 17
Appunianum, 56.
argyrites, 57
argyroneuron, 5
argyroneurum, 5.
argyrospilum, 36.
Baraquini, 12
Belleymei, 49
bicolor, 8, 11
Brongniartii, 32.
Chantinii, 17
Connærtii, 17.
cordatum, 3
cupreum, 53
Curwadlii, 37.
Devosianum, 28.
discolor, 29
Duchartrei, 35
Eckhartii, 23
elegans, 54
Enkeanum, 45
erythræum, 3.
firmulum, 9
Gardtii, 15
grisco-argenteum, 39.
Haageanum, 17
hæmatostigmatum, 29
hastatum, 50.
Hendersonii, 24
Houbyanum, 26
Houlletii, 18
Humboldtii, 57.
Kettelerii, 13
Kochii, 38
Kramerianum, 20
Lauchеanum, 14
Lemaireanum, 55
Leopoldii, 15
Lindenii, 46
macrophyllum, 39.
marginatum, 19
marmoratum, 7
marmoreum, 2
Martersteyanum, 17
mirabile, 33
Moorеanum, 18
myriostigma, 58
Neumanii, 40
Osyrianum, 52
Ottonis, 28
pallidinervium, 30
pellucidum, 27, 29
Perrierii, 22
pictum, 4, 34
picturatum, 48, 55
pœcile, 30
porphyroneuron, 53
punctatissimum, 17.
Purdieanum, 9
pusillum, 9.
regale, 31
Reichenbachianum, 41
Rogiersii, 15
roseum, 14
rubellum, 41
rubicundum, 11
rubronervium, 42.
rubrovenium, 42
sagittæfolium, 31
Schmitzii, 3
Schalleri, 5
Schomburgkii, 1.
Sieboldii, 25
splendens, 14
Spruceanum, 9
Stangeanum, 21.
subrotundum, 6
surinamense, 31.
thripedestum, 7
transparens, 19
Troubetskoyi, 56
Vellozianum, 9
Verschaffeltii, 47
viridissimum, 55
Wagneri, 31
Wallisii, 28
Wightii, 44

It will be seen that most of the cultivated caladiums are considered to be forms of *C bicolor* and *C picturatum* Only five species are concerned in the following list. *Schomburgkii, 1, marmoratum, 7, bicolor, 8, picturatum, 48, Humboldtii, 57.*

A *Blade not at all peltate, obliquely elliptical-ovate*

1 **Schŏmburgkii,** Schott Petiole slender, 4 times longer than the blade, sheathed one-third its length, blade obliquely elliptical-ovate, midrib and 4–5 acutely ascending primary nerves silvery, pale, or red, sparsely spotted above, paler beneath. French Guiana to Para —Runs into the following forms

(1) *Veins red.*

2 Var **marmŏreum,** Engl Blade dull green, with brownish red nerves, bordered with yellow

3. Var **erythræum,** Engl (*C Schmitzii*, Lem. *C cordàtum*, Hort.). Midribs and nerves red I H 8:297.

4. Var. **pictum,** Engl With white or red spots between the red veins S Amer.

(2) *Veins silvery or green.*

5. Var. **argyroneŭrum,** Engl (*C argyroneŭron.* C Koch *C. Schéllerı*, Lem.) Midrib and veins silvery I.H 8 297

6 Var **subrotúndum,** Engl (*C. subrotúndum*, Lem) Lf -blade rounded at the base, or shortly cordate, with white or red spots Brazil.

AA. *Blade distinctly peltate*

B. *Lf. sagittate-oblong-ovate, basal lobes united for two-thirds their length, or more.*

7 **marmoràtum,** Mathieu (*Alocàsia Roézlii*, Bull *C. thripedéstum*, Lem) Petiole cylindrical, 12–16 in long, twice as long as the blade, variegated; blade 6–8 in. long, 4–6 in wide, dark green, with irregular gray, yellowish green and snow-white spots, glaucous-green beneath, sagittate-oblong-ovate, the upper lobe semi-ovate, slightly cuspidate, the basal ones unequal, one-third or one-half as long as the upper, connate two-thirds to three-fourths their length· spathe-blade pale green, 2–3 in long. Ecuador. I.H. 5, p. 59, desc.

BB. *Lf. not as above; basal lobes united one-third their length or less.*

C. *Shape of lf. ovate-triangular, or ovate-sagittate* (8–47).

8. **bícolor,** Vent. (*Arum bícolor,* Ait.). Petiole smooth, 3–7 times as long as the blade, prunose toward the apex; blade ovate-sagittate, or ovate-triangular, variegated above, glaucous beneath, upper lobe semi-ovate, narrowing gradually to a cuspidate point, the basal ones one-half to but little shorter than the upper, oblong-ovate, obtuse, connate one-fifth to one-third their length S Amer Intro. into cult in 1773 B M. 820.—Very common in cult., furnishing many of the fancy-leaved caladiums. The marked varieties are as follows (9–47).

(1) *Lf.-blade and veins of one color.*

9 Var **Velloziànum,** Engl (*C. Velloziànum,* Schott. *C. Purdueànum,* Schott. *C. pusillum,* C. Koch. *C. Spruceànum,* Schott *C. firmulum,* Schott.). Lf.-blade dark green above, basal lobes connate past the middle Brazil, Peru. R B 10.169.

(2) *Lf.-blade more or less variegated.*

(a) *With a colored disk* (Nos. 10–18).

(b) *Disk transparent.*

10 Var **transpárens,** Engl (*C transpárens,* Hort.). Blade with a pale green, nearly transparent disk; midrib and primary veins red-purple.

11 Var **rubicúndum,** Engl (*C. bícolor,* Kunth). Petiole green, or variegated green and violet; blade green, with a red, transparent, central disk, and a very narrow red line between the disk and the margin.

(bb) *Disk opaque.*

(c) *Purple disk*

12 Var **Barâquinii,** Engl (*C Barâquinii,* Hort.). Petiole violet, blade with a purple-red disk, beautiful green between the disk and margin, nerves and midrib red-violet Para I H 7 257 F S 13 1378.

13 Var **Kétteleri,** Engl (*C Kétteleri,* Hort.). Petiole crimson, variegated toward the base, blade with purple disk, midrib and primary veins, sparsely marked between the veins with many small, rosy spots.

(cc) *Red disk.*

14 Var **spléndens,** Engl. (*C róseum,* Hort. *C. splèndens,* Hort.) Petiole green below, red above; blade with a red disk at the middle, midvein and primary veins red-purple, green between the nerves and along the margin. Lowe, 4

15 Var **Lèopoldii,** Engl (*C Lèopoldii,* Hort. *C. Gèrdtii,* C Koch *C Rogièrii,* Chant. & Lem.). Petiole violet beneath, red-purple above, blade with a broad, reddish disk, margin green, red-spotted; midrib and primary veins dark red-purple Para, 1864.

16 Var **albomaculàtum,** Engl (*C Alfred Bleu*). Petiole green, blade green, with red disk, midrib and primary veins, and marked clear to the margin with many large, white spots between the nerves.

(ccc) *Rose disk.*

17. Var. **Chântinii,** Engl (*C. Chántinii,* Lem. *C. Connèrtii,* Hort *C. amœnum,* Hort. *C. Marterstegiànum,* Hort *C. punctatissimum,* Hort. *C. Haageànum,* Hort.). Fig. 732 Petiole more or less violet, blade broadly red-purple along the midrib and primary nerves, rosy at the center, and with very numerous, unequal spots between the nerves clear to the marginal vein. Para, 1858. I H 5:185 F.S. 13:1350–51. B.M. 5255. A.F. 8:129. G. 12:375.

(cccc) *Light green disk.*

18. Var. **Houllétii,** Engl. (*C. Houllétii,* Lem.. *C. Mooreànum,* Hort.) Petiole green, the sheath and a little of the base violet-variegated; basal lobes of the blade somewhat introrse, rounded, connate one-third; blade obscurely green toward the margin, the midrib and primary veins slightly reddish, and with a pale disk marked with many irregular white spots.

(aa) *Without a colored disk.*

(b) *Margins colored throughout.*

(c) *Red margin.*

19. Var. **marginàtum,** Engl. (*C. marginàtum,* C. Koch). Blade dark green, with a red line on the outer margin.

(cc) *Yellow margin.*

20 Var. **Krameriànum,** Engl. (*C. Krameriànum,* Hort.). Veins purple, yellow margin.

21. Var **Stangeànum,** Engl (*C Stangeànum,* C. Koch) Blade reddish, green along the narrow margin, yellowish toward the margin.

(ccc) *Solid white margin*

22. Var. **Perriérii,** Engl (*C Perriérii,* Lem.) Petiole violet-black; blade dull green, with many red-purple spots, and white along the margin Brazil, 1861.

(cccc) *Spotted margin*

23 Var **Éckhartii,** Engl (*C Éckhartii,* Hort.). Petiole violet-blotched at the base, green above the middle, blade green, with few rosy spots along the margin, and small white ones in the middle

24 Var **Héndersonii,** Engl (*C. Héndersonii,* Hort.) Petiole variegated violet and green, reddish toward the apex, blade mostly green, reddish next the lower parts of the nerves, midrib and primary veins red-purple spotted, small red spots along the margin

25 Var **Sièboldii,** Engl (*C Sièboldii,* Hort.) Petiole violet and green, reddish toward the apex, basal lobes of the lf somewhat introrse, connate one-third their length, dark green, midrib and primary veins beautifully red-purple spotted, and a very narrow white border, marked with small purple-red spots A F 8 127.

(ccccc) *Purple margin*

26 Var **Houbyànum,** Engl (*C Houbyànum,* Hort.) Petiole dirty green on the lower surface, bright red above, blade bright green, with large pale spots, and small red-purple ones between the midrib and primary veins, a red-purple spot above the insertion of the petiole, and a pale purple line around the margin

27 Var. **pellùcidum,** Engl (*C pellùcidum,* DC.). Petiole reddish, variegated with violet, blade broadly reddish purple spotted along the midrib and primary veins, and more or less marked with transparent, reddish purple spots between the primary veins, a continuous purple line along the outer margin.

(bb) *Margin colored only on basal sinus.*

28 Var **Devosiànum,** Engl (*C. Devosiànum,* Lem. *C Wallisii,* Hort *C Ottònis,* Hort.) Petiole green; blade bright green, with small, irregular white spots between the midrib and primary veins, and a narrow crimson border at the sinus. Para. I H 9 322.

29. Var. **hæmatostígmatum,** Engl. (*C hæmatostigmatum,* Kunth *C. pellúcidum,* DC *C. díscolor,* Hort.) Petiole violet, blade dark green, with a purple line on the basal sinus, and sparsely marked with blood-red spots. Para.

30 Var **pœcile,** Engl (*C. pœcile,* Schott. *C. pallidinérvium,* Hort.). Petiole reddish brown, or closely streaked-variegated, blade dark green, midrib and primary veins paler, often whitish, a red-purple spot where the petiole joins the blade, narrowly purple-margined in the sinus. Brazil

31. Var. **regàle,** Engl (*C. regàle,* Lem *C. Wágneri,* Hort *C surinaménse,* Miq *C sagittæfòlium,* Sieb.). Blade bright green, purple-margined at the sinus, every-

where marked with small, confluent white spots. W. Indies, 1710. I.H. 9:316

(bbb) *Margin and disk without color.*

(c) *Variegated green blade.*

32. Var. **Brongniártii,** Engl (*C Brongniártii*, Lem.). Very large, petiole variegated violet and green, reddish toward the apex; blade green, except along the nerves below, where it is colored reddish, paler green between the primary nerves, deep green toward the margin; veins and nerves red-purple. Brazil, 1858. F.S. 13:1348–9 I H. 5, p. 58, desc.

33. Var **mirábile,** Engl. (*C mirábile*, Lem.). Petiole green; blade bright green, densely covered with large and small irregular pale green spots between the primary nerves and midvein. Para I H 10:354.

(cc) *Blue-green blade.*

34. Var. **pictum,** Kunth (*C. pictum*, DC.). Petiole greenish, variegated beneath; basal lobes connate one-fifth their length; blade thin, blue-green, marked with large, irregular, usually confluent, pale yellowish semi-transparent spots. Lowe, 43.

(ccc) *Colorless blade.*

35. Var. **Duchártrei,** Engl (*C. Duchártrei*, Hort.). The long petiole green above, variegated below the middle with violet-black; blade colorless, except the midrib and all the veins, or here and there pale rosy or red-spotted, or even more or less dirty green. A.F. 8:129.

(cccc) *Solid green blade.*

(d) *Dark green.*

36. Var. **argyróspilum,** Engl. (*C. argyróspilum*, Lem). Petiole grayish red, sparsely and finely streaked; blade a most beautiful green, with a crimson spot at the middle, and with many small white spots between the primary veins. Para. F.S. 13.1346–7.



733. Caladium picturatum var. Belleymei (No 49)

37. Var. **Curwádlii,** Engl (*C. Curwádlii*, Hort.). Petiole greenish, slightly violet-blotched toward the base; blade reddish purple along the midrib and primary veins, marked between the veins with large white spots; otherwise dark green

38. Var. **Kòchii,** Engl (*C. Kòchii*, Hort.). Lf.-blade more rounded, dark green, with small white spots midway between the midrib and margin. Para, 1862.

39. Var. **macrophýllum,** Engl. (*C. macrophýllum*, Lem *C. griseo-argénteum*, Hort.). Petiole green; blade dark green, marked everywhere with many small, scarcely confluent white or slightly rosy spots Para, 1862 I H 9:316.

40. Var. **Neùmannii,** Engl. (*C. Neùmannii*, Lem.). Petiole green, blade very beautiful dark green, with scarcely paler veins, marked between the primary veins with large and small white-margined, reddish purple spots. F.S. 13:1352–3. B.M. 5199.

(dd) *Light green.*

(e) *Not spotted.*

41. Var. **rubéllum,** Engl. (*C. rubéllum*, Hort. *C. Reichenbachiànum*, Stange). Blade green, with reddish purple midrib and primary veins

42 Var. **rubrovènium,** Engl (*C. rubrovènium*, Hort. *C. rubronérvium*, Hort). Petiole variegated green and violet, blade small, oblong-ovoid, the basal lobes somewhat introrse, obtuse, connate almost to the middle, pale caulescent or red-green along the midrib and primary veins; veins pale red or scarlet. Para, 1862.

(ee) *Spotted.*

(f) *With white spots.*

43. Var. **Laucheànum,** Engl (*C Laucheànum*, C. Koch). Blade bright green, with white spots at the middle.

(ff) *With purple and white spots.*

44 Var **Wightii,** Engl. (*C Wightii*, Hort.). Petiole pale green; blade very beautiful green, marked between the primary veins with large, red-purple and small white spots. French Guiana

(fff) *With red or crimson spots*

45. Var. **Enkeànum,** Engl (*C Enkeànum*, C. Koch) Blade bright green, marked with large and small red spots.

46. Var. **Líndenii,** Engl (*C Líndenii*, Hort). Blade bright green, with confluent small red spots

47. Var **Verschafféltii,** Engl. (*C Verschafféltii*, Lem). Petiole pale green, blade very beautiful green, with few irregular crimson spots I.H 5 185 B M. 5263. Lowe, 46.

cc *Shape of blade lanceolate-sagittate.*

48 **picturàtum,** C Koch Petioles usually green, variegated below, elongated; blade lanceolate-sagittate, cuspidate and submucronate at the apex, the upper lobe nearly triangular, oblong or ovate-lanceolate, basal lobes over half as long, lanceolate subacute, connate one-sixth to one-fourth their length, separated by a triangular sinus; primary lateral veins 4–7, erect-spreading or spreading Brazil —Variable, furnishing many of the fancy-leaved caladiums.

(1) *Transparent white blade.*

49. Var. **Belleỳmei,** Engl. (*C Belleỳmii*, Hort.). Fig. 733. Petiole greenish above, variegated violet beneath; blade slenderly hastate-sagittate, white, translucent except the green veins and nerves, with small green spots along the margin; basal lobes 1–5, or rarely one-fourth or one-third connate. Para. I.H. 7:252. A.F. 8:127. G. 2.89.

(2) *Pale green blade.*

(a) *With transparent blotches.*

50. Var. **hastàtum,** Engl. (*C hastàtum*, Lem.). Petiole long, stout, white, violet-spotted; blade hastate-sagittate, slightly contracted above the lobes; dull, pale green, very irregularly marked with transparent blotches; basal lobe one-fourth connate, crimson margined in the sinus. Para.

(aa) *Opaque.*

51. Var. **albostriátulum,** Engl. Blade greenish white along the midrib and veins, white-striped and dotted between the nerves.

52. Var. **Osyànum,** C. Koch. Blade white along the midrib and primary veins, with purple spots between the veins.

53. Var. **porphyroneûron,** Engl (*C. porphyroneùron,* C. Koch. *C cùpreum,* Hort *Alocàsia porphyroneùra,* Lem). Petiole pale reddish, variegated with dull violet, blade broadly hastate-sagittate, dull, pale green, slightly reddish on the veins, opaque basal lobes one-sixth to one-third connate. Peru and Brazil. I.H. 8.297

(3) *Dark green blade.*

54 Var **élegans,** Engl Petiole rosy, greenish below, variegated, blade narrowly hastate-sagittate, slightly contracted above the lobes, dark green above, broadly red or purple next the midrib and primary lateral veins, basal lobes one-fifth connate

55 Var **Lemaireànum,** Engl (*C. Lemaireànum,* Barr *C picturàtum albinérvium,* C Koch *C. picturàtum viridíssimum,* C Koch) Blade shaped like preceding, dark green, midrib and primary veins pale green or white S Amer , 1861. I H 9 311

56 Var **Troubétskoyi,** Engl (*C Troubétskoyi,* Chantin *C Appunànum,* Hort) Petiole red, variegated, blade very narrowly hastate-sagittate, slightly contracted above the lobes, dark green above, broadly marked with pale red along the midrib and primary veins, and with scattered, transparent, small white or rose spots F S 13 1379

ccc *Shape of blade oblong-ovate, or oblong· plant small.*

57 **Húmboldtii,** Schott (*C argyrites,* Lem) Fig. 734 Petiole slender, variegated, 2 to 3 times longer than the blade, sheath slender, narrow; blade oblong-ovate, or oblong, green along the margin, midrib and primary veins, with many large and small transparent spots between, shortly and very acutely acuminate, the apical lobe oblong-ovate, twice as long as the oblong or ovate-triangular, obtuse basal ones, basal lobes one-third connate, separated by an obtuse triangular sinus, the 3–4 primary veins of the apical lobe uniting in a collective nerve remote from the margin. Brazil I H 5 185 F S 13 1345. Gng 3 279. A F. 10 197 Lowe, 22 C L A 19 343. G 14 501.

58 Var **myriostígma,** Engl (*C myriostígma,* C. Koch) Blade marked everywhere with small white spots

The following names are in the trade, or occur in the lists of dealers and fanciers, but are not identified botanically —*albanense, Barrattii, candidum, Endlicherianum, Fenzlianum, Ortgiesii, Petschkanii, Rodeckii, speciosum, Thelemannii, venosum.*

C esculéntum=Colocasia antiquorum esculenta —*C odorâtum,* Lodd =Alocasia macrorrhiza —*C. pubéscens,* N.E.Br. A new species, distinct from those already in cult. by being pubescent. Peru B.M. 8402

JARED G. SMITH.
GEO. V. NASH.†

CALAMAGRÓSTIS (Greek, *calamos,* a reed, and *agrostis,* a grass). Syn *Deyeuxia. Gramíneæ.* Usually tall or reed-like perennials bearing rootstocks. Including hay grasses and a few more or less ornamental species.

Spikelets 1-fld., the rachilla prolonged behind the palea as a usually hairy pedicel, lemma hairy on the callus, awned from the back —Species about 120, distributed throughout the world in temperate and arctic regions, usually in damp or swampy soil. The species are often valuable native forage grasses. One species, **C. canadénsis,** Beauv., is a source of an excellent quality of native hay in the northwestern states, where it is called blue-joint. Another species, **C. stricta,** Beauv., native of the northern states, is sometimes cult. in a variegated form as an ornamental.

C. brevípilis=Calamovilfa brevipilis. A. S. HITCHCOCK.

CALAMINT, CALAMINTHA: *Satureia*

CALAMOVÍLFA (Greek, *calamos,* a reed, and *vilfa,* a kind of grass). *Gramíneæ.* PURPLE BENT-GRASS. A group differing from Calamagrostis in having awnless spikelets and no prolongation of the rachilla. Species 3, in S E. U. S. **C. brevípilis,** Hack , is cult as an ornamental grass. This is a stout, tufted grass, 2–4 ft., with short, horizontal rootstocks, pyramidal purplish panicle 4–8 in. Sandy swamps in pine-barrens, N. J. to N. C. Dept. Agric., Div Agros. 7:156; 20.84.

A. S. HITCHCOCK.



734. Caladium Humboldtii. (No. 57.)

CALÁMPELIS. *Eccremocarpus*

CÁLAMUS (Greek for *reed*) *Palmàceæ,* tribe *Lepidocárpæ.* A group of interesting, usually climbing pinnate palms of the Old World tropics, not much known to the trade although over thirty species are in the European catalogues

Stems very slender, always more or less prickly, usually climbing and never bearing a terminal infl : lvs. alternate, pinnate, often ending in a terminal sometimes elongated cirrus, by which they are attached to their support, lfts narrow, with 1–5 nerves, lf -sheaths at first completely inclosing the internodes, sometimes split and open. spadix laterally attached at the summit of the lf -sheaths, often elongate and slender and frequently ending in a tail-like appendage (flagellum) which is thorny; spathes long and narrow, hardly if at all split, differing from Dæmonorops which has a readily opening spathe; fls. dioecious, paniculate or branched 2 or 3 times; corolla coriaceous, longer than the calyx in male fls., as long as the calyx in the female. fr. globose, ovoid or ellipsoid, topped by a short permanent style —There are more than 200 species, most of which inhabit India. See Beccari's excellent monograph Ann. Royal. Bot Gard Calcutta 11, 1908

Calamus is an easily grown group of palms, very ornamental, even in a young state. Some of the species have stems several hundred feet long, which enable them to unfold their leaves at the tops of the tallest trees The leaves are peculiarly well adapted to assist the plant in climbing, having numerous hook-like processes arranged on a long continuation of the midrib of the leaf When accommodations can be given, these plants should be selected, as their growth is rapid, and they are capable of furnishing a large conservatory quickly. Numerous suckers are produced, so that when the main stem ascends the lower part is clothed in foliage. *Calamus tenuis* (or *C Roylеanus*) and *C Rotang* furnish the rattan canes. Malacca canes are furnished by *C Scipionum* —Young plants thrive best in a rooting medium containing a considerable quantity of leaf-mold. Older plants need soil of a more lasting nature; a quantity of ground bone and charcoal in the soil may

be used to advantage. Old well-furnished plants need enormous quantities of water. All of them require stove temperature (G. W. Oliver)

ciliàris, Blume St. slender, climbing by means of long axillary leafless branches, covered with short hooked spines: lvs. 1½–2½ ft. long, 6 in. wide; lfts. 40–50 on each side, hairy; petiole 2 in. long with few hooked spines: spadix of female and male fls finely hairy-hispid on the spathes: fr. globose, about ½in. diam. Java and Sumatra. F R. 1 607. G.C. III. 21:86.—Intro. into cult. in 1869. To be grown in tropical house.

aspérrimus, Blume. St. slender, climbing by the prickly cirrus of the lvs and the prickly branches: lvs. without stalks, about 18 in. long, bearing not more than 8–10 thin, papery, irregularly placed lfts. on each side of the rachis spadix simply decompound, about 7 ft. long, terminating in a slender prickly appendage. Mts. of Java.—Can be grown in a cooler house than the preceding.

C Andreànum, Hort., Pill & Mitterb=(?) —*C calicárpus,* Griff. =Dæmonorops calicarpus, Mart.—*C. dealbàtus* Hort.=Acanthophœnix rubra, Wendl —*C Lewisiànus,* Griff =Dæmonorops Lewisianus, Mart.

N. TAYLOR.

CÁLAMUS or SWEET FLAG: *Acorus Calamus.*

CALÁNCHOË: *Kalanchoe.*

CALANDRÌNIA (J. L. Calandrini, Genevan botanist, who wrote an important thesis in 1734). *Portulacàceæ.* Fleshy, spreading or nearly trailing plants, sometimes cult in borders and rockeries, or used for edgings in sunny places.

Flowers red or pink or rose-color, of short duration; petals 3–7, sepals 2; stamens 5 (or 3) to 12; style with 3 branches. lvs alternate, narrow —About 60 species, Brit Col to S Amer and in Austral. Annuals and perennials, but the latter mostly treated as annuals; not much grown in gardens.

A. *Fls. in a short umbel-like cluster.*

umbellàta, DC Perennial, 4–6 in.: lvs linear and hairy: fls in a corymb, or umbel-like terminal cluster, bright crimson. Peru. R.H. 1853:5.—The *C. umbellata* of gardens is hardy in many parts of the U. S.; in New York it should be planted in a well-sheltered position, or provided with ample protection in winter; sometimes it acts like the biennials, but, as seeds are produced very freely, young seedlings spring up constantly between the old plants, and one does not miss the few which may decay during the second year; the plant forms a very neat, slightly spreading tuft; fls. are produced in many-fld. umbels, terminal, numerous, and large, glowing crimson-magenta, saucer-shaped, very showy. June to Nov. Full exposure to sun, and light sandy soil, are needed to bring out the rare beauty of these plants. The fls. close up when evening comes, like the annual portulacas, but they reopen on the following day. In the sunny sloping part of a rockery, even when quite dry, or among other low plants in a bed or border, they are highly satisfactory. Although perennial, it may also be treated like the annuals, as it flowers the first summer as freely as afterwards. Can be prop. by cuttings.

AA. *Fls. in longer clusters, pedicels often more or less drooping.*

díscolor, Schrad (*C. élegans,* Hort.). Perennial, 1–2½ ft.: lvs. fleshy, spatulate to obovate, purple beneath, gray-green above, blunt· fls bright light purple, 2 in. across, with yellow stamens. Chile. B.M. 3357.

Ménziesii, Torr. & Gray (*C. speciòsa,* Lindl.). Red Maids. Annual: 3–12 in. high, with green herbage, glabrous, or nearly so: lvs. linear, or spatulate-oblanceolate: fls. rose-red or purple, rather large and long-peduncled (petals ½ in. long). Calif., N. B.R. 1598.—Variable. There is a white-fld. variety advertised.

grandiflòra, Lindl. Perennial, 1–3 ft.: much like *C. discolor,* but lvs. oval and pointed, narrowed to petiole, green, 4–8 in. long: fls. somewhat smaller, light purple. Chile.

spectábilis, Otto & Dietr. Perennial, 2 ft : lvs. lance-spatulate or rhomboid, 1½ in. long, somewhat pointed. fls bright purple, 2 in across. Chile.—Said to produce seed seldom; prop by cuttings.

Bùridgii, Hort. Annual, 1 ft lvs. linear-lanceolate, smooth fls. many, small, copper-rose or brick-red, in leafy clusters. S. Amer.

chromántha, Griseb One ft., loosely branched: lvs. rather large. fls. and buds rose-colored: fr. orange-yellow, persisting. Argentina.

C. oppositifòlia, Wats.=Lewisia oppositifolia.

J B Keller.
L. H B.

CALÁNTHE (Greek for *beautiful flower*). *Orchidàceæ.* Sub-epiphytal or terrestrial hothouse orchids found in the eastern hemisphere, and sparingly in the western hemisphere.

Scapes erect, many-fld : lvs broad, plaited fls white or rose-colored, rarely yellow. pseudobulbs angulate, with grayish green sheaths in the Vestitæ section, but absent in the Veratrifoliæ section.—Forty to 50 species in tropics of both hemispheres.

Most of the species and the numerous varieties grown are deciduous, losing the foliage about the time of flowering, and, at this season, water is given sparingly until the flowers are cut, then the bulbs are kept in a dry warm place until signs of growth in spring All calanthes are terrestrial and should be potted each year in fibrous loam, with a small portion of old manure and sand mixed in Use plenty of drainage as for other orchids, and about 2 inches of soil; secure the bulbs firmly by means of part of the old wiry roots, water very sparingly until active root-action takes place, but, when in full growth, weak manure-water may be given at each watering The young foliage is very sensitive to sun, and must be shaded as soon as it develops, keep the plants near the glass and give all light possible, and the warmest treatment permitted in orchid culture. They enjoy a little heat, even in summertime, from the pipes at night The best place to grow calanthes is a sunken, well-heated pit facing south, lowering the plant as the foliage nears the glass *Calanthe veratrifolia* is an evergreen species and may be treated similarly to the Phaius. Calanthes are easily increased by separation of the bulbs at the time of repotting Young bulbs are often produced from the apex of old ones, old ones will start again the second year and make increase. (E. O Orpet)

vestíta, Lindl. (*C. oculàta,* Hort). Lvs. broadly lanceolate, nearly 2 ft long, from grayish green pseudobulbs· fls nearly 3 in. across, numerous, in racemes; petals and sepals whitish, all more or less overlapping, the former oval-oblong, the latter obovate-oblong; labellum flat, large, 3-lobed, the mid-lobe cleft; a yellow or crimson blotch in front of the short column; scapes from 2–3 ft. high, hairy. Blooms in winter Malaya. B M. 4671 F.E 9.325 A F. 6:655. F.S. 8:816.—A most popular orchid There are many forms, of which the following are the most important: Var **gigantèa,** Hort. Larger in all parts: fls. white, with red eye. Var **nivàlis,** Hort. Fls. pure white. Var. **Túrneri,** Hort. (*C Túrneri,* Reichb. f). Fls. more numerous, labellum with a crimson blotch; blooms later in the season than the next. Var **rùbro-oculàta,** Hort. Labellum with a crimson-purple blotch. Oct.–Feb. G. 10:629. Var. **lùteo-oculàta,** Hort. Yellow-blotched. Var. **Regnièri,** Hort. (*C. Regnièri,* Reichb. f. *C. Stevensiàna,* Regnier). Pseudobulbs more elongated, with a depression above the middle: labellum rose-colored, with a purple blotch in front of column, less deeply

lobed than in the type. A.F. 6:655 Var. **Regnièri Williamsii,** Hort (*C. Williamsii,* Hort.) Sepals white, sometimes shaded pink; petals white, rose-bordered, lip deep rose.

veratrifòlia, R Br Lvs oblong-lanceolate, about 2 ft long, from a creeping rhizome. fls white, in dense corymbose racemes; petals obovate-spatulate; sepals obovate-oblong; labellum 4-parted, the anterior lobes usually broader than the posterior or basal lobes Blooms May–July. Malaya B.M. 2615.

Veitchii, Lindl Fig 735 A hybrid between *C rosea* and *C vestita* fls. rose-colored; labellum with white spot near the base. Winter-flowering. There is also a white variety This hybrid was raised by Veitch, in 1856 B M 5375 Gng. 14.134 A F 25:1093 Forms of this are var **bélla,** Hort., with pink fls.; var. **nigro-oculàta gigantèa,** Hort., with stout sts., the fls. white with an eye of reddish crimson, var. **Sandhurstiàna,** Hort., with crimson fls; var **Sèdenii,** Hort., with deep rose fls., var **supérba,** Hort., has richer color.

Masùca, Lindl Scape 2 ft long, with large, many-ribbed, dark lvs: fls 1 in. across, the segms overlapping, deep violet, fading to lilac, the lip deep violet-purple Summer and autumn. N. India B M 4541 Var **grandiflòra,** Hort., is of greater size throughout.

C burmánica, Rolfe Fls. mauve-purple, with yellow crest Burma *C Clive,* Hort (C Veitchii × ?) —*C Cooksonii,* Hort (C Veitchii × C vestita luteo-oculata) Fls pure white, except a blotch of yellow in the throat and a few lemon-yellow lines on lip —*C Cornelius Vanderbilt,* Hort (C vestita rubro-oculata × C Veitchii) —*C discolor,* Lindl Sts leafy fls with claret sepals and petals and a 3-lobed white lip flushed rose Japan G C III. 35: 389 B R 26 55 —*C Eyermanni,* Hort (C vestita rubro-oculata × C Veitchii) Racemes shorter than in C Veitchii, with larger more spreading white fls with a reddish blotch at the base of the lip G F 4 12 —*C gigas,* Hort (C grandiflora × C Regnieri) Fls nearly 3 in. across, borne on a st over 5 ft tall, sepals and petals milk-white the latter tinged rose at base and apex lip 4 lobed, bright rose, striated with pale rose or white, a reddish crimson blotch at the base —*C Hénnisii,* Lober Similar to C vestita Philippines G C. III 46 34, desc —*C madagascariensis,* Rolfe Sepal and petals rosy mauve, lip dull magenta with white spot at base G C III 28 135, desc —*C McWilliamsii,* Hort = (?) —*C Orpetiàna,* Hort —*C summitalense,* Hort —*C Warpuri,* Rolfe Sepals white, petals much narrower, white, lobed lip dull purple, changing finally to orange Madagascar

GEO. V. NASH †



735.
Calanthe Veitchii.
(×½)

CALATHÈA (Greek for *basket,* the application not apparent) *Marantàceæ* Perennial foliage plants of warmhouses, with maranta-like leaves arising in a tuft from the crown

Sepals 3, free and equal; corolla tubular, with 3 spreading lobes, stamens 3, petal-like, 2 sterile, and 1 bearing an anther on its side (compare *Canna*). From Maranta the genus differs chiefly in technical characters In Maranta the fr is 1-seeded, in Calathea usually 3-seeded, in the former the fl.-clusters are branched and few-fld., in Calathea usually capitate or cone-like —Of calatheas there are more than 100 species, mostly of Trop. Amer., but a few of trop. Afr. The lvs, for which the plant is grown, are variously marked with shades of green, red, brown, yellow, and white. They spring from the very base of the short st., just above the rhizome, the rhizomes themselves more or less tuberiferous (Fig. 736). Monogr by Schumann in Engler's Pflanzenreich, hft. 11 (1902).

All the calatheas thrive in a moist tropical house in a temperature that does not go below 65° F., with a rise during the day to 90° or 95° F. For general purposes, the best compost in which to grow them is made of equal parts of good turfy loam, leaf-mold and sand. Some of the more delicate species are best grown in leaf-mold and sand only. Stagnation of the soil must be particularly avoided by abundance of drainage, as they require to be kept rather moister at the roots than most stove plants The close moist atmospherical conditions that these plants require can be secured only by constant syringing and damping down amongst the plants; therefore the need for abundance of drainage is apparent, whether they are grown in pots or planted out in a border. It is only by planting them out with a free root-run that calatheas may be had in their full beauty; and when so grown a collection of these plants forms one of the most beautiful examples of tropical foliage. Particular attention should be given to protecting them from all strong sunshine, the thin texture of their leaves rendering them specially liable to damage from this cause. Most of the species are of easy culture providing the above conditions are followed Many of them spread rapidly and make quick growth; therefore they require to be potted or overhauled every spring, but when once well established, they may be fed with liquid manure once a week — Propagation is by dividing the crowns, or by cuttings in those kinds that make secondary growths, these cuttings being taken just below the nodes In spring, just before growth begins, is a good time for this work Tubers may be used, if produced

In Florida, calatheas grow exceedingly well in shady lath plant-houses The soil should be leaf-mold and very old cow-manure added to the original natural soil Commercial fertilizer should never be used. In very cold weather they should be covered with pine branches and leaves or pine-needles. All the kinds soon form very beautiful clumps All of them need much water while they are growing, but not in the winter if they are planted out in beds Each spring they must be replanted in fresh soil Then the clumps may be divided, or if large specimen plants are desired, they may be left intact. (Nehrling)

The calatheas are a confusing group to the horticulturist, because the differences that he knows lie mostly in characters of leaf and habit and these are variable. The size of leaf and plant depends much on the treatment, and in some species the juvenile leaves are different from the mature ones. The coloration of the foliage depends much on the age, and the way in which the plants are grown. However, we may roughly throw the species into two groups,—the small-

leaved and the large-leaved, although it is a question where to place such intermediate kinds as *C Veitchiana, C insignis, C leopardina, C Sanderiana, C nigricans,* and some others; or we may arrange them in two groups by the red-marked kinds (of foliage), and by the green-, gray- and white-marked kinds, but this would not account for the juvenile and adult stages of *C. leopardina, C. imperialis, C Chantrieri, C. ornata,* and others. The botanical classification by floral characters would be of little use to the general horticulturist Some plants known in collections as calatheas are likely to be marantas, phrynıums, monotagmas, ctenanthe, or others. The radical tufted leaves and capitate inflorescence of Calathea, and the zigzag stems and branched inflorescence and small flowers of Maranta are general characters of separation between these two genera In the present account, the attempt has been made to draw the characters as much as possible from cultivated specimens apparently authentically named.

INDEX.

Albertii, 15.
albo-lineata, 12, 35.
Alluia, 32
angustifolia, 3.
argyrophylla, 39.
Bachemiana, 45.
Binotii, 42
Chantrieri, 34.
chimboracensis, 5.
conspicua, 23
crocata, 18
crotalifera, 31.
discolor, 3
eximia, 26
farinosa, 8.
fasciata, 8
flavescens, 10.
Foxii, 19
Goultii, 22.
gracilis, 25.
grandiflora, 10.
illustris, 20
imperialis, 36
insignis, 38.
Legrelliana, 30.
leopardina, 33.
Lietzei, 23.
Lindeniana, 28.
Louisæ, 21
Luciana, 9
majestica, 35
Makoyana, 16.
Marcellii, 14.
micans, 4
Neubertii, 23.
nigricans, 40.
nitens, 17.
noctiflora, 25.
olivaris, 16.
ornata, 12, 35.
ovalifolia, 8.
Pavonii, 2.
picta, 24
princeps, 29.
propinquum, 7.
pulchella, 43.
pumilum, 4.
regalis, 35.
roseo-lineata, 1.
roseo-picta, 1.
roseo-strata, 29.
rotundifolia, 8.
rufibarba, 27
Sagoreana, 11
Sanderiana, 37.
Sophiæ, 41
tigrina, 43
trifasciata, 7.
tubispatha, 2
Vandenheckei, 22.
Veitchiana, 19.
virginalis, 14.
vittata, 12.
Wagneri, 1.
Wallisii, 13.
Warscewiczii, 44.
Wiotiana, 6.
zebrina, 42.

A. *Markings of lf. (upper surface) in red or brown, at least in part.*

1. **rŏseo-pĭcta,** Regel (*C. rŏseo-lineăta,* Hort.? *Maránta rŏseo-pícta,* Lind. *M Wágneri,* Hort). Dwarf. lvs nearly orbicular, purple beneath, the upper side dark green, the midrib red, and an irregular red zone (sometimes two zones) two-thirds of the distance from the midrib toward the margin Amazon. F S 16:1675–6 Gn. 2, p 3

2. **Pavŏnii,** Kœrn. (*C. tubíspatha,* Hook f). Two feet or less high. lvs. obovate-elliptic, short-acuminate or cuspidate, thin, greenish beneath, lively green above, and marked midway between the rib and the margin with lighter green and squarish patches of brown. Peru. B M. 5542.

3 **angustifŏlia,** Kœrn. (*Maránta discolor,* Hort). Habit loose, erect, only slightly spreading at apex: growths bearing 1–4 lvs. from 1–5 ft. high; blade lanceolate, unequilateral, ¾–2 ft long, rich light green with fine lines of purple-red above, rich shining red beneath, petiole erect, stout, 1–3 ft. high, rich dark red, heavily marked with light green tuberculate spots, sheath extending from one-third to one-half its length. in the juvenile form the whole of the plant is densely covered with reddish brown hairs, but in the adult plant, the blade is almost entirely glabrous. Cent Amer. B.M. 8149

AA. *Markings of lf. mostly on the order of green or white (exceptions in juvenile stages of Nos. 35, 36, 37 and others).*

B. *Lf.-blades small or short, usually less than 12 in. long.*

C. *Under side of lvs. green, grayish, or yellowish (violet in forms of No. 14).*

4. **micans,** Kœrn. (*Maránta micans,* Math. *Phrynium pumilum,* Klotzsch). Very small: lvs. 2–3 in. long, and 1 in. wide, oblong-lanceolate, somewhat acuminate, green and shining above, the rib in a feathered white stripe, paler beneath. Brazil —Probably the smallest cult Calathea.

5. **chimboracénsis,** Lind. Dwarf: lvs. oblong-ovate, 8–12 in. long, acuminate, green above and below, with a very dark green white-margined band running lengthwise the blade midway between the rib and each margin. Neighborhood of Mt. Chumborazo. I H. 17:6.

6 **Wiotiàna,** Makoy (*Maránta Wiótii,* Morr.). Habit dwarf, spreading: rhizomes branching freely: growths bearing only a single lf. each; blade lincar-lanceolate, slightly oblique, 4–12 in. long, undulate, acute, upper side silvery gray with a narrow band of light green around the margin; midrib green, with a row arranged pinnately, along either side of the midrib, of dark olive-green blotches or stripes; under side dull grayish green finely striated all over between the principal veins with patches of light yellowish green; petiole 3–15 in. long, erect or spreading, light green, terete sheath entirely absent Probably Brazil —A most beautiful species; thrives best in leaf-mold and sand.



736. Tuber of calathea. (×½)

7. **trifasciàta,** Kœrn. (*Phrỳnium propínquum,* Poepp. & Endl.). Habit dwarf, spreading, with short free-branching rhizomes. growths bearing 1 lf. only, blade cordate-ovate, unequilateral, 3–12 in long, apex acute, and half twisted around, upper side silvery gray shading to green at the margins and with a row on either side of the midrib of dark green stripes arranged pinnately, under side light green, prominently striated on both upper and lower sides with a network of fine veins connecting all the principal lateral veins, midrib pale yellowish brown on the under side and covered with dark brown hairs in the lower half and extending for an inch or more on the apex of the petiole, petiole 3–12 in long, light green, glabrous except in the upper inch or so; scale lvs reddish brown. Guiana —A companion plant to *C Wiotiana,* to which it is closely allied, but differs in the broader and paler color of the lvs Of easy cult.

8. **fasciàta,** Regel & Kœrn. Habit dwarf, compact: lvs 10–18 in long, reflexed; growths bearing 1–3 lvs.; blade broadly ovate or orbicular, acute or obtuse, glabrous 5–10 in long, slightly undulate; upper side rich dark olive-green alternately marked by transverse bars of silvery white; under side dull grayish green; petiole 4–8 in. long, spreading, dull green, covered with short and minute brownish hairs; sheath extending up to one-half the length of the petiole, upper part terete. Brazil Gn 2, p. 3 —Considered by some to be a variety of *C rotundifolia,* Kœrn *C. farinosa* and *C. ovalifolia* are probably stages in the development of this plant or perhaps slight varieties.

9. **Luciàna,** Hort. Habit medium to strong, compact, more or less tufted: growths with 2–5 lvs , usually with 3, arching over at the tips and ½–3 ft. high; blade elliptic, oblique, glabrous, acute, slightly undulate, 3–12 in long, upper side light pea-green feathered along the midrib with pale greenish white and with a concentric zone of the same shade near the margin of the lf., under side dull grayish green; petiole erect, slender, rigid, pale green, glabrous or nearly so; sheath extending from one-half to nearly the entire length of the petiole, upper part oval, slightly flattened on each side: infl. a short few-fld. spike; peduncle 1–3 in long; bracts spreading or erect, ovate, light reddish brown, 1½ in. long; fls. in pairs, yellow; sepals thin, linear, one-third the length of the tube; corolla yellow; petals elliptic, ⅔in. long, spreading, acute; the 2 petaloid aborted stamens obovate, ⅓in. long, bright yellow,

and striped or blotched with bright red; style curved, ½in. long, yellow. Trop. Amer.

10. **flavéscens,** Lindl Habit tufted, glabrous in all parts growths with 3–5 lvs, 1–2½ ft high, blade elliptic, slightly oblique, 6–12 in long, acute, light green above, soft grayish green below, petiole 12–18 in long, pale yellowish green finely spotted with darker green, sheath one-third to one-half the length of the petiole, upper part oval· infl. a dense globose short raceme, peduncle less than an inch; bracts large, elliptic, outer ones 2 in long, bracteoles smaller, linear or lanceolate; fls in pairs, sessile or nearly so, an inch diam, sepal primrose, equal, lanceolate; petals large, bilobed, obovate, bright yellow Brazil B R 932 —Perhaps to be referred to *C grandiflora,* Schum.

11 **Sagoreàna,** Hort (*Maránta Sagoreàna,* Hort). Habit dwarf and compact growth bearing 2–4 lvs, usually with 3, and from 6–18 in high, erect at first, arching towards the apex, blade lanceolate, unequilateral, 4-9 in long, pale yellowish green with a row on either side of the midrib of arrowhead-shaped blotches of dark green which give this plant a distinct and pretty appearance, the under side in plain yellowish green, petiole slender, erect, 6–12 in long; sheath extending only to about a quarter of its length, upper part terete

12 **vittàta,** Kœrn (*C álbo-lineàta,* Hort *C ornàta* var *álbo-lineàta* and *Maránta álbo-lineàta,* Hort) Habit dwarf, compact, ½-2 ft high growths with 2–5 lvs, blade elliptic-lanceolate, slightly oblique, 3–12 in long, glabrous, acute, upper side light green, pinnately striped with white from apex to base, underside pale dull green shaded between the veins with slightly lighter yellowish green, petiole slender, erect or spreading, 3 15 in high, light green, glabrous, sheath extending from one-third to one-half its length, upper part terete Probably Colombia

13 **Wállisii,** Regel (*Maránta Wállisii,* Lind). Habit strong, but neat and graceful, branching and forming numerous growths· growths bearing from 2–7 lvs, and 1–4 ft high, blade broadly ovate, acute or obtuse, 6–12 in long, rich light velvety green along the margin and midrib and with a row on either side of the midrib of dark irregular blotches of olive-green, under side soft grayish green, petiole erect, slender, sheath extending to half the length of the petiole, and covered with soft hairs, upper part terete with the exception of the sheathing lower half of the lf-stalks, the whole plant is glabrous Peru —One of the commonest species in cult and of very easy culture A useful and decorative pot-plant

14 **virginàlis,** Lind Lvs soft-hairy below, broad-oval, rather blunt, 7–9 in long, 4–6 in broad, upper surface light green, and below, in the common form, whitish green and lighter zones shown, as on the upper surface,—or in another form, which has been distributed in gardens as *C (Maranta) Marcellii,* under side shaded a light violet and without zones. Brazil. A F 7·611 —Allied to *C. Veitchiana,* but has bracts with indurated tips rather than membranaceous.

cc *Under side of lvs. violet, purple, or suffused with red.*

15 **Álbertii,** Hort (*Maránta Álbertii,* Pynaert & Van Geert) Habit dwarf, spreading, less than a foot high. growths bearing 2–5 lvs, erect or spreading; blade oblique, elliptic, undulate, acute, 4–9 in. long, glabrous, upper side dark green feathered on either side of the midrib with a band of pale yellowish green, under side dull green suffused with light purple-red: infl. a few-fld. terminal spike; peduncle 3–4 in. long, pale green; floral bracts half reflexed outwards, orbicular or broadly ovate, ¾in. long; bracteoles 4–6, white, scarious, fls. in pairs, pure white; sepals half the length of the tube; petals lanceolate, ½in. long, tube ⅔in. long; 2 petaloid stamens slightly longer than the petals, obovate, fertile stamen hooded and curved over the stigma; style and stigma short curved, white.

16 **Makoyàna,** Nichols. (*Maránta Makoyàna,* Morr. *M. olivàris,* Hort). One to 4 ft.· lvs. broad-oblong, obtuse or somewhat short-pointed, the stalks red, the lf olive-green or cream-colored above but marked against the midrib with outspreading, dark green blotches of oblong, oval or pyriform shape, the under surface similarly marked, but in red. Brazil. F S 20 2048–9. G C. 1872.1589 Gn 4, p 87.

17 **nitens,** Bull. Habit dwarf, blade elliptic, acute, glabrous, upper side bright green, with oblong acute bars of dark olive-green, alternate long and short, on either side of the midrib, under side dull green tinted with dull red. Brazil —Distinct and pretty.

18 **crocàta,** Morr. & Joris Whole plant 12 in high lvs sub-distichous, petiole 2–3 in long, sheathing most of its length, blade 4–5 in. long, erect, ovate-lanceolate, acuminate, somewhat undulate, dark green and veined above, rose-purple beneath spike short, the bracts bright saffron-yellow. Brazil B M 7820 G C III. 28 113. G M 53 265. J H. III. 60:329 G 32.263 F.W. 1876.161 —A free bloomer and showy when in flower.

19. **Veitchiàna,** Hook f. Fig 737. Habit strong, loose, and spreading, 1–4 ft high· growths with 2–8 lvs, usually with 3; blade ovate or elliptic-ovate, oblique, acute, undulate, glabrous, 4–12 in long, upper side rich dark glossy green, feathered along either side of the midrib with an irregular band of pale green and with an inner zone of dark olive-green blotches and an outer one of pale yellowish green (often shading to white) between the midrib and margin; under side similarly blotched, but in shades of purple-red and rosy red; petiole ½-3 ft long, stout, green and glabrous above, tinted with reddish brown and hairy in lower part; sheath extending from one-third to one-half the length of the petiole, upper part terete: infl.



737. Calathea Veitchiana.

on erect densely fld. spike on peduncle 4–6 *in. long;* spike 2–3 in. long, with a rosette 2 *in. diam., of large* green foliolose erect or capped *spreading bracts;* floral bracts erect, spreading at the tips, ovate, an inch long, outer ones *covered in lower part with brown hairs;* fls. in pairs, primrose-white, tube ¾in. long, slender; sepals erect, ½in. long, lanceolate, petals elliptic ½in. long, reflexed; fertile stamen hooded, small, 2 aborted petaloid ones longer than the petals, obovate, bilobed, with a bright violet blotch on the front; style and stigma small, curved. Peru. B M 5535. G C 1870:924. Gn 2, p 545 F S 16:1655–8.—A dwarf var **Fŏxii,** Raffill, has recently been intro into cult from Venezuela. It differs from the type in its dwarf habit, rarely exceeding 10–12 in high: lvs. broader, more reflexed, and with a bright rose or red midrib, the color of the markings of the lf. are darker and of a slightly different shape, the dark inner zone of green being more broken in outline, and running into the midrib infl smaller, but the fls in size and color are the same as in the type.

20 **illústris,** Nichols. (*Maránta illústris,* Lindl.). Habit dwarf and compact, 6–9 in high lvs spreading, growths bearing 2–5 lvs 6–9 in. long, blade oblique, ovate, acute, undulate, 4–6 in. long, 2–5 in broad, upper side rich dark shining olive-green, with a bluish metallic luster over the whole, the midrib being feathered on either side with dull silvery white and an irregular zone of the same color running the complete circle of the blade, under side dull purplish red; petiole 2–3 in long, spreading, dull greenish brown; sheath extending to one-half the length of the petiole, upper part terete; petioles, lf.-scales and under side of the midrib covered with minute brown hairs infl an erect, capitate, few-fld. spike, on slender peduncle 4–6 in long; bracts of two kinds, the upper 3 or 4 green, foliolose ovate, spreading over the floral bracts, and curving upward at the tips; lower bracts scarious, orbicular, light brown and shading to bright red at the point of attachment to the rachis, bracteoles 2–4, lanceolate, shorter than the bract· fls. in pairs, sepals white, two-thirds length of the tube, tube ⅔in. long, petals lanceolate, white, spreading, ½in long; 2 aborted petaloid stamens larger than the petals, obovate, lower one heavily blotched with purple; stamen hooded; style and stigma white, curved, ½in. long; ovary minute, white Ecuador. F S 16:1691-2.—By some regarded as derived from *C. roseo-picta.*

21. **Louïsæ,** Chantrier (*Maránta Louïsæ,* Hort). Habit tufted, 2–3 ft. high: growths with 2–5 lvs ; blade elliptic, only slightly oblique, glabrous, acute margins plain or slightly undulate, 6–12 in. long, upper side light pea-green, feathered along the midrib with white, changing with age to a soft greenish white; under side light green tinted with pale purple-red; petiole ½–2½ ft. long, slender, erect, green, covered with soft minute brown hairs, sheath extending from one-third to one-half the length of the petiole, upper part terete: infl. an erect spike, elliptic in outline, on a leafy peduncle 4–12 in. long; bracts creamy white, reniform, obtuse or acute, bracteoles numerous, white, scarious; fls in pairs; sepals linear, cream, half the length of the tube, tube ¾in. long; petals lanceolate, reflexed; lip elliptic, with bright yellow disk reflexed with scarious margins; column white or cream, linear curved towards the lip

22. **Vándenheckei,** Regel (*Maránta* and *C. Goulétii,* Hort.). Habit dense and tufted, 1–2½ ft high· growths with 1–3 lvs , usually 2; blade oblique, elliptic or elliptic-ovate, 3–9 in. long, acute, upper side glabrous, rich dark green, marbled with silvery white along the midrib and an irregular undulating line of the same color running the complete circle of the blade, the intervening tissue in some cases will be also entirely composed of this silvery white colored tissue and the green part reduced to a marginal ring ½in. diam.; *these two strikingly distinct forms of lvs. will often be found on a single plant in adjoining growths; in this case it is not that either of them represent the adult stage, as both are of frequent occurrence on the* same plant and both produce infls.; under side, dull purple-red; petiole erect or spreading, dull reddish brown; sheath reaching from one-third to one-half its length, upper part terete or oval· infl an erect narrow spike, sometimes sessile but more commonly on a peduncle 3–15 in. high; bracts erect, ovate, green tinted with brown, closely adpressed and forming a narrow cone-like mass some 3–5 in. long, the upper pair of bracts always being enlarged and spreading outwards like 2 small elliptic lvs : fls. in pairs, white; sepals half the length of the tube; tube ¾in long, petals elliptic spreading; column curved, white with brown stripe —A fine stove plant for large or small pots, and on account of its tufted habit is of great use for decoration. Of very easy cult.

23. **Lièt'zei,** E. Morr. (*Maránta conspícua,* Bull *M. Neùbertii,* Hort.). Habit dwarf, spreading by means of runners: growths bearing from 1–7 lvs ½–2 ft high; blade obliquely elliptic, acute, undulate, glabrous, 3–9 in long, upper side soft velvety green, striped along the principal veins with dark olive-green and feathered between the veins with splashes of yellowish green, lower side dull purple-red, midrib brown, petiole 3–15 in long, softly tomentose in lower part, sheath extending from one-half to nearly the entire length of the petiole infl borne upon long slender leafy sts , which later become swollen and root at the nodes and change to runners, thus forming an easy means of prop few-fld , bracts green, ovate, fls. in pairs in axil of each bract, pure white, ½in diam ; sepals linear, petals obovate. Brazil B H. 25 273.

24. **pícta,** Hook. f. (*Maránta pícta,* Hort) Habit dense and compact, covered in all parts with soft velvety hairs growths with 4–10 lvs. and ½–3 ft. high, blade elliptic, undulate, acute, 6–15 in long, upper side rich velvety olive-green, feathered on either side of the midrib, pale yellowish green, under side rich purple-red, petiole 3–18 in. long, dull red, sheath extending nearly the entire length of the petiole, the upper inch or two being terete, and rather brighter in color than the lower part: infl. a dense cone-like spike, borne on long slender terete sts. 1–3 ft long and bearing 1 or more lvs. which change into runners after the fls. are over, becoming fleshy and rooting at the nodes, forming a ready means of prop ; bracts 1–2 in. long, erect, elliptic or ovate, pale primrose tinted with rose or violet; fls. in pairs, 1 in diam , primrose tinted with violet Brazil. B M. 7674 G C III 22.293.

25 **noctiflòra,** Hort. (*Maránta noctiflòra,* Regel & Kœrn. *M. grácilis,* Hort). Habit loose and spreading, 1–2½ ft high: growths with 2 or 3 lvs ; blade elliptic or elliptic-ovate, 6–12 in. long, pendulous or horizontal, upper side pale yellowish green, pinnately striped with rich dark green bars along the principal veins, lower side light green faintly suffused with dull red, the principal veins being more strongly marked with a deeper shade of red; petiole erect, rigid, 6–18 in. long; sheath, extending to half its length, upper part terete, green. Probably Brazil —Perhaps a true Maranta.

26. **eximia,** Kœrn. (*Phrỳnium eximum,* Koch). Habit loose and spreading. growths bearing 1–3 lvs , usually 2, and from 1–3 ft. long; blade elliptic or elliptic-ovate, acute, 6–15 in. long, upper surface alternately striped with rich olive-green and light silver tissue, and arranged in the form of a feather, midrib channeled pale yellowish green, under side rich dark wine-red, glabrous above, softly tomentose with brown hairs beneath; petiole spreading, stout, 1–2 ft long, lower part light green, reddish brown above, beneath extending from one-third to nearly the entire length of

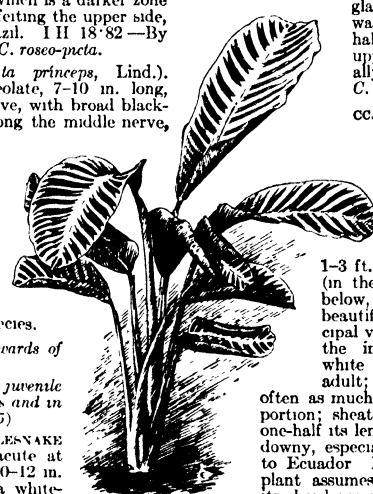
the petiole, upper part oval or terete. Cent. Amer. Gt. 686.—One of the finest and most beautiful members of the genus.

27. **rufibárba,** Fenzl. Habit erect, densely tufted: growths with 3–7 lvs. 1½–4 ft long; blades linear-lanceolate, 6–12 in. long, rich shining green, suffused with purplish red below, undulate, acute, petiole ¾–2½ ft long, terete above the sheath, sheath extending from 2–10 in. of the base of the lf., dull red heavily spotted with green. Probably Brazil. B.M. 7560.—Densely hairy in all its parts.

28. **Lindeniàna,** Wallis (*C. Lindenii*, Wallis & André). Lvs. elliptic-oblong, short-acuminate (12 in. or less long), deep green above with an olive-green zone either side of the midrib, and beyond which is a darker zone of green, the under side counterfeiting the upper side, but with purplish zones. Brazil. I.H. 18:82.—By some considered to be a form of *C. roseo-picta*.

29 **princeps,** Regel (*Maránta princeps*, Lind.). Lf. elongated or elliptical-lanceolate, 7–10 in. long, 3–3½ in. broad, light green above, with broad black-green, flaming, broken band along the middle nerve, violet-purple below. Amazon.

30 **Legrelliàna,** Regel. Lf. elliptical, pointed, 5–6 in. long, 2–3½ in. broad, above shining green, with broad, white, flaming, broken middle band along the middle nerve and numerous broken white linear small bands between the side nerves, lower surface whitish green and marked with red and green. Colombia, Ecuador.—A neat species.



738. Calathea zebrina.

bb. *Lf.-blades larger, mostly upwards of 12 in. long.*

c. *Under side of lvs green (red in juvenile states of Nos. 34 and others and in No. 37 and perhaps No. 45)*

31. **crotalífera,** Wats. Rattlesnake Plant. Lvs. oval, abruptly acute at each end, 1½–2 ft. long, and 10–12 in. broad, yellowish green, with a white-margined midrib, paler underneath; petiole 2–3 ft. long, curved, sheathing: peduncles 1 or 2, 8–10 in. high, bearing distichous yellow-fld. spikes. Guatemala.—Offered in Fla. The spikes suggest the rattle of a rattlesnake (Crotalus) whence the specific name.

32. **Allùia,** Lindl. Habit erect: growths bearing 4–10 lvs. 2–4 ft. long, blade 1–2 ft. long, elliptic, arching in upper half, light green above, pale silvery gray below, margins slightly undulate; petiole erect, often as much as 2 ft. long, green, striped with dull red on each side, the sheath extending up to within 2–3 in. of the apex, where it becomes terete. W. Indies.—Alluia is a native Carib name.

33. **leopardìna,** Regel (*Maránta leopardìna*, Bull). Habit strong and vigorous, quickly forming a large and fine specimen: growths bearing 3–7 erect or spreading lvs., often as much as 5 ft. high, and arching over at the tip; blade to 20 in. long, elliptic, slightly oblique, acute, slightly undulate, and glabrous in all parts, upper side rich green in the adult stage; in the juvenile stage the lvs. are dark olive-green in the center, with an irregular outer band of paler green, forming a complete zone between the dark green center and margin; under side light green; petiole 1–4 ft. high, rigid, erect; sheath extending from one-third to one-half the length of the petiole, upper part terete, glabrous, shining light green. Brazil.—A near ally of *C. Chantrieri*, but not so brightly colored in the markings of the lf.

34. **Chantrieri,** Hort. (*Maránta Chantrièri*, André). Habit strong and vigorous, erect, spreading and arching above: growths bearing 3–4 lvs. and reaching as much as 6 or 7 ft. high in the adult stage, blade elliptic, glabrous; in the juvenile stage the larger part of the upper side of the lf. is a pale yellowish green with a dark green irregular band running around the margins and along the midrib, the under side is rich purplish red, in the adult stage the color on both sides of the lf. is all lost and becomes a rich dark green, the intermediate stages of development are marked by a gradual loss of the light yellowish green on the upper side and purple-red of the lower and the gradual encroachment of the dark green color which predominates in the adult stage; petiole 1½–5 ft. long, downy when young, glabrous when old, spreading outward, sheath extending from one-half to three-fourths of its length, upper part terete. Brazil.—A near ally, if not a variety of the older *C. leopardina*, Regel.

cc. *Under side of lvs. in shades of purple or red (or perhaps green in No. 45).*

35. **ornàta,** Kœrn (*Maránta ornàta*, Lind. *M. regàlis*, Hort.). Habit vigorous, erect, spreading with age: growths bearing 1–4 lvs., blade elliptic or elliptic-cordate, acute, 1–3 ft. long, rich shining green above (in the adult stage), dull purple-red below, the lvs. in the juvenile stage all beautifully striped between the principal veins with rose or pink, which in the intermediate stage changes to white and disappears entirely in the adult; petiole erect spreading with age, often as much as 4 ft. long and thick in proportion; sheath extending from one-third to one-half its length, upper part terete, slightly downy, especially in the lower part. Guiana to Ecuador. F.S. 4:413–14.—The forms this plant assumes during the different stages of its development have been distinguished by some nurserymen who have distributed them under separate names, *C. regalis*, *C. majestica*, and *C. roseo-striata* all being stages of the one plant. To add to the confusion they are also known in the trade under the generic name of Maranta. The plant known as *C. albo-lineata* or *Maranta albo-lineata*, has been referred by some authors to this species, but it has no near affinity and is a different plant from *C. ornata*, *C. imperialis* or *C. Sanderiana*.

36. **imperiàlis,** Hort. (*Maránta imperiàlis*, Hort.). Habit vigorous, erect, spreading in the adult stage: growths with 2–7 lvs. 6 in. to 5 ft. long, blade as much as 2 ft. long when adult, elliptic-ovate, acute, entire, shiny green above, rich purple-red below, petiole stout, erect or spreading, dull green; sheath developed about half its length, upper part terete.—One of the best species for decorative effect. This species presents a striking dissimilarity between the juvenile and adult stages of growth. The juvenile stage is much the better for horticultural purposes as the lvs. are then striped with bright rose or pink between the principal lateral veins. This color gradually changes as the plant grows stronger and becomes vigorous, the stripes on the lower lvs. first becoming white and gradually disappearing on the lvs. that are developed after the plant reaches the adult stage, until a stage is reached when all the color and stripes on the upper side of the lvs. are lost and the lvs. are a rich shining green color. The high color is again developed as soon as the plant is disturbed at the roots either for prop or by injury.

37. **Sanderiàna,** Hort. (*Marànta Sanderiàna*). A species closely allied to *C. imperialis* but differing in the broader and shorter lf.-blades, darker color of the under sides of the lvs, transverse striation between the veins, the hairy character of the petioles and under side of the lvs. Habit erect, spreading with age: growths bearing 1–4 lvs; blades ovate, or elliptic-ovate, up to as much as 2 ft long when adult, acute, green above (in the adult stage), rich plum-red below; lvs. in the juvenile stage are striped with bright rose which become white in the intermediate stage and entirely disappear in the adult; petiole erect, stout; sheath extending from one-third to one-half its length, upper part terete; lf.-scales, petioles and under sides of the lvs. slightly pubescent. Brazil.—*C. ornata*, *C. imperialis* and *C. Sanderiana* are probably all forms of one very variable species.

38. **insignis,** Bull. Habit tufted, dwarf and compact: growths bearing 2–3 lvs. and from ½–3 ft. high; blade linear-lanceolate, 3–18 in. long, undulate, acute, glabrous, upper side highly glabrous, pale yellowish green shading to rich olive green at the edges, and with a row on either side of the midrib arranged pinnately of alternate long and short blotches of dark olive-green, giving the plant a most distinct and striking effect; under side a rich dark maroon-red, petiole 3–20 in. long, rigid, slender; sheath only developed near the base, upper part terete, green. Brazil. J H. III 45:218.—One of the most beautiful foliage plants in cult. and one which thrives well in a hot moist stove in a mixture of leaf-mold and sand.

39. **argyrophýlla,** Hort. A garden hybrid. Habit spreading: growths with 2–5 lvs 1–3½ ft. long, 12–20 in long, elliptic, silvery white, feathered with pale green above and rich reddish brown below; petiole 12–20 in. long, pale green, striped along the back with red; sheath extending up to within 4–8 in. of the lf.-blade, upper part terete and slightly channeled on upper side, glabrous in all parts

40. **nígricans,** Gagnep. Habit loose, light and elegant, erect at first, spreading with age: growths bearing 2–3 lvs, 2–5 ft high, blade elliptic, occasionally lanceolate, acute, undulate, 12–20 in long, rich dark velvety green above, dull red below, petiole 1–4 ft long, erect; sheath extending to one-third the length of the petiole, upper two-thirds terete, dull green in color. infl. arising from center of the growth of the lvs, an erect globose spike with large foliose; bracts: fls. 2–3 in the axil of each bract, 1 in diam, primrose in color, petals shaded with purple; tube 1 in. long; bracts green, reflexed, upper ones forming an umbrella-like mass under which the fls. are developed in the axils of the lower bracts. Trop. Amer. R H. 1904, p 576

41. **Sòphiæ,** Hort. Habit medium to strong: growths with 3–7 lvs and 1–3 ft. high; blade elliptic, acute, undulate, 12–18 in long, rich bright velvety green with a bright yellowish green channeled midrib above, light red below; petiole erect, rigid, covered with soft tomentum; sheath extending from one-third to one-half the length of the petiole, upper part terete.—Closely allied to *C. nigricans*.

42. **zebrina,** Lindl (*Marànta zebrìna*, Sims). ZEBRA PLANT Fig. 738. Habit compact, 1–3 ft. high. growths bearing from 6–20 spreading lvs.; blade elliptic, obtuse or acute, slightly undulate, ¾–2 ft. long, upper side rich velvety green, with alternating bars of pale yellowish green and dark olive-green, under side light purple-red in the adult stage, and pale grayish green in the young stage; petiole ½–2 ft. long, pale green; sheath large, canaliculate, and extending nearly the whole length of the petiole; scape short. Variable. Brazil. B.M. 1926. L.B.C. 5:494. R.H. 1865, p. 90. S.H. 1:164. Lowe, 1.—The commonest species, occurring in nearly all collections of warm greenhouse plants.

Var. Binòtii, Hort., is a stronger-growing variety with darker colored foliage, with lvs. as much as 4½ ft. long.—One of the finest and best stove foliage plants in cult, of easy culture and one that should be in all collections.

43 **pulchélla,** Kœrn. (*Marànta tigrìna*, Bull). Weaker grower than *C zebrina*, the lvs. lighter colored, with two series (large and small) of broad green bars. Brazil.—By some considered to be a form of *C. zebrina*.

44. **Warscewíczii,** Kœrn. Rather large: lvs 2 ft. long, oblong-lanceolate, acuminate, purple beneath, dark, velvety green above, but the midrib broadly feathered with yellow-green. Costa Rica F.S. 9:939–40 Gn. 17.560. Lowe, 17.—One of the best.

45. **Bachemiàna,** Morr. Lvs. unequilateral, cordate at the base, ovate-lanceolate or rarely oblong, attenuate-acuminate, smooth, silvery green above, finely striate, with parallel greenish or whitish markings along the primary nerves, purplish or greenish beneath Brazil.

C. argyrèa, Kœrn. Lvs very short, unequal, oblong-lanceolate, short-acuminate, above deep green and ash-colored, beneath purple. Country unknown.—*C. arrécta*, Lind & André Tall, lvs oblong, red beneath, green above, with the nerves all prominent Ecuador I H 18 77.—*C bambusàcea*, Poepp & Endl =Ischnosiphon.—*C Baraquìnii*, Regel. Lvs oval-lanceolate, green, with bands of white Brazil.—*C. fascinàtor*, Hort Dwarf lvs broad-ovate-oblong, purplish beneath, green above and with blotches of lighter color and transverse narrow bars of red Brazil I H 41.104 (as Maranta Fascinator).—*C. gigas*, Gagnep Eight ft lf.-blade lanceolate, 2 ft long, 8–10 in broad, violet-purple when young but becoming green, petioles 5 ft long spike cylindric, about 4 in long, bearing 8 pairs of yellow-and-white fls Trop Amer.—*C hieroglyphica*, Lind & André Dwarf lvs short-ovate, short-pointed, purplish beneath, green above and marked by many oblique bands or bars of silvery white Colombia I H 20 122–3.—*C Kerchoveàna*, Hort =Maranta bicolor var.—*C Lageriàna*, Hort Lvs large, dark red beneath, the prominent veins rich bronze.—*C. mdjor*, Hort =Ischnosiphon.—*C Massangeàna*, Hort =Maranta bicolor var Massangeana.—*C media-picta*, Makoy (Maranta prasina, Bull) Lvs oval-lanceolate and tapering to both ends, dark green, with the rib feathered with white from base to summit Brazil.—*C musàica*, Hort (Maranta musaica, Bull) A dwarf-growing species with obliquely cordate ovate lvs 4–6 in long, glabrous, acute, upper side pale shining green marked with numerous close set transverse veins of a lighter shade, petiole 3–6 in long Brazil.—*C Oppenheimiàna*, Morr = Ctenanthe.—*C pardìna*, Planch & Lind =C villosa.—*C smaragdìna*, Lind & André=Monostagma.—*C splèndens* and *splèndida*, Hort =Maranta splendida.—*C villòsa*, Lindl Large lvs 10–20 in long, oblong-ovate, pale green with dark brown angular blotches. fls. yellow S Amer F S 11 1101–2 (as C pardina), also, Lowe, 32.

L H B

C P. RAFFILL.

CALCEOLÀRIA (Latin *calceolus*, a slipper, alluding to the saccate flower; these plants are sometimes called lady-slippers, but the name is best used for Cypripedium). *Scrophulariàceæ*. Showy-flowered herbs and shrubs, grown both in the greenhouse and in the open.

Leaves mostly opposite, usually hairy and rugose, entire or incised or pinnatifid. corolla 2-parted nearly to the base, the lower part or lip deflexed and inflated slipper-like, the upper lip smaller and ascending, but usually saccate; stamens 2 or rarely 3, and no rudiments (A, Fig 739) fr a many-seeded caps.—About 200 species, mostly from the Andes of Peru and Chile, but extending north to Mex; also 2 in New Zealand. **Monogr.** by Kranzlin, Engler's Pflanzenreich, hft. 28 (1907).

Many species of Calceolaria have been cultivated at one time or another, but the number now grown is few, most of the garden kinds apparently being hybrids or marked variations from specific types. The genus falls into two horticultural sections, the herbaceous kinds, and the shrubby kinds. The former are the only ones generally known in this country, being treated more or less as annuals. The herbaceous garden forms Rodigas considers to be offshoots chiefly of *C. arachnoidea* and *C crenatiflora*, and he has called this race *C. arachnoideo-crenatiflora* (see I H. 31:528, 536; 35:54). In this work, however, the more inclusive terms *C. herbeohybrida* of Voss is employed (Fig. 739); and also the corresponding *C. frutcoybrida* for the shrubby

derivatives. *C. crenatiflora* seems to have left its impress most distinctly on the greenhouse forms. The calceolarias are grown for the variously colored and often spotted slipper-like flowers. The shrubby forms, grown much in England, do not thrive in the heat of the American summer.

The cultivation of the herbaceous and the shrubby kinds of calceolarias is about the same, with the difference that the herbaceous kinds are nearly always grown from seeds, while the shrubby varieties are oftener grown from cuttings.—Seeds may be sown from the end of March until the first of September, according to the size of the plant required. Those sown early are more easily carried through the hot months than any that are propagated in the end of May or in the month of June. Sow the seeds in shallow pans with good drainage in a compost of equal parts of sand and of



739 Calceolaria herbeohybrida.

the peat which is shaken out of fern-root that is to be used for potting orchids, adding about one-fourth of charcoal All this should be sifted through a fine sieve. This material should be well mixed and placed an inch in depth in the receptacle that the seeds are to be sown in. The surface should be made as level as possible, and the seeds, after being thinly scattered over the same, may be pressed gently into the compost, covering them very lightly with sphagnum moss sifted through a very fine sieve. Water by dipping the pan in a tank of water, allowing it to soak through the holes in the bottom of the pan. This mode of watering is not so liable to disturb the small seeds, as an overhead watering with a fine rose on the watering-pot. A temperature of 60° will cause calceolaria seeds to germinate, but the sun should not strike them until the cool of autumn comes. A greenhouse with a northern aspect is best for them until the end of September, giving all the air possible day and night. From the first of October until the end of March, the plants will stand the full sun, and should then be grown in a night temperature of 40°, allowing 10° or 15° of rise during the day. For a first potting (which may be to 2-inch pots) the same mixture in which the seeds were sown is the best, and the seedlings should be big enough to be easily held between the finger and thumb; and as the plants are moved along into larger pots, equal parts of fibrous loam, fern-root, leaf-mold, sand and dried cow-manure may be used, always having this compost in as lumpy a state as can be equally and conveniently packed around the plant. When the plants are well rooted in their flowering pots, they may be watered with manure water An ordinary handful of green cow-manure to about three gallons of water may be used, and if any of the commonly used fertilizers are to be employed for a change, the same amount of fertilizer to an equal amount of water is about right; but always water with clean water twice between these applications.—If cuttings are to be used for the propagation of calceolarias, they should be rooted in a temperature of 45° to 50°, kept shaded from the sun. Cuttings may be procured from the plants that are trimmed into shape during their growing period (in August or September) and should have two leaves attached and another joint to go in the sand When rooted, treat them as described above for the seedlings. The varieties of the rugosa section are largely used for bedding plants in Europe —Calceolarias are very subject to attacks of green- and white-fly, the best means of keeping these pests in check is by fumigation with hydrocyanic gas. In the evening is the best time to fumigate, and the foliage of the plants should be perfectly dry; in fact, it is better if possible to use no water at all in the greenhouse the day they are to be treated. In the hot months of summer, a cool evening should be selected and one-quarter of an ounce of cyanide of potassium, one ounce of sulfuric acid and two ounces of water to every 1,000 cubic feet contained in the greenhouse may be used (See *Fumigation*.) The house at this season of the year should be opened up in forty-five minutes after the cyanide has been dropped into the liquid. Repeat at intervals of about three weeks In winter the quantity may be doubled to the same cubic feet of space, and the house may be kept closed until morning When opening the ventilators after fumigating in this manner, do not breathe in the greenhouse until the air has changed, say about half an hour after, as the gas is deadly to human beings. Fumigating with tobacco will kill the green-fly, but it has no effect on the white-fly. (Geo F Stewart)

INDEX

alba, 14.
amplexicaulis, 13.
arachnoidea, 7.
ascendens, 18.
biflora, 3.
Burbidgei, 5
corymbosa, 2.
crenatiflora, 1.
dentata, 15
fruticohybrida, 15.
herbacea, 10.
herbeohybrida, 10.
Herbertiana, 6
heterophylla, 8.
hybrida, 5, 10.
integrifolia, 11, 15.
mirabilis, 1
Morrisonii, 3
Pavonii, 4
pendula, 1
pinnata, 8, 9.
plantaginea, 3
purpurea, 6.
rugosa, 11
salviæfolia, 11
scabiosæfolia, 8
suberecta, 3.
thyrsiflora, 12
viscosissima, 11.
Wheeleri, 2.
Youngii, 10.

A. *Herbaceous calceolarias, some of them parents of the florists' varieties of this country.*

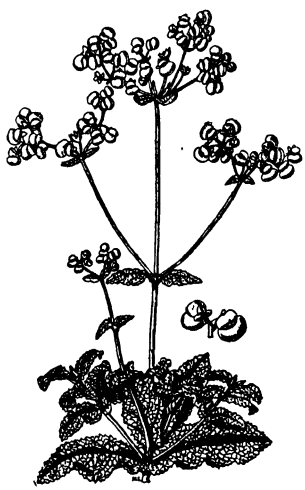
B. *Lvs. simple.*

C. *Fls. essentially yellow.*

1. **crenatiflōra,** Cav. (*C. péndula,* Sweet. *C. mirabilis,* Knowl. & Wesc). One to 2 ft , the st. soft-hairy, terete: radical lvs ovate and long-petioled (the petioles winged at top), undulate and dentate, sometimes obscurely lobed, rugose and pubescent, paler beneath, often purplish toward the tip; st -lvs. shorter-petioled and becoming sessile above. fls in a forking corymb, the slipper large, oblong or oblong-obovate, furrowed or crenate, hanging, yellow, with orange-brown dots Chile. B.M 3255 —From this species we appear to have derived the spots of calceolaria fls.

2. **corymbòsa,** Ruiz & Pav. (*C. Wheèleri*, Sweet). One to 3 ft. high, the st. 4-angled: radical lvs. ovate and sometimes cordate, obtuse or nearly so, doubly crenate, rugose and hairy, whitish beneath: st.-lvs. smaller and narrower, somewhat clasping, opposite: fls. small (about half as large as in *C. crenatiflora*), in a broad, somewhat loose corymb, the slipper somewhat short-oblong, clear yellow outside and marked with red lines inside. Chile. B.M. 2418.

3. **bifiòra,** Lam. (*C. plantaginea*, Smith. *C. suberècta*, Hort. *C. Mòrrisonii*, Don). Herbaceous, stemless: lvs. ovate-spatulate, toothed at top. scapes many, few-fld, fls. large, yellow, lower lip large and the upper one small and notched, the under side of the slipper dotted with red. Chile, Argentina. B M. 2805. L. B. C. 15:1402. F.S.R. 2:312.



740. Calceolaria integrifolia var. viscosissima. (×⅓)

4. **Pavònii,** Benth. An erect, strong-growing, herbaceous, or half shrubby species: st. terete, green, stout lvs perfoliate, on short winged petioles, ovate or elliptic, coarsely serrate, 5–9 in. long (in a vigorous plant), and a rich light green in color. sts. and lvs. densely hairy, infl paniculate, terminal, large and handsome; fls. rich golden-yellow and marked in throat with brown, and about 1 in. diam. Peru. B.M. 4525. G. 27:663. J.H III. 50:489. J F. 1, pl. 32.—One of the parents of several handsome hybrids.

5. **Búrbidgei,** Hort. (*C. hýbrida* var. *Búrbidgei*, Gumbl.). A garden hybrid raised at Trinity College, Dublin, by Burbidge between *C. Pavonii* on the one side and *C. deflexa* (*C fuchsiæfolia*) or possibly *C. amplexicaulis* on the other: plant erect: sts. hairy, terete: lvs. light green, lanceolate, 5–9 in long, serrate, winged along the petiole: infl. large, in terminal free-branching panicles; fls. 1 in. diam., rich golden yellow. G. 25:547. Gn. 47:306.—One of the finest of cool greenhouse kinds and valuable also as a bedding plant as it grows into a fine large specimen as much as 6 ft. high and branches freely from the base. Readily prop. by cuttings.

cc. *Fls. purple.*

6. **purpùrea,** Graham (*C. Herbertiàna*, Lindl.). Sts. erect, pubescent, 1–2 ft.: radical lvs. spatulate and acutish, with a strong midrib, sparsely hairy, rugose, dentate; st.-lvs. broad-cordate and clasping, less toothed: fls. in loose corymbs, small, purplish or reddish violet, the slipper somewhat furrowed. Chile. B.M. 2775. B.R. 1313.—Supposed to have entered largely into purple-fld. varieties.

7. **arachnoídea,** Graham. St. a foot or two high, terete, branchy, woolly, with appressed hairs: lvs. oblong or lingulate, narrowing into long-winged petioles, clasping, obscurely toothed, rugose, woolly on both sides: peduncles in pairs, forking: fls. small, dull purple, the slipper nearly globular and furrowed. Chile. B.M. 2874. L B.C. 16:1557.

bb. *Lvs. compound, or essentially so.*

8. **scabiosæfòlia,** Sims (*C pinnàta*, Ruiz & Pav. *C. heterophýlla*, Willd.). Often 2 ft, the st. terete, hairy, and leafy: lvs opposite, with clasping petioles, cut nearly or completely to the midrib; lfts. varying from lanceolate to broad-oval, acuminate, ciliate, dentate: fls very small, in small hairy corymbs, pale yellow, the slipper nearly orbicular in outline. Chile, Peru, Ecuador. B.M 2405.—This is sold by seedsmen as an annual bedding plant.

9. **pinnàta,** Linn Often reaches 3 ft. or more: lvs. pinnatifid or completely compound, the divisions short and nearly entire, obtuse or nearly so: fls. small, sulfur-yellow Chile, Peru, Bolivia. B.M. 41.—The first known garden species, still sold as an annual.

10 **herbeohýbrida,** Voss (*C. hýbrida, C. herbàcea, C. Youngii*, Hort, and others). Derivatives of the herbaceous calceolarias: mostly dwarf or small (2 ft or less), in many colors, usually with well-inflated slippers.

aa. *Shrubby calceolarias.*

b. *Fls yellow.*

11. **integrifòlia,** Murr. (*C rugòsa*, Ruiz & Pav. *C. salviæfòlia*, Pers.). Two to 6 ft. high, branchy and bushy: lvs glabrous, oval-lanceolate, crisped and dentate, the short petioles winged fls in terminal clusters, small, yellow Chile. L B C 10 942 B R. 744, 1083 —Variable. Probably the chief source of shrubby calceolarias Var **viscosíssima,** Hort (Fig. 740), is a sticky-hairy form with sessile lvs and showy fls.

12 **thyrsifiòra,** Graham. More shrubby: lvs. linear and clustered, toothed, sessile, not hairy. fls. small, yellow, in a close, terminal cluster. Chile. B M. 2915.

13 **amplexicaùlis,** HBK A foot or two high: lvs. cordate-ovate to ovate-lanceolate, long-acuminate, pubescent, woolly beneath and deep-rugose above, clasping. fls. small, in an upright corymb, pale yellow and spotless, the slipper hoof-shaped. Ecuador, Peru.

bb. *Fls. white.*

14 **álba,** Ruiz & Pav. Shrubby, erect, branched, the branches opposite: lvs linear, toothed above, with fascicles of fls. in axils: fls. small, white, of 2 very unequal lips, the upper one being very small, the throat closed Chile B M 4157. G C III 22:141 Gn. 51:60; 75, p 6 J H III 61:419.—A most beautiful species in England when planted out in a soil rich in humus, but should be shaded from hot sun The plant dislikes pot culture This species has recently been used by the hybridist in order to secure a race with white fls. The new hybrid *C. Veitchii* is likely to prove a great aquisition to gardens, and is partly derived from this species.

15. **fruticohýbrida,** Voss (*C. ascéndens*, Hort, not Lindl. *C. dentàta*, and *C. integrifòlia*, Hort, for the most part). Here may be grouped the shrubby garden calceolarias that are derivatives of most other species. They are marked by the prevailing under-color of yellow, orange or orange-red; sometimes they are yellowish white or dull red.

C andìna, Benth. (C. Herbertiana var pallidiflora, Lindl). Shrubby, glandular-pubescent: lvs orbicular-ovate, thick, rugose, hairy fls small, yellow, the slipper crenate Chile B M. 7326. B R 1576 —*C. bicolor*, Ruiz & Pav Shrubby: lvs ovate, dentate: fls small, the slipper sulfur-yellow above and white below Peru. B M 3036 L.B C. 18:1783 —*C càna*, Cav Herbaceous, tufted, scapose, 1–1½ ft: lvs. radical, oblong-lanceolate, spatulate or obovate fls white with small purple or rose-colored lines and blotches Chile B M 8416 —*C Clibràni* Hort —C. profusa. F E 28:143 —*C. deflèxa*, Ruiz & Pav. (C fuchsiæfolia, Hemsl). Shrubby: lvs. lanceolate: fls. yellow, panicled, the upper lip very large Peru B M 6431. G.C II. 15 269 Gn. 15 258 —*C flexuòsa*, Ruiz & Pav shrubby at base: lvs. large-ovate, coarsely crenate-dentate fls rather large, clear yellow, with very large

green calices. Peru. B.M 5154 F S. 22 2331 —*C. Forgéti*, Skan Undershrub, 1–1½ ft., slender lvs ovate, obtuse or somewhat acute, serrate fls small, pale yellow with a large reddish brown blotch inside the lower lip Peru B M. 8436 —*C. fuchsiæfolia*, Hemsl. =C deflexa —*C. Hénrici*, Hook f Shrubby, evergreen, lvs willow-like, small-toothed fls panicled, clear yellow, the upper lip large Peru B M 5772 —*C. hyssopifólia*, HBK Shrubby lvs crowded, small, lanceolate and toothed, or at top of st linear and entire, margins revolute fls rather large, in many-fld corymbs, pale sulfur-yellow, the slipper obovate-orbicular and crenate Ecuador —*C. Jeffreyi*, Hort., is a hybrid group between herbaceous greenhouse kinds and C integrifolia, produced about 10 years ago in England 2–6 ft., with branching panicles bearing fls about 1 in across of few colors —*C. kewensis*, Hort Cross of C. Jeffreyi with herbaceous varieties more compact and larger-fld than C Jeffreyi, colors of wide range plant 1–2½ ft high and about as broad when in good bloom G C III 39 390 —*C. lobàta*, Cav Herbaceous lvs triangular-ovate, palmately 5–7-lobed, dentate fls in terminal clusters, clear, pale yellow, and spotted on the up-curved slipper Peru, Bolivia B M 1525, 6330 —*C. mexicàna*, Benth., is a small-fld., pale yellow species hardy in England annual lower lvs 3-parted or -lobed, the upper ones pinnatisect Mts., Mex., Costa Rica —*C. petiolàris*, Cav (C floribunda, Lindl.) Herbaceous lvs ovate, the lower ones wing-petioled, toothed, rugose fls yellow in loose panicles, the lips connivent Chile —*C. pisacoménsis*, Meyen Shrubby lvs ovate-cordate, nearly or quite obtuse nearly sessile, irregularly crenate, margins reflexed fls large, orange varying to red, the slipper up-curved Peru B M 5077 —*C. polyrrhiza*, Cav A dwarf and tufted species from Patagonia, with dark yellow purple-spotted fls herbaceous, cespitose lvs crowded, lanceolate S Chile, Patagonia For rockwork —*C. profusa*, Hort (C Chibrani, Hort.) On the order of C Burbidgei A garden form of free-flowering habit —*C. Sinclairii*, Hook Herbaceous, half-hardy lvs oblong-ovate, stalked, crenate-dentate, hairy fls small, lilac or flesh-colored, spotted within, the 2 lips nearly equal, not saccate New Zeal B M 6597 Now referred to Jovellana (J. Sinclairii, Kränzl.) —*C. tenélla*, Poepp & Endl. Herbaceous, half-hardy, 6 in high lvs ovate or orbicular, small (¼in. long), nearly or quite sessile fls yellow, spotted within Chile B M 6231 —*C. Veitchii*, Hort Hybrid of C alba and a garden variety 3–5 ft., erect and branched fls many, rather small, pale lemon-yellow G C III 51, Suppl. June 1 Gn 76, p 271 (See No 14.) —*C. violacea*, Cav (Jovellana violacea, Don) Shrubby lvs small, ovate-cordate, deep-toothed, stalked fls yellow-salmon, spotted within and without, the two lips not saccate Chile B M 1929 —*C. virgata*, Ruiz & Pav Bushy, 1–1½ ft lvs ovate, short-stalked fls rather small, numerous, white Peru, Bolivia G C III 51 50

L H B

CALÉNDULA (Latin, *calendæ* or *calends* throughout the months) *Compósitæ* Flower-garden plants

Small herbs, the common cult species annual, others perennial, with alternate simple lvs, mostly large heads with yellow or orange rays, glabrous incurved achenes, plane naked receptacle, pappus none, and involucre broad, with scales in one or two series, their margin usually scarious —Some 15 species from Canary Isls to Persia

officinàlis, Linn POT MARIGOLD Fig 741 Annual 1–2 ft high, more or less hairy lvs oblong and more or less clasping, entire, thickish heads solitary, on stout stalks, large with flat spreading rays, showy, closing at night S Eu B M. 3204 V 5 44, 16 165 —One of the most universal garden fls, running into many vars, distinguished by size, color, and degree of doubling The color varies from white-yellow to deep orange This is the marygold of Shakespeare's time The fl.-heads are sometimes used in cookery, to flavor soups and stews The calendula is of the easiest culture in any warm, loose soil The seeds are usually sown where the plants are to stand, but they may be sown indoors or in a frame and the plants transplanted The achenes are large and germinate quickly The plant blooms the whole season, particularly if the fls. are picked It is a hardy annual, and in the southern states will bloom most of the year. In the N it blooms up to the first frosts, sometimes beyond. Sown in summer or autumn, it makes a good winter bloomer. Florets are used in medicine as a vulnerary and anti-emetic. The flowering plant was formerly used for removing warts.



741. Calendula officinalis, double-flowered. (×⅔)

suffruticòsa, Vahl (*C. Noeàna*, Boiss.) More diffuse, annual· lvs. sessile, lanceolate, somewhat dentate: heads bright yellow, not doubled, very numerous, on long peduncles W. Medit region.—Seeds are sold by American dealers.

C. Póngei, Hort, and *C. pluvialis*, Linn., will be found under Dimorphotheca.

L. H B.

CALICO BUSH. *Kalmia*

CALIFORNIA POPPY: *Eschscholtzia*

CALIFORNIA YELLOW BELLS: *Emmenanthe penduliflora.*

CALÍMERIS (Greek, *beautiful arrangement*). *Compósitæ* Good daisy-like border plants

Calimeris comprises about 10 Asian herbs, now mostly united with Aster, but horticulturally distinct, and differing from that genus in the hemispherical involucre of few nearly equal scarious-margined bracts, and broad convex receptacle achene flat and hairy. Hardy perennials of low growth, suited to the border in front of stronger plants *C. tatarica* is described in the genus Heteropappus.

incìsa, DC (*C. incisifólia*, Hort? *Aster incisus*, Fisch.) One to 2 ft., erect, corymbose at the summit· lvs lanceolate, remotely incise-dentate; scales of involucre red-margined fls large, purple-rayed or almost white, and yellow-centered —Of easy cult in any good soil, making a display throughout July and Aug The commonest species in cult

altàica, Nees (*Aster altàicus*, Willd.) Lower, pubescent or hispid lvs linear-lanceolate and entire scales of involucre pubescent and white-margined, rays narrow, blue. L. H. B

CALIPHRÙRIA: *Callisphruria*

CÁLLA (ancient name, of obscure meaning). *Arácex.* A monotypic genus, containing a native bog-plant with a white spathe

Herb, with creeping rhizomes and 2-ranked lvs Differs from Orontium in the parallel secondary and tertiary veins of the lf.-blade, as well as in having a prominent more or less fleshy persistent spathe enveloping the spadix, and in the absence of perianth; lower fls perfect, upper staminate; fr a red berry. See *Zantedeschia* for *C. æthiopica*, *C. albo-maculata*, and others The calla of florists, or calla lily, is Richardia of recent books, but is properly Zantedeschia, where it is described and the culture given in this work

palústris, Linn. WATER ARUM Fig 742 Rhizome bearing many distichous lvs. one year, the next only 2 lvs and the peduncle: petioles cylindrical, long-sheathed; blade cordate: spathe elliptical, or ovate-lanceolate, white Eu., N.

Asia, and E. N. Amer. V. 2·197; 14.244. B.M. 1831. —An interesting little perennial plant, useful for outdoor ponds. JARED G. SMITH.

CALLIÁNDRA (Greek, *beautiful stamens*). *Leguminòsæ* Evergreen shrubs and trees of greenhouse culture, planted in the open far south



742. Calla palustris.

Leaves bipinnate; flts numerous: fls usually in globose heads or clusters, corolla small, obscured by the numerous, long, silky, purple or white stamens.—About 120 species, widely distributed in tropics Distinguished from Acacia by the presence of a thickened margin on the pod

Propagation is by cuttings placed in sand over bottom heat Keep in warmhouse, with the exception of those from Mexico.

Lambertiàna, Benth (*Acàcia Lambertiàna*, D. Don) Unarmed; branches terete: lvs. puberulous-villous; pinnæ 2-3-yoked; lflts. 9–12-yoked, oval-oblong, obtuse at both ends, peduncles 3–5, racemose, heads roundish, stamens 20–25, pink. Mex B.R. 721.

tetragòna, Benth (*Acàcia tetragòna*, Willd) Unarmed; branches tetragonal pinnæ 5–6-yoked lflts. 16–29-yoked, linear, acute, the outer larger: heads pedunculate, axillary, fls white. Trop Amer.

portoricénsis, Benth. (*Acàcia portoricénsis*, Willd.). Unarmed shrub or small tree. pinnæ 2–4-yoked; lflts. 15–25-yoked, linear, obtuse, closing at evening, branchlets pubescent: heads globose, pedunculate, axillary, the white fls. opening as lvs close; calyx ciliate on the margin; stamens 20–25, filaments long, white· pod straight, linear, tapering at base W Indies —Endures temperatures as low as 24° F in Calif Var **màjor,** a splendid form, is known abroad B M 8129

Tweèdyi, Benth. Unarmed shrub, lightly pubescent pinnæ 3–4-yoked, lflts 20–30-yoked, linear, obtuse, shining: peduncles axillary, 1–2 in long, from large scaly buds, calyx and corolla silky, lobes erect; stamens long, numerous, purple Brazil B.M 4188.

C calsfórnica, Benth A stiff, hairy, much-branched shrub cult in Calif. It is native near Magdalena Bay and is the most northerly known representative of the genus —*C caracasàna*, Benth (Mimosa caracasana, Jacq) differs from C portoricensis in having purple stamens, but is probably not distinct —*C grandiflòra*, Benth Not over 10 ft foliage glaucous fls. scarlet Intro by Franceschi =Mimosa grandiflora, L Her (?) —*C. Samán*, Griseb., =Pithecolobium Saman. HARVEY MONROE HALL.†

CALLIÁNTHEMUM (Greek, *beautiful flower*). *Ranunculàceæ*. Two or 3 little herbs of the mountains of Eu. and Cent. Asia, allied to Anemone, sometimes mentioned for outdoor planting. Lvs radical (very small or none on the st), decompound fls. terminal, white or rose-color, sepals 5, deciduous; petals 5–15, showy, with nectaries at the base. The species apparently intergrade. **C. anemonoides,** Endl. Three to 10 in. high, blooming in spring: lvs. as broad as long, triangular in outline, bipinnatifid. fls. 1½ in. or less across; sepals broad; petals narrow: rhizome somewhat fleshy. Tyrol. Useful in rockwork.

CALLICÁRPA (Greek, *beauty* and *fruit*) *Verbenàceæ* Ornamental woody plants cultivated chiefly for their brightly colored berry-like fruit appearing late in autumn; also for the attractive flowers which appear in summer.

Flowers perfect; calyx short-campanulate, truncate or slightly 4-toothed, rarely 4-parted, corolla with short tube, 4-lobed; stamens 4, of equal length; ovary 4-celled, cells 1-ovuled. fr a subglobose berry-like drupe with 2–4 stones.—More than 30 species in tropical and subtropical regions of Asia, Austral., N. and Cent. Amer

Callicarpas are shrubs or trees, often with stellate hairs, with opposite, usually serrate, deciduous leaves and small pink, bluish or whitish flowers in axillary clusters, followed in autumn by small berry-like lilac, violet or red, rarely white fruits The hardiest are *C. dichotoma*, *C japonica* and *C Giraldii*, which may be grown even North in sheltered positions, if somewhat protected during the winter If killed to the ground, young shoots spring up vigorously, and will produce flowers and fruit in the same season If grown in the greenhouse, they require a sandy compost of loam and peat, and plenty of light and air Propagation is readily effected by greenwood cuttings in spring or summer under glass, also by hardwood cuttings, layers and seeds.

A *Lvs tomentose beneath.*

americàna, Linn Shrub, 3–6 ft, with scurfy, downy tomentum. lvs cuneate, elliptic-ovate, acuminate, obtusely serrate, 3–6 in. long. cymes short-stalked; corolla bluish, glabrous fr violet July, Aug Woods and rich soil. Va to Texas and W Indies —One of the handsomest in fr, but more tender than the Japanese species Var **álba,** Hort, has white fr; very conspicuous in fall and early winter.

AA. *Lvs not or slightly pubescent below and glandular. corolla glandular outside*

B. *Peduncles longer than petioles lvs glabrous or nearly so below*

japónica, Thunb (*C Mimurazàki*, Sieb) Fig 743 Shrub, 2–5 ft lvs cuneate, elliptic or ovate-lanceolate, long-acuminate, serrulate, 2½–5 in. long· cymes peduncled, many-fld; fls pink or whitish. fr violet Aug. Japan. S I F. 1.70. G C. 1871:173 P. F G 2, p 165. H F. 1861 12. Var. **leucocárpa,** Sieb. With white fr



743. Callicarpa japonica. (×¼)

dichótoma, Koch (*C gracilis*, Sieb. & Zucc *C purpùrea*, Juss) Shrub, 1 4 ft: lvs. cuneate, elliptic or obovate, crenately serrate above the middle, entire toward the base, 1½–3 in. long:

cymes peduncled, few- or many-fld.; fls. pink: fr. lilac-violet. Aug. Japan, China. Gn 23:540.—Closely allied to the former, but smaller in every part.

BB. *Peduncles shorter than petioles.*

Giráldii, Hesse. Shrub: lvs. broadly elliptic or elliptic-ovate to elliptic-lanceolate, 2–4 in. long, dentate, glandular beneath, and sparingly stellate-pubescent; petioles slender, ½–½in long fls pink in dense cymes on pubescent stalks shorter than the petioles: fr. violet. W. China.

C. cána, Lann Shrub, lvs. broadly elliptic, shining above and whitish-tomentose beneath fr deep purple E India, China, Philippine Isls B M 2107 —*C. longifólia,* Lam Shrub lvs oblong-lanceolate or lanceolate, narrowed at both ends, 4–5 in long, stellate pubescent and glandular beneath cymes short-peduncled, fls pink or purple fr white Himalayas, China B. R. 10 864 H E 2 133 —*C. mollis,* Sieb & Zucc Shrub, to 4 ft., lvs. oblong-lanceolate, rounded at the base, tomentose beneath fls. and fr pink. Japan S I F. 1 70 —*C. pedunculáta,* R Br (*C lanata,* Schau., not Linn.) Shrub lvs oblong-ovate, nearly sessile, and rounded at the base, green and slightly tomentose beneath cymes slender-peduncled E Indies Austral Sieb. Flor. d Jard 4 97 —*C. rubélla,* Lindl (*C dichotoma,* Hort., not Juss.) Shrub or small tree, to 20 ft lvs cordate-oblong, tomentose beneath fr purple Himalayas, China B R 11 883 F.S. 13.1359. I H. 6 202 G.C. 1859.96. R H 1859, p 106, 107.

ALFRED REHDER.

CALLICHRÒA: *Lavia*

CALLIÓPSIS: *Coreopsis.*

CALLIPHRÙRIA (Greek, *beautiful prison;* referring to the spathe inclosing the flowers) Written also *Callphuria* *Amaryllidàceæ* Tender bulbs.

Distinguished from Eucharis by the stamens, the filaments being petaloid, with 3 large linear teeth on top, the middle one bearing the anther The fls appear with the lvs, perianth funnel-shaped, spreading upward, stamens inserted at the throat of the tube caps tardily splitting —Three species from Colombia

Calliphrurias are warmhouse plants and should be grown in a rich soil of loam, peat or leaf-mold and sand. Propagated by offsets.

Hartwegiàna, Herb Bulb ovoid, 1 in. thick, stoloniferous, with brown membranous tunics lvs bright green, firmer and more closely veined than in Eucharis, with an oblong-acute blade 4–5 in. long, 2 in broad, narrowed into a petiole, which is flat above and round beneath scape slender, 1 ft long, fls 6–8, in an umbel, white, perianth 1 in long and wide Andes of Bogota — B.M. 6259 B R. 30, p 87, desc. Intro. in 1839 by Reasoner

C subedentàta, Baker=Eucharis subedentata.

N. TAYLOR.†

CALLIPRÒRA. *Brodiæa*

CALLIPSŸCHE (Greek, *beautiful* and *butterfly*) *Amaryllidàceæ* Three bulbous plants from Ecuador and Peru, the lvs produced after the yellow or greenish yellow fls, probably not in the horticultural trade. Leaves thin, oblong and stalked: fls. many in an umbel on a hollow peduncle or scape; perianth funnelform with short tube, the segms. all equal and oblanceolate to oblong, stamens 6, much exserted, attached at the throat. fr. a deeply 3-lobed caps, with many seeds. They require the general treatment given amaryllis. **C. mirábilis,** Baker, has an oblong bulb 2 in. diam.: lvs. 1 or 2, blade 5 or 6 in broad: peduncle 2–3 ft.; fls. greenish yellow, about 30 in a dense umbel, stamens three times as long as perianth and widely spreading. July, Aug **C. aurantiaca,** Baker, has an ovoid bulb 1 in diam: lvs. few. peduncle 1½–2 ft.; fls. bright yellow, 6–8 in the umbel, stamens green, twice the length of perianth. Autumn and winter B M 6841.

L. H. B.

CALLÍPTERIS (Greek, *beautiful fern*). *Polypodiàceæ.* Ferns allied to Asplenium and Diplazium, with elongate sori formed on both sides of the veins, and the veins uniting to form meshes or areoles —Some 15 species are known from the warmer parts of both hemispheres The following is the only one in cult. Culture the same as for tropical aspleniums

prolífera, Bory (*Asplènium decussàtum,* Swartz). Lvs 3–6 ft. long, the stalks 1–2 ft. long, the pinnæ numerous, 6–12 in long, 1–2 in. wide, with deeply crenate margins and frequently with bulblets in the axils; veins pinnate, with the branches of contiguous veins uniting. Polynesia and Malaya.

L M. UNDERWOOD.

CALLÍRHOË (Greek mythological name). Written also *Callirrhoe* *Malvàceæ* Hardy showy herbs, for outdoor planting.

Perennials or annuals lvs alternate, with lobed or cleft blades or more finely dissected. fls. showy, axillary or sometimes in terminal racemes, the petals irregularly cut at the apex or truncate, differing in this from the notched petals of Malva, involucel of 1–3 bracts, or wanting —Nine species, native

The callirhoes are of the easiest culture, and deserving of a much greater popularity. They are chiefly propagated by seeds, but the perennial species may also be propagated by cuttings



744 Callirhoe pedata.

A *Annual involucel absent*

pedàta, Gray Fig 744 Height 1–3 ft. st erect, leafy. radical and lower lvs. round-cordate, palmately or pedately 5–7-lobed or -parted, the lobes coarsely toothed or incised, upper 3–5-cleft or -parted, usually into narrow divisions fls red-purple, cherry-red, varying to lilac On plains and in sand, S. U. S., spring and summer. R.H. 1857, p 430

AA *Perennial: involucel present.*

involucràta, Gray Height 9–12 in, plant hirsute or even hispid. root large, napiform sts. procumbent: lvs of rounded outline, palmately or pedately 5–7-parted or -cleft, the divisions mostly wedge-shaped, incised, the lobes oblong to lanceolate: fls. crimson-purple, cherry-red or paler All summer. Minn. to Texas R H 1862:171 (as *C verticillata*).

Var **linearíloba,** Gray (*C. linearíloba,* Gray). Less hirsute than the type: sts ascending: lvs. smaller, 1–2 in. across, the upper or all dissected into linear lobes. fls lilac or pinkish. Texas and adjacent Mex.— An excellent trailer, especially for rockeries. Thrives even in very dry soils, the root penetrating to a great depth. A sunny position is preferable.

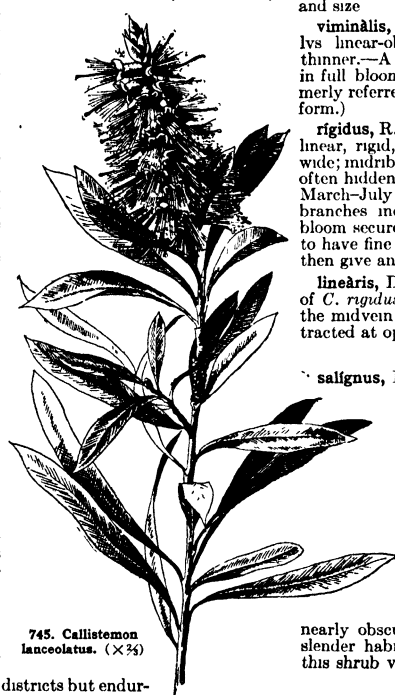
C Papáver, Gray A perennial decumbent or ascending plant with 3–5-lobed or -parted lvs and involucrate purple-red fls S U.S. —Useful for very dry sandy places.

N TAYLOR †

CALLÍSTA· *Dendrobium.*

CALLISTÈMON (Greek, *kallos*, beauty; *stemon*, a stamen; in most of the species the stamens are of a beautiful scarlet or crimson color). *Myrtàceæ* BOTTLE-BRUSH Ornamental shrubs, thriving without irrigation in California, where they are hardy and much used; also planted to some extent elsewhere in warm climates and occasionally seen under glass. Page 3566

Leaves alternate, entire, lanceolate or linear, mostly with oil- or resin-dots and fragrant when crushed. fls. in dense cylindric spikes, at first terminal but the axis growing out as a leafy shoot; calyx-teeth 5; petals 5, deciduous; stamens indefinite in number, not united; anthers versatile, the cells parallel and bursting longitudinally; ovary inferior, maturing into a caps. which persists for several years.—About 25 species, natives of Austral., where they inhabit arid districts Distinguished from Melaleuca only by the stamens, which in that genus are united into bundles. Hall, Univ Calif. Pub Bot 4:22.



745. Callistemon lanceolatus. (×⅜)

The showy flower-clusters, resembling bottlebrushes in shape, and so giving the common name to the genus, are highly colored and render these shrubs very ornamental The quantity of bloom may be much increased by judicious autumn pruning The various species are recommended for parks, depot-grounds, school-yards, and also for smaller yards if kept well pruned Hardy only in warm-temperate districts but enduring temperatures less than 20° F

Propagation from seeds is satisfactory: these are gathered during the summer months by allowing the capsules to open in boxes or on sheets of paper kept in a warm place, sow in early spring in finely sifted mixture of sand, leaf-mold, and loam, and cover very lightly; the ordinary cool greenhouse is warm enough. Some nurserymen state that plants from cuttings of ripened wood or of wood which is getting firm at the base will blossom earlier than seedlings; others find no advantage in this method. Although adapted to nearly every variety of soil, these plants make but slow growth in heavy clay

A *Stamens ¾–1 in. long.*

lanceolàtus, DC. (*Metrosidèros semperflòrens*, Lodd.). Fig. 745. Height 6–12 ft.: lvs. lanceolate, 1¼–2½ in. long, about ¼in. wide, acute, reddish when young; midrib and lateral veins prominent: spikes 2–4 in long, bright red, less dense than in the following species: fr. ovoid, contracted at summit. Jan.–June. B.M. 260 (as *M. citrina*). Maiden, Fl. Pl. and Ferns of New S. Wales, 8.—Attains 30 ft. in Austral. where the hard and heavy wood is used for wheelwrights' work and for mallets. Garden hybrids between this and other species have been developed, especially in Eu.

speciòsus, DC. Large shrub: lvs. narrowly lanceolate, obtuse or acute, 1½–4 in. long, about ¼in broad; midrib prominent but lateral veins obscure. spikes 2–6 in long, bright red, very dense. fr. nearly globose, the summit scarcely contracted. March–June. B.M. 1761. —The most highly colored callistemon, the golden anthers contrasting well with the dark red filaments. There are many garden forms varying in color, habit, and size

viminàlis, Cheel Tall slender tree of pendulous habit: lvs linear-oblong. stamens slightly shorter: rim of fr. thinner.—A handsome, graceful tree, very showy when in full bloom. Grown at Santa Barbara, Calif. (Formerly referred to *C. speciòsus*, of which this may be a form.)

rígidus, R. Br. (*C. linearifòlius*, DC.). Lvs. narrowly linear, rigid, sharp-pointed, 2–5 in long, about ⅛in. wide; midrib and marginal ribs prominent; cross-nerves often hidden by oil-dots. spikes deep red, large, dense March–July B.R. 393. —Stiffly branched shrub, the branches inclined to become rangy; best form and bloom secured by means of autumn pruning In order to have fine specimen plants, cult well and now and then give an application of commercial fertilizer

lineàris, DC Scarcely more than an extreme form of *C. rigidus* with very narrow lvs channeled above, the midvein quite obscure: fr. more globular and contracted at opening.

AA *Stamens ½in. or less long.*

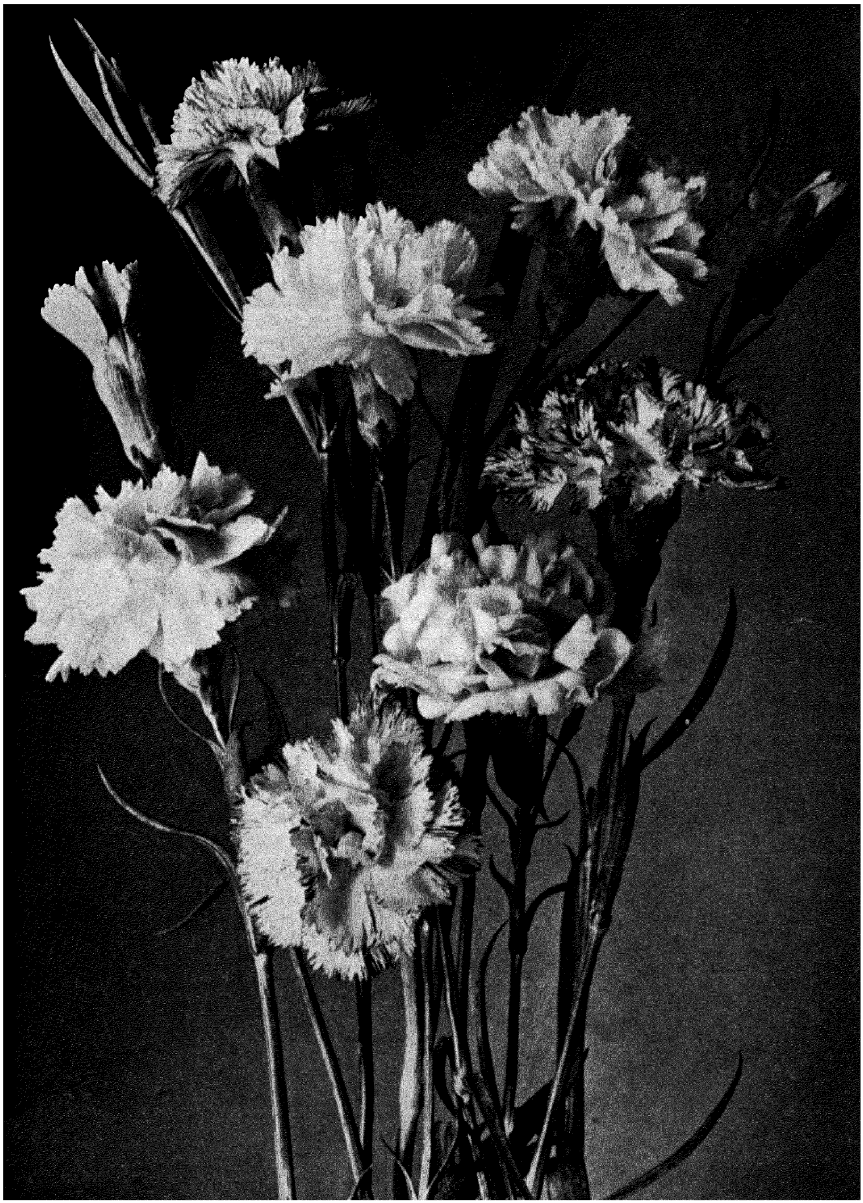
salígnus, DC Tall shrub or small tree: lvs. lanceolate, acute, 1½–3 in long, ¼–¾in wide (much narrower in one variety), very distinctly penniveined. spikes yellow or light pink, 1–2 in long fr nearly globular, with rather large opening. Apr., May. B M 1821 Var **viridiflòrus,** F v M Lvs. only 1–2 in long, thicker, rigid; veins obscure fls greenish yellow B M. 2602.

brachyándrus, Lindl Slender shrub, young shoots soft-hairy or whole plant gray with a soft pubescence lvs rigid, nearly terete, ¾–1½ in. long: spike 2–3 in. long, the filaments dark red but nearly obscured by the golden yellow anthers —The slender habit, gray foliage, and golden bloom render this shrub very desirable for ornamental planting

HARVEY MONROE HALL.

CALLÍSTEPHUS (Greek words for *beautiful crown*, said to be in allusion to character of fruit) *Compósitæ.* CHINA ASTER (See page 419, Vol. 1) One species in China and Japan. The genus Callistemma, also erected by Cassini, is older than Callistephus, but the latter is one of the "nomina conservanda" of the Vienna code, retained because accepted and in general use for fifty years following its publication. Under both these generic names, Cassini described the China aster as *C hortensis* It was first named by Linnæus, however, as *Aster chinensis*, and Nees subsequently transferred this name to Callistephus, so that the plant now would better bear the name *Callistephus chinensis*, Nees.

Callistephus is closely allied to Aster, from which it differs, among other things, in its pappus, which is minute and forming a crown in the outer series, and of slender longer barbellate and caducous bristles in the inner series: annual, erect, hispid-hairy branching herbs, with showy terminal fl.-heads: lvs. alternate,



XXII. Carnations. — Types of the American winter-flowering varieties. (Half size.)

broadly ovate or triangular-ovate and deeply and irregularly toothed; blade decurrent into a petiole, those on the upper parts becoming spatulate or narrower: heads in wild plant heterogamous and radiate, the ray-florets in 1–2 series and pistillate, the disk-florets perfect and fertile; involucre hemispherical, the bracts imbricated in many series and the outer ones large and green. fr. a compressed achene. The rays become much multiplied under cult., and they are also variable in size, shape and color. The colors are violet, purple, blue and white, the rays never being true yellow. Widely variable under cult., and one of the best of the garden annuals, growing from 6 in. to 2½ ft. high. It is the Reine-marguerite of the French and the Sommeraster of the Germans. L. H. B.

CALLÍTRIS (from the Greek for *beautiful*). Including *Frenela* and *Widdringtonia*. *Pinaceæ*. Evergreen trees or shrubs, not quite hardy in the open in England, but thriving well in the southernmost parts of the United States; allied to Thuja.

Leaves scale-like or awl-like, in whorls of 3 or 4 on jointed branches, or sometimes alternate: monœcious; sterile catkins cylindrical or ovoid, the stamens in whorls of 3 or 4, the scales broad and sometimes peltate, fertile cones of 4–8 scales, and borne on short and thick peduncles, either solitary or clustered, usually ripening the second year and often persisting after the seeds have fallen.—About 15 species in Austral., New Caledonia and Afr. Little known in cult. here.

A. *Cone 6-valved*

robústa, R. Br (*Frenela robusta*, Cunn.). Cypress Pine. Ranging from a shrub to a tree 90 ft. high: branchlets crowded, short and erect: sterile catkins ¼in. or less long, solitary or in 3's: cones solitary or few-clustered, nearly globular, about 1 in. diam.; seeds usually 2-winged. Austral.—Trees about 30 years old are said to be growing at Santa Barbara. In S. Fla. it makes good specimens, in 5 years becoming 10–12 ft. high. The tree somewhat resembles red cedar, and is reported as useful for tall hedges and windbreaks. This is one of the "pines" of Austral., the wood being used in building and for the making of furniture.

rhomboídea, R. Br. (*Frenela rhomboidea*, Endl.). Smaller, reaching 25–50 ft. branches somewhat slender and often drooping, angled when young: cones usually only one-half the diam. of those of *C. robusta*, globular, the 6 valves alternately larger and smaller, the larger valves having a broadly rhomboidal apex with a protuberance at the center. Austral. and Tasmania.—Timber used for telegraph poles and in construction.

AA. *Cone 4-valved.*

quadriválvis, Vent. (*Thuja articulata*, Vahl). Arar-Tree. Sandarach Gum Tree. Small tree, with fragrant hard durable wood. branches jointed and spreading. lvs. very small, flattened, distichous, reduced to scales at the nodes. cone 4-sided, small, the valves oval and with a protuberance near the tip. N. Afr., in the mts. L.B.C. 9.844.—Furnishes varnish resin (gum sandarach).

Whÿtei, Engler (*Widdringtonia Whytei*, M. Wood). The wood is dull reddish white, strongly aromatic, and locally used for furniture and for doors and windows. Tree attaining a maximum height of 140 ft., with a diam. of 5½ ft. at a point 6 ft. above the ground, the trunk being clear for 90 ft.: lvs. on ultimate branchlets, deltoid and closely appressed opposite; on other branchlets usually linear-lanceolate, spreading at the tips, alternate. in seedling stage linear, spreading and about 1 in. long: cones 4–6 together, about ¾in. long and ¾–1 in. wide when open. S. E. Afr.—It grows at an altitude of 5,000–7,000 ft. on Mt. Milanji in Nyassaland and is known as the Milanji cypress or cedar. Apparently hardy in parts of Cent. Calif. L. H. B.

CALLÓPSIS (*Calla-like*). *Aracæ*. A single species from German E. Afr. **C. Vólkensii,** Engler. Spathe like that of a little calla, snow-white, 1¼ in. long by 1 in. broad, the spadix partly united to it (and yellow): lvs. crowded, cordate-ovate, 5 in. long, shining, the petiole about 2 in. long, semi-epiphytic, with creeping rhizome. Probably cult. only in botanic gardens or other collections.

CALLÙNA (Greek, *to sweep*, the branches are sometimes used for making brooms). *Ericaceæ*. Heather. Low evergreen shrubs cultivated chiefly for their bright rosy pink, rarely white flowers appearing in great profusion late in summer.

Leaves scale-like, opposite, in 4 rows, the branchlets therefore quadrangular: fls. in terminal, 1-sided spikes; corolla campanulate, 4-parted, shorter than the 4-parted colored calyx, stamens 8, with 2 reflexed appendages: fr. a septicide, 4-celled, few-seeded caps.—One species in W. and N. Eu., also in Asia Minor; in E. N. Amer. in some localities naturalized. The genus differs from the closely related Erica in its deeply 4-parted colored calyx, longer than the 4-parted corolla. For culture, see *Erica*.



746. Calluna vulgaris. (Plant ×⅓)

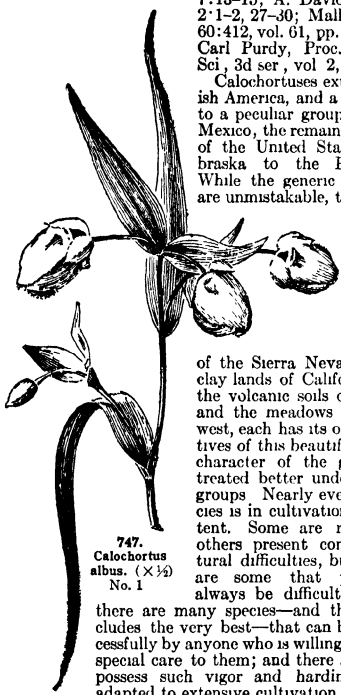
vulgàris, Salisb. (*Erica vulgaris*, Linn.). Fig. 746. From ½–3 ft.: lvs. oblong-linear, obtuse, sagittate at the base, glabrous or pubescent. fls. small, in long, erect, rather dense racemes, rosy pink, sometimes white. Aug., Sept.—Some of the most distinct of the numerous named varieties are the following: **Var. álba,** Don (and var. *álba Hámmondii*), with white fls.; var **Alpòrtii,** Kirchn., of more vigorous growth, with rosy carmine fls.; var **cárnea,** Hort., with flesh-colored fls.; var. **plèna,** Regel, with double rose-colored fls.; **var. hirsùta,** Gray (var *tomentòsa*, Don), the branchlets and lvs. with grayish tomentum; var **nàna,** Kirchn. (var *pÿgmæa*, Hort.), forming low moss-like tufts, var **rùbra,** Kirchn., with deep rosy carmine fls., var **prostràta,** Kirchn., with the branches spreading and partly prostrate, fls. pink; var **Sèarlei,** Hort (var *álba Sèrlei*, Hort.), fls. white, appearing late in autumn.—The heather is a very handsome small shrub, well adapted for borders of evergreen shrubberies, or for dry slopes and sandy banks and preferring sunny positions; it is also found growing well in swamps and in partly shaded situations. Cut branches keep their life-like appearance for many months.

Alfred Rehder.

CALOCHÓRTUS (Greek for *beautiful* and *grass*). *Liliaceæ*. Incl. *Cyclobothra*. Mariposa Lily. Star Tulip. Globe Tulip. West American cormous plants, the occidental representatives of Tulipa, useful as border plants and to some extent for indoor culture.

Stem usually branched, and from a coated corm, more or less leafy: perianth of unequal segms., the outer ones the smaller and more or less sepal-like, the 3 inner ones large and showy and bearing glands and hairs; stigmas 3, sessile and recurved, stamens 6; fls. showy, shallow-cupped on the inner segms., arching.—From 40–50 species, mostly on the Pacific side of the con-

tinent from Wash. to Mex., and some of them in the interior country. Nearly all the species are in cult. Monogr. by J G. Baker, Journ. Linn. Soc 14:302–10 (1875); and by S Watson, Proc. Amer. Acad. Arts and Sci. 14:262–8 (1879). See also Colochorti in the Sierra Nevada, by George Hansen, Erythea, 7:13–15, A. Davidson, Erythea, 2·1–2, 27–30; Mallett. Gn. 1901, 60:412, vol. 61, pp. 185, 203, 220; Carl Purdy, Proc. Calif. Acad. Sci, 3d ser, vol 2, No 4 (1901).



747. Calochortus albus. (×½) No. 1

Calochortuses extend into British America, and a few, belonging to a peculiar group, are found in Mexico, the remainder are natives of the United States, from Nebraska to the Pacific Ocean. While the generic characteristics are unmistakable, the species and even varieties have the most variable inclinations as to soil, exposure and climate. The Colorado Desert and the summits of the Sierra Nevada, the heavy clay lands of Californian valleys, the volcanic soils of the foothills and the meadows of the Northwest, each has its own representatives of this beautiful tribe. The character of the genus can be treated better under the various groups Nearly every known species is in cultivation to some extent. Some are readily grown, others present considerable cultural difficulties, but while there are some that probably will always be difficult to cultivate, there are many species—and the number includes the very best—that can be grown successfully by anyone who is willing to give a little special care to them; and there are a few that possess such vigor and hardiness as to be adapted to extensive cultivation.

All calochortuses are hardy in the sense of withstanding extreme cold, but they will not endure alternate thawing and freezing nearly so well; and thus there is the paradox of their going safely through severe eastern or European winters and suffering the loss of foliage in mild ones. They should be planted in the fall, and it is better to plant late, so that leaf-growth is delayed until spring. Diverse as are their natural habitats, one soil will answer the needs of all. A light loam, made lighter with sand or sawdust, powdered charcoal, or spent tan-bark, is best. Excellent results have been secured with a mixture of equal parts of a good light loam and spent tan-bark, with a little broken charcoal. Wallace, one of the most successful English growers, recommends making a bed sloping to the south, composed of leaf-mold and road grit in equal parts, with a smaller proportion of sharp sand. The idea is to have a light and porous, not too stimulating soil, with perfect drainage. Wallace recommends covering the beds with reeds to throw off the heavy rains. The same end may be attained by such thorough drainage that the rains pass through quickly. In New York, they have been carried through the winter safely under a covering put on before the ground freezes hard. It is well to keep a few leaves about the shoots for a time and to have extra leaves at hand to be used when frost threatens. It is better to lift the bulbs as soon as they ripen, and replant in the fall. Water sparingly at all times Under suitable conditions they are hardy and tenacious of life, but excessive moisture, either in air or ground, is not to their liking after the flowering season arrives. Theoretically, all calochortuses of Section A (star and globe tulips) should have shade, and all mariposas (AA) sunshine; but the light shade of a lath-house suits all alike, giving much finer bloom in the mariposas. The flowering season extends over three months, according to species.

They take well to pot culture with similar soils and treatment. While not to be forced rapidly, they considerably anticipate their out-of-door season. The same treatment can be used in coldframe culture, but they must not be coddled too much.

INDEX.

albus, 1.
amabilis, 3.
amœnus, 1.
apiculatus, 12
atrovioláceus, 28.
aureus, 22
Bonplandianus, 37.
Benthamii, 6
cæruleus, 7
catalinæ, 31.
citrinus, 25
clavatus, 23
collinus, 10
concolor, 24
Eldorado, 27.
elegans, 8, 9.
flavus, 36
flexuosus, 29.
Goldyi, 4
Greenei, 17.
Gunnisonii, 34.
Howellii, 19
Kennedyi, 21.
Leichtlinii, 33.
lilacinus, 15.
Lobbii, 9.
longebarbatus, 18.
luteus, 24, 25
Lyallii, 8
Lyonii, 31
macrocárpus, 35.
major, 5, 28
Maweanus, 5
montanus, 28.
nanus, 8
nitidus, 16
nudus, 14
Nuttallii, 32
obispoensis, 20.
oculatus, 25
Palmeri, 30
pictus, 27
Plummeræ, 20
pulchellus, 2
Purdyi, 13
purpurascens, 20, 27.
purpureus, 37
robustus, 25
roseus, 5, 27
rubra, 5, 28
sanguineus, 27.
splendens, 28
sulphureus, 27.
Tolmiei, 11
umbellatus, 10.
uniflorus, 15
venustus, 25, 27.
Vesta, 26
vestus, 20
Wallacei, 6
Weedii, 20

A. *Blossoms or fr more or less nodding (unless No 4)· inner perianth-segms strongly arched lvs long and glossy, not channeled. (Eucalochortus)*

B. *Fls. subglobose, nodding st usually tall and branching* GLOBE TULIPS —These have a single long and narrow shining lf from the base, and slender, flexuous, leafy sts, the perfection of grace in outline The fls are exquisite in delicacy of tints Woodland plants

1. **álbus,** Douglas (*Cyclobóthra álba,* Benth) Fig 747. Strong, 1–2 ft. high, glaucous. fls globular, pendent, 1 in across, of a satiny texture, delicately fringed with hairs, very strongly marched or practically closed Calif B R. 1661 F S. 11.1171 —Chaste and delicate The form from the Coast Range is the Pearl calochortus of gardens; the form from the Sierras with fls less strongly marched and at length opening slightly is the *C albus* of horticulture.

Var. **amœnus,** Hort (*C. amœnus,* Greene) Like *C albus,* but rose-colored, lower and more slender fls opening in full bloom. Fresno and Tulare Co, Calif.

2. **pulchéllus,** Douglas (*Cyclobóthra pulchélla,* Benth) Stout, glaucous, 8–16 in, usually branching fls yellow, strongly inarched but parts not overlapping, sepals shorter than petals, ovate-acuminate, yellow tinged with brown on the back, petals ovate, obtuse, 1 in. or less long, canary-yellow, with long silky hairs above the gland. Cent. Calif. B R 1662

3. **amábilis,** Purdy. Habit like *C albus* sts stout, usually branching in pairs. petals clear yellow, very strongly inarched so that the tips overlap each other much like a child's pin-wheel; gland lined with stiff hairs that cross each other; petals margined with a line of stiff hairs. Cent. and N Calif.

4. **Góldyi,** Watkins. Possibly *C Benthamii* × *C. amabilis* Sts several, freely branched, bearing 15–20 fls.: lvs. narrow-lanceolate: fls erect, 1 in across, straw-yellow, inner surfaces covered with long silky sulfur-tinted hairs and a few shorter crimson hairs deep down in the cup; petals rounded and very hooded. Apparently of garden origin.

BB. *Fls. bell-shaped, erect when open, mostly lined with hairs, the pedicels becoming recurved: st. mostly low, and fls often more or less umbellate.* STAR TULIPS proper.—Like the globe tulip, but smaller as a rule, and the fls. dainty open cups. All of the species resemble each other, and were first included under the name *C. elegans.*

5. **Maweànus,** Leichtl Plant low (3–10 in.), very slender, usually branched: fls. white, purplish at the base, filled with silky hairs, the gland covered by a broad semi-circular scale: caps long-elliptic. Calif.,north. B M. 5976 (as *C elegans*) —Variable Var. **màjor,** Hort. Twice as large in all its parts. fls. lighter colored. Var **rôseus,** Hort. Fls. tinged rose.

6. **Bénthamii,** Baker Sts 7 in. high, very flexuose, dividing into pairs: lvs. linear-lanceolate fls. nearly erect, yellow, the segms ½in long and brown at the base Sierra Nevadas, in Calif B M 6475. J H III. 30 519 Var **Wállacei** (*C Wállacei,* Hort). Claw of the petal dark red or nearly black

7. **cærûleus,** Wats. Similar to small plants of *C. Maweanus,* but lined and dotted with blue: low, 2–5-fld , the pedicels very slender; perianth ciliate inside caps nearly or quite orbicular. Calif , in the Sierras Not variable

8 **élegans,** Purs. Similar to the last: petals greenish white and purplish at base, bearded, little or not at all ciliate gland covered by a deeply fringed scale. Ore , Idaho

Var **nànus,** Wood (*C. Lyàllii,* Baker). Subalpine, dwarf and very slender petals delicate cream-color, narrow and usually more acute, more hairy and ciliate. Mts Calif , N

9 **Lôbbii,** Purdy (*C. élegans* var *Lóbbii,* Baker). St 3–5 in high petals white tinged green, broadly rhombic-ovate, very deeply pitted and with the pit showing as a prominent knob on back of petal. Mt. Jefferson, Ore

10 **umbellàtus,** Wood (*C. collìnus,* Lemm.). Low and branching, 3–15 in , flexuose fls 5–10, white; petals broadly fan-shaped, nude excepting for many white hairs just above the scale In open grassy places around San Francisco Bay.

BBB *Fls bell-shaped like* BB, *but tall (1 ft or more), and stoutly erect, with several fine, erect cups, similar to C Maweanus.* GIANT STAR TULIPS — In this splendid group the very dainty silky fls. and handsome glossy lvs of the star tulip are shown with a stout st. a foot or two high, and large fls Unlike the others, they grow naturally in open places, and have a vigor and health which are a high recommendation

11. **Tôlmiei,** Hook & Arn Stout, a foot high, generally branched petals often more than an inch long, tinged lilac, with purple and white hairs. gland without a scale caps broad-elliptic, acutish. Mt. Shasta, N.— Remains a long time in bloom

12 **apiculàtus,** Baker. Taller and stouter, 12–18 in , with umbellate straw-colored fls. N. Idaho

13. **Púrdyi,** East Glabrous and glaucous, 8–16 in., rather stout, branching, 2- to many-fld fls. creamy white or purple-tinged, filled with blue hairs, gland absent. S. Ore. G C. III. 23 395.—Very handsome.

BBBB. *Fls bell-shaped, the petals naked or hairy only at the base: low: if solitary.* MEADOW TULIPS — These calochortuses are natives of wet meadows. *C. uniflorus* and *C Vesta* grow well in all soils so long as well drained, and, as garden plants, thrive everywhere. In habit they are low, flexuous and leafy. The cups are open, erect and numerous, an inch or so in diam.

14. **nûdus,** Wats. Low, 2–4 in., delicate: lf. solitary: fls. 1–6, umbellate, small, greenish white or pale lilac, nude except for a tuft of 2 or 3 short hairs at each extremity of scale, denticulate. Calif., in the Sierras.

15. **unifl5rus,** Hook. & Arn. (*C. lilacinus,* Kell.). Handsome species, 4–8 in high. fls. 4–10, on long pedicels, clear lilac, hairy only at base: caps elliptic, obtuse. B.M. 5804 —Grows naturally in wet meadows, and makes offsets very freely. Often seen in a depauperate starved form, but responds at once to good treatment.

AA. *Blossoms on stout, erect pedicels, the sts. stout and strict: fls. open-bell-shaped.* MARIPOSA TULIPS.— Excepting in B, the mariposa or butterfly tulips have slender, grassy, radical lvs , stiff, erect sts. bearing cup-shaped fls , and sparingly leafy and with an erect caps. Bulbs small.

B. *Caps. oblong, acute-angled or winged: fls. lilac or white* These are hardy species, growing in the meadows from Ore to Mont , where they endure much cold. They form a connecting link between the giant star tulips and the true mariposas. Their lvs are like those of the star tulips —long, broad and glossy Like the star tulips, also, the seed-pod is handsome, 3-cornered and winged. The sts are stiffly erect the fls cup-shaped, not so brilliant as the true mariposas, but very delicate the plants are hardy, healthy and vigorous, and are to be highly recommended for cold climates

16. **nîtidus,** Douglas Scape erect, but not stiff lf. solitary, glossy, narrow fls 1–3, large and showy, lilac, yellowish, or white, with a deep indigo blotch in the center, lined with yellow hairs Meadows, E Ore to Mont and N E Nev Specimens from Yellowstone Lake are yellow.—Very beautiful and showy.

17. **Greènei,** Wats St stout and branching, 1 ft , 2–5-fld.: sepals with a yellowish hairy spot, petals lilac barred with yellow below, and somewhat purplish, loose-hairy, not ciliate caps beaked Calif. and Ore.

18 **longebarbàtus,** Wats Slender, about 1 ft high, bulb-bearing near the base, with 1 or 2 narrow radical lvs , 2-branched and usually 2-fld fls erect or nearly so, lilac with yellow at base, scarcely hairy except the long-bearded gland. Wash

19 **Hòwellii,** Wats St erect, 1 ft or more, 1–2-fld : lvs very narrow sepals ovate, short-acuminate; petals yellowish white, 1 in long, denticulate, slightly ciliate near the base, brown-hairy inside, the gland yellow-hairy. Ore.

BB *Caps. oblong, obtuse-angled.*

C. *Color yellow or orange or orange-red, more or less marked with brown and purple (except in forms of C luteus): in cult forms running into other colors.*

20 **Weèdii,** Wood Radical lf single, glossy, broad: st. tall, leafy, bearing large orange-colored fls dotted with purple. petals triangular, square-topped gland small, hairy: bulb heavily coated with fiber. S Calif. B M. 6200 (as *C citrinus*). G C III. 16.183.—Varies to white.

Var **purpurâscens,** Wats. (*C. Plúmmeræ,* Greene). Similar, but lilac or purple and very showy. Calif. G C III. 16·133. J H III 29:289. Gn. 47: 80 —A fine form with fl. of large size and full outline, lined with long, silky yellow hairs.

Var **vêstus,** Purdy. Petals much more truncated and curiously fringed with brown hairs; reddish brown. Santa Barbara.

Var. **obispoénsis,** Purdy (*C obispoénsis,* Lemm.). Fig. 748. Tall and slender, branching, very floriferous: petals yellow, verging to red at the tip and less than half the length of the orange-brown sepals. Calif. G.F. 2:161 (adapted in Fig. 748).—Odd and bizarre.

21. **Kénnedyi,** Porter. Bulb small and ovoid: st. very low, 1–4 in.: lvs. linear, tufted from the branching of the st.: fls. 2–4, in an umbel; sepals broad with a purple spot; petals red-orange to vermilion, not ciliate nor prominently hairy, purple-spotted at the center. Desert species of S. Calif. B M. 7264. Gn. 43:108. —Brilliant and desirable, but difficult to grow.

22. **aûreus,** Wats. Low, 4–6 in., with a single carinate radical lf.: petals yellow, not hairy, the hairy gland purple-bordered. S. Utah.



748. Calochortus obispoensis. No. 20 var. (×½)

23. **clavàtus,** Wats. Petals yellow lined with brown, the lower part bearing club-shaped (clavate) hairs, the gland deep and circular; anthers purple. Calif.— In this excellent sort we have the largest-fld. and stoutest-stemmed of all mariposas. The bulb is very large, the single bare lf. 1 or 2 ft. long: the st. is heavy, stout and zigzag. The fls. are shaped like a broad-based bowl, sometimes 5 or 6 in across The color is a deep, rich yellow, and the lower half is covered thickly with stiff yellow hairs, each tipped with a round translucent knob, and in the light look like tiny icicles. There are various strains: Eldorado, the largest, not so deep yellow; Ventura, very stout, deep yellow; Obispo, like the last, but the upper half of the back of each petal is olive-brown, which shows through the deep yellow of the inside, giving changeable shades.

24 **cóncolor,** Purdy (*C. lùteus* var. *cóncolor,* Baker). Bulb large reddish. lvs. narrow, glaucous: st. 1–2 ft., umbellate, if more than 1-fld.: not zigzag; petals a rich deep yellow, tending toward orange, lower third densely hairy with long yellow hairs above an oblong gland. A desert species of S Calif. Much like *C. clavatus* in general aspect.

25. **lùteus,** Douglas. Butterfly Tulip. St. 1–10-fld, bulb-bearing near the base. lvs. very narrow: sepals narrow-lanceolate, with a brown spot; petals 2 in. or less long, yellow or orange, brown-lined, slightly hairy below the middle, the gland densely hairy. Calif B.R. 1567.—Variable. Some of the forms are sold as *C. venustus.*

Var. **citrìnus,** Wats. (*C. venùstus* var. *citrìnus,* Baker). Petals lemon-yellow, with a central brown spot.

Var. **oculàtus,** Wats. (*C. venùstus* var. *oculàtus,* Hort.). Petals pale or white, lilac or yellowish, with a dark spot.

Var. **robústus,** Purdy (*C. venùstus* var. *robústus,* Hort.). A very bulbiferous form having white fls. luridly tinged in browns and purples. Very beautiful and also one of the hardiest.

26. **Vésta,** Purdy. Butterfly Tulip. Tall and large-fld. with petals more narrowly cuneate than in *C. luteus* var. *oculatus,* and the gland narrow and doubly lunate, color from white tinged through lilac to pink and lilac-purple; fl. often lacinately gashed, above the gland bearing rich maroon pencilings and markings. N. W. Calif. in adobe soil —One of the largest-fld., showiest and most easily grown of mariposa tulips. Named by its author in compliment to his wife

cc. *Color prevailingly white or lilac, but sometimes running into yellows.*

27. **venùstus,** Benth. Butterfly Tulip Stout, 6–36 in.: petals white or pale lilac, with a reddish spot at top, a brown-yellow center, and brown base: gland large and oblong, usually densely hairy. caps. 1–2½ in. long. Calif B R. 1669. F S 2 104 Gn. 46, p. 395.—Very variable The yellow forms (as var *sulphùreus,* Hort) are often treated as forms of *C luteus* To this group of calochortuses is properly applied the Spanish name mariposa (butterfly), for their brilliantly colored fls, with eye-like spots on each petal and sepal, and other delicate markings with dots, lines and hairs, which are strongly suggestive of the wings of a brilliantly colored butterfly. Botanists have variously divided this great group of allied forms between *C. luteus* and *C. venustus* Botanically all may be considered as either strains of one variable species or as a number of closely allied species.

Var. **Eldorâdo,** Purdy. The finest strain of *C. venustus* in cult. It occurs naturally in a wonderfully varied mixture, in color from pure white through pink, to deep glowing reds and through lilac to deep purples. In one locality a few may vary to light yellow. Some of these forms have been named var *pictus* for the white form, var. *sanguineus* for the blood-red. The purple forms are entirely distinct from *C. venustus* var. *purpurascens.* Sierran foothills from Eldorado County to the far South. Altogether these plants comprise the loveliest group of the mariposa tulips.

Var. **purpurascens,** Wats. Petals deep lilac or purplish, darker at center, the fl. fully 3 in. across. Coast Range. Strong grower. Gn. 46.394.

Var. **rôseus,** Hort. (*C. rôseus,* Hort.). Creamy white or lilac, with an eye midway and a rose-colored blotch at apex. Gn 46.394.

Var. **sulphùreus,** Purdy. Taller than the type: petals light warm yellow with eye, and with a rose-colored blotch at top. Lower part of San Joaquin Valley, Calif.

28. **spléndens,** Douglas. Tall and slender, 1–2 ft.: fls. 1–1½ in. across, deep purple with a dark spot on the claw and with or without a gland covered with matted hairs. San Diego Co., Calif. Known in horticulture as *C. splendens* var. *atrovioiaceus.*

Var. **màjor,** Purdy. Strong and tall, 1–2 ft.: fls. 2–3 in. across; petals large, clear lilac, paler below, with a

darker claw and scattered long white hairs below the middle. Coast Ranges, Monterey Co., Calif.

Var. **montànus,** Purdy. More slender than the type, often bulbiferous: lilac to salmon-pink, densely hairy with short yellow hairs about the gland. High mts., S. Calif.

Var. **rùbra,** Purdy. Large, with deep-seated reddish bulb, 1–3 ft.: fls. reddish lilac, pink or purple; petals quite hairy, with short hairs on the lower third. Lake Co., Calif.



749. Calochortus Gunnisonii. (×½)

29. **flexuòsus,** Wats. Related to *C. splendens,* but with sts. so weak as almost to be said to creep. The fls. are large and very brilliant, a dazzling purple, with a darker purple eye, and yellow hairs below. S. Utah.—Intro. by Purdy in 1897.

30 **Pálmeri,** Wats. St. 1–2 ft, very slender and flexuous, 1–7-fld, bulb-bearing near the base: sepals with long, narrow, recurved tips, spotted; petals 1 in or less long, white (or yellowish below), with a brownish claw and bearing scattered hairs about the gland: caps very narrow. S. Calif.—The *C. Palmeri* of dealers is sometimes *C. splendens* var. *montanus.*

31 **catalinæ,** Wats. (*C. Lyònii,* Wats.). Habit of *C. splendens* st. 1–2 ft, branching: fls. white to lilac, or deep lilac, very large and handsome, a large round black spot at base of each petal.—A lovely species between *C. splendens* and *C. venustus* Remarkable for blooming with the star tulip section, fully a month before other mariposas Native to Santa Catalina Isl., off S Calif., also to Calif. coast

32 **Núttallii,** Torr & Gray Sego Lily. St. erect and stiff, 1–2 ft, bulb-bearing at base, usually with only 1 cauline lf, 1–5-fld: sepals ovate-lanceolate, often dark-spotted, petals 1–2 in long, white tinged with greenish yellow or lilac, with a purplish spot or band above the yellow base and hairy about the gland; anthers obtuse Dak and Neb to Calif. and New Mex., having the widest range of any calochortus.—There are no more exquisitely beautiful fls than these sego lilies (the Mormon name) of the Great Basin Most of them are plants of the sage-brush deserts. The lvs. are an ashy green, the foliage scant, but the great fls. are wonderful in tintings. There are shades in blue, pink, lilac, and yellowish; also white. The sego lily is the State flower of Utah.

33 **Leichtlinii,** Hook. f Slender alpine species (5–6 in. high), by some regarded as a form of *C. Nuttallii* fls smoky white, banded with green and marked with dark brown Sierra Nevadas. B.M. 5862. F.S. 20 2116.

34. **Gúnnisonii,** Wats. Fig 749. Much like *C. Nuttallii.* anthers acuminate. fls. light blue or almost white, delicate yellowish green below the middle, purple-banded at the base, and bearing a band of green hairs across each petal. Rocky Mts., Wyo. to New Mex.

35. **macrocárpus,** Douglas. Green-banded Mariposa Lily. St. stiff, the cauline lvs. 3–5: fls. 1 or 2; sepals acuminate, sometimes spotted; petals 2 in. or less, acute, lilac with a greenish midvein, somewhat hairy. B.R. 1152. N Calif. to Wash. and Idaho.—This fine species forms a group by itself. It has a very large bulb, a stout almost leafless st.; and a large fl. of an exquisite pale lavender, banded down the back with green. Petals long, narrow and pointed.

BBB. *Caps. linear, not winged or prominently angled.*

36. **flàvus,** Schult. f. (*Cyclobóthra flàva,* Lindl.). St. slender, 1–2 ft., forked: lvs. 2 or 3 below the fork, linear, long-acuminate: fls. yellow, upright; petals and sepals acute, rhombic-oblong, with a darker somewhat hairy gland, the petals hairy and usually denticulate. Mex.

37. **Bonplandiànus,** Schult. f. (*C. purpùreus,* Baker. *Cyclobóthra purpùrea,* Sweet). Rather stout, 3 ft.: st.-lvs. short, acuminate-lanceolate: fls. yellow and purple: the sepals with a purple pit and the petals purple outside: gland naked. Mex.

Carl Purdy.
L. H. B.

CALODÉNDRUM (Greek, *beautiful tree*). *Pallàsia,* Houtt, which is the older name *Rutàceæ.* One of the handsomest deciduous trees at the Cape of Good Hope; cultivated in northern greenhouses, and outdoors in southern California and southern Florida.

The great panicles of white or flesh-colored fls. are sometimes 7 in across and 6 in deep It is a symmetrical tree, with attractive evergreen foliage and many interesting features. Called "wild chestnut" in Afr. Prop. by cuttings of half-ripened wood under glass in heat A monotypic genus.

capénsis, Thunb. Cape Chestnut. Height in Afr. 70 ft.. branches opposite, or in 3's: lvs. simple, decussate, ovate, obtuse retuse or acute, parallel-nerved, 4–5 in. long, studded with oil-cysts, which look like translucent spots when held to the light panicles terminal, peduncles usually trichotomous; calyx deciduous, petals 5, linear-oblong, 1½ in long, 2 lines wide, sprinkled with purple glands, stamens 10, 5 alternate, sterile, and petaloid: seeds 2 in each cell, larger than a hazelnut, black and shining. G.C. II. 19:217. Also written *Calodendron capense.*

CALONŸCTION (Greek, referring to the beauty of the flower, and the night-blooming habit). *Convolvulàceæ.* Moonflower Twining perennial herbs with large night-blooming flowers.

Flowers white or purple, fragrant, showy; sepals 5, the outer ones with horn-like tips, corolla salver-form, the limb more or less flat, the tube very long and not dilated at the throat; stamens 5, exserted; style capitate and obscurely 2-lobed, ovules 4: lvs. broad, alternate.—Three species in Trop. Amer., two of which are widely cult By some, the genus is united with Ipomœa, but it is well distinguished by the salver-form rather than funnelform or bell-shaped corolla, by the exserted stamens and style, and by the night-blooming habit.

aculeàtum, House (*C speciòsum,* Choisy. *Ipomœa Bòna-nóx,* Linn.). Moonflower. Fig 750. St 10–20 ft. high, with milky juice. lvs. 3–8 in long, cordate to hastate, angular or 3-lobed, acute, glabrous: peduncles 2–6 in. long, 1–7-fld., equaling the petioles; corolla 3–6 in. long, 3–6 in. wide, trumpet-shaped, white, sometimes with greenish plaits; fls. fragrant, usually closing in the morning, sometimes remaining open till noon. Aug., Sept. B.M. 752. B.R. 11:889, 917 (as *Ipomœa latiflora*). Gn. 21, p. 259; 27, p. 473. V. 10:359. Known in gardens chiefly as *Ipomœa Bona-nox* var. *grandiflora,* Hort. (*I. grandiflòra,* Roxbg. and Hort., not Lam.), which does not differ materially from the type. Most of the large-fld. and very fragrant forms in cult. may be referred here. Var. **grandifldrum,** Hort., is sold under the following names: *Ipomœa Childsii,*



750. Moonflower—Calonyction aculeatum. (×½)

I. noctiphyton, I. noctiflora, I. mexicana grandiflora, I. mexicana grandiflora alba, I. mexicana grandiflora vera. These trade names represent strains of varying excellence. (*C. grandiflorum*, Choisy, is *Ipomœa Tuba*.) A form with variegated lvs. is offered. Var. **heterophýllum**, has lvs. 3–5-lobed and subhastate.—The moonflower is most popular as a garden plant, but it also does well trained along the roof of a low house or against a pillar. It is excellent for cut-fls. in the evening. Little grown in the open N. because it does not mature in the short seasons. It grows wild in swamps and thickets in peninsular Fla., and is probably indigenous there. Widespread in tropics of both hemispheres.

muricàtum, G. Don. (*Convólvulus muricàtus*, Linn. *Ipomœa muricàta*, Jacq. *Calonyction speciósum* var. *muricátum*, Choisy). Fls. purple, smaller than those of *C. speciosum*, the tube very slender and the expanded part of the tube not over 3 in. broad.—Tropical regions; extensively cult. in Japan and India, and often seen in American conservatories

C. tastense, House (Ipomœa tastense, Brandeg.), is the third species of Calonyction. It is native to Lower Calif., and now in cult. *C. grandiflorum*, Choisy.=Ipomœa Tuba. L. H. B.



751. Calophaca wolgarica. (×½)

CALÓPHACA (Greek, *kalos*, beautiful, and *phaka*, lentil). *Legumindsæ*. Ornamental plants cultivated chiefly for their bright yellow flowers appearing in summer

Deciduous shrubs or herbs, with alternate, odd-pinnate, pubescent, and often glandular lvs.: stipules scarious or herbaceous, adnate to the petiole: fls. papilionaceous, solitary or in racemes; calyx tubular with 5 nearly equal teeth; standard upright; wings oblong, free, as long as keel; ovary sessile with many ovules: pod pubescent and glandular, cylindrical.—About 10 species from S Russia to E India.

The two cultivated species are low, prostrate shrubs, with grayish green foliage, and rather large yellow flowers in erect axillary racemes, followed by decorative reddish pods. They prefer a well-drained soil and sunny position, and are well adapted for borders of shrubberies and sandy or rocky slopes. Propagated by seeds sown in spring; the young seedlings should have plenty of light and air, as they are very liable to damp-off if kept too moist and shady. Sometimes grafted high on Caragana or Laburnum, forming a very attractive small standard tree with pendulous branches.

wolgárica, Fisch. Fig 751. Two to 3 ft.: pubescent and glandular lfts 11–17, roundish-ovate or oval, ⅛–½in. long: racemes long-peduncled, with 4–7 fls.; corolla over ¾in. long. June, July. S. Russia, Turkestan. **C. grandiflòra,** Regel, is similar, but lfts. 17–25: racemes 10–16-fld.; corolla 1 in. long. S. Russia. Gt. 35:1231. ALFRED REHDER.

CALOPHÝLLUM (Greek, *beautiful-leaved*). *Guttiferàceæ*. Woody plants of the Old World and American tropics, with shining leathery leaves, sometimes planted South.

Leaves parallel-veined at right angles to the midrib: fls. polygamous in many axillary or terminal clusters; sepals and petals 4–12, in 2–3 series; stamens very numerous. fr. a drupe with a single erect seed.—Sixty species. Closely related to Garcinia, which, however, has only 4–8 sepals.

In India, several species are of considerable economic importance, especially *C. inophyllum*, which is the source of a gum, and the seeds of which contain the well-known domba oil used extensively for lighting purposes. They must be grown in a warmhouse and in a rich well-aerated soil.

Calàba, Jacq. CALABA TREE. A tree, to 60 ft.: lvs. variable, dark glossy green, 3–10 in long: fls. in axillary racemes, white, rarely produced in cult., the petals about 3 lines long: fr. about 1 in. diam. W. Indies, perhaps intro. from the Old World. Timber and oil

inophýllum, Linn. A medium-sized tree, with gray smooth bark: lvs. 4–8 in. long, 3–4 in. wide, shining on both surfaces: racemes in the upper axils, the fls. about ¾in. diam. and pure white; inner sepals petal-like: fr. about 1 in diam., yellow, smooth, almost fleshy. Trop. Asia. N. TAYLOR.

CALOPÒGON (Greek, *beautiful beard*, in allusion to the fringed or bearded lip). *Orchidàceæ*. A very attractive native orchid, sometimes planted in bog-gardens and rock-gardens.

Flowers magenta-crimson, varying to white, in a loose raceme on a naked scape, sepals and petals all distinct and spreading, the lip narrow at base but broader and hairy above, column winged at summit, not attached to other parts; pollinia 2 in each anther cell.—One species, in bogs and moist meadows, Newfoundland to Fla. and westward. Cathea is an older name, but, because of its general acceptance, Calopogon is retained in the "nomina conservanda" of the Vienna code.

A moist and shaded position and very porous soil are most suitable for this pretty plant, although it may do admirably in a rock-garden only slightly shaded at midday. If the plants are watered very freely every day during hot or dry weather. Propagated by offsets, separated from the old tubers, but the old established plants should not be disturbed very often. Collected clumps of many native orchids are offered at very reasonable figures, and these give immediate results, while the small offsets would not be strong enough to flower for several years, and require much attention during the first year, or perhaps longer (J. B. Keller)

pulchéllus, R. Br. (*Limodòrum tuberòsum*, Linn., in part). Height 12–18 in., from a solid bulb or corm, bearing a single grass-like lf. at the base: scape 2–12-fld.; lip bearded with white, yellow, and purple club-shaped hairs; pretty. G.F. 10:505. J.H. III. 35:45. B.M. 116. L. H. B.†

CALOSCÓRDUM: *Nothoscordum.*

CALOTHÁMNUS (Greek, *beautiful bush*). *Myrtàceæ*. Australian shrubs (more than twenty species) somewhat similar to Callistemon but more graceful in habit; evergreen greenhouse subjects, and hardy out-of-doors in California.

Leaves long, alternate: fls. showy, usually red, in lateral clusters; stamens united in bundles opposite the petals; anthers erect, attached by the base, oblong or linear; cells parallel, turned inwards, opening by longitudinal slits. For cult., see *Callistemon*.

quadrifidus, R. Br. Height 2–4 ft.: lvs. narrow, terete or slightly flattened, heath-like, glandular-dotted: fls. rich crimson, 4-merous; calyx 2-lobed in fr.; staminal bundles nearly equal, of 15–20 or more filaments. W. Austral. B M. 1506.

C. rupéstris, Schau. Evergreen shrub, the branches densely covered with needle-like small lvs.; fls. in small clusters on previous year's growth, stamens with crimson filaments and yellow anthers. B M. 7906.

J. Burtt Davy.

CALÓTROPIS (from Greek words referring to the beauty of parts of the flower). *Asclepiadàceæ.* Milkweed-like shrubs, or small trees, grown in the American tropics and one species offered in southern California

Branching, glabrous or tomentose-canescent: lvs. opposite, subsessile, broad. fls. with 5-parted calyx glandular inside, corolla bell-shaped or somewhat rotate, 5-parted with broad lobes; crown of 5 narrow fleshy scales adnate to the staminal tube and free and received at the base; pollinia solitary in each cell, obovate-oblong and compressed, hanging from the apex fr short horned gibbous acuminate pods mostly in pairs, seeds with silky hairs.—Three species in Trop. Asia and Afr., sometimes grown under glass in collections but in this country practically confined to the tropics The bark of *C. gigantea* produces a strong fiber, and the acrid milky juice dries into a substance like gutta-percha The silk on the seeds is used in fabrics by natives, that of *C. procera* is said to be exported from the Cape Verde Isls as kapok (kapok is usually from the ceiba or silk-cotton tree).

gigantèa, R Br (*Asclèpias gigantèa,* Willd.). Giant Milkweed Tree-like, 8–15 ft., with pale bark and woolly shoots lvs obovate to broad wedge-shaped, entire, woolly beneath fls rose and purple, in simple or compound umbels with involucrate scales, the corolla-segms bent downwards and twisted with age: fr 3–4 in. long; seeds broadly ovate. B.R 58. India, and planted or escaped in W. Indies.

procèra, Dry (*Asclèpias procèra,* Ait.) Shrub or bush, to 15 ft lvs more oblong and acute than those of *C. gigantea,* grayish: fls. white and purple in long-peduncled cottony umbels; corolla-lobes erect: fr. 4–5 in long, recurved; seeds ovoid. B R. 1792 India. —Offered in S Calif., and said to be known in Porto Rico as Algodon de seda.

L. H. B.

CALPÚRNIA (after Calpurnius, an imitator of Virgil, because these plants are allied to Virgilia) *Leguminòsæ* Trees and shrubs from tropical and southern Africa, cultivated out-of-doors in southern California and other subtropical regions.

Leaves odd-pinnate with numerous lfts: racemes long, axillary and terminal, the peduncles often paniculate, giving rise to a splendid showy infl.; fls. yellow, the calyx bell-shaped; petals pea-like: pods membranous-winged on one side, often flattish.—Ten species.

sylvática, Mey. Shrub, 6–10 ft high· lvs 2–6 in. long; lfts. in 3–10 pairs, membranous, obovate-elliptical, retuse or obtuse: fls. ½in. long; ovary glabrous. Caffraria.—Also rarely cult. N. as a greenhouse shrub.

lasiógyne, Mey. (*C. aùrea,* Benth.). A taller shrub, very rarely tree-like, with larger evergreen lvs., more coriaceous, more pubescent, and exactly elliptical or oblong lfts: fls. racemose, much like Laburnum, appearing in winter, as do the fls. of most S. African plants. The silky ovary at once distinguishes it. Natal.

N. Taylor.†

CÁLTHA (Latin name of the marigold). *Ranunculàceæ.* Beautiful hardy blooming marsh plants, the largest and best of which are used about water-gardens and moist parts of borders.

Succulent perennial herbs, glabrous, with a fascicle of strong, fibrous roots: lvs. simple, rather rounded-cordate at base: fls. yellow, white or pink; sepals large, deciduous, petal-like; petals none; stamens numerous: carpels sessile, becoming follicles, with 2 rows of seeds. —About 10 species of temperate and frigid regions. Monogr. by G Beck, in Kaiserlich-Konigliche Zoöl. Bot. Gesellschaft (Vienna, 1886), 36:347–363; E. Huth, Monogr in Helios 9·69–74.

Calthas flourish best in wet places near running water Though naturally bog-plants, they succeed admirably well in an ordinary border in rather rich soil. They should be introduced more liberally into the flower-garden, where they bloom very freely year after year, and usually mature a second quite abundant crop of bloom in the fall. The flowers last a long time in water, and sell readily in the cut-flower market

The propagation is naturally accomplished by roots and by seed. The roots divide easily and several of the species send out rootstalks The divisions may be made best in late fall or mild winter weather If seeds are used, they must be fresh and given a moist, cool place in partial shade.

biflòra, DC. No true st.: scape slender, usually 2-fld.: lvs. as in *C. palustris:* sepals 6–9, nearly white or sometimes blush: follicles at maturity distinctly stalked Spring. Calif. to Alaska.

leptosépala, DC. Stout scape, 8–12 in · lvs all basal or barely 1 on st.; nerves at base nearly parallel, otherwise like those of *C. biflora.* sepals 7–10, oblong, becoming narrower, white: fls solitary: follicles scarcely stalked. May, June. Alaska to Wash. and Colo. Gn. 30.340.

palústris, Linn Marsh Marigold. St. hollow, 1–2 ft, branching, several-fld lvs cordate or reniform, dentate, crenate or entire fls bright yellow, 1–2 in. broad; sepals 5 or 6, rarely 7: follicles compressed, ½in long. Apr.–June Wet ground Carolinas to Canada and westward Gt 47, p 630 Gn 50, p 166.—Used before flowering in the spring as "cow-lip greens." Var **monstròsa-plèno,** Hort (var. *flòre-pleno,* Hort.) An improvement on the above· fls. larger, of greater substance, and often much doubled. Very beautiful Var. **Tÿermanni,** Hort. A dwarf form with golden fls. G M. 52:415.

polypétala, Hochst. Two ft. high· lvs 10–12 in. across: fls. 3 in. across. Caucasus and Asia Minor.—The plant spreads rapidly by stolons and may thus be easily prop. Gn. 69, p 269

C. elata, Duthie. Fls smaller than in C. palustris, golden yellow with orange-colored filaments and black anthers. Himalaya Gn.W. 21 666, desc

K. C. Davis.

CALTROPS: *Trapa*

CALVÒA (apparently a personal name). *Melastomàceæ.* A half-dozen or more herbs and shrubs in Trop. Afr., often succulent, with terete or 4-angled branches, enlarged nodes, long-petioled ovate 3–5-nerved lvs., and red, rosy or violet fls in scorpioid cymes None of them is likely to be in commerce for cult., although *C. orientàlis,* Taub., is known in botanic gardens It is a small shrub with 4-angled sts. producing aerial roots: lvs. nearly ovate, shining green and veined red at the base, the petioles red: fls. red, becoming violet, less than ¾in. across.

CALYCÁNTHUS (*Kalyx* and *anthos,* flower; the calyx is large and conspicuous). Syn *Butnèria. Calycanthàceæ.* Carolina Allspice. Sweet-scented Shrub. Ornamental shrubs, cultivated chiefly for their fragrant flowers.

Winter-buds small, without bud-scales, hidden by the base of petiole before the lvs. fall: lvs. opposite, petioled, entire· fls with numerous imbricate sepals and no distinct petals; stamens many, short with innate anthers, pistils many, inclosed in a hollow receptacle: fr caps-like, formed like the rose-hip by the calyx-tube and containing numerous achenes.—Four species in N Amer.

These are deciduous shrubs of aromatic fragrance, with opposite rather large leaves usually rough above and brown or brownish usually fragrant flowers, terminal on leafy branchlets followed by a large capsule-like dry fruit Except *C. occidentalis*, the species are hardy or nearly hardy North. They grow in almost



752. Calycanthus floridus.

any well-drained and somewhat rich soil, and succeed as well in shady as in sunny positions Propagated by seeds sown in spring; also increased by layers put down in summer, and by suckers or division of older plants

A. *Lvs densely pubescent beneath.*

flóridus, Linn Fig. 752. Three to 6 ft.. lvs oval or broad-ovate, acuminate, dark green above, pale or grayish green beneath, 1½–3 in long fls dark reddish brown, fragrant, about 2 in broad Va to Fla B M 503 Gn 21, p 184, 33, p. 392 —This species is much cult for its very fragrant fls and is the hardiest of all Var **ovàtus,** Lav (*C. ovàtus*, Ait.). Lvs ovate to ovate-oblong, rounded or subcordate at the base. L.I. 24.

AA. *Lvs. glabrous beneath or nearly so: fls. slightly or not fragrant.*

fértilis, Walt (*C féràx*, Michx *C. lævigàtus*, Willd *C. nàna*, Loisel). Three to 6 ft : lvs usually elliptic or oblong, acute or acuminate, green beneath, 2–5½ in. long fls reddish brown, 1½ in. broad; anthers oblong: fr. ovoid, contracted at the mouth as in the preceding species. Alleghanies, from Ga to N C. and Ala. B.R. 6:481 —Roots, lvs and bark used for their antiperiodic properties. Fr. said to be poisonous to sheep. Var. **glaùcus,** Schneid (*C glaùcus*, Willd) Fig 753. Lvs usually ovate or oblong-ovate, acuminate, glaucous beneath· fls paler B R 5:404. Var **oblongifòlius,** Nutt , with oblong-lanceolate lvs glaucous beneath.

occidentàlis, Hook. & Arn. (*C. macrophýllus*, Hort.). To 12 ft . lvs. usually rounded at the base, ovate or oblong-ovate, green beneath and sometimes slightly pubescent, 4–6 in. long· fls light brown, 3 in. broad; anthers linear: fr. campanulate, not contracted at the mouth. Calif. B M. 4808. F.S. 11:1113. R.H. 1854: 341. Gn 33, p. 392.,

C. Móhrii, Small. Shrub, 2–6 ft.: lvs. ovate to oblong-ovate at the base, rounded to subcordate or broadly cuneate, densely pubescent beneath, 2–7 in long fls. purple, fragrant, more than 2 in. across Tenn and Ala. Little-known species, very similar to *C. floridus* var ovatus, but the fr campanulate and not contracted at the mouth. It has proved hardy at the Arnold Arboretum —*C. prècox*, Linn.=Meratia præcox. ALFRED REHDER.

CALYCOCÁRPUM (Greek, *cup-fruit*, alluding to the stone). *Menispermàceæ*. A tall-climbing vine. genus monotypic. **C. Lỳonii,** Nutt , in rich woods, Ky. to Kans and south: woody twiner: lvs large and broad, simple, deeply palmately 3–5-lobed, the lobes pointed: fls. small, greenish, in long racemose panicles, in May and June: fr. a globular drupe, the stone or pit hollowed out on one side, ripe in Aug.

CALYCÓTOME (*Kalyx*, and *tome*, a section or cut; calyx looks as if cut off). *Leguminòsæ* Ornamental shrubs chiefly grown for their profusely produced yellow flowers, also used for low hedges

Leaves 3-foliolate, without stipules fls papilionaceous; calyx turbinate, truncate, colored; standard upright; keel obtuse, curved, shorter than standard; stamens 10 with the filaments connate; ovary sessile, many-ovuled· pod linear-oblong, along the upper suture winged or strongly thickened, 2-valved —Five species in the Medit region

Calycotomes are low spiny shrubs with small 3-foliolate deciduous leaves and fascicled or solitary yellow papilionaceous flowers. Hardy only in warmer temperate regions. They prefer a sunny position and well-drained soil For propagation, see *Cytisus*

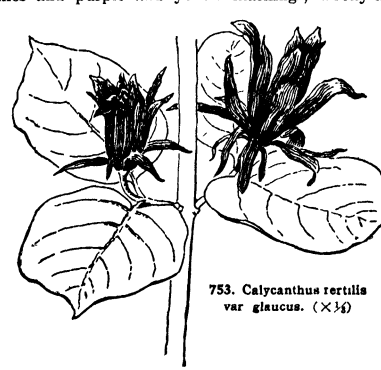
villòsa, Link Two to 4 ft : branchlets grayish tomentose lfts obovate to oblong-obovate, densely silky beneath, under ½in long fls ½in long, 3 or more, fascicled: pod villous. May, June —It is excellent for dense low hedges

spinòsa, Link Closely allied, but somewhat larger in every part, and with glabrous branchlets and pods: fls. solitary or few. B R. 32:55. ALFRED REHDER

CALÝPSO (from the Greek goddess, whose name signifies concealment, referring to its rarity and beauty). *Orchidàceæ*. One of the rarest and most prized native orchids

A delicate bog-plant, 3–4 in high, with a small bulb, 1 roundish or ovate striated lf , and 1 pink fl with a spotted sac. For culture, see *Calopogon*, but more difficult to grow than that plant. A monotypic genus.

bulbòsa, Oakes Fig. 754 Lf an inch wide and long: scape 3–4 in. high, with about 3 sheaths; sepals and petals similar, ascending, lanceolate, acuminate, pink; lip larger than the rest of the fl., with brown spots in lines and purple and yellow markings, woolly-hairy



753. Calycanthus fertilis var glaucus. (×⅓)

within; column petal-like, ovate, bearing the lid-like anther just below the apex. Maine to Minn. and N; also Eu Abundant in parts of Ore. and Wash. B.M. 2763. G.C. II. 16:656.

CALYPTRÓGYNE (from *calyptra*, hidden, and *gyne*, woman, in allusion to the half-hidden gynœcium). *Palmàceæ*, tribe *Geonòmeæ* Short, almost completely stemless and unarmed palms with unequally pinnate terminal leaves.

Stems frequently stoloniferous, when present, ringed below. lvs. numerous, often with the pinnate segms joined together, in extreme youth 4-parted instead of bi-partite as in most related genera, lfts somewhat irregularly disposed on the rachis, broadly or narrowly scythe-shaped, running at the tip to an abrupt point, at the base revolute, petiole very short or practically none spadix simple or sometimes branched at the base, long-stalked, spathes 2, fls. a little unequal, with 3 sepals, 3 petals and 6 stamens, the style half immersed in the spadix fr oblong or obovoid, 1-seeded —About 4 species, all from Trop N Amer From Geonoma, a near relative and horticulturally a much more important genus, Calyptrogyne is distinguished only by the almost stemless habit, and the purely technical character of having prominently arrow-shaped anthers. In Geonoma the anthers are pendulous, but not sagittate

Calyptrogynes are handsome palms, seldom seen outside of large collections Special care must be given to the soil so that it will be sweet and porous, especially after the plants leave the seed-pan Well-drained pots and a little charcoal mixed with the soil, and the plants kept in a uniformly moist state, are conditions essential to the healthy growth of the plants In this genus, *C. Ghiesbreghtiana* is the most widely known species, another garden name for which is *Geonoma Verschaffeltii* These are shade-loving palms, having leaves of comparatively thin texture, and consequently are subject to attacks of red spider unless properly cared for in regard to moisture Calyptrogynes are most useful in a small state, old plants in general being rather leggy and poorly furnished (G. W. Oliver and W H. Taplin.)



754. Calypso borealis.

glaùca, H. Wendl. (*Geònoma glaùca*, Oerst) Practically stemless: lvs 4–5 ft long, the sheathing petiole brownish, about 1 ft long; lfts numerous, about 2–3 in. apart, with 4 principal nerves, and scarcely any secondary ones: spadix simple, differing from the following species in which the spadix is often branched, 2–3 ft. long, the pistillate fls half hidden in tiny pits Cent. Amer. G C. III. 30 179 — Not a common species, but young plants are specially attractive.



755. Camarotis rostrata

Ghiesbreghtiàna, H Wendl. (*Geònoma Ghiesbreghtiàna*, Lindl. & H Wendl. *G. magnífica* and *G. Verschaffèltii*, Hort) St short or almost none: petiole 5 ft long: lvs elongate-oval; segms in 6 pairs, unequal, almost opposite, rather remote, lanceolate, very long-acuminate, falcate, the 2 uppermost on each side very wide spadix often branched below, the fls half hidden in tiny pits Chiapas, Mex B M 5782

C. sarapiquénsis, H. Wendl St short lvs 6 ft long Costa Rica. G C III 20 217, desc —*C. spicigera*, H Wendl St evident lvs, irregularly pinnate, 3 ft or less long, the stalks flat on upper side. Guatemala —*C. Swártzii*, Hort, is a Geonoma N Taylor.

CALYPTROSTÍGMA. *Diervilla Middendorffiana.*

CALYSTÈGIA. *Convolvulus*

CAMARÒTIS (a *vault*, in reference to the cavity in the apex of the lip) *Orchidàceæ* Epiphytic hothouse orchids.

Stems elongated, with short lvs, and many-fld. racemes sepals and petals similar, spreading, lip spurred, 3-lobed, rostellum and anther beaked, pollinia 2, upon long thin stipes —Species 2, in E India

rostràta, Reichb (*C purpùrea*, Lindl *Sarchochilus purpùreus*, Benth) Fig 755 Sts 2–3 ft long, climbing lvs oblong-linear, bifid at apex, 3–4 in long: racemes longer than lvs; fls. crowded, about 1 in. diam, rose-purple, the lip somewhat darker India. P M. 7:25.—A scarce plant, now offered in American lists. Free-growing plant with aerial roots similar to some epidendrums The treatment accorded to the vandas and saccolabiums with similar roots will suit the camarotis. George V. Nash.

CAMÁSSIA (*Quamash* or *Camass* is the Indian name). Sometimes written *Quamasia*. *Liliàceæ*. Camass West American spring-flowering bulbs.

Leaves all radical, long-lance-shaped, sheathing, from a true bulb that is pointed and with a rounded rather flattened base: sts. erect, 2–3 ft, bearing many bracted blossoms that open from the bottom of the raceme upward, in long succession. fls. blue, purple, white or cream, with 6 spreading 3–7-nerved segms.,

6 thread-like filaments, filiform style, and 3-angled, 3-valved, several-seeded caps.—Five or 6 species in the temperate regions of W. N. Amer. from Cent. Calif. to Brit. Col. and east to Texas and Ark. They have resemblances to Scilla, but are much handsomer. The bulbs produce no offsets unless wounded. All the



756. Camassia Cusickii. (fls. ×½)

species vary greatly in width of lvs, size and number of fls., so that definite figures mean little. The large bulb and broad bluish lvs of *C. Cusickii*, the heavy st., regular fls, and twisted old segms. of *C. Leichtlinii*, the irregular fl. and drooping segms of *C. Quamash*, and the time of flowering of *C. Howellii*, are good general characters to distinguish them.

Camassias are natives of rich meadows, very wet in winter and spring but dry in summer. Water often stands on the surface at flowering time. While the very best success can perhaps be attained by giving them a rather heavy soil with abundant moisture in the early season, they are most amenable to cultivation and thrive in any loam (only avoiding too rank manures), and they are perfectly hardy. They have been thoroughly tested throughout the region from Illinois east. Plant in early fall, from 3 to 4 inches apart and 3 to 6 inches deep, and do not disturb thereafter. As cut-flowers, they are excellent as they open in long succession. Seeds grow readily, but from three to four years are required to make flowering plants.

Cusickii, Wats. Fig. 756. Bulbs very large (weighing 4–8 ozs.). lvs. numerous, broad, glaucous, somewhat undulate (15 in. long by 1½ in. wide): st. often 3 ft. high: fls. 30–100, very pale delicately blue; segms. spreading, crinkled at base, faintly 3–5-nerved. Ore. G.F. 1:174 (adapted in Fig. 756).—The very large bulb and broader and more numerous lvs. easily distinguish this species. Very easily grown.

Quámash, Greene (*C. esculénta*, Lindl.). Common Camass. Fig. 757. This species varies greatly; some forms are low and slender, others 2–3 ft. high, stout and many-fld.; it can be distinguished by the irregular perianth in which 5 segms. are more or less on one side and 1 on the other: lvs. ⅜in. broad or less: fls. 10–40, varying from almost white to intense ultramarine in the varieties; segms. 3–5-nerved and a little longer than the stamens, narrow and channeled at the base; pedicels not exceeding the fls.: caps. ovate-oblong, obtuse, transversely veined. Calif. to Utah and north to Brit. Col. B.R. 1486. F.S. 3: 275. Gn. 46: 338 and p. 339.—Bulb cooked and eaten by the Indians. The fls. vary to white. The large ultramarine form is the one in the trade. The withered segments fall down about the pedicel irregularly.

Leichtlinii, Wats. Stout, often 3 ft. or even more in height: fls. white, cream-colored, blue or purple, nearly regular; stamens and style ascending; segms. broad and flattened at the base, usually 5–7-nerved: caps. oblong-ovate, emarginate, obliquely veined. The withered segms. of the perianth twist about the caps like bonbons; this is an infallible distinctive mark of the species. *C. Leichtlinii* is not common, but is distributed from Mendocino Co., Calif., to Brit. Col. B.M. 6287 (as *C. esculenta* var. *Leichtlinii*, Baker).—In Mendocino Co., a clear blue form grows rarely in mountain meadows. In the Umpqua Valley, Ore., the type is clear cream approaching white. In the same region and farther north, a very large deep blue or purple form is found, while in Brit. Col., the cream-colored form again appears but is rare. At their best, the sts. are stiff and heavy, the fls. large and many, and the masses of bloom approach the Eremurus in beauty and are even finer in separate fls. *C. Leichtlinii* is the finest of all camassias. Several color forms are described, as var. *atrovioláceа*, deep purple, and others.

Howellii, Wats. Bulb rather small. lvs. few, 1 ft. long and less than ½in. wide: st. often 2 ft. high, many-fld., with spreading pedicels twice or more the length of the linear bracts. fls. pale purple, opening in the afternoon, the segms. ½in. long, 3–5-nerved; pedicels longer than the fls.: caps. small, broadly ovate and very obtuse. S. Ore. Intro. by Pilkington & Co., 1892.

esculénta, Robins. (*C. Frásери*, Torr.). Scape 12–18 in. high. lvs. keeled. fls. light blue, smaller than in *C. Quamash;* segms. 3-nerved; pedicels mostly longer than fls. Pa., west and south. B.M. 1574 (as *Scilla esculenta*).

Var. **angústa** (*C. angústa*, Hort.). Very slender, and lvs. narrower (¼in. wide): fls. smaller, ⅓ or ¼in. long. La. and Ark. to Texas.



757. Camassia Quamash. (× ½)

Carl Purdy.

CAMÉLLIA (after George Joseph Kamel or Camellus, a Moravian Jesuit, who traveled in Asia in the seventeenth century). *Ternstrœmiàceæ*. CAMELLIA Woody plants, chiefly grown for their showy white or red flowers and also for their handsome evergreen foliage.

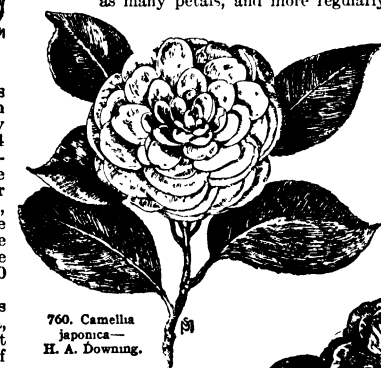
Evergreen trees or shrubs with alternate short-petioled serrate lvs. and large terminal or axillary white or red fls followed by subglobose woody caps: fls. sessile, upright; sepals many, imbricate, deciduous; petals 5 or more; stamens numerous, more or less connate; ovary 3–5-celled, with slender styles connate, at least below; fr. a dehiscent caps., with few large subglobose seeds.—About 10 species in tropical and subtropical Asia. Often united with Thea, which differs in its nodding and stalked fls with a persistent calyx consisting of 5 nearly equal sepals. There is a monograph of this genus by Seemann in Trans. Linn. Soc. 22: 337–352 (1859) and by Kochs in Engler Bot. Jahrb. 27: 577–634 (1900). Illustrated monographs of the horticultural varieties are Curtis, Monogr. of the genus Camellia (1819); Baumann, Bollweiler Camelliensammlung (1828), Chandler, Camelliæ (1831), Berlèse, Monogr. du genre Camellia a. (1839); Verschaffelt, Nouvelle Monographie du Camellia (1848–1860) the last with 576 and the previous one with 300 colored plates.



758. Camellia japonica—Abby Wilder.



759. Camellia japonica—Lucida.



760. Camellia japonica—H. A. Downing.



761. Camellia japonica—President Clark

Camellias grow like natives on sandy lands and even on high pine land in central Florida, but they flower best in half-shady somewhat moist places. The half-double varieties of *Camellia japonica* do best, while the very double kinds often drop their buds entirely. The flowers suffer very much from the sun and cannot be grown much farther south than central Florida. *Camellia Sasanqua*, single, half-double and double kinds, grow much more satisfactorily than the varieties of *C. japonica*. They begin to flower late in October and early November, and the double white *C. Sasanqua* is a mass of pure white usually at Christmas time. All the varieties of *C. Sasanqua* have somewhat fragrant flowers. *C. reticulata* does equally well in Florida. It is very distinct in foliage from the two former species which have glossy leaves, while the leaves of *C. reticulata* are dull green. All the camellias are extremely slow growers if not carefully cultivated and fertilized. A mulch of old cow-manure, now and then a little commercial fertilizer, and thorough watering during the dry season several times a week start the bushes into a vigorous and healthy growth. They are so extremely beautiful when in flower that all the care given them is well repaid. (H. Nehrling.)

A. *Ovary and lvs. perfectly glabrous.*

japónica, Linn. (*Thèa japónica*, Nois.). Figs. 758–761. Shrub or tree, sometimes to 40 ft., glabrous: lvs very shining and dark green above, ovate or elliptic, acuminate, sharply serrate, 2–4 in. long: fls. red in the type, 3–5 in. across, petals 5–7, roundish. China, Japan. B.M. 42. S.Z. 82. F.S. 20:2121. S.I.F. 1:73. Gn. 24, p. 411; 28, p. 203, 36, p. 241. Var. **álba,** Lodd. Fls. white. L.B.C. 7:636. Gn. 54, p. 243. J.H. III. 54:227; 64.397. Var. **álba-plèna,** Lodd. Fls. white, double. L.B.C. 3:269. Gn. 53, p. 244. Var. **anemoniflòra,** Curtis. Fls. red, with 5 large petals, the stamens changed into numerous smaller and narrow petals; the whole fl. resembling that of a double anemone. L.B.C. 537. B.M. 1654. Gn. 44, p. 329. Var. **magnolièflòra,** Hort. Fls. pale rose, semi-double, with 12–15 petals rather narrow and half upright. Gn. 76, p. 31. Var. **apucæfórmis,** Rehd. (*C. apucæfórmis*, Jacob-Mackoy). Lvs. bifid at the apex.—For the numerous other garden forms, see the above-mentioned monographs; also, Flore des Serres, L'Illustration Horticole, and other older horticultural publications contain a large number of varieties with illustrations.

AA. *Ovary and lvs. on the midrib above pubescent.*

reticulàta, Lindl. (*Thèa reticulàta*, Pierre). Large shrub, glabrous: lvs. dull green, not shining above, reticulate, flat, elliptic-oblong, acuminate, serrate, 3–5 in. long: fls. 5–7 in. across, purplish rose; petals 15–20, obovate, loosely arranged. China. B.R. 13:1078. B.M. 2784. P.M. 3:101. G.M. 35: suppl. Apr. 2. F.W. 1880:321. G. 25:59. Var. **plèna,** Hort. Fls. with twice as many petals, and more regularly arranged. B.M. 4976. F.S. 12: 1279–80.

Sasánqua, Thunb. (*Thèa Sasánqua*, Nois.). Shrub of loose, straggling habit, and with the branches pubescent when young. lvs. elliptic to oblong-ovate, bluntly pointed at the apex, crenate-serrate, shining, dark green and hairy on the midrib above, 1–2 in. long: fls. 1½–2 in. across, white, petals 5 or more, obovate or oblong. China, Japan. Gn. 54:142. S.Z. 83 (except the red vars.). S.I.F. 2:52. J.H. III. 43: 131. G.M. 36:51. Runs into many forms. Var. **semi-plèna,** Hort. Fls. semi-double, white. B.R. 1:12; 13:1091. Var. **anemoniflòra,** Seem. Fls. large, double, outer petals white, inner ones much smaller, yellow. B.M. 5152. Var. **oleòsa,** Rehd. (*Thèa Sasánqua* var. *oleòsa*, Pierre. *C. oleífera*, Lindl.). Of more robust habit, with lvs. and the single white fls. larger than in the type. B.R. 11: 942. L.B.C. 11:1065. Var. **Kissi,** Rehd. (*Thèa Sasánqua* var. *Kissi*, Pierre. *C. Kissi*, Wall.). Lvs. oval-oblong to ovate, long-acuminate, to 3½ in. long. Himalayas.

C azillàris, Roxbg.=Gordonia anomala —*C. cuspidàta*, Hort =Thea cuspidata —*C. drupifera*, Lour Shrub to 8 ft lvs. elliptic, long-acuminate fls. 1½ in wide, fragrant, white, petals obovate Himalayas, India L B C 19 1815 —*C euryoides*, Lindl. =Thea euryoides —*C euryoides*, Hort =Thea maliflora —*C. hongkongénsis*, Seem (Thea hongkongensis, Pierre). Tree with glabrous branches lvs. ovate-lanceolate to lanceolate, indistinctly serrate, lustrous above, coriaceous, 3–4 in long fls red, 2 in. across, petals slightly emarginate, ovary pubescent Hongkong Trans Linn. Soc 22 60 —*C maliflóra*, Lindl =Thea maliflora —*C rosiflóra*, Hook =Thea maliflora —*C sinénsis*, Kuntze=Thea sinensis —*C. spectábilis*, Champ.=Tutcheria spectabilis —*C Thea*, Link=Thea sinensis.

ALFRED REHDER.

CAMOÉNSIA (Louis Camoens, Portugese poet). *Leguminòsæ*. Two species of climbing shrubs from W. Trop Afr, with digitately 3-foliolate lvs, and large papilionaceous fls. Calyx top-shaped; petals with long claws, the standard orbicular or nearly so; stamens free; ovary stipitate, with many ovules, the stigma small and capitate fr a broad-linear flattened 2-valved pod. **C. máxima**, Welw, has recently been offered by an English firm. Described by Baker as "a magnificent species" and by Bull as "one of the most gorgeously beautiful of tropical climbers" lfts obovate-oblong, 5–6 in. long, cuspidate. fls. milk-white tinged with gold and frilled on the edges of the petals, in short-stalked 6–8-fld. axillary racemes; standard projecting 4 in. beyond the calyx, 3–4 in. broad, other petals shorter and not more than 1 in. broad pod 6–8 in. long Trans. Linn. Soc. 25·36. B.M. 7572. G C. III. 20. 597.

L. H. B.

CAMPÁNULA (Latin, *little bell*, from the shape of the corolla in some species). *Campanulàceæ*. BELLFLOWER HAREBELL BLUEBELL. A large group of attractively flowering herbs, containing some of the most popular garden plants, especially of hardy herbaceous perennials

Annual, biennial or perennial, mostly the last, often small and tufted· root-lvs usually larger than the st-lvs, and often of different shape and more or less transitory: fls. blue, violet or white, sometimes yellow; calyx 5-fid; corolla 5-lobed or 5-fid; stamens 5, free; filaments wide at the base, membranaceous, stigmas 3 or 5, filiform· caps 3–5-valved, dehiscing on the sides or (as in Fig 762) at the base by 3–5 small valves; seeds ovate, complanate or ovoid.—Probably 250 species, nearly all in the northern hemisphere with the center of distribution in the Medit region, about a dozen species are N. American. The species mostly inhabit swamps or moist ground, or alpine and boreal regions. Allied genera of garden value are Adenophora, Jasione, Lightfootia, Michauxia, Ostrowskia, Phyteuma, Platycodon, Specularia, Symphyandra, Trachelium, and Wahlenbergia, in which genera many species originally described as campanulas may be sought Of these, perhaps the two best known cases are *Platycodon grandiflorum*, the "balloon flower," with its characteristic inflated buds, dark green, glossy, leathery lvs.; and *Specularia Speculum* (*C. Speculum*), "Venus' looking-glass," a pretty annual, which grows in the grain fields of S Eu, and is cult. for its violet fls with a white eye The calyx-tube of Specularia is relatively much longer than in any campanula. The most prominent campanulas now in cult. seem to be the forms of *C Medium*, *C. carpatica*, *C. persicifolia*, *C. pyramidalis*, *C punctata*, *C. pusilla* (*cæspitosa*), *C rotundifolia*.



762. Capsule of Campanula with basal dehiscence.

Botanically, campanulas fall into two important groups, based on the presence or absence of calyx appendages The subgenus Medium has the appendages, and Eucodon lacks them. These appendages are often small and disguised. The genus may also be thrown into two broad groups based on the dehiscence, —the subgenus Medium with capsule opening near the base, and Rapunculus with the openings near the top For the horticulturist, the most serviceable classification is based on the use that he makes of the plants, —whether as a garden vegetable, as border plants, or as rock-garden or alpine subjects, and this is the division attempted here In cultivation, campanulas tend to become taller and more robust, less hairy, more branched, and more floriferous. Blue is the prevailing color in the genus A very few have white or yellowish flowers, with no blue or violet forms Any blue or violet-flowered form is likely to have white varieties, and double and semi-double forms are common in three or four of the most popular species All flowers tend to become larger and more numerous on a stem. In cultivation, the three-celled species are likely to have five stigmas instead of three, and five-celled capsules, often along with normally constructed flowers on the same plant The height is the most variable feature of all, and in the scheme below *C. carpatica*, *C. punctata* and forms of *C glomerata* especially will seem wrongly placed to many But the characters used by botanists are well-nigh useless to the gardener, and nothing but a distinction of height can bring out the two important cultural groups of campanulas For a recent garden monography of dwarf campanulas, see Correvon, "The Garden," 59 (1901) pp 276, 450, 60, pp 51, 64, 111, 161, 218

Cultivation.—The genus Campanula is extraordinarily rich in flowering garden plants of merit The alpine section is distinguished by a charming grace both in character of growth and size and bearing of flowers The peach-leaved class (*C persicifolia*) is characterized by the noble and beautiful form of single and semi-double blossoms carried by thin erect stems 2–3 feet high The luster and clearness of tints of the bushy biennial Medium and calycanthema type are remarkable, while the rambling habit and the marvelous floriferousness of the varieties *C isophylla* and its descendant *C Mayi*, indicate the wide range of ornamental usefulness of bellflowers Considering the good lasting qualities in a cut state and the great popularity of the flowers of long-stemmed sorts for indoor decoration, it is safe to say that campanulas will steadily gain in importance as material upon the florists' counter as well as for garden planting The greatest curiosities are *C. punctata*, *C macrostyla*, *C Zoysii* and *C rotundifolia* var *soldanellæflora* For exhibition and for pot culture and also for large single specimens, *C pyramidalis* is most used For edgings, *C. carpatica* is perhaps the favorite Of all wild forms, the best known is certainly *C. rotundifolia*, the true harebell, or "blue bells of Scotland" It is native in North America as well as in Europe, on rocky banks and shores —Wherever rock-gardens are planned, alpine campanulas have become indispensable. The greater part of typical mountain inhabitants chiefly available for this purpose being spring-flowering plants, the summer flowers of campanulas are especially welcome One of the best bellflowers for rock-gardens is *C carpatica*, blue and white, with its var *compacta* also in blue and white, var. *cælestina*, sky blue, var *pelviformis*, light blue, and var *Riverslea* with large dark-blue bells; but there are a number of other very handsome species possessing commercial value that deserve the attention of progressive growers The demand is for a plant material easy to handle, resistant and free-flowering. As such may be recommended for rockeries, *C. garganica* and *C. garganica* var *hirsuta*, both 4 inches high, flowers light blue. *C. pusilla*, in white and blue, is regarded as the hardiest low-growing alpine bellflower. Excellent effect may be secured from a number of the garden hybrids, when rightly employed; plantations of *C. Wilsonii*, cross between *C. pulla* and *C. turbinata*, dark blue, 6 inches tall, and *C Fergusonii* and *C. Hen-*

dersonii, 12 to 18 inches, all blooming freely from late in June to early August, are good examples. *Campanula glomerata* var. *acaulis*, a clustered-flowering low-growing form, violet-blue, June and July, answers the same purpose, while *C. glomerata* var. *dahurica*, 12 to 18 inches, dark violet-blue and white, very free-flowering, is valuable also as a border plant Other good rockery kinds are *C. fragilis* (which needs protection, but makes a good pot-plant), *C. pulla* in sheltered position, *C. Portenschlagrana*, and *C rotundifolia*. Many of the larger-growing kinds are also good for the rock-garden. —The best two representatives of the biennial class, are *C. Medium* and *C calycanthema*, both standard garden flowers In the northern states, especially, they do exceedingly well. When used for mass effects, their full bloom becomes a prominent feature of June. The delicate shades of pink and pale lavender, the purity of the white, and the rich tints in purple and blue are a revelation They transplant very easily, even in an advanced state of growth, and readily respond to mild forcing under glass in spring In a cut state, they show remarkably good lasting qualities and are of excellent value as material for filling vases. A few other good biennials are *C sibirica*, *C. primulæfolia*, *C. spicata*, (p 650), *C thyrsoides* —The peach-leaved section comprises the most perfect forms of the bellflower family, although *C persicifolia* has been surpassed in popular favor by the more vigorous *C grandiflora* varieties in white and blue, which are really platycodons *C isophylla*, native of Italy, is not hardy in Maine and must be overwintered under glass It is a very effective basket- and balcony-box plant, its long hanging vines being covered with large and attractive flowers in July and August The color is a delicate light blue, while the bells of its garden descendant *C Mayi*, have a deeper shade For the South, both are valuable acquisitions for rockeries —Of the perennial species, according to Robert Cameron, the best border plants are the following *C carpatica* and vars. *alba* and *turbinata*, *C. glomerata*, especially var *dahurica*, *C. lactiflora*, *C latifolia*, especially its vars *eriocarpa* and *macrantha*, *C. nobilis* (about 2 ft in height), *C persicifolia* and its numerous vars, especially the white kinds; *C. punctata* (about 1½ ft), *C pyramidalis*, a very showy plant when well grown, but not quite reliable in the eastern states as to hardiness, making a good pot-plant for the cool greenhouse, *C rapunculoides*, which spreads rapidly and must be so placed that it will not crowd out the other plants that are near it; *C rotundifolia; C. Trachelium*, *C Van Houttei*, a hybrid, and one of the best bellflowers —Campanulas are raised from seed and also by division or cuttings Seeds should be started early under glass Cover very shallow, and place the shallow seed-pans near the light in an average temperature of 60°. Shade at midday while in process of germinating; avoid over-watering and "sticky" atmosphere Transplant seedlings into flats as soon as they can be handled Harden young plants gradually and transfer them to the open ground in May. *C. Medium*, *C calycanthema*, and all the *C. persicifolia* varieties, when grown for the cut-flower trade, should be placed on beds where they are intended to be flowered and cropped the next season They thrive best in a rather light well-manured garden soil. Some of the alpine species require a sandy humus with additions of fine limestone material When grown for floral garden effect, the open sunny position is preferable throughout the North, while for the South half-shade at midday is likely to prolong the flowering season. Seedlings of single varieties come true to color to a high percentage Of the semi-double and double *C. persicifolia* sorts, propagation is usually by division in September *C isophylla* and *C Mayi* are shy seeders and are propagated by cuttings in spring For winter protection, a light covering of straw, leaves or evergreen boughs is sufficient south of New York. In more northern parts, hardy campanulas require a uniform layer of leaves 2 to 3 inches thick. The annuals can be raised in the border by seeds sown late in April or May, or raised in the greenhouse and then transferred to the border. The best of the annuals are *C. ramosissima* and var. *alba*, *C. drabifolia*, *C. Erinus*, *C. macrostyla*, and *C. americana*. (Richard Rothe.)

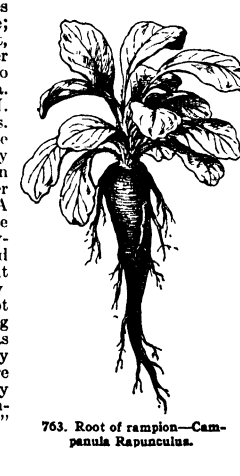
INDEX.

acaulis, 12
alaskana, 44
alba, 11, 16, 19, 32, 39, 45, 46
alba grandiflora, 10.
allariæfolia, 5.
Allionii, 26.
alpina, 29.
americana, 9.
arctica, 44.
attica, 43
Backhousei, 10.
barbata, 27
biserrata, 13
bononiensis, 18.
caespitosa, 46.
calycanthema, 4.
carpatica, 39.
celtidifolia, 13.
coelestina, 39.
cœrulea, 13
compacta, 16, 39
coronata, 10
dahurica, 12
divaricata, 23.
divergens, 30
drabifolia, 43.
Elatines, 35
Erinus, 49
eriocarpa, 17.
excisa, 47
eximia, 30
Fergusonii, 16
floribunda, 40
fragilis, 33
garganica, 34
glomerata, 12.
grandis, 11
Grosseki, 7
haylodgensis, 39
Hendersonii, 39.
hirsuta, 33, 34
Hoheneckeri, 30
Hostii, 44
imperialis, 4
isophylla, 40
lactiflora, 13
lamifolia, 5
latifolia, 17.
latiloba, 11
lanifolia, 45
longestyla, 3.
Lorei, 32
macrantha, 10, 17.
macrophylla, 5
macrostyla, 2
major, 36.
marginata, 10
Mayi, 40
Medium, 4
mirabilis, 8
Moerheimei, 10
mollis, 28
muralis, 36.
nobilis, 24
pallida, 25, 46
parviflora, 3
pelviformis, 39
persicifolia, 10
Portenschlagiana, 36
pulla, 42
pulloides, 42.
pumila, 46
punctata, 24.
pusilla, 46.
pyramidalis, 16.
Raineri, 37.
ramosissima, 32.
rapunculoides, 21.
Rapunculus, 1
rhomboidalis, 19.
riversiea, 39
rotundifolia, 44.
ruthenica, 18.
sarmatica, 6
Scheuchzeri, 45.
Scouleri, 41.
sibirica, 30
soldanella, 44
soldanelliæflora, 44.
sparsiflora, 12.
speciosa, 12, 14
Stansfieldii, 31, 39.
stenocodon, 44.
superba, 12
Tenori, 38
Tommasiniana, 31.
thyrsoides, 14.
Trachelium, 20.
turbinata, 39.
urticifolia, 20
Van Houttei, 25.
velutina, 44
versicolor, 22.
verus, 1
Vidali, 15.
Waldsteiniana, 31.
Wiegandii, 4.
Wilsonii, 39.
Zoysii, 48.

C primulæfolia and *C spicata* will be found in the supplementary list, p 650

GROUP I *Kitchen-garden vegetable: roots radish-like: a salad plant*

1 **Rapúnculus,** LINN. (*Rapúnculus vèrus*, FOURT.). RAMPION Fig 763 Biennial or perennial, 2–3 ft.: root spindle- or long-radish-shaped, ½in thick, white: st erect sulcate lower lvs. obovate, short-petioled, somewhat crenate, st -lvs. linear-lanceolate, entire fls calyx-tube obconical, lobes lilac, in a spike or raceme; glabrous or bristly, erect, awl-shaped, a half shorter than or nearly equal to the funnel-shaped corolla. Eu., Orient, N. Asia, N. Afr —The roots and lvs. are eaten as a salad The seeds, which are very small, are sown in the open ground in early May either broadcast or in drills. A little sand mixed with the seed gives an evener sowing Press firmly, and water carefully. Thin out the seedlings if necessary Water freely in hot weather. A fresh sowing may be made in June, as early-sown plants may run to seed. Roots are gathered in Oct and may be stored in sand for winter use. "Rapunculus" means a little turnip.



763. Root of rampion—Campanula Rapunculus.

GROUP II. *Tall or border campanulas, characteristically a foot or 15 in. or more high. Nos. 2–23.*

A. *Calyx with an appendage at the base of each sinus.*

B. *Caps. 5-celled and stigmas 5 (variable in No. 3).*

C. *Style excessively long, the stigma an inch or more long.*

2. **macróstyla,** BOISS. & HELDR. Annual, 1–2 ft., branched from the base, hispid with rigid spreading scattered bristles. branches stout. lvs scattered, small for the size of the plant, sessile, bristly on both surfaces; lower ones ovate-oblong, acute; upper ovate-lanceolate, recurved, cordate, eared at the base: calyx-tube hidden by the bladdery appendages, small, broader than long; fls. solitary; on stout peduncles, 2–2½ in. broad; corolla very broad and open, pale purple without, dull purple within, marked with violet, and hairy toward the bottom; lobes very broad, short and acute Mt. Taurus in Anatolia. Gn 15: 356 and 12, p. 209 B M 6394. —The very long exserted style is brown and spindle-shaped before spreading open. Self-sown seeds sometimes remain a year before sprouting.



764. Campanula Medium, the Canterbury Bell. Modified forms are shown.

CC *Style not excessively long*

3 **longéstyla,** FOMIN. Perennial, 1½–2½ ft., more or less hairy. basal lvs lance-oval, lobed, the st-lvs oblong and sessile fls blue-purple, drooping; calyx-lobes lanceolate-pointed, the appendages reflexed on the peduncle; corolla almost urn-shaped, dilated below the middle, style exserted with 3, 4 or 5 stigmas. caps 3–5-celled Caucasus. Gn W. 23 671 Var **parviflóra,** BOIS Fls smaller. R H 1911·548, p 549

4 **Médium,** LINN (*Médium grandiflórum,* SPACH). CANTERBURY BELLS Fig 764 Biennial, 1–4 ft.; plant pilose st erect. lvs sessile, ovate-lanceolate or lanceolate, crenate-dentate. raceme lax, many-fld; fls. violet-blue, varying to several shades and to white, 2 in. long; calyx-lobes ovate-acuminate, the appendages half as long as the ample ovate obtuse lobes; corolla bell-shaped, inflated S Eu. Gn. M 14:9. Two forms (aside from the single-fld) occur the double, Fig 764*a*, with 1–3 extra corollas, and the var **calycánthema,** HORT, Fig 764*b*, with an enlarged spreading and petal-like outer part sometimes deeply divided and sometimes little lobed or nearly entire (varying on the same plant). The var. *calycanthema* is the CUP-AND-SAUCER form (the name hose-in-hose, sometimes applied in Campanula, would better be retained for *Primula elatior*), a fair percentage come true from seed; usually a stronger plant than the common *C Medium.* G C. III. 24·65. R H. 1896, p 301; 1897, p 238. Gng. 5 88. Gn. 48, p. 295. F S. 19, p. 152. G.W. 3, p. 291 G.Z. 17: 113. Var. **Wiègandii,** HORT. Lvs golden yellow: fls. blue. Var **imperiàlis,** HORT, is a very floriferous form or possibly a hybrid —Canterbury bells are most commonly treated as hardy biennials, the seed being sown in the open border, but they do not flower the first year. They can also be treated as tender annuals, the seed being sown indoors in early spring and the plants set out May 1–15 They will then flower well the first season, but always better the second year. Sowings may also be made in April, May or later, in pots, boxes or beds, and plants then be transferred into some sheltered place where they can be slightly protected during the winter, and then transplanted in spring to their permanent places into good rich soil, where they will make a great show if they have had the right treatment Let them stand 18–24 in apart Seedlings potted up in autumn may be brought into bloom readily indoors in spring, and even blooming plants, if not spent, may be potted direct from the garden and used in the house in autumn

BB *Caps 3-celled. stigmas 3.*

5 **alliariæfòlia,** WILLD (*C lamiifòlia,* BIEB *C. macrophylla,* SIMS) Perennial, 1½–2 ft st erect, striate, woolly, branched only at the top root-lvs large, heart-shaped, crenate, tomentose, st-lvs on petioles which gradually shorten upward, the highest being sessile. fls white, nodding, on short stalks, borne singly in the axils of the floral lvs as in *C sarmatica,* but the floral lvs larger and broader, calyx a third or a fourth shorter than the corolla, with margins rolled back, and appendages less minute than in *C sarmatica,* corolla always white, 2 in long, ciliated at the margin, and with characteristic tooth-like processes at the base of each sinus. Caucasus, Asia Minor B M 912 Gn M 14 9

6 **sarmática,** KER-GAWL Perennial, 1–2 ft st simple, striate, pubescent lvs remarkable for their gray color, harsh, leathery, wrinkled, tomentose, oblong-cordate, crenate, the lower long-petioled, the upper sessile calyx with minute reflexed appendages, and a short, densely hairy tuft fls about 6 on a st, nodding, corolla about 1 in long, and 1½ in across, pale blue, marked with 5 hairy lines Caucasus, in subalpine places B M 2019 L B C 6 581.

7 **Grósseki,** HEUFF Has the habit and infl of *C. Trachelium,* but the calyx is appendaged, perennial, 2½ ft, branching from the base, angled, pilose. lvs. hispid, the lower cordate, unequally petioled, doubly crenate-serrate, the uppermost ovate-acute, narrowed into a petiole calyx setose-ciliate, lobes spreading, reflexed at the apex, appendages lanceolate, a third shorter than the lobes, corolla hispid, 2 or 3 times longer than the calyx-lobes. fls large, bell-shaped, violet, in a long raceme Hungary Gt 35, p 477. G. 27.459.

8 **mirábilis,** ALBOFF Biennial or short-lived perennial, 1 ft or more; whole plant forms a broad dense cone with such a profusion of bloom as almost to hide the foliage lower lvs 4–6 in long, obovate or spatulate, obtuse, coarsely toothed, petiole winged. fls pale lilac, erect, broadly campanulate, 2 in. across, the corolla hairy on margins and back Caucasus. B M. 7714. G C III 24:33, 42:144–5. Gt. 47, p 192. Gn. 54, p 454; 60, p 58 G.W. 12, p. 445.—A very beautiful and remarkable plant.

AA. *Calyx without an appendage at the base of each sinus.*

B. *Fls. rotate or wheel-shaped.*

9. **americàna,** LINN. Annual and biennial, 3–6 ft.: st. erect, simple: lvs. thin, serrate, somewhat pilose;

root-lvs. ovate-acute, subcordate, petiolate; **st.-lvs.** ovate-lanceolate, acuminate at both ends· calyx-tube long, obconical, the teeth linear-acuminate, almost entire, spreading, shorter than the 5-fid, wheel-shaped corolla; fls. light blue, 1 in. broad, in long spikes, solitary or in 3's, corolla shallow, lobes pilose outside and at the apex; style long, strongly declined and upwardly curved: caps cylindrical, grooved Shaded low ground Canada to Iowa, south to Fla. and Ark —Rarely cult It is possible that *Phyteuma canescens* is still cult. as *C. americana.*

BB *Fls. saucer-shaped or broadly bell-shaped, i. e., the tube shallower and the limbs more widely spreading than the bell-shaped.*

c *St -lvs linear-lanceolate, crenulate.*

10 **persicifòlia,** Linn Fig 765. Perennial, 2–3 ft : st. erect lvs glabrous, rigid, crenulate, root-lvs lanceolate-obovate, st -lvs linear-lanceolate or spatulate, often 3 in. long calyx-lobes acuminate, wide at the base, entire, half as long as the broadly bell-shaped corolla. fls blue or white, pedicelled, solitary, terminal and axillary, often 1½ in long, 2 in broad caps ovoid, 3-grooved. Eu. B M 397. G.C III 43 384 Gn. 75, p 30 G 6·297. Gn M 14 9 G W 3, p 292. C.L A. 13.478, the white form in G. 13:71 and Gn. W 23 Suppl Jan 27; the double white in G.C III 27 409 and G 3 563. One of the best of all perennial campanulas Var. **macrántha** is a large-fld form with fls all along the st. Gt 44, p 148 Gn 48, p 306 A F 6 383 S.H. 1:131. Var. **álba grandiflòra** and var. **Bäckhousei** are among the popular white-fld forms There are double and semi-double forms in blue and white The double white is useful for cutting For portraits of var. *grandiflora,* see G 27 158, 28 553, 673, G W 12, p 133. Var **coronàta,** Hort , is a semi-double white form F S. 7 699 The pictures in B M. and F S show distinctly saucer-shaped fls. Var. **Moerheimei,** Hort White-fld, double, 2–3 in diam · excellent G C III 27.414 G M 49 535 G W 6, p 545; 12, p 434 A G 23 497 Var. **marginàta,** Hort , has white fls tinted blue on the borders R B 32, p 252 This species occasionally runs wild, especially in England. The lvs. are very characteristic, and, once seen, are never forgotten.

cc *St.-lvs wider and coarsely toothed.*

11 **latifloba,** DC (*C grándis,* Fisch & Mey) Perennial, 1–1½ ft, glabrous. st erect, simple, terete· st.-lvs 3–5 in long, 4–6 lines wide, lanceolate, narrowed at both ends, crenate-serrate· calyx-lobes ovate-acute, broad, entire, erect, one-half shorter than the broadly bell-shaped corolla: fls. blue, often 2 in. wide, sessile, solitary or somewhat clustered, sometimes equaling the ovate-acute, dentate bracts Mt Olympus. P.M. 10.31. H U 3, p 137. Gt 7 202 —Fls. like *C. persicifolia.* Quickly forms a dense carpet. Variable in color. Var. **álba,** Hort. White fls. G. 19:440.

BBB. *Fls. bell-shaped or tubular, not saucer-shaped.*

c. *Infl. a dense roundish head.*

12. **glomeràta,** Linn. One of the most variable: perennial, 1–2 ft , typically pubescent: st erect, simple, terete. lvs. serrulate, lower ones rough with very short, stiff hairs, 1½–3 in. long, 1–2 in. wide, with a cordate, ovate-oblong blade shorter than the petiole; upper ones sessile, ovate, acute. fls. violet-blue to white, in dense heads or glomes, 15–20 in the terminal heads, fewer in axillary ones. Eu , Armenia, Persia, Siberia, sometimes escaped in this country. Gn M. 14 9. B.M. 2649 is var. **speciòsa,** which has the largest fls L B C. 6·505 is var. **sparsifiòra,** with much smaller clusters.—This is one of the earliest flowering and easiest of cult. Fls. typically dark purple, running into lighter varieties Var **dahùrica,** Hort , is probably the commonest form· terminal clusters 3 in. or more thick, a very characteristic infl. The fl. has a longer tube than *C. lactiflora* and *C. thyrsoides.* G. 26.305. Var **acaùlis,** Hort , is an almost stemless form with very large fls.: sts only 3–5 in. high. G W. 9, p. 272. Var. **supérba,** Hort , is a cross of the dwarf variety with var. *dahurica:* large heads of deep violet fls.

cc. *Infl. a spike or raceme, dense or loose.*

D. *Color of fls normally white or yellowish.*

E. *Corolla small, short-tubed.*

13 **lactiflòra,** Bieb Perennial, 2½–6 ft.: st. erect, branching· lvs sessile, ovate-lanceolate, acutely serrate calyx-lobes very broad, acute, serrulate, one-half shorter than the broadly bell-shaped corolla: fls in a loose or dense panicle, which may be 3½ in. long and thick; corolla white or pale blue, 1 in. long, nearly 1½ in broad caps ovoid, erect Caucasus, Siberia. B.M. 1973 G C III 50 438. Gn. 61, p. 29, 63, p. 90; 71, p 418, 75, p 89 G M 46: 168, 48 545. Gn W. 23 623. The normally milk-white blue-tinged fls are characteristic. Var. **cœrùlea,** Hort , has light blue fls.—*C. celtidifòlia,* Boiss , referred to the above, may be a strongly marked variety. *C. biserràta,* Koch, is also referred here.



765. A narrow-flowered form of Campanula persicifolia.

14 **thyrsoides,** Linn Biennial, 1–1½ ft ; st. grooved lvs all covered with long hairs at the margin; root-lvs. sessile, spatulate or obtusely lanceolate, 2½ in. long, ¾in wide, in a dense rosette, lying on the ground; upper lvs more narrow and acute fls 40–50, sulfur or creamy yellow, in a dense thyrse-like spike, which may be 6 in long and 2½ in broad; style exserted. Alps and Jura, 3,000–6,000 ft. B M 1290 L B C. 17 1644.—Intermingled with the fls in the spike are lvs. which are longer than the fls , which is not true of *C. lactiflora.* Should not be confounded with *C thrysoidea,* Lapeyr , which = *C. speciosa,* (see supplementary list). Apparently no blue or purple forms are known. The picture in B.M. shows a characteristic red-tipped calyx. Garden hybrids are reported with *C. spicata* (see Kew Bull 1910, p. 322).

EE *Corolla large, long-tubed.*

15 **Vidálii,** H C. Wats Perennial, 1–2 ft · st branching from the base. some branches short, sterile, others tall, floriferous, all grooved, clammy, glossy. lvs 3–4 in long, oblong-spatulate, coarsely serrate, thick, fleshy, firm, viscid, the upper ones gradually becoming bracts fls 2 in long, nodding, about 9 in a loose terminal raceme; calyx-lobes triangular, thick, one-fourth shorter than the corolla; corolla tubular, swelled below, constricted above, white with a yellow base Azores. B.M. 4748. F S. 7:729 A. F. 3:116. G C III 18·95; 34:330–1 Gn. 54, p 299, 63, p. 297; 74, p. 402; 75, p. 410. J.F. 3, pl. 274.—Very distinct.

DD. *Color of fls. normally blue or purple (with white varieties).*

E. *Size of fls. large.*

F. *Raceme pyramidal or long-conical, usually dense.*

16. **pyramidàlis,** Linn CHIMNEY CAMPANULA. Fig. 766. Glabrous perennial, 4–5 ft.: lvs. glandular-den-

tate, lower petiolate, ovate-oblong, subcordate; st.-lvs. sessile, ovate-lanceolate: calyx-lobes acuminate, spreading, half as long as the broadly bell-shaped corolla. fls. numerous, in pyramidal racemes, pale blue varying to white and darker at the base. G.C. III. 32:388. Gn 45, p. 67; 48, p. 306; 51, p. 221 (a staked pot plant); 47, p. 86 (with extensive cultural notes); 53, p. 535, 62, p. 254, 64, p. 96; 68, p. 137; 69, p 4, 74, p. 548. R H 1897, p. 238. G M 46 612; 53 · 811. G.W. 1, p 39, 7, p. 7; 11, p 137; 13, p. 571. Var **álba,** Hort., has white fls Gn 74, p. 645. J H III. 51·257. Var **compácta,** Hort. Dwarfer: fls. larger and of better substance. The compact variety is very floriferous and convenient for conservatory, but lacks the characteristic erect, pyramidal habit Gn 73, p 54 G. 18 64 S. H. 2 : 97. *C Férgusonii,* Hort., is a hybrid of *C pyramidalis* and *C carpatica,* resembling a dwarf form of the former in growth, 18 in. petals more pointed than those of the latter: fls bright lilac Gn 66, p. 276.



766. Campanula pyramidalis.

Hybrids between *C. pyramidalis* and *C versicolor* are reported.

FF. *Raceme not pyramidal, usually looser.*

17 **latifólia,** Linn. Perennial, 3–4 ft lvs large, doubly serrate; root-lvs. sometimes 6 in long, petiolate, cordate, covered with soft hairs; st.-lvs sessile, more acuminate. peduncle 1-fld.; calyx-lobes long-acuminate, one-third shorter than the corolla, fls 6–15 in a loose spike or raceme about 8 in long, erect, very large, 2½ in. long, purple or dark blue, hairy Eu., Persia G.W 8, p. 445. Var **macrántha,** Sims (*C. macrántha,* Fisch.) is commoner in cult than the type, a little hairier, with a glabrous calyx and very large fls. B M. 2553, 3347 R H. 1897, p. 239. J.H. III 60.263. Var. **eriocárpa,** DC., has the st and lvs. pilose and more pallid, and a hispid calyx-tube. There is a white-fld form. It is native to England, and is easily naturalized there in wild gardens. The st.-lvs. are probably the largest of any of the garden kinds, often 3½ in. long and 2 in. wide.

EE. *Size of fls small, less than 1 in. long.*

18 **bononiénsis,** Linn Perennial, 2–2½ ft.; scabrous: st. simple. lvs. serrulate, ovate-acuminate, pallid beneath; root-lvs. cordate-petiolate; upper lvs. clasping: calyx-lobes acuminate, one-fourth shorter than the funnel-shaped corolla· fls. normally purplish, in a long, loose, pyramidal spike, which may be 2 ft long, with 60–100 small fls ; corolla ¾in. long and broad. E. Eu., W. Siberia, and Caucasus. Var **ruthénica** (*C. ruthénica,* Bieb.), has lvs. wider and tomentose beneath. Caucasus and Tauria. B.M. 2653. There is a white-fld. form The fls are much smaller than in *C. latifolia,* and the raceme is much larger.

19. **rhomboídalis,** Linn. Perennial, 1 ft., sometimes 2 ft.: st. simple, erect: lvs. sessile, ovate-acute, serrate: calyx-lobes awl-shaped, one-half shorter than the bell-shaped corolla; fls. 8–10 in an almost corymbose raceme, the lower pedicels of which may be 3 in. long, the uppermost 1 in. or less, corolla purplish blue, 1 in. long, and a little wider. Mts of Eu. B.M 551 (as *C. azurea*) J.H III 50:541 Var. **álba,** Hort, has white fls G.W. 3, p. 14.—It flowers in July and August, after which the sts and lvs. die down quickly.

20 **Trachélium,** Linn THROATWORT Fig 767. Perennial, 2–3 ft.: st. angular, somewhat bristly (as also the fls): lvs. rough, acuminate, coarsely crenate-dentate; root-lvs cordate, ovate, short-stalked· calyx-lobes erect, triangular-acuminate, one-third shorter than the bell-shaped blue or white corolla peduncle 1–3-fld , fls erect at first, at length tending to droop in a loose raceme, which may be 12–18 in long caps nodding Eu , Caucasus, Siberia, Japan, and run wild in parts of N Amer R H 1897, p 239 There is a double-fld form and variations in color.—One of the commonest and hardiest of the border plants, often running out the other campanulas, and passing under many names, especially as *C. urticifolia.*

21. **rapunculoídes,** Linn Fig 768 Perennial, 2–4 ft : st. indistinctly pubescent or almost smooth lvs. rough, ovate-acuminate, root-lvs petiolate, cordate, crenulate; st.-lvs serrulate calyx a little rougher than in *C Trachelium,* the lobes linear-lanceolate, at length reflexed, one-fourth length of the oblong-campanulate bright blue corolla, fls soon declined or nodding, in long mostly 1-sided racemes or spikes, bright blue. Eu , Caucasus, Siberia, and common in patches on old roadsides and about yards Summer Gn. M 14 9

22 **versícolor,** Sibth & Smith Perennial, 3–4 ft ; plant glabrous st ascending lvs serrate, root-lvs. long-petioled, ovate-acute, subcordate, st.-lvs short-petioled, ovate-lanceolate, acuminate calyx-teeth acuminate, spreading, at length reflexed, one-half as long as the corolla· fls in long, spicate racemes, style exserted caps spheroid Greece

CCC. *Infl an open, compound panicle*

23. **divaricàta,** Michx Glabrous perennial, 1–3 ft st erect, slender, paniculate above branches slender, divergent lvs sparse, subsessile, ovate-lanceolate, acuminate at both ends, coarsely serrate calyx-lobes awl-shaped, one-half shorter than the tubular, bell-shaped corolla, fls small, nodding, pale blue, in a very open and compound panicle, style straight, exserted Alleghanies, from Va to Ga.—Rare in gardens



767. Campanula Trachelium. (×⅓)

GROUP III *Low-growing or rock-garden campanulas, mostly less than a foot or 15 in. high* Nos 24-49

A. *Calyx with an appendage at the base of each sinus, often minute or disguised in form.*

B. *Throat of corolla spotted violet.*

24. **punctàta,** Lam. (*C. nóbilis,* Lindl.). Named from the spotted whitish corolla, the purplish spots being inside and showing through faintly in the fresh fl. but

more plainly in the dried specimen: like *C. alliariæfolia*. Perennial, 1 ft, with long and loose hairs: upper lvs nearly sessile, and more sharply toothed than the lower: calyx-lobes one-third as long as the corolla, longer, looser and hairier than in *C. alliariæfolia*, and the margins much more recurved: peduncle 1-4-fld, fls nodding, corolla cylindrical, 2¼ in. long, white, spotted within, strongly ribbed Siberia, Japan. G C III 38, supp Aug. 26. 42:96. Gn 73, p 423; 75, p 158 G M 51 781. G 29:595 —*C. nobilis* has been considered distinct. In F S. 3 247 the corolla is dark violet without, the limb hairy, while in B M 1723 (*C. punctata*) the corolla is white outside and not bearded. In F S 6:563 (*C. nobilis* var *alba*) the limb is not bearded and the st. is red, and not hairy The three pictures show great differences in foliage, pubescence and appendages This is one of the most interesting of all campanulas, and is, unfortunately, usually considered more quaint than beautiful. The spotted throat readily separates it from other campanulas.

BB *Throat of corolla not spotted.*

C *Sts commonly 1-fld.*

25 **Van Houttei,** Carr Perennial, 2 ft: root-lvs. long-petioled, roundish cordate, more or less lobed; st-lvs sessile, oval-lanceolate, irregularly bi-dentate, 2½–4 in. long, more or less villous, strongly nerved. fls usually solitary, nodding at the end of a small branchlet, 2 in long, half as broad, indigo-blue, or violet, calyx-lobes linear, spreading, 1 in. long —A garden hybrid resembling *C. punctata*. Intro into France 1878 by Thibaut and Keteleer. Var **pállida,** Hort, has pale lavender fls

26 **Allióni,** Vill Perennial, 3–5 in. rootstock slender, creeping underground, sending up sts. at intervals of ½ in lvs few, about 7 on a st, 1–2 in long, linear-lanceolate, sessile, slightly hairy, entire, midrib distinct, lower ones in a whorl of about 5, upper ones similar but more erect calyx-lobes lanceolate, half as long as the corolla, the appendages ovate, reflexed, one-third the length of the calyx-lobes; fls purple, with a rare white variety, only one on a st, inclined or nodding, 1½ in long, and as broad across the mouth, probably the largest for the size of the plant of any campanula A very local species, found only in the western Alps. B M. 6588 G C III 52 52 Gn 60, p 51

CC *Sts usually several-fld*

D *Margin of corolla bearded.*

27. **barbàta,** Linn Perennial, 6–9 in: st pilose. lvs. villous, entire or nearly so, root-lvs tufted, lanceolate; st-lvs few, ligulate (?): raceme loose, 3–4-fld, fls nodding, pale blue, calyx appendage ovate, obtuse, half as long as the lobes, corolla bell-shaped, shorter than in *C. Allionii*, and with a bearded mouth Alps L B C 8:788 G C III 18 388 Gn 48, p 297. G W 12, p 417 —There is a white-fld form, but apparently no purple Readily distinguished from *C. Allionii* by the different colored, bearded and smaller fls, which are rarely borne singly, and by the dense, soft hairs of the st Alps, 2,400-6,000 ft, widely distributed, mts. of Norway, and the Carpathians Becomes coarse when grown in rich ground.

DD. *Margin of corolla not bearded.*

E *Fls erect.*

28. **móllis,** Linn Perennial, velvety gray, 6–8 in: sts. procumbent, about 2-fld root-lvs tufted, obovate or spatulate, st-lvs ovate or rotund fls loosely panicled; calyx-lobes lanceolate, erect, half shorter than the glabrous, bell-shaped corolla, appendages minute, shorter than the calyx-tube; corolla erect, dark purplish blue or lavender, with a white throat, the tube long, segms short, broad, spreading, acute Spain, Crete. B.M 404 —Rock or border plant.

EE *Fls nodding*

29 **alpìna,** Jacq Perennial, 3–8 in: st furrowed. lvs smaller than in *C barbata*, more narrowly lanceolate, entire, hairy fls typically deep blue, bell-shaped, with broader and shorter segms than in *C barbata;* calyx-lobes proportionately very long, surpassing the ft-bud, and nearly as long as the flower, but widely spreading Alps of Austria, Lombardy and Transylvania, 6,000–7,000 ft altitude B M 957 J H III 29 5 — There is a white-fld var. The plant has a characteristic shaggy appearance from the hairy lvs. Easy of cult.



768. Campanula rapunculoides. (×⅔)

30. **sibírica,** Linn. (*C Hohenackeri*, Fisch.). Biennial or perennial, setaceous-pilose. st. erect, simple, paniculed above lvs crenulate; root-lvs petioled, obovate, obtuse; st-lvs lanceolate-acuminate calyx hairy, the lobes long-acuminate, a third shorter than the corolla, calyx appendages like the lobes but half shorter and reflexed; fls. 25 or more, violet, with a longer and narrower tube than in *C. alpina*, and longer divisions of the limb. N. Asia, Caucasus, W. Eu. B M. 659. R H. 1861:431 —The type is rare, but var **exímia,** Hort, is somewhat commoner. it is dwarfer, much branched, with long, scabrous lvs. and pale blush to violet fls. Var. **divérgens,** Willd, has larger fls and broader lvs than the type. G.C. III 16:597. *C. sibirica* usually does best when treated as a biennial.

AA *Calyx without appendages.*

B. *Fls. very wide-spreading, i.e., rotate, wheel-shaped, almost flat.*

C. *Blossoms all erect.*

31 **Waldsteiniàna,** Roem & Schult. **Perennial, 4–6 in. sts. rigid, glabrous: lvs. fleshy, sessile, gray-green,**

lanceolate, slightly serrate-dentate, the lower obtuse, the upper long-acuminate: calyx-lobes awl-shaped, spreading or recurved, one-fourth shorter than the corolla: fls. 5–9 in a corymbose raceme 1¼ in. long, ¾in. wide, pale purplish blue; corolla rotate, almost starlike, with a dark spot in the throat; pistil large, white, twice the length of the corolla, with a yellow stigma S Austria. Gn 8, p. 173. G. 18:81. G W 12, pp. 446, 710 *C. Tommasiniàna*, Hort., is an allied plant, with very wiry growth and pendent pale blue fls. *C. Stansfieldii*, Hort., is a supposed hybrid, perhaps between *C. Waldsteiniana* and *C. carpatica*.



769. Campanula carpatica. (×⅔)

32. **ramosíssima,** Sibth. & Smith (*C Lòrei*, Poll.) Annual, 1 ft or less, branching· lower lvs. obovate and crenate, upper lvs. narrow, entire: fls. violet with white base and blue intermediate parts, erect on long simple pedicels Eu B M 2581. Var. **álba,** Hort Fls. white.

CC. *Blossoms not all erect.*

D. *Habit trailing or pendulous.*

33. **frágilis,** Cyrill. Perennial, 4–6 in : st diffuse, trailing: root-lvs. long-petioled, roundish-cordate, obtusely dentate, or crenately lobed; st-lvs. smaller, scattered, the uppermost ovate-lanceolate: fls. pale purplish blue with a white center, 1½ in. wide, in loose corymbs; calyx-lobes linear-lanceolate, acuminate, erect, almost equaling the corolla; style exserted: caps. ovoid. Italy B.M. 6504. P.M. 11:25. G.C. III. 43·378. Gn. 8, p. 174; 47, p. 278; 63, p. 53. G. 18:120. G.W. 2, p. 381. Var. **hirsùta,** DC., is a hairier form.—This is the best species for hanging-baskets, window- and veranda-boxes, and for covering large stones in the rockery. Prop by cuttings in spring, the roots being too fragile to divide well. Not so hardy as *C. garganica*.

34. **gargánica,** Tenore Perennial, 3–6 in : st. diffuse, with pendent branches: lower lvs. reniform-cordate, crenate-dentate; upper lvs ovate-acute, dentate: raceme lax; peduncles 1–2-fld ; calyx-tube spheroid, the lobes spreading, a third or fourth shorter than the glabrous blue rotate corolla Mt. Gargano in Italy, and elsewhere B R. 1768 Gn 48, p 295; 43, p. 25. G M. 54.664. G W. 4, p 255. Var. **hirsùta,** Hort., is a hairier form. Gn. 46, p 253; 48, p 297.—Half-shaded position. Prop. by cuttings or by division.

DD. *Habit not trailing or pendulous.*

35. **Elatines,** Linn. Perennial, more or less pubescent, 5–6 in.: lvs. cordate, coarsely and acutely dentate, lower rotund, others ovate-acute raceme lax; calyx-tube spherical, the lobes spreading, linear-lanceolate, somewhat unequal, a half shorter than the rotate purplish corolla, style exserted. Piedmont. Gn. 60, p. 64.—Rare rock-plant for light, stony soil.

36. **Portenschlagiàna,** Roem. & Schult. (*C. muràlis*, Port.). Perennial, 6–9 in : sts. somewhat erect: lvs. all alike petiolate, cordate, roundish, acutely angular-dentate: calyx-tube spheroid, lobes erect, acuminate, a third shorter than the infundibuliform blue-purple corolla: fls. racemose. Dalmatia.—Allied to *C. garganica*, but the corolla not so deeply 5-cut. Gn. 61, p. 225, 72, p. 469. Var. **màjor,** Hort. Fls. nearly twice larger than in the type, 1½ in. across, making a large mound of purple-blue. G C. III. 48:58. Gn. 60, p. 111; 63, p. 110. G.W. 3, p. 13.

BB. *Fls. broadly bell-shaped, less widely spreading than in* B, *wider than in* BBB (*except perhaps in No. 40*).

C. *Height 2–3 in.*

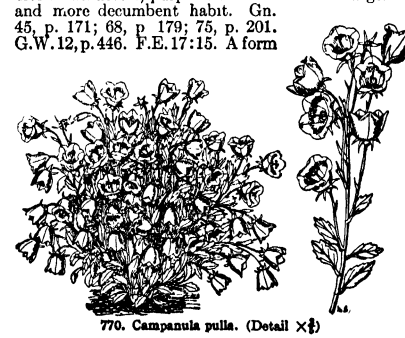
37. **Ràinerii,** Perpenti. Perennial, 2–3 in.: sts. suberect, branching· branches 1–3-fld : lvs. subsessile, ovate, distantly serrate, the lower smaller and obovate: calyx-tube obconical, the lobes long-acuminate, erect, half shorter than the broadly infundibuliform corolla: fls. large, solitary, erect, dark purplish blue; style short, not exserted: caps. obovate. Mts N Italy. F.S. 18:1908. Gn 60, p. 163.—One of the choicest rock-plants, but somewhat rare. Several forms of the hybrid *C. Wilsonii* are often cult under this name, but their lvs. are lighter green and less tomentose than *C. Rainerii*. Thrives in a well-drained, sunny position.

CC. *Height more than 2–3 in.*

D. *Style not exserted.*

38. **Tenòrii,** Moretti Perennial, 8–12 in , glabrous: st. ascending or prostrate: lvs leathery; root-lvs. long-petioled, ovate, subcordate, irregularly serrate, st-lvs petiolate, ovate-acute, coarsely serrate calyx-lobes linear-lanceolate, spreading, half as long as the broadly bell-shaped corolla fls racemose, blue· caps spherical. Apennines, near Naples.—This is referred by botanists to the Grecian species *C. versicolor*, which is typically taller, but is kept distinct by Correvon and others In the garden, *C. Tenorii* resembles *C. pyramidalis* in foliage and fl., but is shorter.

39. **carpática,** Jacq Fig 769. Perennial, 9–18 in , glabrous. st. branching· lower lvs. thin, long-petioled, ovate-rotund, cordate, coarsely dentate, undulate; upper ones shorter petioled, ovate-acuminate· peduncles long, terminal and axillary, 1-fld ; fls. large, often 1½ in. wide, bright deep blue; calyx-tube obconical, the lobes acute, wide at the base, subdentate-erect, a third or half as long as the broadly bell-shaped corolla; style not exserted: caps. ovoid-cylindrical. Carpathian Mts. of Austria. B.M. 117. G.C. III 46:412. G.W. 12, p. 436. Gn. 48, p. 297; 62, p. 326. Var. **cœlestìna,** Hort. Fls. sky-blue. Var. **álba,** Hort. Fls. white. G M. 55:615. Var. **turbinàta,** Hort. (*C turbinàta*, Schott), is dwarfer, more compact, with fls. more bell- or top-shaped, and often 2 in. across, purplish blue. It also has larger lvs. and more decumbent habit. Gn. 45, p. 171; 68, p 179; 75, p. 201. G.W. 12, p. 446. F.E. 17:15. A form



770. Campanula pulla. (Detail ×½)

with pallid fls. is rarer. Var. **Wilsonii,** Hort. (*C. Wilsonii,* Hort.), is a hybrid of var. *turbinata* and *C. pulla,* with the large fls. of the former and the handsome dark foliage of the latter. it is compact, dwarf, and small, ovate, very hairy lvs., with crenate-serrate margin. Gn. 60, p. 219. Var. **haylodgénsis,** Hort. (*C. haylodgénsis,* Hort.), is a garden hybrid, probably between *C. carpatica* and *C. cæspitosa.* Raised by Anderson Henry, Hay Lodge, Edinburgh. Height 6–9 in.: root-lvs. tufted, roundish cordate, slightly dentate, st.-lvs. light green, ovate-cordate, conspicuously toothed. fls. light blue, bell-shaped, few, at the ends of sts. Var **pelviformis,** Hort., from Crete, has very large, pale lilac, almost saucer-shaped fls. R.H. 1882, p. 509. G.C. III. 44:64. Var. **Hendersonii,** Hort., is often referred to var. *turbinata,* but is more robust; there is doubt as to its origin, *C. pyramidalis* or *C. alliariæfolia* possibly having played some part in it: lvs. ovate and ovate-cordate, 1½ in. long, ¾in. broad, slightly hairy on both sides, folded upwards, serrate; petioles 1–1½ in. long: fls. dark blue, 1½–2 in. wide, in short, 6–9-fld. racemes. G.W. 8, p. 65; 14, p. 581. Var. **riverslèa,** Hort. Fls. dark blue, 2–3 in. across: sts. 12–15 in. long but spreading, parts of corolla often 6 or 7. G.M. 43·627. Var **compacta,** Hort., is a condensed dwarf form of *C. Stánsfieldii,* Hort., is supposed to be a hybrid between *C. carpatica* and *C. Waldsteiniana* (No. 31).—This species is very variable in height and in shape of fls.

DD. *Style exserted*

40. **isophýlla,** Moretti (*C. floribúnda,* Viv.). Perennial. st. suberect: lvs. all of same form, petiolate, roundish cordate, crenate-dentate. calyx-lobes acuminate, half shorter than the broadly bell-shaped or saucer-shaped corolla; fls. pale blue, 1 in. or more wide, corymbose, style exserted. caps. ovoid. Italy. B.M. 5745. Gn. 49, p. 483; 48, p. 297.—A desirable basket or rock plant in sun or half shade. The white form, Var. **álba,** is most excellent free-flowering. **C. Máyii,** Hort., is supposed to be a derivative of this species. lvs. soft and woolly. Choice.



771. Campanula rotundifolia. (×1)

BBB. *Fls. bell-shaped.*

c. *Style exserted*

41. **Scouleri,** Hook. Perennial, 3–12 in.: st. simple or branched: lvs. acutely serrate, somewhat hirsute; lower ones ovate-acute, petioled; middle ones ovate-lanceolate; upper linear-lanceolate, sessile, calyx-lobes awl-shaped, erect, one-third shorter than the corolla. fls. pale blue, racemose, or more or less panicled, style exserted: caps. ovoid. N. Calif. to Puget Sound.—The capsular valves are a little above the middle, while in *C. carpatica* and *C. persicifolia* they are near the apex.

CC. *Style not exserted.*

D *Color dark purple.*

42. **púlla,** Linn. Fig. 770. Perennial, 3–8 in., tufted or in clumps, showy: st. normally 1-fld.: lvs. glabrous, crenulate-dentate, lower ones short-petioled, ovate-rotund; upper sessile, ovate-acute: calyx-lobes long-acuminate, erect, a half shorter than the bell-shaped, nodding corolla. Mts. of Austria, 4,000–6,000 ft. In B.M. 2492 the calyx-lobes are short-acuminate, a sixth as long as the corolla. L.B.C. 6:554. Gn. 63, p. 140. *C. pulloides,* Hort., is a supposed hybrid between *C. pulla* and *C. turbinata,* with habit of former: 5 in.: fls. glistening purple-blue. Gn. 66, p. 203.

DD. *Color not dark purple, but violet or blue (varying to white.)*

43. **drabifòlia,** Sibth. & Smith (*C. áttica,* Boiss.). Annual, hispid, 3–4 in.. lower lvs. oblong or elliptic, dentate, tapering into a petiole. fls. large, blue and lighter on the tube, bell-shaped, on forking sts. Greece.



772 Campanula rotundifolia var. soldanellæflora. (×¾)

44 **rotundifòlia,** Linn. HAREBELL. HAIRBELL. BLUE BELLS OF SCOTLAND. Fig. 771. Perennial, 6–12 in.: root-lvs. petiolate, orbicular or cordate, crenate-dentate. st.-lvs. linear or lanceolate, usually entire. calyx-lobes awl-shaped, erect, a third shorter than the bell-shaped bright blue corolla; fl.-buds erect. Eu., Siberia, N. Amer. Gn. 53.42; 62, p. 59. Gn. M. 14·10.—This is one of the most cosmopolitan of all campanulas, and the true harebell or bluebell of literature. In the wild it is usually slenderer and taller than in the garden. In shady woods it often grows 2 ft. high. The type has a white-fld. variety which is much less popular, but G.C. 1861.698 shows an excellent pot-plant of it. Var. **alaskàna,** Gray. Dwarfer, leafy to the top: radical lvs. cordate, lowest st.-lvs. ovate and: the upper ones becoming lanceolate. calyx-lobes attenuate, becoming deflexed; corolla ½–1½ in. long. Alaska. Var. **árctica,** Lange. Rigid, 1- to few-fld. corolla 1 in. long, the calyx-lobes very slender and soon spreading or deflexing. Canada: north. Var **velùtina,** DC. Herbage whitish pubescent. Var. **Hòstii,** Hort. (*C. Hòstii,* Baumg.), has larger fls. than the type and stouter sts. The lower st.-lvs. are lanceolate, remotely dentate, the upper linear entire: calyx-lobes longer than in the type, a half shorter than the corolla. The white-fld. form is not so vigorous. G. 5. 207. The most pronounced variant is var **soldanellæflòra,** Hort (*C. soldanélla,* Hort.). Fig. 772. With semi-double blue fls. split to the base into about 25 divisions. F.S. 18·1880. Gn. 60, p. 162. This curious variation is unique in the genus. The alpine soldanellas are famous among travelers for melting their way through the ice. They have fringed blue fls.—The name *C. rotundifolia* seems singularly inappropriate until one finds the root-lvs. in early spring. *C. stenocòdon,* Boiss. & Reut., by some referred to *C. rotundifolia,* is more slender and with narrower st.-lvs.: fls. long and narrow, tubular, rich lilac-purple. Alps.

45. **Scheuchzeri,** Vill. (*C. linifòlia,* Willd.) Perennial, 4–12 in. st. 1–4-fld., usually 1-fld.. root-lvs. roundish, ovate, or cordate; st.-lvs. linear or narrowly lanceolate, sessile, denticulate, the lowest st.-lvs. spatulate: calyx-lobes slender, linear-awl-shaped, nearly as long as the bell-shaped dark blue corolla. Alpine and subarctic regions of Newfoundland, Labrador, Alaska, and Rocky Mts. to Colo., also in Eu. and N. Asia. F.S. 21:2205, not L.B.C. 5.485, which De-Candolle states is *C. rotundifolia.* Var. **álba,** Hort. Fls. white. Gn. 60, p. 164. The st.-lvs. of *C. Scheuch-*

zeri are distinctly serrate, while in *C. rotundifolia* they are entire; the fl.-buds nod in the former, but are erect in the latter. The calyx-lobes are relatively longer in *C. Scheuchzeri*, and perhaps the bell is deeper.

46. **cæspitòsa**, Scop. (*C. pùmila*, Curt *C pusilla*, Hænk.) Perennial, 4–6 in.. root-lvs. tufted, short-petioled, ovate, glandular-dentate, shining: calyx-lobes linear, erect, a third shorter than the bell-shaped corolla: fls. nodding, blue; pollen violet-colored B.M. 512. Gn. 43.24; 48, p 297; 60, p. 161 G 25 307. R.H 1908, p. 223.—Dwarfer than *C rotundifolia*, with root-lvs never reniform, shorter-petioled, and lasting until after fls. have gone. Perennial, quickly forms a dense mat, and blooming from June till Oct The European trade catalogues usually offer *C cæspitosa* and *C. pusilla* separately, and doubtless plants of distinct horticultural value are passing under these names, but there seem to be no sufficient botanical characters to distinguish them Correvon says that *C pusilla* differs from *C. cæspitosa* only by its less stoloniferous character. Var. **álba**, Hort., has white fls G C III, 48:96. Gn. 72, p. 143, 75, p 368 G M 51:466. Var. **pállida**, Hort , has pale blue fls. G M 53 . 612

47. **excìsa**, Schleich Perennial, glabrous, height 4–5 in : sts slender, 1-fld : root-lvs spatulate, upper lvs. linear; calyx-lobes bristly, spreading, at length reflexed, a third shorter than the bell-shaped corolla. fls pale blue, divided to about half their depth, with a round hole at the base of each sinus, which easily distinguishes it from *C. pulla* and all other campanulas. Rare in Alps. B M 7358. L.B.C. 6.561. Gn. 60, p. 64.—A rare rock-plant. Likes cool, moist air, and not too full exposure to sun.

BBBB. *Fls. tubular, often long and narrow.*

48. **Zóysii**, Wulf. Perennial, 3–4 in.: plant tufted, glabrous. sts. few-fld.: root-lvs entire, crowded, petiolate, ovate-oborate, obtuse, st.-lvs obovate-lanceolate and linear: peduncles 1-fld , terminal, rarely axillary; fls. azure-blue, large for the plant, terminated by a stellar process before expansion; calyx-lobes linear, awl-shaped, spreading, a fourth shorter than the corolla; corolla long-cylindrical, constricted at the apex, wider at the base, sharply angled, pale blue. Austrian Alps, 6,000–8,000 ft Gn 8, p 173 G.C III. 20:183, 38:228 —A rare and abnormal species.

49. **Erinus**, Linn. Annual. plant hispid: height 3–9 in.: lvs small, glossy, ¼–¾in broad, cordate, deeply cut, the pointed lobes conspicuous: fls. sessile, pale blue with a light center, tubular, ½in. broad, with acute narrow lobes; style long, conspicuous, colored like corolla racemes long, semi-prostrate, 10–12-fld. Medit —Rare, short-lived rock-plant; also for edgings and pots

C. abretina, Grisb Rare tufted rockery plant, with slender, wiry sts 9–15 in. high fls light blue, in loose branching spikes, July, Aug E Eu —*C acutángula*, Ler & Lev Dwarf, with trailing sts from a rosette of ivy-like lvs st -lvs small, rounded and toothed fls solitary on each st , rather large and star-like, purple-blue N Spain G C III. 50 220 —*C amábilis*, Leicht =C phyctidocalyx —*C. Beaverdiàna*, Fomine Slender, to 2 ft , glabrous or finely hairy: lower lvs oblong-ovate to broadly ovate, obtuse, crenate-serrate fls few or solitary, slender-pedicelled, blue, 1¼ in. across B M 8299 Caucasus —*C calycánthema*, Hort =C. Medium var calycanthema —*C centúsa*, Linn A rare rock-plant from Mt Cenis and other mts of the Alps, with solitary deep blue fls on sts 2 in high Root-lvs obovate, obtuse, st -lvs ovate-oblong, all lvs sessile-entire calyx hirsute, the lobes linear-lanceolate, a half shorter than the deeply 5-cut, spreading corolla —*C. grandiflòra*, Jacq =Platycodon —*C hederácea*, Linn =Wahlenbergia.—*C. smeretina*, Rupr Dwarf, branching, resembling *C. sibirica* lvs small fls violet-blue Caucasus —*C incúrva*, Aucher= C. Leutweinii —*C kolenatiàna*, Mey Perennial, 9 in. or less lvs. mostly radical ovate, about 1 in long fls in long-stalked raceme, bluish violet, 1 in. long, inside hairy Caucasus —*C lacinìata*, Linn. Robust much-branched biennial, 2 ft , somewhat pubescent: lower lvs. 8 in long by 2½ in broad, deeply cut fls about 2 in. across, upwards of 1 in long, pale blue Greece G C III. 40:165. —*C. Leutweinii*, Heldr (C incurva, Aucher) Perennial, simple, 1 ft. or more lvs cordate, white-downy, crenate, rounded at apex: fls. pale blue, 1¼ in long Greece —*C Mariesi*, Hort =Platycodon.—*C. michauxioides*, Boiss. Tall-growing fls. bluish white, the segms recurved Asia Minor.—*C. Lamárckii*, D Dietr.= Adenophora Lamarckii —*C nitida*, Ait =C planiflora —*C. petræa*, Linn Biennial, with ascending st , hairy, 6–12 in lower lvs. lance-oblong, narrowed to the base, toothed, upper lvs. ovate and sessile fls small, pale yellow, in dense terminal and axillary heads N Italy.—*C phyctidocályx*, Boiss & Noé (C. amabilis, Leicht) Like C Rapunculus in habit, 2–2½ ft.. lvs. lanceolate or cordate fls 10–12 in raceme, dark blue with black styles, resembling those of C. persicifolia Armenia.—*C planiflòra*, Lam (C nitida, Ait) Glabrous height 3–9 in st simple: lvs sessile, leathery, shining, root-lvs crowded in a dense rosette, ovate or obovate-obtuse, crenulate, 1½ in long, st -lvs. linear-lanceolate, acute, nearly entire fls blue or white, with double varieties, in spicate racemes, calyx-lobes ovate, acute, broad, erect, a third shorter than the broadly bell-shaped or saucer-shaped corolla. Not American, though commonly so stated Habitat unknown. J H III 33 283 —Rock-plant, for sunny position —*C primulæfólia*, Brot St hairy, simple, 1–3 ft lowest lvs , lanceolate, st -lvs oblong fls blue, downy at bottom, nearly rotate Portugal. B M 4879 —*C Raddeána*, Trautv Perennial, glabrous, 1 ft : lvs cordate, long-stalked fls large, dark purple Caucasus —*C. speciósa*, Pourr , is a rare species Most of the plants passing under this name are likely to be C glomerata B M 2649 is C glomerata var speciosa C thyrsoidea, Lapeyr , is referred here —*C Spéculum*, Linn =Specularia —*C spicáta*, Linn Biennial, 1–2 ft lvs. very narrow, nearly or quite entire fls 1–3, sessile, in a long interrupted spike, blue Eu J H III 47 207 —*C sulphúrea*, Boiss. Annual fls size of those of C rotundifolia, pale straw-color outside and sulfur-yellow inside Palestine —*C urticifólia* This name is now abandoned Plants are likely to be C Trachelium.

WILHELM MILLER.
L. H B †

CAMPANUMÆA (variant of Campanula) *Campanulàceæ* Twining or loose-growing perennial herbs, with rhizomes or tubers, rarely grown in greenhouses. Lvs mostly opposite, simple and often cordate, petioled fls yellowish or greenish, broadly bell-shaped, 4–6-lobed fr a berry —Five species occur in the Himalayan and E Asian region and the Malay Archipelago *C javánica*, Blume, and *C. inflàta*, Clarke, both with yellowish brown-veined fls. are mentioned in gardening literature the fls are about 1¼in , in the former the calyx is nearly free from the berry, which is hemispherical, in the latter the calyx is adnate to the berry, which is ellipsoidal, both are twiners. *C grácilis*, Hort , is of the genus Leptocodon, and *C. lanceolàta*, Sieb & Zucc , is a Codonopsis.

CAMPHÒRA: *Cinnamomum.*

CAMPION: *Silene.*

CAMPSÍDIUM (alluding to its similarity to *Campsis*) *Bignoniàceæ* Ornamental vines grown for their bright orange flowers and also for their handsome evergreen finely pinnate foliage

Evergreen shrubs, high-climbing, without tendrils and without rootlets, with odd-pinnate, opposite lvs. and tubular, orange, slender-pedicelled fls. in terminal, loose and short racemes. calyx turbinate, 5-toothed, glandless; corolla tubular, slightly ventricose, straight, with 5 short equal lobes, stamens, 4, the 2 longer with the anthers exserted; anther-sacs parallel, disk cupular, flat: fr a narrow caps with many winged seeds.—Two species in Chile and in the Fiji Isls

They are adapted only for subtropical regions and do not seem to bloom readily, but even without flowers they are worth planting for their foliage alone. In Old World gardens, they are sometimes cultivated as stove plants, but *C. valdivianum*, judging from its habitat, might do better in the cool greenhouse Propagated by greenwood cuttings under glass For further culture, see *Campsis*

Campsidium filicifolium, from the Fiji Islands, has never flowered in the writer's garden (in Florida) and is cut down by frost almost every winter, but it is a strong grower and worth planting for the foliage alone. *C. valdivianum* has proved to be a very poor grower and is very difficult to keep in health for any length of time. (H Nehrling)

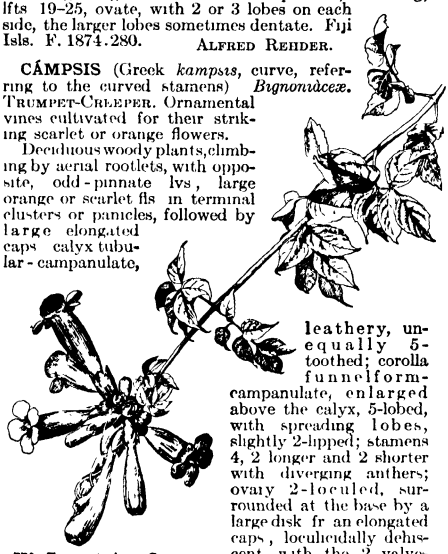
valdiviànum, Seem. (*C. chilénse*, Reissek & Seem. *Técoma valdiviàna*, Phil). Climbing, to 50 ft branches angular, glabrous: lvs. glabrous, 4–6 in. long; lfts. usually 11–13, sessile, elliptic-oblong, ¾–1½ in. long, serrate near the apex or almost entire: racemes pendulous, 6–10-fld.;

fls about 1½ in. long, orange: caps. 3–4 in long, narrowly elliptic-oblong. Chile. G.C. 1870:1182. B.M. 6111 F.S 20:2142.

filicifòlium, Van Geert (*Técoma filicifòlia,* Nichols.). Climbing evergreen shrub: lvs. odd-pinnate, 5 in. long; lfts 19–25, ovate, with 2 or 3 lobes on each side, the larger lobes sometimes dentate. Fiji Isls. F. 1874.280. ALFRED RENDER.

CÁMPSIS (Greek *kampsis,* curve, referring to the curved stamens) *Bignoniàceæ.* TRUMPET-CREEPER. Ornamental vines cultivated for their striking scarlet or orange flowers.

Deciduous woody plants, climbing by aerial rootlets, with opposite, odd-pinnate lvs., large orange or scarlet fls in terminal clusters or panicles, followed by large elongated caps. calyx tubular-campanulate, leathery, unequally 5-toothed; corolla funnelform-campanulate, enlarged above the calyx, 5-lobed, with spreading lobes, slightly 2-lipped; stamens 4, 2 longer and 2 shorter with diverging anthers; ovary 2-loculed, surrounded at the base by a large disk fr an elongated caps., loculicidally dehiscent, with the 2 valves separating from the septum to which the seeds are attached, seeds numerous, compressed, with 2 large translucent wings.—One species in N. Amer and one in China and Japan. By some botanists, Bignonia is considered the correct name for this genus, because the original description was chiefly based on *C. radicans,* while Tecoma is the proper name for the genus known as Stenolobium.

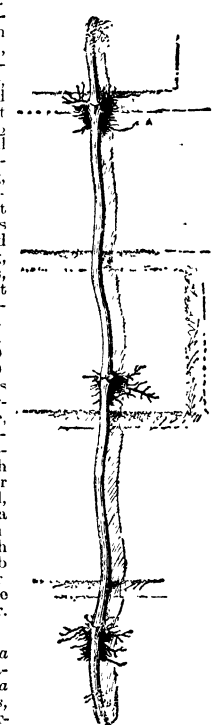


773 Trumpet-vine—Campsis radicans. (×⅓)

The hardiest species is *C radicans,* which may be grown as far north as Massachusetts, at least in sheltered positions, while *C chinensis* is more tender, the hybrid is intermediate between the two in hardiness. *C chinensis* and *C hybrida,* as well as *C radicans* var *speciosa,* can be grown as bushy specimens and will bloom freely on the young shoots, even if cut back almost to the ground by frost. Such plants can be easily protected during the winter by laying them down and covering them with earth. *C radicans* is particularly adapted for covering walls and rocks, as it climbs with aerial rootlets and clings firmly to its support. The species of campsis prefer rich rather moist soil and sunny positions. Propagated by seeds, by greenwood cuttings under glass, or by hardwood and also by root-cuttings and layers.

Trumpet-vines in the South.—The trumpet-vines are very successfully cultivated in Florida, being well adapted to the soil and climate, but to do their best need to be planted from the start in rich soil; and in addition they should be well fertilized at least once a year. They prefer a fertilizer rich in nitrogen, and a heavy mulch will also prove very beneficial. They should be grown on posts and tall stumps, or they may be trained over small oaks, persimmon trees or catalpas. Other bignoniads of similar culture are *Tecomaria capensis,* a half-climbing species with scarlet flowers effectively used for decoration of the veranda, and *Tecoma stans.* That and *Campsis chinensis* are the two showiest bignoniads cultivated in Florida, the latter being a climber, flowering abundantly in May and June, while the first one is a large-growing bushy species opening its immense corymbs of vivid yellow flowers the latter part of November and early in December. The Chinese trumpet creeper, *C chinensis,* is the most floriferous and gorgeous. In the writer's garden a large pine stump, about 16 feet high, in May and June is completely covered with masses of brilliant fiery orange-scarlet flowers which can be seen at a distance of half a mile. The flowers are much larger, more brilliant and much more abundantly produced than those of the native *C. radicans.* It is sometimes infested by a voracious caterpillar, which devours the leaves greedily. The lubber grasshoppers also attack the lower foliage. *C. chinensis* grows well in the poor sandy soil, perfecting luxuriant shoots 25 to 30 feet long in one season if well fertilized. The native trumpet creeper, *C radicans,* is very common in the southern woodlands and fields. There is a great variety in the brilliancy of the blossoms. This is an excellent plant for covering the bare trunks of palmettos. (H. Nehrling.)

radìcans, Seem (*Técoma radicans,* Juss. *Bignònia radicans,* Linn.) TRUMPET-CREEPER. TRUMPET-VINE. TRUMPET-HONEYSUCKLE. Figs. 773, 774. High-climbing shrub, clinging with rootlets: lvs. odd-pinnate, lfts. 9–11, oval to ovate-oblong, acuminate, serrate, dark green above, pale and pubescent beneath, at least along the midrib, 1½–2½ in. long: fls. in terminal racemes; corolla tubular-funnelform, about 3 in. long, with 5 spreading lobes, usually orange with scarlet limb, tube almost thrice as long as the short-toothed calyx: fr. cylindric-oblong, keeled along the sutures, stalked and with a beak at the apex, 3–5 in. long. July-Sept. Pa. and Ill. to Fla. and Texas. B.M. 485. Gn. 22, p. 339. F. 1873, p. 220. A.F. 12:34. Mn. 2:9. Var. **atropurpùrea,** Voss (var. *grandiflòra atropurpùrea,* Hort.) With large, deep scarlet fls. Var. **speciòsa,** Voss. Scarcely climbing, usually forming a bush with long and slender branches. lfts. small, oval, abruptly narrowed into a slender point often ¾ in. long: fls. orange-red, with rather straight tube; limb about 1¼ in. across. Var. **præcox,** Schneid. Large scarlet fls. in June. Var. **aùrea,** Hort. Fls. yellow.



774 The Trumpet-creeper climbs by means of aerial roots.—Campsis radicans.

chinénsis, Voss (*Técoma grandiflòra,* Delaun. *T. chinénsis,* C. Koch. *Bignònia chinénsis,* Lam. *C. adrèpens,* Lour.) CHINESE TRUMPET-CREEPER. Fig. 775 (adapted from Gardening) Climbing shrub, with few or no aerial rootlets: lvs. odd-pinnate;

lfts. usually 7–9, ovate to ovate-lanceolate, serrate, glabrous beneath, 1½–2½ in. long: fls. in terminal racemes; corolla funnelform-campanulate, shorter and broader than that of the preceding species, scarlet, about 2 in. across; calyx 5-lobed to the middle, about as long as the tube of the corolla. fr. obtuse at the apex. Aug., Sept. China, Japan. B.M. 1398; 3011. F.S. 11:1124–5. Gn. 27, p. 94; 33, p. 348; 47, p. 373. G.F. 3.393. F.R. 2.27. Gng. 4:195.—Less high-growing and sometimes shrubby; blooms when quite small and can be grown as a pot-plant, also suited for forcing. Var. **Thúnbergii,** Voss (*Técoma Thúnbergu*, Sieb.). Fls. bright scarlet, with very short tube and reflexed lobes. Often a var. of *C. radicans* is cult. under the name *C. Thunbergu*. Var **Príncei,** Voss (*Técoma grandiflòra* var *Princei*, Dipp.), probably belongs to the following hybrid.



775. Campsis chinensis on a clothes-post.

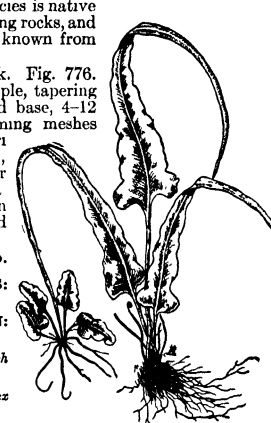
hýbrida, Schneid. (*Técoma hýbrida*, Journ. *T. intermèdia*, Schelle. *T radicans grandiflòra atropurpùrea*, Hort. *T. Princei grandiflòra*, Hort. *T. chinénsis aurantiaca*, Hort.). Hybrid between the two preceding species, somewhat climbing, often forming a bush with straggling branches. lfts. 7–11, ovate to elliptic-ovate, usually pubescent along the veins beneath. fls. in terminal loose panicles, calyx divided for about one-third into ovate long-acuminate lobes much shorter than the corolla-tube, corolla funnelform-campanulate with orange-yellow tube and scarlet limb, about 2 in. across and 3 in. long. July–Sept. Garden origin. S.T.S. 1:47. M.D.G. 1904:123.—The fls. are almost as large and showy as those of *C. chinensis* and the plant is hardier.

ALFRED REHDER.

CAMPTOSÒRUS (Greek, *bent sori*, alluding to the irregular arrangement). *Polypodiàceæ*. Two species of hardy ferns, with simple pointed lvs., which take root at the apex, and are hence known as "walking-leaf ferns." A single species is native mostly on lime-bearing rocks, and an allied species is known from Japan and N. Asia.

rhizophýllus, Link. Fig. 776. Lvs. evergreen, simple, tapering from a heart-shaped base, 4–12 in. long; veins forming meshes near the midrib; sori irregularly scattered, linear, straight or bent. Canada to Ala.—Sometimes grown in rockeries and wild gardens.

L. M. UNDERWOOD.



776. Camptosorus rhizophyllus. (×⅓)

CAMPYLOBÒTRYS: *Hoffmannia.*

CAMPYLONEÙRON: *Polypodium.*

CANADA: *British North America.*

CANAIGRE: *Rumex hymenosepalus.*

CANÁNGA: } *Cananga.*

CANÁNGIUM (Makassar, *kananga;* Malay, *kenanga*) *Annonàceæ*. Perfume-yielding tropical trees.

Closely allied to Desmos but differing in having the apex of the connectives of the stamens prolonged into a point, instead of being broadened into a hood-like covering for the pollen-sacs. sepals 3, petals 6 in 2 series, valvate, nearly equal, flat, linear; stamens many, closely crowded on the convex torus, the connective produced into a long tapering point; carpels indefinite,



777. Cananga odoratum. *a*, flowering branch, *b*, stamens, *c*, longitudinal section of fruit, *d*, fruit cluster.

clustered in the center of the mass of stamens; ovules in 2 columns or apparently in a single column, style linear or linear-oblong, terminating in an obtuse swelling, ripe carpels (fr.) several, pedicelled, ovoid or oblong and more or less constricted between the seeds. The name Cananga, usually applied to this genus, was used by Aublet in 1775 for an entirely different genus, and cannot therefore be valid for the present one. Baillon recognized this fact, and proposed the name Canangium, without, however, coupling it with specific names. It was taken up by Sir George King in his Annonaceæ of British India, 1893, and was applied by him to the celebrated ylang-ylang tree, *Canangium odoratum*.

odoràtum, King (*Uvària odoràta*, Lam. *Unòna odoràta*, Dunal. *Canánga odoràta*, Hook. f. & Thoms.) YLANGYLANG. ILANGILANG. ALANGILANG. MOSO'OI. MOTO-OI. Fig. 777. A tree bearing a profusion of greenish yellow fragrant fls. with long narrow petals, from which the celebrated ilangilang is made. The tree is found in S. India, Java, the Philippines, the Malay Archipelago, and many islands of the tropical Pacific. It occurs spontaneously as well as in cult., and its seeds are widely scattered by fruit-pigeons and other birds. In the Samoan Isls. it is much beloved by the natives, who make garlands of "moso'oi" with which to adorn themselves, and they celebrate its fragrance in their songs. The fls. yield a fragrant volatile oil known in commerce as the oil of ilangilang, usually obtained by steam distillation. The natives use a much simpler process in securing oil for anointing their heads and bodies. Fls. are put into coconut oil and, after remaining a short time, are replaced by fresh ones,

the oil being subjected to a gentle heat. "Macassar oil" is prepared in this way, fls. of *Michelia Champaca* being often added to those of the ylangylang

Brandisânum, Safford (*Unòna Brandisàna,* Pierre. *Unòna latifòlia,* Hook. f. & Thoms., not Dunal) A tree endemic in the forests of lower Cochin China and Cambodia, with very fragrant fls resembling those of *C. odoratum* but with the petals relatively broader, constricted at the base, and thicker, and the lvs usually cordate at the base and tomentose beneath, instead of rounded at the base and pubescent beneath the fr resembles that of the preceding species but with fewer seeds arranged almost in a single row, but on close inspection seen to be biseriate The fls yield a perfume similar to that of the true ylangylang of commerce W. E. SAFFORD

CANARÌNA (from the Canary Islands) *Campanulàceæ* Cool-house tuberous-rooted herb closely allied to Campanula, but with the tubes of the calyx and corolla grown together, and the floral parts in 6's.—Three species **C. Campánula,** Lam., is a tender perennial from the Canaries, about 6–8 ft tall, with drooping, inflated buds and solitary, bell-shaped fls. more than 1 in. long and 1½ in. wide, dull yellow, flushed and veined with dull purplish brown the lobes of the corolla strongly reflexed lvs hastate, coarsely repand-dentate fr a fleshy berry. B M. 444 —Intro. by Franceschi in 1895

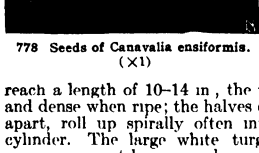
CANARY-BIRD FLOWER *Tropæolum*

CANARY GRASS *Phalaris*

CANAVÀLIA (an aboriginal name). Including *Malocchia Leguminòsæ* Bean-like plants, some of them producing edible seeds and some more or less grown for ornament

Prostrate trailing or twining herbs, with pinnately 3-foliolate lvs fls in axillary racemes or fascicles, often large, violet, rose or white, with bell-shaped, 2-lipped calyx, papilionaceous corolla, 9 stamens united and 1 free for all or part of its length pods large and ribbed on edges —A dozen species, widely distributed in warm countries

ensifórmis, DC (*C. gladiàta* var *ensifórmis,* DC.). JACK BEAN CHICKASAW LIMA Figs 485 (Vol I), 778 Glabrous or nearly so lfts ovate-oblong or ovate, mucronate upper lip of calyx longer than the tube, recurved and notched, keel blunt, curved seeds white, with a dark raphe Tropics of both hemispheres —B M 4027 A G 14. 84 —Grown in the southern states for stock, but the pods make passable snap beans when not more than 4–6 in. long In warm countries it is a bushy plant, with little tendency to climb The pods reach a length of 10–14 in., the walls being very hard and dense when ripe; the halves of the pod, when split apart, roll up spirally often into an almost perfect cylinder. The large white turgid beans, bearing a very prominent brown seed-scar, are packed crosswise the pod, imbedded in a very thin white papery lining The fls are small and light purple, resembling those of the cowpea (but larger) and of various species of Dolichos The lfts are large and broad (5–8 in. long and half or three-fifths as broad), strongly veined and dull, dark green, abruptly pointed and smooth. Beans said to be used as a coffee substitute.



778 Seeds of Canavalia ensiformis. (×1)

C. bonariénsis, Lindl Twining lfts ovate, with the long apex obtuse. fls purple in drooping racemes that exceed the lvs., the standard large broad and notched Uruguay and S Brazil B R 1199 H U 4, p 129 —*C. obtusifolia,* DC Prostrate or climbing lfts nearly orbicular to oval or obovate, rounded or cuneate at base fls pink, in racemes exceeding the lvs seed brown, oblong Fla and Texas south Known as "mato de la playa" in Porto Rico —*C. rusiosperma,* Urban. Large and tall, ascending highest forest trees seeds red. Known as "Mato colorado" W. Indies. L. H. B.

CANDELILLO. *Euphorbia antisyphilitica*

CANDLEBERRY, CANDLENUT. *Aleurites.*

CANDÒLLEA (A. P. DeCandolle, 1778–1841, famous botanist of Geneva, Switzerland). *Candolleàceæ;* formerly referred to *Dilleniàceæ* Herbs or woody plants sometimes grown under glass or in the open far South for the mostly yellow flowers

Shrubs or undershrubs or herbs, mostly glabrous. lvs simple, mostly narrow, sometimes with margins revolute. fls few or solitary at the ends of the branches; sepals and petals 5, stamens many, united into 5 bundles or sets, each set bearing several anthers; carpels 2–3–5, with 1–3 ovules in each —As now understood, probably 80–90 species, mostly W Australian, but 1 in Trop Asia and S China and 1 in the E Indies. Little known in cult, but the following Australian species are now offered

tetrándra, Lindl Shrub, with branches angular, pubescent lvs. narrow-oblong to oblong-ovate, obtuse or short-acuminate, 2½ in. or less long, clasping, margins not revolute. fls much larger, paler yellow, the petals 1 in. long and the acute sepals ¾in. long· fr with orange aril B R 29 50 —Offered as a greenhouse plant.

cuneifórmis, Labill Erect shrub, 6 ft and more, with short crowded branches that are somewhat hairy when young· lvs oblong-cuneate to obovate, truncate or few-toothed at apex, 1 in. long fls bright sulfur-yellow, sessile in the crowded floral lvs; sepals about ½in., and the notched petals somewhat longer B M. 2711 —Offered in S. Calif., where it blooms March–June L. H. B.

CANDYTUFT. *Iberis*

CANE-BRAKE Species of *Arundinaria* (treated under Bamboo)

CANÍSTRUM (Greek, a *basket*) *Bromeliàceæ.* Epiphytic or terrestrial hothouse plants, requiring the treatment of billbergias

Leaves in a dense tuft, acute, spinulose on the margin infl compound, in a cup of lvs, on a very short st as in Nidularium, or on a longer exserted st, fls usually green, rarely golden or blue —A genus of about 10 species, natives of Brazil. They are sometimes referred to Nidularium

Líndenii, Mez (*Æchmèa ebúrnea,* Baker *Guzmània fràgrans,* Hort *Nidulàrium Lindenii,* Regel) Lvs. about 20, in a dense rosette, tomentose, green-spotted, the bract-lvs. cream-white. fls. white or greenish

amazónicum, Mez (*Karàtas amazónica,* Baker *Nidulàrium amazónicum,* Lind & André *Æchmèa amazónica,* Hort.) Lvs 15–20, 10–20 in. long, and rather wide at the middle, greenish brown above and light brown beneath, not spotted or scurfy, the bract-lvs greenish brown· fls white, with a green tube, in a dense head

C. aurantiacum, E. Morr (Æchmea aurantiaca, Baker). Plant vigorous lvs expanded in the middle fls yellow, 2 in. long S. Amer B H 1873 15 GEORGE V. NASH †

CÁNNA (name of oriental origin, of no application). *Cannàceæ.* Popular tall ornamental plants, prized for their stately habit, strong foliage and showy flowers: much used for bedding

Stout, unbranched: fls mostly red or yellow, in a terminal raceme or panicle, very irregular: caps. 3-loculed and several- to many-seeded (Fig. 779, *p.*); sepals

(*s*) 3 and small and usually green; petals (*ccc*) 3, mostly narrow and pointed, green or colored, style (*e*) single and long, the stamens are commonly petal-like, oblanceolate bodies or staminodia (*aaab*), 2 or 3 of which are usually much produced and broadened, and one is deflexed and narrower and forms the lip of the fl (*b*), the pollen is borne in a single-loculed anther (*f*), borne on the side of a narrow and more or less coiled staminodium — In the latest monograph, 1912 (Kranzlin, in Engler's Pflanzenreich, hft 56), 51 species of Canna are described from subtropical and tropical Amer. and Asia



779. The parts of the Canna flower.

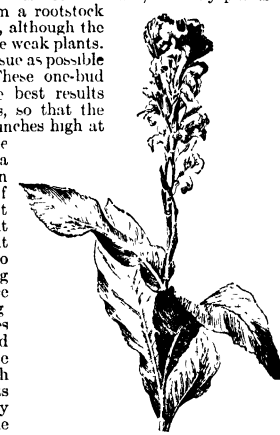
A generation or two ago, cannas were grown for their foliage or mass-effect. They were tall and long-jointed, with small and late flowers (Fig 780) An old-time garden race of tall cannas was *C Annæi*, raised by M Année, of France, from seeds of the true *C nepalensis*, sown in 1848 The flowers from which the seeds were taken probably had been pollinated by some other species, most likely with *C glauca* In 1863, a new race appeared, as the result of the union of *C viridiflora* with *C Warscewiczii* This hybrid was known as *C Ehemanni* (and *C viridiflora hybrida*) This was of intermediate stature, with showy foliage and better drooping flowers Under this name plants are still sold, but they may not be identical with the original *C Ehemanni*. This race has been variously crossed with other species and forms, and from innumerable seedlings there have been selected the dwarf and large-flowered cannas (Figs. 781, 782), which have now practically driven out the old tall small-flowered forms These dwarf cannas are often known as French cannas, from the country of their origin; also, as Crozy cannas, from a renowned breeder of them Within recent years, another race of cannas has arisen from the amalgamation of our native *C flaccida* with the garden forms and with *C viridiflora* These have come mostly from Italy and are known as Italian cannas; also as orchid-flowered cannas The flowers are characterized by soft and flowing iris-like outlines, but they are short-lived Of this class are the varieties Italia (Fig. 783), Austria, Bavaria, Burgundia, America, Pandora, Burbank and others. For a sketch of the evolution of the garden cannas, see J G. Baker, Journ. Roy Hort. Soc., Jan., 1894; also, for the history of the Italian race, Revue Horticole, 1895, 516, and Gardeners' Chronicle, Dec. 14, 1895; Kranzlin, cited above.


780. Old-time canna.

The culture of cannas is simple and easy. They demand a warm, friable, rich and moist soil. They are injured by frost, and therefore should not be planted out until the weather is thoroughly settled For dense mass effects, set the plants not more than 1 foot apart each way, but if it is desired to show individual plants and their flowers at the best, give three times that amount of room to a single plant Pick the flowers as soon as they wilt, to prevent the formation of seeds (which causes the plant to lessen flowering), and keep the plants in tidy condition. Give the soil and treatment that produce the best results with Indian corn.

New varieties are raised from seeds The seeds usually germinate slowly, and sometimes not at all, unless the integument is cut or filed, or is softened by soaking in water, these precautions taken, they germinate quickly Sow late in winter, in rather strong bottom heat, in flats or pots. Prick out, and give plenty of room. They should make blooming plants the first year.

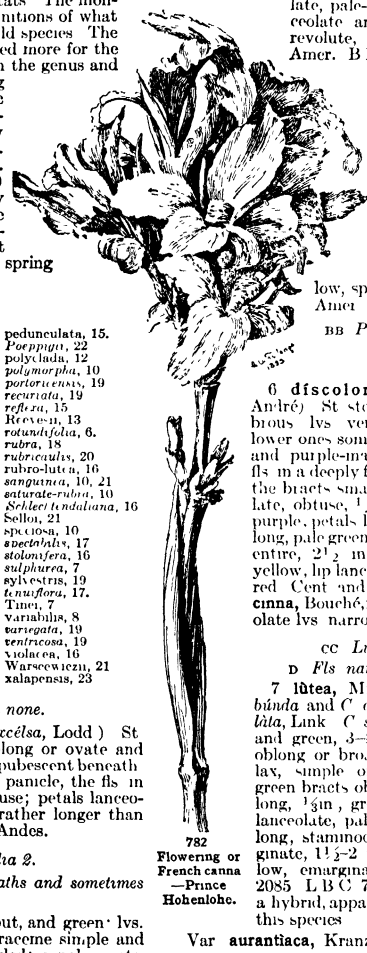
Commonly, cannas are propagated by dividing the rootstock This rootstock is a branchy mass, with many large buds If stock is not abundant, as many plants may be made from a rootstock as there are buds, although the weak buds produce weak plants. Leave as much tissue as possible with each bud These one-bud parts usually give best results if started in pots, so that the plant is 6 to 12 inches high at planting time. The commercial canna plants are grown mostly in pots If one has sufficient roots, however, it is better not to cut so close, but to leave several strong buds on each piece (as shown in Fig 784) These pieces may be planted directly in the ground, although more certain results are to be secured by starting them in the house in boxes or pots If strong effects are desired, particularly in shrub borders, it is well to plant the entire stool In the fall, when the plants are killed by frost and the tops have dried a few days, dig the roots, and let them dry, retaining some of the earth on them Then store them on shelves in a cellar that will keep Irish or round potatoes well Take care that the roots do not become too warm, particularly before cold weather sets in, nor too moist Well-cured roots from matured plants usually keep without much difficulty If they do not hold much earth, it is well to throw a thin covering of light soil over them, particularly if they are the highly improved kinds.


781. Modern flowering canna.

Cannas are commonly used only in formal beds, but most excellent effects may be secured by scattering them singly or in very small clumps in the hardy border or amongst shrubbery. Against a heavy background of green, the gaudy flowers show to their best, and the ragged effect of the dying flowers is not noticed. They also make excellent centerpieces for formal beds The tall-growing cannas, with small and late flowers, have given way almost wholly to the modern race of Crozy or French dwarf cannas, which usually remain under 4 feet high, and give an abundance of large early flowers. The canna always must be used for bold planting effects, because the flowers

have not sufficient durability to be very useful as cut-flowers As individual blooms, the flowers are not usually attractive, but they are showy and interesting in the mass and at a distance. The new race of Italian or Flaccida cannas has more attractive flowers, but even these are most useful when on the plant

It is impossible for the gardener to determine species of canna in the common garden forms In fact, the species are little known except in herbaria and as wild plants growing in their original habitats The monographers do not agree as to the definitions of what have been described as original or wild species The following account of species is included more for the purpose of showing the range within the genus and of making a catalogue of leading botanical names than to set specific limits or to indicate what species-forms are in cultivation The Crozy experiments began with crossing *C. Warscewiczii* with a variety of *C. nepalensis* of gardens (*C flaccida*?) having large yellow flowers and very long creeping tubers, and some of the progeny was crossed with *C aureo-picta* (a garden form) The recent attractive orchid-flowered cannas spring largely from the *C flaccida* forms.



782 Flowering or French canna —Prince Hohenlohe.

INDEX.

Achiras, 3
Altensteinii, 23.
angustifolia, 13.
Annei, 16
aurantiaca, 7
aureo-vittata, 19.
Bucki, 15
carnea, 8
cearensis, 12
chinensis, 10
cinnabarina, 9
coccinea, 17, 18.
commutata, 7
compacta, 2
concinna, 6
crocea, 17
denudata, 7.
discolor, 6.
edulis, 20
esculenta, 20.
excelsa, 1
exigua, 9
exmia, 12
Fintelmanni, 14.
flaccida, 13
flavescens, 11
floribunda, 7, 19.
formosa, 18.
fulgida, 9
gemella, 23
gigantea, 23
glauca, 13, 16.
heliconiifolia, 23.
humilis, 9
indica, 17
iridiflora, 24
lata, 19
lagunensis, 4
Lambertii, 22
lanceolata, 16
lanuginosa, 3
latifolia, 24
leptochila, 10
leucocarpa, 16
liliiflora, 25
limbata, 19
longifolia, 16
lutea, 7
macrophylla, 23
maculata, 7
mexicana, 16
Moritziana, 5
neglecta, 23
nepalensis, 10
orientalis, 11
pallida, 5
paniculata, 1
patens, 17, 19, 21
pedunculata, 15.
Poeppigii, 22
polyclada, 12
polymorpha, 10
portoricensis, 19
recurvata, 19
reflexa, 15
Reevesii, 13
rotundifolia, 6.
rubra, 18
rubricaulis, 20
rubro-lutea, 16
sanguinea, 10, 21
saturate-rubra, 10
Schlechtendaliana, 16
Sellori, 21
speciosa, 10
spectabilis, 17
stolonifera, 16
sulphurea, 7
sylvestris, 19
tenuiflora, 17.
Timei, 7
variabilis, 8
variegata, 19
ventricosa, 19
violacea, 16
Warscewiczii, 21
xalapensis, 23

A. *Petal-like staminodia none.*

1. **paniculàta,** Ruiz & Pav (*C excélsa,* Lodd) St very tall, slender, glabrous lvs oblong or ovate and acute, green and glabrous above and pubescent beneath racemes lax, disposed in a squarrose panicle, the fls in 2's, sepals lanceolate, ¾in long, obtuse; petals lanceolate, yellow-green, 2–3 in long, lip rather longer than the petals, crimson. Subequatorial Andes.

AA *Petal-like staminodia 2.*

B. *Plant woolly-pubescent on the sheaths and sometimes on the lf.-blades*

2 **compácta,** Roscoe. St tall, stout, and green· lvs. many, oblong to ovate and acute raceme simple and densely many-fld , the rachis 3-angled; sepals ovate, acute, ½in long; petals unequal, narrowly lanceolate and long-acuminate, 1½ in. long, red-yellow; staminodia oblanceolate, slightly emarginate, 1½–2 in long, scarlet or deep orange-red; lip broad-linear, emarginate, red-yellow. S Amer

3. **lanuginòsa,** Roscoe (*C Achìras,* Litt) St green, woolly, 4–6 ft , densely lvd · lvs. ovate-oblong, acute, green: raceme long and contracted, many-fld , simple, the bracts obtuse, small and green, sepals ovate-lanceolate, greenish red, ½in or less long; petals long-lanceolate, 1½ in long, tinged with red, staminodia entire, red or red-yellow, lip the same color, and revolute. Brazil, Peru B R 1358

4 **lagunénsis,** Lindl Differs from *C lanuginosa* in having long pale yellows fls , by some referred to *C lutea* plant of medium size, lightly lanate on the sheaths lf.-blades ovate-oblong, short-acute and apiculate, pale-margined petals linear-lanceolate and acuminate lip strongly revolute, red-spotted Mex , Cent. Amer. B R. 1311, 1358 Aug.–Nov

5 **pállida,** Roscoe (*C. Moritziàna,* Bouché) Plant medium height lf.-blade elongate-elliptic, acuminate and filamentous at end, sometimes white-margined: raceme simple and narrow, the bracts broadly oblong-cuneate; sepals ovate and obtuse, green, petals lanceolate and acuminate, greenish-sulfur-color, lip linear, 2-tipped, revolute, pale yellow, spotted W Indies and N S. Amer

BB *Plant glabrous on sheaths and lf.-blades*

C *Lvs of 3 colors.*

6 **díscolor,** Lindl (*C rotundifòlia,* André) St stout, 6–10 ft , purple and glabrous lvs very broad-oblong, acute, the lower ones sometimes 3 ft long, dark green and purple-margined, red-purple beneath: fls in a deeply forked panicle of lax racemes, the bracts small and oblong, sepals lanceolate, obtuse, ½in long, green, tinted with purple, petals lanceolate, acuminate, 1½ in. long, pale green tinted with rose, staminodia entire, 2½ in long, bright red, exterior yellow, lip lanceolate and emarginate, brick-red Cent and S Amer B R 1231 **C. concinna,** Bouché, is a related species with lanceolate lvs narrowed at both ends. S Amer.

CC *Lvs unicolored, green*

D *Fls narrow, the parts connivent*

7 **lûtea,** Miller (*C commutàta, C floribúnda* and *C densifòlia,* Bouché *C maculàta,* Link *C sulphùrea,* Hort) St slender and green, 3–4 ft , distantly foliated lvs. oblong or broad-lanceolate, acute raceme lax, simple or rarely forked, the small green bracts oblong and obtuse, sepals oblong, ½in , green, white-margined, petals lanceolate, pale yellowish white, 1–1¼ in long, staminodia pale yellow, often emarginate, 1½–2 in long, lip linear, pale yellow, emarginate Mex to Brazil B M 2085 L B C 7 646 **C. Timei,** Tod , perhaps a hybrid, apparently is to be associated with this species

Var **aurantiaca,** Kranzl Fls. orange; lip yellow

8 **variábilis,** Willd (*C cárnea,* Roscoe). St. green, 3–6 ft · lvs broad-lanceolate or elliptic, acute, bright green raceme simple and lax, the small bracts oblong and obtuse, sepals lanceolate, green, ½in. long, petals lanceolate, acuminate, concave, 1½ in. long, pale flesh-color, staminodia 2, spatulate-linear, mostly entire, variable in color but mostly orange or rose; lip linear or ligulate and entire· caps. small, globose S Brazil, the particular place unknown.

DD. *Fls. ringent or gaping, or open-spreading.*

E. *Infl. simple or only moderately branched.*

9. **hùmilis,** Bouché (*C exígua,* Bouché) Low, 3 ft. or less, slender. lvs. short-petioled, the blade oblong, acute or short-acuminate, glabrous above and below, 10–16 in long raceme sub-simple (rarely paniculate), bearing fls large for size of plant (about 3 in long); sepals very unequal, ovate-oblong, petals long-lanceolate, concave, connate at base into a tube, scarlet; staminodia spatulate, more or less 2-lobed at apex, lip rather narrow, about 2¼ in long Farther India, China, etc **C. cinnabarina,** Bouché (*C. fúlgida,* Bouché), is a related species but larger and with yellow and scarlet rather smaller fls Mex., Cent Amer., W. Indies



783. Italia canna.

10 **speciòsa,** Roscoe (*C. leptochìla* and *C saturàte-rùbra,* Bouché *C polymórpha,* Loud. *C. sanguínea,* Hort.) Large: st. green, 5–6 ft. lvs broad-oblong, acute· fls. in an elongated raceme or sometimes paniculate; sepals lancéolate, ¾in. long, pale purple; petals linear-lanceolate, 1½in long, erect, pale purple; staminodia 3 in. long, emarginate, bright red; lip emarginate, yellow. Himalayas B M 2317. B.R. 1276. **C. chinénsis,** Willd. (*C nepalénsis,* Wall.), differs in having reflexed petals

11 **orientàlis,** Roscoe (*C. flavéscens,* Link). St. slender, glabrous, 3–4 ft. lvs ovate-oblong, a foot or more long. raceme lax, simple or forked, the bracts oblong; sepals oblong-lanceolate, obtuse, ½in. or less long, pale green and rose-tinted; petals lanceolate, acuminate, 1½ in. long, pale rose, upper staminodia 2½ in or less long, bright red, often emarginate, lip red-yellow caps globose and very small Malaysian tropics

EE. *Infl. much-branched; fls purple.*

12. **polyclàda,** Wawra (*C eximia,* Bouché. *C. cearénsis,* Huber) St tall and very slender· lvs. ovate or ovate-lanceolate, acute fls (often in pairs) in a long, much-branched panicle, the bracts nearly orbicular, sepals lanceolate, ½in long; petals long-lanceolate and unequal, acuminate, the longest about 2½ in., purple; staminodia acute, scarcely longer than the petals; lip oblanceolate, scarlet-spotted. Brazil

AAA. *Petal-like staminodia 3 (exception in No. 18).*

B *Lvs. lanceolate fls. mostly yellow or orange.*

C. *Petals deflexed.*

13 **flàccida,** Salisb (*C glaùca* and *C. angustifòlia,* Walt.) St. green and glabrous, 4–6 ft., very leafy below lvs ovate-lanceolate to narrowly elliptic, acute, green. raceme simple, lax and few-fld., the bracts very small; sepals lanceolate or oblong, acuminate, 1 in. long, green; petals broadly linear-lanceolate to obovate and reflexed, to 3 in long (as is also the tube); staminodia obovate, sulfur-yellow, 2–3 in. long by 1½ in. broad, lip large, yellow. Swamps S C. to Fla., near the coast. L B C. 6.562. G.W. 12, p. 253.—Useful for its good habit and iris-like fls **C. Reèvesii,** Lindl., of India and the Philippines, has the outside staminodia acute rather than all obtuse or emarginate as in *C flaccida,* and fls. less than 4 in. across rather than about 6 in. across. B R 2004.

14 **Fíntelmannii,** Bouché. St. green and glaucous, 4–5 ft.: lvs. oblong or ovate-elliptic and acute, bright green. raceme few-fld and rather dense, the bracts green and oblong; sepals oblong, ½in., green; petals lanceolate, acuminate, greenish yellow, 1½–2 in.; staminodia obtuse and entire (or 2-lobed at apex), 2–3 in., yellow; lip linear, strongly reflexed, yellow, mottled red: caps. large. Mex. and Cent. Amer.

15. **pedunculàta,** Sims (*C. Buékii,* Weinm. *C. reflèxa,* Nees). St. tall, slender, green and glaucous, 5–6 ft: lvs. oblong-lanceolate, green and glaucous. 1–2 ft. long and 3–4 in. broad. fls. in a many-fld long raceme, with a hairy rachis and long-spreading pedicels, the bracts small, oblong and obtuse, sepals oblong, small and green; petals linear-lanceolate, greenish yellow, reflexed, 2 in long; staminodia emarginate, about 2 in. long, pale yellow; lip oblanceolate, yellow caps globose, small. W. Indies, S. Amer B M. 2323. L.B.C. 7:622.

CC. *Petals erect.*

16 **glaùca,** Linn. (*C. Schlechtendaliàna,* Bouché. *C Annæi,* André *C mexicàna,* and *C stolonífera,* Bouché. *C lanceolàta,* Lodd.). St. green and glaucous, 5–6 ft., from a long and stoloniferous rhizome: lvs green and glaucous, oblong-lanceolate and very acute, tapering both ways (the middle of the blade 4–6 in wide), white-margined· raceme lax, simple or forked; sepals ovate-obtuse, green, ½in long, petals linear-lanceolate, yellow-green, 1½–2 in., staminodia entire, 2½–3 in., yellow, not spotted, lip linear or obovate-oblong, emarginate, pale yellow: caps oblong, 1½-2 in long W. Indies, S Amer Var **rùbro-lùtea,** Hort., has fls. deep yellow tinted red, or in some portraits represented as deep purple B M. 3437. **C. longifòlia,** Bouché, from Mex and Cent. Amer., has the petals all free, whereas they are united in a tube in *C glauca,* and with curved sulfur-yellow fls **C. leucocárpa,** Bouché, S. Amer., has petals united into a short tube, the fls small, pale orange with broad leafy style. **C. violàcea,** Bouché, habitat unknown, has petals united in short tube, fls violet, strongly gaping, plant deciduous-woolly above.

BB. *Lvs. broadly oblong or elliptic· rhizome tuberous.*

C. *Plant low or medium in height (mostly 5 ft. or less).*

D. *Staminodia entire at apex.*

17. **índica,** Linn. (*C. pàtens,* Roscoe. *C. cròcea,* Hort. *C. tenuiflòra* and *C. spectábilis,* Bouché. *C. coccínea,* Link). INDIAN SHOT St. slender, glabrous, green, 3–5 ft: lvs oblong and acute, green, not glaucous, half as broad as long (1–1½ ft. long) racemes simple or very nearly so and lax, some of the fls in pairs, the bracts green and nearly orbicular, fls small, sepals oblong and green, ¼in. long; petals lanceolate, pale green, about 1½ in. long; upper staminodia bright red, entire, 2 in. long but narrow; lip linear, red-yellow, minutely spotted with red: caps. globose, 1 in diam. W. Indies, Cent. and S. Amer. Naturalized in parts of southern states. B.M. 454. B.R. 776. L B.C. 17:1693.

18. **coccínea,** Miller (*C. rùbra,* Willd.). St. slender, green, 4–5 or sometimes 6 ft.: lvs. oblong, or oblong-lanceolate, and acute: raceme simple and lax, with small green, orbicular bracts; sepals lanceolate, ½in. or less

long, green tinged with red; petals lanceolate. acuminate, 1½ in. long, pale scarlet; staminodia 2, long and narrow, mostly emarginate; lip yellow-spotted. caps. globose and small. W Indies, Cent. and S Amer. **C. formòsa,** Bouché, Brazil, has 3 unlike staminodia.

DD. *Staminodia 2-lobed.*

19. **sylvéstris,** Roscoe (*C. portoricénsis,* Bouché). Plant stout, 4–5 or 6 ft lvs. long-oblong or oblong-lanceolate, acuminate, bright green, to 2½ ft long and one-third as wide. raceme slender, usually squarrose, rarely simple, fls narrow and elongated, red, sepals lanceolate and acute, ½in. long, petals much longer, lanceolate and very acuminate, staminodia sub-equal, narrow-spatulate; lip narrow, strongly revolute W. Indies, Cent Amer **C. limbàta,** Roscoe (*C pàtens,* Hook. *C aùreo-vittàta,* Lodd *C floribùnda, C variegàta, C recurvàta, C làta* and *C ventricòsa,* Bouché), of S Brazil, has unlike staminodia, the largest being 2-lobed, the medium one emarginate, the other entire, all red with yellow margins. B R. 771 L B C 449

CC *Plant tall, often up to 10 ft (No 21 perhaps excepted).*

D. *Staminodia of medium length (3 in or less).*

E *The staminodia not united.*

20 **edûlis,** Ker (*C esculénta,* Lodd *C rubricaùlis,* Link) Rootstock thick and edible st stout, 8–12 ft, purple: lvs large, oblong, or ovate-oblong, green or bronze, 1–2 ft long raceme lax, forked or simple, fls red or brick-red, usually in pairs, the bracts orbicular or oblong, sepals oblong-lanceolate, ½in long, tinged with red, petals oblong-lanceolate, 1½ in , staminodia entire or emarginate, 2½ in long, bright red or orange, lip bright red or yellow-red caps large W Indies, S Amer B M 2498 B R 775 —Starch is procured from the roots, and for this purpose the plant is widely cult in the tropics

21 **Warscewíczii,** Dietr (*C sanguínea,* Warsc) St claret-purple and glaucous, 3-4 ft lvs oblong and acute, more or less claret- or bronze-tinged, ½ft long and nearly one-half as broad raceme simple and rather dense, with ovate, brown, glaucous bracts; sepals lanceolate, ½in , glaucous purple, petals lanceolate, acuminate, nearly 2 in long, reddish and glaucous; staminodia oblanceolate, entire, 2½-3 in long, bright scarlet, lip oblanceolate, emarginate, bright scarlet. Costa Rica, Brazil B M 4854 **C. Sellòi,** Hort (*C pàtens,* Baker), of S Brazil, is tomentose sepals ovate; petals oblong-lanceolate, united into a tube, staminodia strongly reflexed, one 2-parted.

EE *The staminodia united into a tube, or at least connate at base*

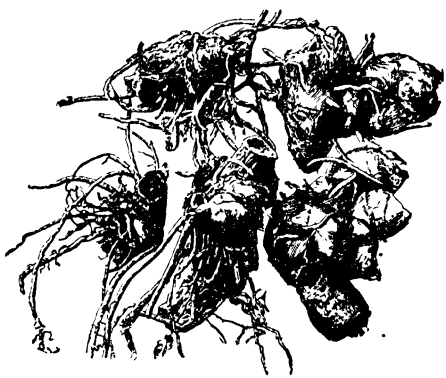
22 **Lámbertii,** Lindl (*C Pœppigii,* Bouché) St stout, very tall (to 10 or 11 ft) green and glabrous, 12–14 ft . lvs. oblong-lanceolate to elliptic, green, acute: raceme simple or forked, lax and few-fld , the bracts large and oblong, green, sepals lanceolate, pale purple or lilac, ½in long; petals lanceolate, acuminate, 1½ in long, purple, staminodia unlike, obovate, entire, scarcely longer than the petals, connate at base, bright crimson; lip bright crimson-purple caps oblong, large W Indies, S. Amer B R 470

23 **latifòlia,** Miller (*C gigantea,* Desf. *C macrophylla,* Hort *C. neglécta,* Wemm *C gemélla,* Nees. *C. Altensteinii,* Bouché). St. stout, very tall (10–16 ft) pubescent: lvs. ovate or ovate-oblong, acute, green, but purple-margined when young, the lower ones often 3–4 ft. long. fls. in several racemes forming a panicle, the bracts oblong or the lower ones becoming several inches long; sepals oblong and green, ½in long, very unequal, petals lanceolate, acuminate, 2 in long, scarlet; staminodia united into a tube, entire at apex or one of them 2-lobed, somewhat twisted, brick-red; lip brick-red: caps. large S Amer L.B C. 7:634. —**C. heliconiifòlia,** Bouché, Texas to Venezuela, has the staminodia more or less connivent fls orange-red lvs long-petioled, more or less woolly, oblong-acuminate plant 7–8 ft Var **xalapénsis,** Kranzl (*C xalapénsis,* Bouché), has narrower lvs. and smaller stature

DD. *Staminodia large (3 in or less long), united into a tube*

E. *Fls pendulous, rose-colored*

24 **iridiflòra,** Ruiz & Pav St green, 6–12 ft. lvs broad-oblong, bright green, slightly pubescent beneath: racemes paniculate, drooping; fls large, beautiful rose-color, tube of corolla and staminodia as long as the blade, sepals lanceolate, 1 in long, corolla-lobes lanceolate, 2½ in long; 3 upper staminodia somewhat longer than the corolla-lobes, obovate, nearly or quite 1 in broad, rose-crimson, lip narrow, deeply emarginate, rose-crimson Andes of Peru B M 1968 B R 609 L B C 10 905 R H 1861 110



784. Stool of canna, showing how it may be divided.

EE. *Fls. erect-spreading, white and red.*

25. **liliflòra,** Warsc St robust, green, 8–10 ft.: lvs many, oblong, green, 3–4 ft long, spreading from the st at a right angle fls in a corymbose panicle; sepals linear, as long as the tube of the corolla, corolla-lobes lanceolate, 2–3 in long, pale green, the tube of equal length, 3 upper staminodia white, united into a tube for half their length, the blade obovate and spreading, lip oblanceolate, as long as the staminodia Colombia. R H 1884:132 F S 10 1055–6 —A fine species. The white fls finally become tinged with brown; lonicera-scented. L H B.

CÁNNABIS (the ancient Greek name) *Moràceæ.* HEMP. A widely cultivated fiber plant, and also used occasionally as an ornamental subject, being grown from seeds and treated as a half-hardy annual

Hemp is dioecious staminate fls. in axillary panicles, with 5 sepals and 5 drooping stamens and no petals, pistillate fls in short spikes, with 1 sepal folding about the ovary lvs digitate, with 5–7 nearly linear, coarse-toothed lfts.. fr a hard and brittle achene **C. sativa,** Linn , probably native in Cent Asia, is now escaped in many parts of the world tall, rough and strong-smelling, 8–12 ft lfts 5–11, linear-lanceolate, toothed, the upper lvs alternate and the others more or less opposite Only one species, but various forms have received specific names In gardens, the form known as *C. gigantea* is commonest, this reaches a height of 10 ft. and more The seeds are usually sown where the

plants are to stand; but if quick effects are wanted, they may be started indoors in pots or boxes. Hemp makes excellent screens in remote places. It thrives best in a rich rather moist soil For field cult for fiber (which is derived from the inner bark), see Cyclo Amer Agric, Vol II, p. 377. L. H. B.

CANTELOUPE: *Muskmelon.*

CANTERBURY BELL: *Campanula Medium.*

CÁNTUA (from Cantu, Peruvian name). *Polemoniàceæ.* Showy flowering shrubs, with variable foliage, in greenhouses, and out-of-doors far South.



785. Capparis spinosa. (×⅙)

Flowers corymbose; calyx campanulate, of 5 (rarely 3) sepals, which are much shorter than the long tubular corolla; stamens inserted at the base of the corolla, but exceeding it in length —Six species in S. Amer One kind is recommended in Eu as a coolhouse shrub. No tenderer than fuchsias. Prop. by cuttings in sand under a bell-jar.

buxifòlia, Juss. (*C. depéndens,* Pers.). Much-branched shrub, about 4 ft high, branches more or less downy· lvs. very variable, generally oblong-obovate, acute, tapering at the base, entire or serrate, downy or glabrous. fls 5–8, drooping vertically, in a kind of leafy, terminal corymb, calyx pale, membranous, green-streaked, 5-toothed, a fourth shorter than the corolla-tube; corolla long-funnel-shaped, the tube 2½ in. long, red, usually streaked; limb of fringed, obcordate, crimson lobes which are much shorter than the tube; stamens included Peru Apr, May B M 4582. F.S. 7:650 R.H 1858, p. 294 R B 27 181 —One of the choicest of European greenhouse plants Very liable to red spider.

C bicolor, Lem Distinguished from the above by the entire lvs. which are shorter, about 1 in long, and the solitary fls with a short, yellow tube, the limb not fringed The fls droop, but not vertically Peru B M 4729 F S 4 343 Probably less desirable than the above —*C pyrifòlia,* Juss Lvs generally broader and more toothed than in C bicolor fls as many as 17, in an erect, terminal, compound corymb, calyx red-tipped, nearly half as long as the yellow corolla-tube, corolla about 1¼ in long, with a white limb, stamens long, exserted. Peru B.M. 4386 F S 4 383

WILHELM MILLER.
N. TAYLOR.†

CAOUTCHOUC TREE: *Hura, Manihot, Ficus elastica, Castilloa, Hevea, Landolphia,* and others, not treated here

CAPE BULBS. A name applied to bulbous and bulb-like plants native to South Africa. They are dry-region plants, and often bloom with us in summer and autumn Some of the leading genera are Amaryllis, Brunsvigia, Nerine, Ixia, Tritonia, Watsonia. See *Bulbs.*

CAPE CHESTNUT: *Calodendrum capense.*

CAPE GOOSEBERRY: *Physalis.*

CAPE JESSAMINE: *Gardenia.*

CAPER· *Capparis*

CAPE-SPURGE: *Euphorbia Lathyrus.*

CÁPPARIS (Greek, *caper,* said by some to have been derived from the Arabic name of the plant). *Capparidàceæ* CAPER-BUSH, or CAPER-TREE Greenhouse plants North, and suited to the open in Florida and California

Trees and shrubs, with simple lvs: sepals 4, rarely 5; petals usually 4; stamens usually many, inserted on the receptacle, the filaments thread-like and free; ovary long-stalked, 1–4-celled, with many ovules — More than 150 species distributed throughout the warm regions of the earth Differing from Cleome and most other cult genera of the family in having baccate, not capsular, fr

Capers are pickles made by preserving the flower-buds of *C spinosa,* a straggling shrub which grows out of old walls, rocks, and rubbish in Mediterranean regions and India Also rarely cultivated as a greenhouse flowering shrub Propagation is by cuttings of ripe wood, under a bell-jar, in greenhouses, and by seeds South

spinòsa, Linn Fig 785 Spiny shrub, 3 ft high, often straggling and vine-like lvs roundish or ovate, deciduous fls borne singly, alternately, and fading before noon, sepals 4, petals 4, oblong, clawed, wavy, white, 1½ in long, stamens 40–50, filaments purple above, perhaps the chief beauty of the plant B M 291. —What seems to be the long style with a short unopened stigma, is really the elongated peduncle or torus topped by the pistil, which has no style and a minute stigma Var **rupéstris** (*C rupéstris,* Sibth & Smith) is a spineless form

Mitchellii, Lindl A much-branched shrub, usually very spiny, and more or less densely tomentose lvs ovate-oblong, 1–1½ in long, narrowed into a short petiole fls few, axillary, white or yellowish, followed by a tomentose globular berry 2 in diam Sand plains of Austral —Suitable for dry places outdoors in S. Calif

C acuminàta, Lindl St shrubby, with flexuose, smooth branches lvs petiolate ovate-lanceolate, acuminate fls large, solitary, white, the conspicuous stamens 3–4 times as long as the petals. China B R 1326.

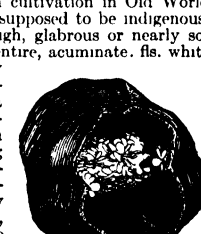
WILHELM MILLER.
N. TAYLOR.†

CAPRIFÒLIUM: *Lonicera.*

CAPRIÒLA: *Cynodon.*

CÁPSICUM (name of uncertain origin, perhaps from *kapto,* to bite, on account of the pungency of the seed or pericarp, or from *capsa,* a chest, having reference to the form of fruit) *Solanàceæ* RED PEPPER CAYENNE PEPPER Herbs or shrubs, originally from tropical America, but escaped from cultivation in Old World tropics, where it was once supposed to be indigenous.

Stem branchy, 1–6 ft high, glabrous or nearly so: lvs. ovate or subelliptical, entire, acuminate. fls. white or greenish white, rarely violaceous, solitary or sometimes in 2's or 3's, corolla rotate, usually 5-lobed, stamens 5, rarely 6 or 7, with bluish anthers dehiscing longitudinally, ovary originally 2–3-loculed fr a juiceless berry or pod, extremely variable in form and size, many-seeded, and with more or less pungency about the seeds and pericarp Fig 786. The fr becomes many-



786 Normal 2-loculed fruit of Capsicum, in cross-section.

loculed and monstrous in cult.—About 90 species have been named, most of which are now considered forms of one or two species. Monogr. by Irish, 9th Ann. Rept Mo. Bot. Gard. For cult., see *Pepper*.

A *Plant annual or biennial*

ánnuum, Linn Fig 787. Herbaceous or suffrutescent, grown as annuals in temperate climates, but in warmer latitudes often treated as biennials. All of the leading commercial varieties in the U S. readily find classification within the types or botanical varieties The species has never been found wild. It is the pimento of Trop Amer.

B *Fr oblong-linear.*

C *Calyx usually embracing base of fr*

Var **conoides,** Irish (*C conoides*, Mill.). Suffrutescent lvs numerous, rather small, 2-3 in long, ¾-2 in. wide peduncles slender, straight, erect; fls. small, calyx obconical or cup-shaped, usually embracing base of fr, corolla greenish white, spreading, ⅜-⅝in fr. erect, subconical or oblong-cylindrical, about 1¼ in long or less, usually shorter than the peduncles and mostly borne above the lvs, very acrid. Coral Gem, Tabasco Gn 66, p 381

Var **fasciculàtum,** Irish (*C fasciculàtum*, Sturt) Red Cluster Pepper Fig 788 St herbaceous, round or nearly so branches few· lvs clustered or crowded in bunches about the summit, elliptical-lanceolate, pointed at both ends fr also clustered, erect, slender, about 3 in long by ¼in diam., very acrid

Var **acuminàtum,** Fingh (*C chilénse*, Hort) Long Cayenne Herbaceous, very branchy, about 2½ ft high, bearing a dense mass of foliage. fl medium size, spread ½-¾in fr larger than the preceding, either erect or pendent Chile

CC *Calyx not usually embracing base of fr*

Var **lóngum,** Sendt (*C ánnuum*, Linn *C lóngum*, DC.) Plant herbaceous, about 2½ ft high, with comparatively few branches lvs large, often 4 in long by 2½ in wide fl. large; corolla spreading, ⅞-1¼ in., dingy white, calyx usually pateriform or funnelform, rarely embracing base of fr fr often a foot long by 2 in diam. at base, flesh thick and in some varieties very mild Garden varieties are· Black Nubian, County Fair, Elephant's Trunk, Ivory Tusk.

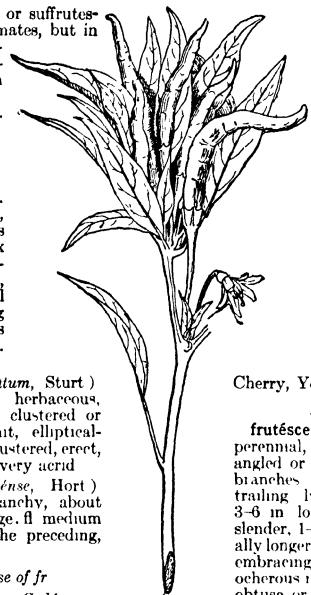


787. A form of Capsicum annuum.

BB. *Fr of various shapes, but not oblong-linear*

Var **grôssum,** Sendt (*C gróssum*, Linn) Herbaceous, about 2 ft high, with few branches: lvs very large, often 3 by 5 in., sometimes coriaceous, lower ones usually pendent; petioles deeply channeled· peduncles stout, about 1 in long; corolla large, spreading, ⅞-1¼ in. fr large, oblate, oblong, or truncated, 3-4-lobed, usually with basal depression, more or less sulcate and rugose, flesh thick, firm, and of a mild flavor. Emperor, Monstrous, Bell, Sweet Mountain, Golden Dawn, Ruby King, Golden King, Brazilian Upright, Golden Upright, Squash, and others, are garden varieties.

Var. **abbreviàtum,** Fingh (*C umbilicàtum*, Vell. *C. lùteum*, Lam.) Suffrutescent lvs broadly ovate, 2-4 in long peduncles slender, straight or curved, as long as or longer than the berry fr about 2 in. long or less, varying much in the different horticultural varieties, in general ovate, quite rugose, except in one variety, sometimes turbinate While this variety is used to some extent for pickling, it is noted more as an ornamental plant. Some garden forms are Celestial, Etna, Kaleidoscope, Red Wrinkled, Yellow Wrinkled.



788 Capsicum annuum var. fasciculatum.

Var **cerasifórme,** Irish (*C. cerasifórme*, Mill.) Suffrutescent lvs medium size, ovate or oblong-acuminate, about 1¼-3½ in calyx seated on base of fr, corolla large, spreading, ⅞-1½ in fr. spherical, subcordate, oblate, or occasionally obscurely pointed or slightly elongated, smooth or rarely minutely rugose or sulcate, flesh firm, ⅛-⅓in thick, extremely pungent Garden forms are: Cherry, Yellow Cherry, Oxheart.

AA *Plant perennial*

frutéscens, Linn Fig 789 Shrubby perennial, 3-6 ft high, with prominently angled or somewhat channeled st and branches branches loosely spreading or trailing lvs broadly ovate-acuminate, 3-6 in long, 2-3½ in wide peduncles slender, 1-2 in long, often in pairs, usually longer than the fr, calyx cup-shaped, embracing base of fr, corolla often with ocherous markings in the throat fr. red, obtuse or oblong-acuminate, ¾-1¼ in. long, ¼-¾in diam., very acrid —Cult. only S, as the seasons in temperate latitudes are not long enough to mature fr.

Var **baccàtum,** Irish (*C baccàtum*, Linn) Plants not so tall, but more erect than the species branches slender, fastigiate, flexuose corolla small, spreading, about ½in. fr ovate or sub-round, about ¼in diam

H C Irish.

CARAGÀNA (*Caragan*, its Mongolian name) *Leguminòsæ* Pea Tree Ornamental shrubs chiefly grown for their bright yellow flowers; some species are also used for hedges

Leaves abruptly pinnate, often with persistent spiny-pointed rachis, lfts small, entire; stipules deciduous or persistent and spiny: fls papilionaceous; standard upright, like the wings with long claws, keel obtuse and straight, stamens 10, 9 connate, 1 free, ovary scarcely stipitate pod linear, terete, straight, 2-valved, with several seeds —More than 50 species from S Russia to China, most of them in Cent Asia Monograph by Komarov in Act Hort Petrop 29·179-388 (1908), with 16 plates



789. Capsicum frutescens.

The caraganas are deciduous unarmed or spiny shrubs

with yellow, rarely whitish or pinkish flowers axillary and solitary or fascicled, followed by linear pods. The cultivated species are quite hardy, except a few Himalayan species They grow in almost any soil, but best in a sandy soil and sunny position, and are well adapted for shrubberies *C arborescens* is the only one which grows into a small tree, and is of upright habit, like *C frutex*, which is about half as high and more graceful; most of the other species are low shrubs, of usually spreading habit. *C. arborescens* is one of the best hedge shrubs for the prairies of the Northwest

Propagation is by seeds sown in fall or in spring; if kept dry during the winter, soaking in tepid water for two or three days before sowing will be of advantage; also increased by root-cuttings and layers, or by grafting on seedling stock of *C. arborescens* in spring



790. Caragana microphylla. (×½)

A. *Lfts. 12–18, ⅛–½ in. long: rachis deciduous.*

microphýlla, Lam (*C Altagàna,* Poir *C arboréscens* var *arenària,* Hort). Fig 790. From 4–6 ft: lfts. 12–18, obovate, pubescent when young, grayish green, ⅓in long or shorter fls 1 or 2, yellow, ¾in long, pedicel about as long as the fl. Siberia, China L B. C 11: 1064 —Under this name a dwarf form of *C. arborescens* is often cult. Var **megalántha,** Schneid Lfts bright green, ⅓ or sometimes ½in. long· fls 1¼ in long.

AA. *Lfts. 8–14, ½–1 in long rachis deciduous.*

arboréscens, Lam. Shrub or small tree, to 20 ft: lfts 8–12, obovate or oblong, sparsely pubescent beneath or glabrous at length: fls 2–4, pale or bright yellow, ¾in long, pedicels usually longer than the fls. pods about 2 in. long. May, June Siberia, Manchuria G O. H 67. Var **péndula,** Dipp, with pendulous branches, is the most remarkable, it should be grafted high M D G 1897·425 Var. **Lorbérgii,** Koehne. Lfts linear to linear-oblanceolate, about 1 in long. A very peculiar and striking form.

fruticòsa, Bess. (*C Redówskii,* Fisch *C arboréscens* var. *arenària,* Sims) Shrub, to 6 ft, very similar to the preceding: lfts 10–14, oblong-elliptic to obovate, cuneate at the base, rounded at the apex; stipules herbaceous or somewhat spiny, pedicels and calyx puberulous, calyx-teeth very short· pods about 1 in long; seeds brown. Amurland, Korea. B M. 1886 (not good).

AAA. *Lfts 2–4*

B. *Rachis of the lvs. deciduous· pedicels as long as or longer than the fls.*

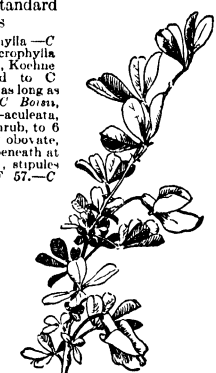
frùtex, Koch (*C. frutéscens,* DC) Fig 791. From 6–10 ft · lfts 4, approximate, nearly digitate, cuneate, obovate or oblong, rounded or emarginate at the apex, glabrous, ⅛–1 in. long· fls solitary, ¾-1 in long, yellow. May. S. Russia to China Gt 10·348 S B F G 3:227. Var **grandiflòra,** Koehne Fls somewhat longer than 1 in.. lfts. usually large and broad. Var. **latifòlia,** Schneid. (var. *obtusifòlia,* Hort) Lfts more than an inch long and about ½ in. broad: fls. as in the type.

BB. *Rachis persistent, spiny: pedicels shorter than the fls.*

Chámlagu, Lam. Shrub, 2–4 ft. spines long lfts 4, in 2 somewhat remote pairs, chartaceous, obovate emarginate or rounded at the apex, glabrous, ¼–¾in long fls solitary, reddish yellow, 1¼ in. long May. N. China. G O H 30

pýgmæa, DC (*C grácilis,* Hort). One to 3 ft: spines short, ¼in. lvs nearly sessile, lfts 4, approximate and almost digitate, cuneate, linear-elliptic or linear-lanceolate, glabrous, ⅛–½in long fls solitary, ¾in long, golden yellow Caucasus to Siberia and Thibet B R. 12 1021 —Grafted high on *C arborescens,* it forms a graceful standard tree, with pendulous branches

C Altagàna, Poir =C microphylla —*C arboréscens arenària,* Hort =C microphylla —*C arenària,* Dipp =C aurantiaca, Koehne —*C aurantiàca,* Koehne Allied to C pygmæa Fls orange-yellow, calyx as long as broad, ovary glabrous Siberia —*C Boisii,* Schneid (C microphylla var crasse-aculeata, Bois) Allied to C arborescens Shrub, to 6 ft lfts 10–12, obovate or narrowly obovate, about ½in long, silky pubescent beneath at least when young, whitish beneath, stipules spiny fls solitary W China W F 57.—*C brevispina,* Royle (C trifloraLindl) Spines 2–3 in long lfts 12–16, pubescent fls 2–4, on a common peduncle Himalayas P F G 2 184 —*C decorticans,* Hemsl Allied to C microphylla Shrub or small tree, spiny lfts 8–12, oval, less than ½in long fls 1–2 Afghanistan H I 18 1725 —*C frutéscens,* DC =C frutex.—*C Gerardiana,* Royle Spines 1½–2 in long stipules large, scarious lfts 8–12, densely pubescent fls 1–2, short-pedicelled Himalayas —*C grácilis,* Hort =C pygmæa —*C grandiflòra,* DC Allied to C pygmæa Lfts cuneate-oblong, glabrous or pubescent fls 1¼ in long, calyx gibbous at the base Caucasus —The plant sometimes cult under this name is a variety of C frutex —*C yubàta,* Pall Sparingly branched shrub with very thick spiny and villous branches stipules large, scarious lfts 8–14, linear-oblong, villous beneath fls whitish, 1 in long, short-pedicelled Siberia F S 19 2013 L B C 6 522 Gt 10 331 A very distinct and curious-looking species hardy —*C sophoræfòlia,* Bess (C arborescens ×C. microphylla C cuneifolia, Dipp) Lfts usually 12, oblong to elliptic, cuneate, acute pods ¾in long Garden origin —*C spinòsa,* DC Spines 1 in long lfts 4, rarely more, approximate, cuneate-lanceolate, glabrous fls solitary, short-pedicelled Siberia —*C spinosíssima,* C Koch=C spinosa —*C tragacanthoìdes,* Poir Spiny lfts 4–8, cuneate, oblong, pubescent fls solitary, short-pedicelled, calyx villous-pubescent Himalayas —*C trifloìra,* Lindl =C brevispina. —*C vulgaris,* Hort =C arborescens



791 Caragana frutex. (×½)

ALFRED REHDER.

CARAGUÀTA By the latest monographer referred to *Guzmania,* which see

CARALLÙMA (aboriginal name) *Asclepiadàceæ.* Low succulents, sometimes seen in collections, about 40 species, from S Spain and Afr to Arabia and India They resemble stapelias, and require similar treatment. The sts are leafless, somewhat branched, erect, 4-sided and the angles toothed: fls near the summit of the sts, more or less clustered, purple, brown and yellow, and other colors, corolla rotate and 5-parted: fr. long and slender follicles. The carallumas are probably not in the American trade Some of the names that may be expected in collections are *C. adscendens,* R. Br; *C affinis,* Wildem.; *C. campanulata,* N E Br. (Boucerosia campanulata, Wight); *C. commutata,* Berger (sometimes grown as C. Sprengeri); *C. fimbriata,* Wall; *C inversa,* N E Br; *C Lunii,* N. E Br.;

C. Sprengeri, N. E. Br.; *C. Simonis*, Berger (Boucerosia Simonis, Hort); *C. torta*, N. E. Br.

CARAMBÒLA: *Averrhoa.*

CARAWAY (*Càrum Càrvi*, Linn). *Umbellíferæ.* A biennial or annual herb grown for its seeds, which are used in flavoring bread, cakes and cheese, also occasionally for the young shoots and leaves, which are eaten. It grows a foot or two high, has finely-cut, pinnately compound foliage, and small white flowers, in umbels. It is of the easiest culture. The seed is usually sown in spring and the crop of seed taken the following year. It thrives in any garden soil. The plant occasionally runs wild. See *Carum*.

CARBÈNIA: An incorrect or doubtful name for *Cnicus*, which see.

CARDÁMINE (Greek name of a cress) *Crucíferæ.* Small mostly leafy-stemmed perennials (the annual species apparently not cultivated), growing in low rich land, blooming in spring or early summer.



792. Cardamine pratensis. Root-leaves not showing.

Flowers sometimes large for size of plant, white or purple; petals obovate or spatulate; pods linear and straight, more or less flattened, the wingless seeds in 1 row; valves usually separating elastically from the base; lvs simple or pinnate or lyrate; root often tuberous or rhizomatous.—About 50 species, largely in boreal or alpine regions. Of easy cult. Only *C. pratensis* is much known among growers.

praténsis, Linn. CUCKOO FLOWER. Fig. 792. Plant slender and usually glabrous, 12–20 in., somewhat branched; lvs pinnately divided, lfts of root-lvs small and rounded (½in. or less across), those of the upper st.-lvs oblong or even linear and entire or somewhat toothed; fls. ½in. long, in a corymb, white or rose-color, pretty. Eu. and Amer., in the northern parts.—In the gardens it is chiefly known in the double-fld. form, which probably has been derived from European rather than American sources. There are other forms of it. It is an excellent little plant to grow in moist places, particularly along creeks and about springs. It is also useful in drier places, as in rockeries.

trifòlia, Linn. Attractive spring bloomer, 6 in., creeping; lvs. ternate, the toothed parts or segms. irregularly roundish; fls. snow-white, on a naked scape. S. Eu. B M 452.

angulàta, Hook. Erect, 1–2 ft. high; lvs. 3–5-foliolate, the lfts. ovate or oblong, and the middle one usually coarsely toothed; fls. rather large, white, in short, few-fld. racemes. Mts. of Ore. and Wash.—Intro. 1881 by Gillett.

L. H. B.

CARDAMON: *Amomum* and *Elettaria.*

CARDIÁNDRA (Greek, *heart*, and *man* or *stamen:* alluding to the shape of the anthers) *Saxifragàceæ.* Ornamental half-shrubby plants, rarely cultivated for their white, lilac or pink flowers.

Suffruticose deciduous plants with alternate rather large lvs. and small pink, lilac or white fls. in terminal loose corymbs surrounded by large sterile fls.; calyx-tube cupulate, adnate to the ovary; petals 5, stamens numerous with filiform filaments and suborbicular anthers; ovary inferior, incompletely 3-celled, styles 3, short; sterile fls. with 3 large sepals, caps. loculicidal.—Three species in Japan and China. Tender plants, thriving in any good garden soil; best in a partly shaded and moist position. Prop. by greenwood cuttings under glass.



793. Fruit of Cardiospermum. (×½)

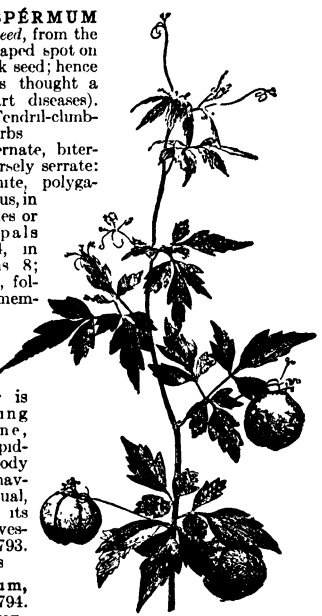
alternifòlia, Sieb. & Zucc. One to 3 ft.; lvs. broadly elliptic to elliptic-lanceolate, tapering into a very short petiole, coarsely serrate, sparsely pilose, membranaceous, 3–7 in. long; fls. pink, lilac or white. Summer. S. Z. 66, 67. Gt. 14, 486.

ALFRED REHDER.

CARDINAL FLOWER: *Lobelia cardinalis.*

CARDIOSPÉRMUM (Greek, *heart-seed*, from the white heart-shaped spot on the round black seed; hence the plant was thought a cure for heart diseases). *Sapindàceæ.* Tendril-climbing tropical herbs.

Leaves alternate, biternate, lfts. coarsely serrate; fls. small, white, polygamous or dioecious, in axillary racemes or corymbs, sepals and petals 4, in pairs, stamens 8; ovary 3-celled, followed by a membranous caps.—A dozen species widely distributed. The most popular is the interesting balloon-vine, which is a rapid-growing, woody perennial, behaving as an annual, curious for its inflated seed-vessels. Fig. 793. Prop. by seeds.



794. Balloon-Vine—Cardiospermum Halicacabum. (×½)

Halicàcabum, Linn. Fig. 794. BALLOON-VINE. HEART-SEED. HEART-PEA. Height 10 ft. st. and branches grooved. lvs. glabrous, oblong-acuminate, deeply dentate, balloons an inch or more thick. Trop. India, Afr., and Amer. B M 1049.—A general favorite, especially with children. Grown as a garden annual.

hirsùtum, Willd. Creeping or ascending perennial vine with densely hairy grooved st. and lvs. as in the preceding, but usually hairy on the under surface. fls. not showy. fr. pointed, hirsute, the globular chocolate-brown seed is borne on the detaching parachute-like dissepiment. Afr.—A useful perennial in S. Calif. for covering arbors; evergreen and blooming continuously.

N. TAYLOR †

CARDOON (*Cynara Cardúnculus*, Linn.). A thistle-like plant of southern Europe, cultivated for the thick leaf-stalk and midrib.

It is thought to be of the same species as the artichoke, and to have been developed from it by long cultivation and selection. See *Cynara.* The plant has been

introduced into South America, and has run wild extensively on the pampas Darwin writes that "no cultivated plant has run wild on so enormous a scale as the cardoon." From the artichoke it differs in taller and more prickly growth and smaller heads. The cardoon is perennial, but it is not hardy, and is treated as an annual. Seeds are sown in spring, either in pots under glass or in the open where the plants are to stand. The later sowing is usually preferred The plants are given



795 Leaf of Canada thistle.—Carduus arvensis or Cirsium arvense. (×½)

rich soil and should have abundant moisture supply, for they must make continuous and strong growth. When the leaves are nearly full grown, they are tied together near the top, straw is piled around the head, and earth is banked against it This is to blanch the plant, for it is inedible unless so treated From two to four weeks is required for the blanching The procedure is not very unlike that adopted for the blanching of celery or endive. If the plants are late, they may be dug just before frost and blanched in a storage pit The plants are usually grown 2 to 3 feet apart, in rows which are 4 feet apart. They are sometimes grown in trenches, after the old way of growing celery. Cardoon is very little known as a vegetable in America except among foreigners. L. H. B.

CÁRDUUS (the ancient Latin name of these plants). *Compósitæ* THISTLE Spiny-leaved annual, biennial or perennial herbs, sometimes grown in borders and rock-gardens for the interesting habit and the heads of purple or white flowers.

Carduus is sometimes united with Cirsium, but is here kept distinct, being separated chiefly by non-plumose or only indistinctly serrate pappus-bristles (see *Cirsium*). The common weedy thistles are referred either to Carduus or Cirsium, depending on the definition of the genus. Fig 795 shows the spiny leaf of one of these. Under the restricted use of the name, Carduus comprises about 80 species, from the Canary Isls. to Japan. For *C. benedictus*, see *Cnicus*

acanthoides, Linn A much-branched perennial about 18–24 in. high: lvs. bright green, pinnately parted, the nerves very prominent beneath, spinose margined: the solitary heads long-peduncled, the fls. purple and showy. S. Eu —Scarcely known in Amer

C. Marianus, Hort., is a Silybum, and *C. tauricum*, Hort., is a Cirsium Both are advertised in England, but are unknown in Amer N. TAYLOR.†

CÀREX (name of obscure origin). *Cyperàceæ.* SEDGE Grass-like perennials of very many kinds, a few of which are grown in bogs or as border plants.

Flowers unisexual, in spikes, the staminate naked and subtended by a bract or scale, the pistillate comprising a single pistil inclosed in a thin sac or perigynium; monœcious or rarely dioecious: sts or culms solid, not jointed, mostly 3-angled: lvs. grass-like but 3-ranked. One large group has 2 styles and a lenticular achene, and the spikes are commonly androgynous or contain both sexes (Fig 796), another division has 3 styles and a triangular achene, and the spikes are commonly unisexual, the staminate being above (Figs. 797, 798).

Carices are very abundant in cool temperate regions, both in species and in individual plants. There are more than 800 known species. Many of them grow on dry land, but the largest species grow in low grounds and swales, and often form much of the bulk of bog hay. Carices cover great areas of marsh land in the upper Mississippi region and are employed in the manufacture of "grass carpets" or Crex fabrics. The species are difficult to distinguish because they are very similar, and the study of them is usually left to specialists Some of our broad-leaved native species make excellent borders and interesting clumps in corners about buildings and along walls Of such are *C. platyphylla*, *C. plantaginea*, *C. albursina* Many of the lowland species are excellent adjuncts to the pond of hardy aquatics Others have very graceful forms, with drooping spikes and slender culms (Fig 798). The following native species, and probably others, have been offered by collectors: *C. aurea*, *C. eburnea*, *C. flava*, *C. Grayi* (one of the best), *C. hystricina*, *C. lupulina* and its var *pedunculata*, *C. lurida*, *C. paupercula*, *C. pennsylvanica*, *C. plantaginea*, *C. Pseudo-Cyperus*, *C. retrorsa*, *C. Richardsonii*, *C. riparia*, *C. Tuckermanii*, *C. utriculata*, *C. vulpinoidea* The species present no difficulties in cultivation if the natural habitat is imitated Propagated readily by seed sown in late fall (germinating in spring) or by division of the clumps.

Mórrowi, Boott (*C. japónica*, Hort., not Thunb *C. tenuissima*, Hort *C. acutifólia*, Hort.) Fig 799 Lvs stiff and evergreen, long-pointed, in the common garden form with a white band near either margin culm 1 ft with a terminal staminate spike and 2 or 3 slender pistillate spikes (1 in long) from sheaths. perigynium small and firm, somewhat excurved, 2-toothed, glabrous Japan G C. III. 13 173 R B 20, p 9 —A very handsome plant, suited for pots or the border. The stiff clean white-edged foliage keeps in condition for months, making the plant useful for decorations in which pot-plants are used. It is perfectly hardy in Cent N. Y., holding its foliage all winter. A useful florists' plant.



796. Carex (C. scoparia), with androgynous spikes and lenticular achenes. (×1). N. Amer.



797. Carex (C. lurida), with staminate terminal spikes and trigonous achenes. (×½) N. Amer

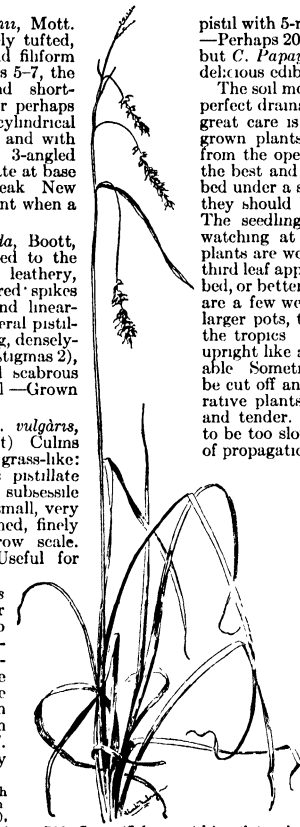
intuméscens, Rudge (*C. tenària*, Hort. *C. ténera*, Hort.). Slender, but stiff, to 30 in.: lvs narrow, rolling more or less when dry: staminate spikes long-stalked: pistillate spikes 1 or 2, short-stalked, short, with few large, turgid, tapering, shining perigynia and awl-like, rough-pointed scales. N. Amer.

culms, Berger (*C. Vilmorinii*, Mott. *C. Vilmoriniana*, Hort.) Densely tufted, with many very narrow lvs., and filiform culms 1½ ft. or less high: spikes 5–7, the terminal staminate, linear and short-stalked, the lateral pistillate (or perhaps staminate at base), oblong or cylindrical and dense-fld., about 1 in long, and with aristate scales: perigynium 3-angled (stigmas 3), lance-ovate, attenuate at base and with a 2-toothed scabrous beak New Zeal —A good hardy edging plant when a tufted grassy effect is desired

Buchánanii, Berger (*C lùcida*, Boott, var. *Buchánanii*, Kuek.) Allied to the preceding densely tufted: lvs leathery, semi-terete, very narrow, brown-red: spikes 5–8, the terminal staminate and linear-cylindrical, long-stalked, the lateral pistillate and cylindrical, 1½ in long, densely-fld perigynium plano-convex (stigmas 2), produced into a long margined scabrous deeply bidentate beak New Zeal —Grown for its reddish foliage

Gaudichaudiàna, Kunth (*C. vulgàris*, Fries, var *Gaudichaudiàna*, Boott) Culms erect, 1–2 ft lvs long and grass-like: staminate fls in terminal spikes pistillate fls in 2–3 cylindrical, sessile or subsessile spikes perigynium lenticular, small, very short-beaked, obscurely 2-toothed, finely nerved, longer than the narrow scale. Japan, Austral New Zeal —Useful for bog planting

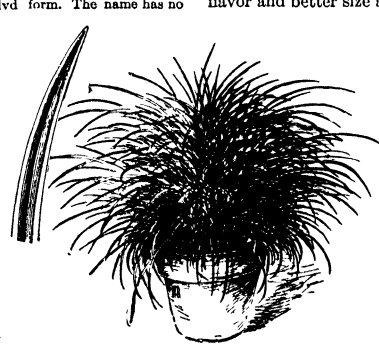
Fràseri, Andr (*Cymophyllus Fràseri*, Mack.) Lvs 1 in or more broad, stiff, but with no midnerve, flat and thick, evergreen culm 16 in or less high-bearing at its summit a single whitish spike which is staminate at top perigynium ovoid, thin and inflated Rich mountain woods, Va B M. 1391 (as *C. Fraseriana*) —Rare, and a very remarkable plant



798 Carex (C longirostris), with terminal staminate spikes and drooping pistillate spikes (×⅓) N Amer

C bàccans, Nees Robust, with curving lvs to 2 ft long and ½in broad fr berry-like (whence the name), crimson or vermilion, in clustered spikes standing well above the lvs India G 1 461 Useful for pots or for planting in a conservatory, for its ornamental fr, but probably not now in cult commercially —*C gallica variegata* is offered abroad as a "very elegant, showy and charming" carex —*C. riparia*, Curt., a rank-growing lowland species of wide distribution, is sometimes grown in a variegated-lvd form. The name has no botanical standing —With the extension of wild gardening, and particularly of bog- and water-gardening, many other species of Carex may be expected to appear in the trade lists

L. H. B.



799. Carex Morrowii.

CÀRICA (a geographical name) *Papayàceæ*. PAPAYA. Small, rapid-growing, unbranched trees, commonly grown in greenhouses as foliage plants and often bearing fruit under such conditions. Juice milky

Leaves large, soft, long-stalked, in clusters at the top of the trunk usually dœcious, the male fls. on long axillary peduncles, funnel-shaped, with 10 anthers in the throat, the pistillate fls. larger and with 5 distinct petals and a single pistil with 5-rayed stigma, sessile in the axils of the lvs. —Perhaps 20 species, all native to the American tropics, but *C. Papaya* is cult. throughout the tropics for its delicious edible fruits. See *Papaya*.

The soil most suited for caricas is a rich loam, having perfect drainage As the stem is succulent and tender, great care is necessary to avoid bruising, hence pot-grown plants are much to be preferred to seedlings from the open ground. Seeds should be selected from the best and largest fruits and sown in a well-worked bed under a slight shade If seeds are quite dry or old, they should be soaked in warm water before sowing. The seedling plants are delicate, and require close watching at first to avoid damping-off As soon as plants are well up remove the shading, and after the third leaf appears they may be pricked out into a larger bed, or better, potted off in fairly rich soil After plants are a few weeks old, and have been shifted once into larger pots, they may be set permanently outdoors in the tropics Caricas seldom branch, but usually grow upright like a palm, hence cuttings are not often available Sometimes small branches form, and these may be cut off and as readily rooted as most tropical decorative plants, provided the cutting is not too young and tender. This method has been found in Florida to be too slow, and what is evidently a better method of propagation, by means of graftage, has been devised by Edward Simmonds, of the Plant Introduction Field Station, Miami, Florida. Numerous shoots are formed by the buds at the leaf-scars when a papaya tree is topped, as many as fifty or more being produced "One of these shoots is taken when a few inches long and about the diameter of a lead pencil, is sharpened to a wedge point, the leaf surface reduced, and inserted in a cleft in a young seedling which has been decapitated when 5 to 10 inches high, and split with an unusually sharp, thin grafting-knife. At this age the trunk of the young seedling has not yet formed the hollow space in the center Seeds planted in the greenhouse in February produce young seedlings large enough to graft some time in March, these grafted trees, which can be grown in pots, when set out in the open ground in May or the latter part of April, make an astonishing growth and come into bearing in November or December, they continue bearing throughout the following spring and summer, and if it is advisable, can be left to bear fruit into the following autumn." Varieties of superior flavor and better size and shape for shipping, as well as hermaphrodite varieties, may now be successfully maintained For complete description of this method see "The Grafted Papaya as an Annual Fruit Tree," by David Fairchild and Edward Simmonds, Circular No 119, Bureau of Plant Industry, 1913 In temperate climates, caricas have been found to be good decorative plants for both conservatory and summer bedding, the deeply cut, palmate leaves forming a striking contrast to ordinary vegetation In bedding out, select open, sunny exposure, with perfect drainage, and make the soil rich and friable Constant cultivation with a light hoe will cause a

luxuriant growth under these conditions, and the planter will be amply repaid for his trouble by beautiful showy specimens as tropical-appearing as palms.

Papàya, Linn. (*Papàya Cárica,* Gaertn.). PAPAYA. PAWPAW. The commonest species in cult., sometimes growing to a height of 20 ft, with large palmately 7-lobed lvs, sometime 2 ft. across, and fr shaped like a roughly angled melon up to 12 in. long and half as thick, hanging, especially from the lower axils of the pistillate plant. B M 2898-9.—From the frs, which vary in size up to 15 lbs. and in number to the tree from 20–50, is extracted the papaya juice, which furnishes the papain of commerce. This is obtained by slashing the fr, and collecting the milky juice in porcelain-lined receptacles, where it is allowed to evaporate. When evaporated to a granular condition, it is ready for the market and brings from $4–$6 a lb. in the crude state. The papaya has of recent years become one of the commonest table frs. of the tropics. The flesh, which is usually of a salmon-pink or yellow color, is excellent when one becomes accustomed to its peculiar flavor, and resembles somewhat a most luscious muskmelon. From its large content of papain, it may be eaten without injury in considerable quantities and assists in the digestion of other foods. As the tree grows with great rapidity in tropical climates, it may be treated as an annual, the seeds being sown early in protected beds, well cared for and transplanted to their permanent places when well established. They will then bear fr. late in the succeeding autumn. The method of graftage described on p. 663 is preferable, however. The frs. have a considerable cavity, which, in the smaller rounded frs, is well filled with the small brownish or blackish seeds. The firm skin, the firmness of which may be increased by selection, will permit of shipping to a distance. The plant is sometimes polygamous, and from such plants in Hawaii there have been bred types which appear to have great promise as a shipping fr. The green frs. are frequently used as vegetables, and the lvs, if cooked with tough meat, are said to make it tender, due to the digestive principle.

candamarcénsis, Hook. f. (*C cundinamarcénsis,* Lindl.) This is a more hardy ornamental species with numerous lvs, dark green above and pale beneath, rounded-heart-shaped, 1¼ ft across, 5-lobed to the center with pinnatifid lobes. fls. green and pubescent: frs. small, pointed, 5-angled, golden yellow. B M 6198. —Hardy in S. Calif., but the frs. of no value as such.

quercifòlia, Benth. & Hook. (*Vasconcéllea quercifòlia,* St. Hil.). Lvs. shaped like those of the English oak, palmately 3-lobed, and containing a greater percentage of papain than *C. Papaya;* frs. small.—Hardy in S. Calif.

grácilis, Solms (*Papàya grácilis,* Regel). Habit of *C Papaya,* trunk simple, 4–6 ft. high, slender, very glabrous. lvs. 5-digitate, the lobes sinuate-lobed, the middle one 3-lobed, the whole blade suborbicular in outline, petioled. Brazil. Gt. 1879.986.

S. C. STUNTZ

CARÍSSA (aboriginal name). *Apocynàceæ.* Very branchy spinose shrubs of the tropics of the eastern hemisphere, cultivated for ornament or hedges, but here mainly for the edible berry-like fruits.

Flowers white, solitary or in cymes; lobes of calyx and corolla 5, the 5 stamens free and included in the throat, the ovary 2-loculed: lvs. opposite and thick, simple.—About 30 species. Used abroad as greenhouse plants but grown in this country only in S. Fla., and Calif. Prop. by seeds and cuttings of ripe wood.

Carándas, Linn. CARAUNDA. CHRIST'S-THORN. Evergreen shrub or small tree, with dark green ovate or elliptic mucronate entire lvs, strong axillary spines (which are often forked) and fragrant white fls. in clusters of 2–3, the corolla twisted to the left in the bud: fr. the size of a cherry (1 in. diam.), reddish, pleasant-flavored. India. L.B.C. 7.663.—Reaches 20 ft. Half-hardy in Cent. Fla. The frs. are eaten from the hand or made into a jelly much like currants when ripe, and pickled when green.

bispinòsa, Desf. (*C arduìna,* Lam.). AMATUNGULU. MARITZGULA. Spines strong, often 2 in. long. lvs. ovate and subcordate, mucronate, glabrous and entire: fls. white, the corolla twisted to the right in the bud. S. Afr.—A choice evergreen shrub, rather hardy, with thick camellia-like very glossy lvs. fls. large, fragrant, white, and borne profusely and continuously: fr. dark red, size of a cherry, good. L.B.C. 4:387.—Closely resembles *C. grandiflora,* but fls. slightly smaller and frs. in clusters, seeds lanceolate.

grandiflòra, DC. NATAL PLUM. Spiny shrub: lvs. ovate-acute, tapering to the base: fls. large, white, fragrant, solitary and terminal, twisted to the right, heterogonous: fr. red, 1–1½ in. long, resembling cranberries in flavor when cooked, and having a papery skin, milky juice and few small almost circular seeds. Sauce made from this fr. is almost indistinguishable in flavor from cranberry sauce, but the frs. ripen so irregularly, although almost continually, as to make the fr. suitable only for home-garden use unless handled on a large scale. Said to be the finest hedge plant in S. Afr. B.M. 6307.

acuminàta, DC. Spines weak. lvs. smaller, ovate-acute, subcordate, mucronate; peduncles short, forked, axillary. fls. with lance-acuminate calyx-lobes, the corolla twisted to the right in the bud. S. Afr.—Perhaps not different from *C bispinosa.*

C edùlis, Vahl. A straggling shrub with small purple edible fr. from Trop. Afr. Intro. from Abyssinia, but has not yet been thoroughly tested. The plant in the American trade under this name is described as much taller than *C. Carandas* and more vigorous. lvs. persistent, ovate-acuminate. fls. 10–25 in axillary clusters, white and pink, jasmine-scented. berries oval, red but turning black at maturity, 1-seeded.—*C ovata,* R. Br., from Austral., a more open shrub than any of the preceding, the small frs. of which are edible and used for jams, has been intro. by the Office of Foreign Seed and Plant Introduction as a possible stock for the more tender species, in the hope of extending the range of these frs.—*C. spinàrum,* DC., a small edible-fruited evergreen shrub from India is said to be an important element in reforestation since it persists on the poorest and rockiest soils in spite of being greedily eaten by sheep and goats.

S. C. STUNTZ.†

CARLÌNA (said to have cured the army of Charlemagne [Carolinus] of the plague). *Compósitæ.* Low rather coarse annuals, biennials or perennials, with thistle-like foliage, large white or purplish heads, a feathery pappus, and chaffy receptacle: outer involucral bracts coriaceous, usually spiny, the inner ones colored or shiny and petal-like. fr. a silky-hairy achene. —Some 15 or 20 species in the Medit. region.

An open sunny place and ordinary garden soil are all they require. They are capital for the sunny part of a rockery. Propagated by cuttings or seeds.

acaùlis, Linn. A very dwarf hardy perennial; height 3–6 in. lvs. glossy, pinnatifid, divided, with spiny ends: fl. rising barely above the foliage, solitary, very interesting, the scales surrounding the fl.-head being long and narrow and ray- or petal-like, silky, shiny: head 6 in. across when expanded, white. June, July and late fall. G.C. II. 13:720–1. G.L. 19:178.

acanthifòlia, Linn. A white-tomentose thick-lvd. biennial, the lvs. oblong, the upper pinnatifid and spiny: fl.-heads 4 in. wide, yellowish purple. S. Eu. July and later. G.C. III. 47:68.—Little known in U. S.

N. TAYLOR.†

CARLUDÓVICA (Charles IV, and his Queen Louisa, of Spain). *Cyclanthàceæ.* Palm-like, sometimes merely herbaceous plants, of tropical America.

The plants are stemless, or sometimes with a lax creeping st., and usually have stalked, sometimes sessile, flabellate lvs.: fls. monœcious, the two sexes being on the same spadix, which is inclosed in a 4-lvd. spathe; staminate fls. with many stamens and many-

lobed calyx, 4 of them surrounding a pistillate fl.—the latter have a 4-sided ovary, 4 barren stamens, and 4-lobed calyx: fr. a 4-sided, many-seeded berry. The carludovicas are usually regarded and treated as stove palms by gardeners. They are useful for decoration. The family Cyclanthaceæ is exclusively tropical American, of about 45 species and 6 genera (Stelestylis, Carludovica, Sarcinanthus, Ludovia, Evodianthus, Cyclanthus); it is often united with the Pandanaceæ or screw-pine family.

The genus is an important economic one, as *C. palmata*, and perhaps other species, are the source of Panama hats In making these, the leaves are cut young, the stiff veins removed, after which the leaves are slit into shreds, but not separated at the stalk end It is said that hats of superior quality are plaited from a single leaf, without any joinings U S Dept. Agric., Fiber Investigations. Rept. 9:112 (1897).



800. Carludovica palmata.

Carludovica palmata is the species most frequently met with under cultivation Under favorable conditions it grows to a height of about 8 feet. All of the kinds need stove treatment during the winter months; in summer they may be used for subtropical bedding with good results. They have a certain palm-like appearance, but the leaves are of a softer texture than any of the palms. They may be propagated by division, choosing the early spring for the operation. *C palmata* seeds freely The fruit, when ripe, has an ornamental appearance for a short time after bursting open. The seeds are very small, and should be carefully washed free from the pulp, and sown on the surface of a pan of finely chopped sphagnum moss. Germination takes place in two weeks from sowing if kept in a brisk, moist heat. The species are not particular as to soil but the drainage must be perfect, as the plants require an abundance of water when growing. (G. W. Oliver.)

A. *Lvs 3–5-lobed.*

palmàta, Ruiz. & Pav Fig 800. No trunk· petioles 3–6 ft long, glabrous, terete and unarmed, blades 4-lobed, the lobes again cut into narrow segms , dark green, gracefully spreading, and drooping at the margin Peru. R H 1861, p 36 —The common species, and a very useful plant

rotundifòlia, Wendl Much like the last, but more compact under cult , owing to the shorter petioles, but growing much larger petiole distinctly pubescent, lf -blade large and orbicular, 3- or 4-lobed. Costa Rica B M 7083

élegans, Williams Blades with 4 or 5 lobes, which are very deeply cut into straight strap-like divisions. Probably of horticultural origin

AA *Lvs 2-lobed*

atròvirens, Wendl Blades very deeply 2-lobed and very deep, rich green (whence the name, *dark green*), glabrous Colombia

hùmilis, Poepp & Endl. Dwarf blades angular, 2-lobed at the summit, the segms more or less jagged but not divided, a foot or less broad Colombia. R H. 1869, p 327 —One of the best

Plùmerii, Kunth (*C palmæfòlia*, Sweet). Caudex erect blades with 2 lanceolate and plicate divisions, bright green above and pale beneath spadices pendulous Martinique

imperiàlis, Lind & André Caudex short and prostrate blades with 2 ovate-lanceolate entire segms , with very prominent veins, the lobes about 5 in wide and shining green; petiole purplish, canaliculate, tumid at the base Ecuador I H 21 166 (by error 165)

The following species are in cult in this country but not as yet known to the trade *C funifera*, Kunth Stemless or sometimes creeping and with a round, sparsely branched st lvs alternate 1–2 ft S Amer —*C incisa*, Wendl A much cut, low plant from Cent Amer —*C macropoda*, Klotzsch St scarcely 1 ft long lvs faintly 3-nerved, deeply 2 parted, 1½–2 ft Colombia.—*C microcéphala*, Hook f St a few inches high lvs numerous, 10–18 in long, split into 2 8-nerved segms , petiole slender, purplish at base. Costa Rica B M 7203 —*C plicata*, Klotzsch St short lvs divided into 2 1-nerved segms , petioles channeled spadix about 6 in. long the thick woody caudex may not rise more than 1 ft Colombia —*C scándens*, Cowell St creeping, often 25 ft. long lvs several at the summit about 18 in long St Kitts

N Taylor.†

CARMICHÆLIA (Capt Dugald Carmichael, Scotch botanist, who wrote on the flora of the Cape and certain islands) *Leguminòsæ* Shrubs, leafless or usually becoming so, either erect or depressed, with reddish or purplish small fls , rarely cult There are about 20 species in New Zeal , very difficult of delimitation Lvs 1- or 3–5-foliolate, wanting or deciduous after the bloom has passed. fls in lateral racemes, calyx cup-shaped or bell-shaped, 5-toothed, corolla papilionaceous, the standard orbicular and usually reflexed, the wings oblong and obtuse and somewhat falcate, the keel oblong and incurved and obtuse, upper stamen free pod small, leathery, oblong to orbicular **C. grandiflòra,** Hook f , is recently offered in S Calif.: it is much-branched, to 6 ft high, with compressed and grooved glabrous erect branches lvs pinnately 3–5-foliolate, appearing in spring and early summer and then caducous, the lfts glabrous and obcordate-cuneate. fls about ¼in long, in drooping racemes of 5–12, white or lilac. **C. odoràta,** Colenso, has pubescent drooping branches, and much smaller fls in 10–20-fld. racemes pod smaller (¼in. or less long) and longer-beaked

L. H B

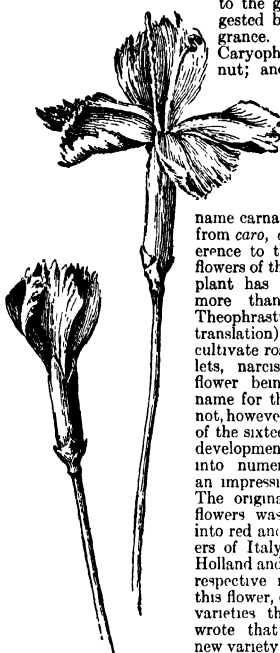
CARNATION (*Diánthus Caryophyllus*, Linn.). *Caryophyllàceæ* Choice and popular flower-garden and greenhouse plants of the pink tribe; in North America grown mostly under glass as florists' flowers. Pl. XXII

The carnation is a half-hardy perennial, herbaceous, suffrutescent at base. height 2 ft.: st branching, with tumid joints. lvs. linear, glaucous, opposite. fls termi-

nal, mostly solitary; petals 5, flesh-colored, very broad, beardless, margins toothed; calyx cylindrical, with scaly bracts at base. June–Aug. S. Eu., occasionally met in the wild state in England, where it was intro. through cult. A single-fld and undeveloped carnation is shown in Fig 801. A section of a single fl is depicted in Fig 802, showing the 2 styles and the 5 stamens, also the bracts at the bottom, in 2 series, beneath the calyx In Fig. 803 some of the beginnings of doubling are shown.

General development. (By Geo. C. Butz)

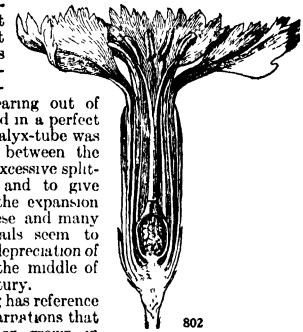
Theophrastus, who lived about 300 years B C, gave the name Dianthus (Greek *dios*, divine; *anthos*, flower) to the group, probably suggested by the delightful fragrance. The specific name Caryophyllus (Greek, *caryon*, nut; and *phyllon*, leaf) has been applied to the clove-tree (*Caryophyllus aromaticus*), and because of the clove-like fragrance of the carnation this name was applied to it The name carnation (Latin, *carnatio*, from *caro, carnis*, flesh) has reference to the flesh-color of the flowers of the original type This plant has been in cultivation more than 2,000 years, for Theophrastus (History of Plants, translation) says: "The Greeks cultivate roses, gillyflowers, violets, narcissi, and iris," gillyflower being the old English name for the carnation It was not, however, until the beginning of the sixteenth century that the development of the carnation into numerous varieties made an impression upon its history The original flesh-color of its flowers was already broken up into red and white The gardeners of Italy, France, Germany, Holland and England, with their respective ideals of beauty in this flower, contributed so many varieties that in 1597 Gerard wrote that "to describe each new variety of carnation were to roll Sisyphus' stone or number the sands"



801. A single-flowered Grenadin carnation. (×⅔)

There have been many attempts at classification, but most of them, like the varieties they serve, have disappeared. Two of them are as follows A French scheme arranges all varieties into three classes: *Grenadins* (Fig 801), including those with strong perfumes, flowers of medium size, either single or double, petals fringed, and of but one color, *Flamands*, including those with large flowers, round and double, rising in the center to form a convex surface, petals entire, either unicolored or striped with two or more colors; *Fancies*, including those with colors arranged in bands on light grounds, the petals toothed or not The English classification of these varieties makes four categories: *Selfs*, or those possessing only one color in the petals, *Flakes*, or those having a pure ground of white or yellow and flaked or striped with one color, as scarlet, purple or rose; *Bizarres*, or those having a pure ground marked as in the Flakes, but with two or three colors, and *Picotees* (Fig. 804), or those having a pure ground of white or yellow, and each petal bordered with a band of color at the margin This last class has been regarded with the distinction of a race.

In the early part of the nineteenth century, English gardeners exercised very great care in the growing of carnations to mature only perfect flowers. Imperfect and superfluous petals were extracted with forceps, petals appearing out of place were arranged in a perfect imbrication, the calyx-tube was cut partly down between the teeth, to prevent excessive splitting at one side and to give more freedom to the expansion of the flower These and many more tedious details seem to have wrought the depreciation of this flower about the middle of the nineteenth century.



802
Section of normal carnation flower.

All the foregoing has reference to those types of carnations that are little known or grown in America at the present day, the varieties so common in Europe are usually kept in coldframes or coolhouses during the winter, and as spring approaches the plants are brought into their blooming quarters, for no flower is expected to appear until the month of July, when there is a great profusion of blossoms, but for a short season. Therefore, they can all be classed as a summer race. They are also grown permanently in the open

Development of the perpetual-flowering carnation (Remontant, Monthly, Forcing, or Tree) Figs. 805–807.

The perpetual-flowering race of carnation, which has been brought to its highest state of perfection by American growers, and which is generally regarded as the "American carnation," really originated in France, and was grown in that country from its origin in 1840 until about the year 1856, before it was introduced to America A French gardener, named M Dalmais, obtained a constant-blooming carnation by crossing Œillet de Mahon, which bloomed in November, with pollen from Œillet Bichon, crossing again with the Flemish carnation, the first-named sort being disseminated under the name "Atim" By the year 1846 varieties in all colors had been secured and the type permanently fixed These were taken up and improved upon in quality by other enthusiasts, among whom were M. Schmidt and M. Alphonse Alegatiere, of Lyons, France. The latter succeeded in securing varieties with rigid stems which in 1866 were given the name "tree-carnation" M Schmidt's most prominent varieties were Arc-en-ciel and Etoile Polaire, which were grown for several years But the strong rigid-stemmed varieties obtained by Alegatiere, which were termed tree-carnations in 1866, proved of greater value commercially, and became more generally cultivated About the year 1852, a native of France who had settled near New York City, imported plants of this strain,



803. The anthers are leafy, showing one process in doubling.

and cultivated several varieties for a number of years. About the year 1856 the firm of Dailledouze, Zeller & Gard imported plants of La Purité, a rose-colored variety, also Mont Blanc and Edwardsu, white, and Manteaux Royal, red-and-white variegated. These were used for crossing, and the first variety produced in America, about the year 1858, proved to be a great improvement on existing varieties It was named "Mrs Degraw," and with another white variety named "Flatbush," was disseminated about the year 1864 Other varieties followed, and the work was taken up by other growers, among whom were M Donati, who raised Astoria, a yellow which is conceded to be the ancestor of all the yellow varieties grown today, Rudolph Heintz, who raised Heintz's White in 1876, Chas T. Starr, whose most famous variety was Buttercup, introduced in 1884, Jos Tailby, whose Grace Wilder became and remained the standard rose-pink variety until the introduction of Wm Scott in 1893, John Thorpe and W P. Simmons, who introduced Portia, Tidal Wave, Silver Spray and Daybreak in the eighties, Sewal Fisher, whose Mrs Fisher appeared in 1890 and became one of the leading whites, E G Hill, whose most notable productions were Flora Hill, the leading white for several years, and America, a scarlet; R Witterstaetter, who obtained Estelle, Aristocrat, Afterglow and Pres J A Valentine, John Hartje, who raised the scarlet Jubilee, Peter Fisher, whose Mrs Thos W Lawson, Beacon, and Enchantress with its several sports, became leaders in their respective colors; C W Ward, who disseminated Governor Roosevelt, Harry Fenn and Mrs C W. Ward



804. Carnation, Picotee.

The late Frederick Dorner conducted the most systematic work in developing the carnation, and succeeded in producing a strain which is recognized as the highest development of the American carnation His records, which cover a period of 22 years, contain a complete list of the many thousands of crosses made during that time This strain is distinguished for its easy-growing habit, its freedom and steadiness in producing blooms, the diversity of colors and its adaptability to commercial growing His labors produced such varieties as Wm. Scott, Mme Diaz Albertini, White Cloud, Mrs Geo M Bradt, G H Crane, Lady Bountiful, White Perfection, Pink Delight, White Wonder and Gloriosa, all leaders in their respective colors

Through the rapid strides in its development, after being introduced in this country, the carnation established itself as one of the leading flowers for commercial growing and now stands second only to the rose in commercial importance Not only does it share equally with the rose the bench space in most large growing establishments, but many large ranges are devoted entirely to the carnation Growing methods have been perfected by the carnation specialists until the practices employed during its early history have been entirely superseded. Since its first arrival in America, over 1,200 varieties have been introduced, and the quality has been improved until the highest developed varieties produce blooms measuring 4½ inches in diameter and are carried on rigid stems 3 feet long.

In 1891 the American Carnation Society was organized to promote the interests of the carnation. By holding exhibitions annually it has assisted materially in popularizing the flower. A system of registering new varieties is in operation, which prevents confusion in nomenclature.

From this country, the improved strain of the perpetual-flowering carnation has returned to European countries, being grown in increased quantities each year and displacing all the older types of carnation for commercial growing

Culture of outdoor or flower-garden carnations. Fig 808.

Americans are not sufficiently aware of the excellence of some of the forms of the flower-garden or border carnation While perennial, like the greenhouse carnation, many of them bloom profusely the first year from seed and are described as annuals. The Marguerite type is one of the most useful These forms bloom by midsummer from early-sown seeds, and with some protection the plants will pass the winter in the open and bloom again the following spring. The Margaret strain, distinct from the Marguerite, bears double flowers, sulfur-yellow, and also blooms the first season from early-sown seed The Chabaud strains behave similarly The Grenadins (Fig 801) bloom the first year from seed They pro-



805 The modern florists' carnation. High-centered dark-colored bloom.

806. Modern florists' or forcing carnation.

duce fine singles, of simple form and strong fragrance, although more than half of any sowing from improved seed may produce various degrees of double bloom. Riviera Market and others bloom in autumn from spring-sown seeds. The culture of the hardy or flower-garden carnations is very simple. Their profusion of summer bloom makes them desirable.



807. Carnation, Little Gem. A striped flower.

The Picotee class (Fig 804) is little known in this country It is a hardy perennial in England, and the fine strains are often propagated by layers (Fig. 809). They also do well from seeds, blooming freely the second year.

The Malmaison strain, which was the leading carnation in England before the advent of the Perpetual-flowering strain, has been found of little value in this country. On account of its large size it was used to some extent for breeding purposes, but with unsatisfactory results.

The border carnation is a more condensed and bushy plant than the long-stemmed few-flowered plant seen in the American greenhouses, although there are different families or groups of them as there are of phlox or snapdragons. Some forms are dwarf and some tall-growing.

American methods of culture for indoor bloom.

The modern method of propagating the carnation for commercial growing is by means of cuttings which are taken from either the blooming stock or from plants that are grown for cuttings alone. The old method of layering (Fig 809) would prove too slow in increasing stock for present-day needs Millions of cuttings are rooted each season for planting the houses for blooming purposes. So much depends on the quality of the cuttings in keeping up the vitality in the stock that expert growers have learned to discriminate in their selection. The best cuttings, if taken from the blooming stock, are those from near the middle of the flower-stems (Fig 810). These will not only show greater vitality than those taken higher up or lower, but they will prove more floriferous The tip cuttings are likely to give a flower-bud immediately and, if this is pinched out, develop into a weak plant. Those taken from the base develop a large spreading growth known as "grassy." The cuttings are severed by an outward pull and are afterward trimmed of all surplus foliage before being inserted in the propagating sand. Have a sharp knife with which to trim and a pail of fresh water into which to throw the cuttings as they are trimmed Make a smooth cut at the base, near the joint, so that the lower pair of leaves will peel off readily, leaving a half-inch of clear stem to go into the sand. Shorten those leaves which turn outward, leaving those which stand fairly upright. The removal of part of the foliage is to avoid crowding in the bench and also to prevent flagging while the cutting is giving off more moisture through its leaves than it is taking up through the stem The cuttings are inserted in the sand about ¾inch deep in rows across the bench, placing the cuttings about ¾inch apart in the row and the rows about 2½ inches apart, according to the size of the cuttings. Use a putty knife for making the cut in the sand. The sand is kept constantly moist and the cuttings are protected from both the sun and drafts by means of muslin curtains. Frequent spraying should be avoided, though it must be resorted to at times to prevent flagging on warm windy days. The most favorable conditions for propagating are usually secured during the months of December, January, February and early March During that period, ventilation is limited and a fairly even bottom-heat is easily maintained Keep a bottom temperature of about 60°, while the overhead temperature should be about 52°. Any bench that can be protected from sun and drafts will prove satisfactory

The bottom of the bench may be of wood or tile, the latter being preferred on account of more perfect drainage and a greater retention of warmth The sand should be 3 inches deep after being packed down by means of a tool made from a 2-inch plank about 6 inches wide and



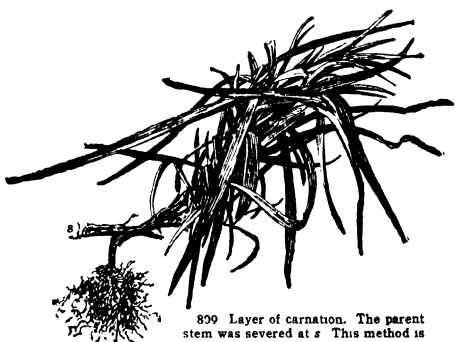
808. Flower-garden or outdoor carnation, showing the condensed bushy habit and short flower-stems

12 inches long with an inverted V-shaped handle. In about four weeks the cuttings should be ready for potting (Fig 811). Those that come out of the sand February 15 or earlier should be potted first into 2-inch pots and later on shifted into larger pots as needed. Those potted later may be placed directly into 2½-inch

pots and left until planted out, the object being to keep the young plants growing steadily until they are planted in the field Stunted, pot-bound plants will be slow in breaking and are likely to develop stem-rot in the field. Use a moderately light soil and only fairly rich.

When the young plants begin to run up to flower, they should be topped back to about four joints above the pot (Fig 812). A low-branched plant will stand up better and will give less trouble in supporting later on. A second topping may be necessary before planting-out time, on early-propagated stock A slight hardening-off of the young plants before planting out is beneficial, though not essential. This is usually done by placing the plants in coldframes about two weeks prior to planting them in the field Late April or early May is the time for planting in the field, according to latitude and climate A rich loam, inclined to sandiness, produces the finest plants in the shortest time In a heavy soil the growth will be heavier, but slower and less branching Set the plants about 8 inches apart in the rows, and if hand-power is to be employed in cultivating, space the rows about 16 inches apart. Space farther if horse-power is to be used

When a large business is done in young plants or rooted cuttings, a part of the stock is grown especially for cuttings alone These plants are benched the same as those for blooming, but are not allowed to



809 Layer of carnation. The parent stem was severed at *s* This method is now employed only in special cases.

bloom As the shoots begin to run up to flower, they are broken off a few joints higher up than is done when topping in the field The young shoots which result from these breaks are taken off for cuttings, the very finest cuttings being secured in this way These are trimmed and handled the same as those taken from the flower-stems.

When packing cuttings for shipping, moist sphagnum moss is used in which to pack the roots Cut papers (newspapers are used mostly) into sheets about 10 by 18 inches Lay a strip of moss about 3 inches wide across the middle of the paper lengthwise Then lay the cuttings side by side with only the roots on the moss When twenty-five have been laid on, begin to roll from one end until all the cuttings have been taken up Then turn in the lower part of the paper and continue to roll until the end of the paper has been reached and tie around with any kind of cord There is little difference in the returns from plants grown for cuttings and those grown for blooms, providing a fair market is found for each

In shipping plants from the field, the soil is all shaken from the roots The plants are then set upright in the shipping-cases with moist moss between the roots, a layer of damp moss having first been placed on the bottom.

Cultivate as soon as practicable after each rain, and in the absence of rain at least once each week Shallow cultivating is recommended, just enough to maintain a loose mulch on the surface.

Do not water carnations in the field under any consideration Cultivation will preserve moisture in the soil without causing soft growth Keep topping back the young shoots as fast as they begin to run up, thus building up a shapely bushy plant

If plants are to be placed inside during the summer, the benches should be refilled and made ready for planting as soon after May 1 as possible. It will be a great help to get the plants under way on the benches before hot weather sets in. Fill the benches the same as for field-grown plants and set the plants where they are to bloom Indoor culture is practicable and profitable only when the benches can be spared by early May. If a good market can be found for the May and June cut, they will more than offset the slight advantage derived in the fall from indoor culture



810. *a* Desirable cuttings. *b* Weak cutting, too high up on stem. *c* Too low on stem.

If the blooming plants have not made an exceedingly rank growth, they may be cut back sharp early in May, cleaned off, mulched with long manure and grown on for blooming the following year. This should not be attempted, however, unless the plants are free from disease or insects and in good condition to break freely from the lower part of the plant

Carnations are grown successfully on both raised and solid benches Perfect drainage is essential, and must be provided for, if solid beds are to be used There will be no difference in the quality or the quantity if both are properly handled

By the end of June the old blooming plants will become exhausted, and refilling the benches to receive the new plants from the field will be in order Clean out the old soil, whitewash the inside of the benches with hot lime and allow to dry before refilling with the new earth Four inches of soil is enough, and should be of equal depth all over the bench, especially along the edges The soil should be fairly moist, but not wet when the plants are set, so that the roots may draw moisture from the soil rather than have the soil draw the moisture from the



811. Strong cutting, well rooted.

roots. On the other hand, soil for potting or planting should never be handled while in a wet condition. If too dry at the time of filling the beds, water, and let stand long enough to dry to the proper state before planting.

Apply a light shade of lime or whiting to the glass, to break the fierceness of the summer sun until the plants become established. This shade should not be too heavy, nor intended to darken the house, else a softening and weakening of the growth will result. Lift the plants carefully by means of a spade and leave a ball of soil about the size of the fist on the roots This ball of soil will greatly assist the plant in re-establishing itself in its new quarters. However, no serious harm will be done should all the soil crumble from the roots without breaking the roots to any considerable extent Set the plants just about as deep into the soil as they stood in the field and space them about 9 by 12 inches, if plants are of ordinary size Larger plants may need more, smaller plants less space It should be borne in mind that the highest quality may be expected only when the plants are not crowded



812. Showing where to top (*a*) or to head back.

After setting a few hundred plants, water each plant individually, saturating the soil thoroughly around each plant, but do not soak the whole bed until the roots become active and the surface of the soil has been worked over and leveled off, which will be about ten days after planting Spray the plants overhead several times during each day to prevent wilting Keeping the walks wet will also help to maintain a humid atmosphere until the roots are able to supply the plants with moisture This transplanting is an ordeal during which the plants are unable to draw on the roots for support until they have taken a new hold on the soil, and wilting must be prevented by artificial means during this time To allow severe wilting means loss of foliage and a loss of vitality, which results in inferior quality in at least the early part of the season

As soon as the soil has been leveled off, and most of the weeds gotten rid of, the supports should be put in place Large growers use one of two styles of supports, or a combination of the two Wires run lengthwise between the rows, with cotton strings crosswise, placing two or three tiers one above the other to suit the height of the plants is extensively used Another device is the carnation support, consisting of a wire stake with wire rings to surround each plant


813. Undeveloped five-petaled carnation.

Yield of bloom.—Plants that were benched in the latter part of July, or early August, which is the time to plant for best results, should begin to yield blooms early in September. If flowers are not desired so early, the stems may be broken off about the time the bud appears, but no general topping should be done after the plants are housed, if a steady cut through the season is desired. Cut the blooms during the early part of the day. They are then fresh and retain their natural colors, much of which would be bleached out of the delicately colored sorts by the sun during a warm day Place in water at once in a cool room as near 50° as possible Sort the blooms in separate colors, making two or three grades of quality, tying them into bunches of twenty-five blooms. Cut the stems even at the bottom and replace in water Avoid crowding the blooms while they are soaking up water, as they will increase 25 per cent in size during the first twenty-four hours in water.

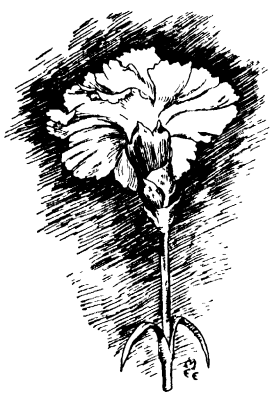
During a season, running from September to the end of the following June, an average cut of twenty blooms per plant may be expected from most varieties Varieties differ somewhat according to the size of the blooms, the smaller-flowered sorts usually being the freer bloomers.

The preparation of the soil for growing carnations is of the greatest importance Choose a piece of land which has not been tilled for some years, if possible If covered with a heavy sod, all the better The soil should be a loam of good substance, with an inclination toward sandiness Break this sod in the fall and leave in a rough state during the winter In the spring plow again and sow to cowpeas or some other leguminous crop After plowing this under in the fall, manure heavily and leave until the following spring when it should be plowed again This soil should be in first-class condition for use the following summer In working or handling soil, always bear in mind that to handle it while it is wet is to ruin it for immediate use Only freezing will restore it again. If it will crumble readily, it is safe to handle Soil which has been prepared in this manner will be rich enough to carry the plants until after the first of the year, when light feeding may be given Feeding should be done judiciously during the short days of winter, to avoid softening the growth and bloom Pulverized sheep-manure, dried blood and wood-ashes are used mostly for this purpose The manure and blood improve the size and quality of the bloom, and the ashes strengthen the stem

Ventilation and temperature—The carnation being a cool-temperature plant, abundant fresh air and ventilation should be provided for. A steady temperature is essential to success in growing carnations. Splitting of


814. Carnation flower showing the calyx which has split on account of poor shape.

the calyx may usually be traced to either irregular temperature or to overdoses of feeding. Any point between 48° and 52° will prove a satisfactory night temperature for most varieties, providing it is evenly maintained. The temperature should be 10° higher during the day. Care should also be exercised, when building, in placing the ventilators, so that the atmosphere in the house may be changed without causing cold drafts to strike the plants. By placing the ventilators alternately on both sides of the ridge, this may be accomplished. The side ventilators are used only during mild weather.



815 Carnation flower showing a well-shaped calyx that will seldom burst

The modern type of carnation house runs east and west, is of even span and is 30 feet or more in width, having ventilators on both sides of the ridge and in the side walls, if houses are detached. Many ranges are connected by gutters 6 feet or more from the ground. When economy in ground is necessary, this is a good plan, but such ranges always contain some benches inferior for growing stock on account of the shade cast by gutters. The single detached house is ideal. See *Greenhouse*.

Varieties

The leading varieties in cultivation in this country at this time are—*White*: White Perfection, White Enchantress, White Wonder, Shasta, Matchless. *Flesh-Pink*: Enchantress, Pink Delight, Mayday, Pres. Valentine. *Rose-Pink*: Rose-Pink Enchantress, Dorothy Gordon, Gloriosa, Mrs. C. W. Ward, Philadelphia Pink. *Dark Pink*: Rosette, Washington, Peerless Pink, Northport. *Scarlet*: Beacon, Victory, St. Nicholas, Herald, Commodore. *Crimson*: Harry Fenn, Octoroon, Pocahontas. *Yellow*: Yellow Prince, Yellowstone. *White Variegated*: Benora, Mrs. B. P. Cheney. *Any other color*: Gorgeous, Rambow. New varieties are being registered with the American Carnation Society at the rate of about twenty-five each year. Few varieties remain in cultivation longer than ten years, so that the list changes continually.

Diseases

Stemrot (*Rhizoctonia*) is the common wet stemrot which does perhaps more damage than all the other diseases combined, and it is also more difficult to control than any of the others. Its presence does not manifest itself until its damage is wrought, and the plant is seen to wilt and die. The cause of the disease is a fungus which exists in the soil, and which will lie dormant in the soil for several years if there are no plants to attack. Hence no carnations should be planted for several years in soil which is known to have this fungus present.

Species of Fusarium cause a slow rot of the heart of the plant, the treatment is same as above.

Carnation-rust (*Uromyces caryophyllinus*) is more common than stemrot, but not nearly so destructive. A slight swelling of the outer tissue of the leaf is the first sign of its presence. Later on this bursts open, releasing a brown-colored powdery substance, comprising the spores by which the fungus is propagated. Keeping the foliage dry and the atmosphere buoyant and bracing will prevent the appearance of this disease. Spraying with bordeaux mixture has been found effective in combating this disease after it has gained a foothold.

Fairy-ring (*Heterosporium echinulatum*) is perhaps the most destructive of the spot diseases. It is brought on by a humid or foul atmosphere, and must be fought with remedies which will produce the opposite in atmospheric condition. Bordeaux is the standard remedy for all spot diseases.

Bench rot may be caused by any one of a number of organisms attacking the ends of the cuttings in the propagating-bench. It is frequently a very serious disease. The fungi most frequently causing the trouble are in the sand and under the ideal conditions of temperature and moisture of the propagating-bench spread very rapidly. The use of clean sand, free from all organic matter, and the securing of new sand for each lot of cuttings and cleanliness in the propagating-house will help to control this trouble.

Insect pests.

A green plant-louse (*Myzus persicæ*) is frequently troublesome on carnations. It also attacks a large number of greenhouse and garden plants as well as several fruit trees. Nicotine applied in one of the many forms will destroy it. Spraying and vaporizing are both employed successfully as preventives of the attacks of aphids.



817 Carnation flower Pink Delight, showing nearly entire-edged petals.

Thrips (*Heliothrips hæmorrhoidalis*) are equally destructive and more difficult to control. The same treatment as for aphis is suggested. Sweetened paris green used as a spray is also effective (three gallons of water, two pounds of brown sugar, two tablespoonfuls paris green).

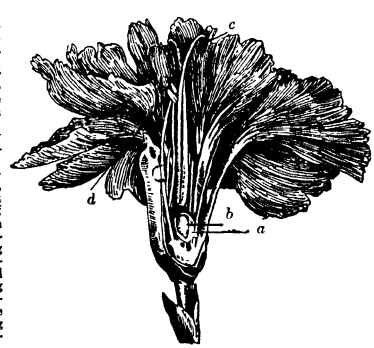
The punctures made by thrips and plant-lice cause yellowish spots on the leaves, a diseased condition known as *stigmanose*.

Red-spider (*Tetranychus bimaculatus*) is found mostly where plants grow near steam-pipes, where ventilation is poor, or in houses kept too dry. Persistent syringing with water will usually destroy them if the spray is applied to the under surface. Use much force and little water to avoid drenching the beds. Sulfur as a dust or in water will also destroy them.

The carnation mite (*Pediculopsis graminum*) injures the buds by transmitting the spores of a fungus (*Sporotrichum poæ*) which causes them to decay. The injured buds are easily recognized and should be promptly gathered and burned to prevent further spread of the trouble.

Raising new varieties

It is a long way from the undeveloped five-petaled carnation (Fig. 813) of early days to the perfectly formed full bloom of today. This filling out of the bloom has evolved gradually, and has been assisted by cross-fertilization and selection by the carnation-breeders through the many years in which the flower has been cultivated. This crossing, which has been the means of perfecting the American strain of the perpetual-flowering carnation, has been prosecuted continuously ever since the arrival of the first plants in this country. Many men have found both pleasure and profit in the work, and those with scientific inclination will find no subject more interesting. Not only have the blooms become larger, but the color has varied widely, the "substance" has been much improved, the calyx has been developed for non-bursting (Figs. 814, 815), the keeping qualities of the flowers have been improved, and the stems have been lengthened.



816. Cross-section of carnation flower showing reproductive organs.

The operation of pollinating the bloom, or transferring the pollen from one flower to the stigma of another, is a simple matter, and is perhaps of less importance than other parts of the work of producing desirable new varieties.

The Fig 816 is a section of a flower showing the reproductive organs; *a* shows the pod which encases the ovules or forming seeds, *b*. From the tip of the pod rises the style which has usually two, but frequently three curved ends, or stigmas, *c*. When the stigma is in the proper stage to be fertilized, which is indicated by the fuzzy appearance of the upper part, the pollen, which is the powdery substance released by the anthers, *d*, is applied to the fuzzy parts. To prevent self-fertilization, these anthers should be removed from flowers intended to be pollinated, before the pollen is released. Within one to three days, if fertilization has taken place, the bloom will wilt, the ovary will begin to swell and within a week the seed-pod can be seen to increase in size As soon as the bloom has wilted, the petals should be removed and the calyx slit down the sides to prevent water from standing inside the calyx and causing the pod to decay In six to eight weeks the seeds will be ripe and should be sown at once Each seed may prove to be the beginning of a variety which will be one of the milestones of progress in the improvement of the carnation Not one should be discarded until it has bloomed



818. Carnation flower Radiance, showing deeply serrated petals.

The seedlings should be potted as soon as the first pair of character-leaves appears. Later on they may be shifted into larger pots and bloomed, or they may be planted in the field and marked as they bloom and only the promising ones housed in the fall. The selecting of the plants for further trial is of the very greatest importance and requires a thorough knowledge of the subject There are many points in the make-up of a first-class carnation, and a combination of as many of these as is possible to get in one plant is the object sought. No carnation has ever been found which was perfect in every way The hybridist must be able to judge correctly as to the relative value or loss represented in certain characteristics shown by a seedling plant. This discrimination between the desirable and undesirable calls for the clearest judgment, and a valuable variety might be discarded through the failure of the grower to see its good points

Among the seedlings will probably appear variety of colors, shapes and sizes of bloom, different types of growth, perfect in some respects and faulty in others. From these the hybridist is to select those which most nearly represent his ideal of the perfect carnation. This ideal should be of a pleasing shade of color, pure in tone, so as to hold when the bloom ages The form should be symmetrical, resembling as nearly as possible a half sphere with just enough petals to fill the bloom nicely without crowding. The petals may range from the smooth-edged, as seen in Fig 817, to the deeply-serrated, as seen in Fig. 818. The texture of the petals should be such as will resist bruising. The odor should be strong clove The size should be as near 4 inches across as possible under ordinary culture. The calyx should be strong and large enough to hold the petals firmly at all stages of development The stem should be 30 to 36 inches long, and strong enough to hold the bloom erect. The plant should have a free-growing habit, throwing blooming shoots freely after a shoot is topped or a bloom is cut. It should also be healthy and disease-resistant. The American Carnation Society uses the following scale of points for new varieties:

Color	25
Size	20
Calyx	5
Stem	20
Substance	15
Form	10
Fragrance	5
	100

The most uniform results have been secured by confining the breeding to separate colors; as, for example, crossing white with white, red with red or crimson, pink with pink, and so on This method has been proved to produce the largest percentage of self-colors, which are considered the most valuable commercially in this country.

New varieties are frequently secured by sporting or mutation A variety of a certain color may produce a bloom of another color, and by propagating the cuttings from the stem which carried the odd bloom a new variety is established The securing of a new variety in this way is purely a matter of good fortune, as no method for causing the sporting is yet known.

Leading books on the carnation are. "The American Carnation," by C W Ward; "Carnations, Picotees and Pinks," by T W. Sanders; "Carnations and Pinks," by T H. Cook, Jas Douglas and J F McLeod; "Carnation Culture," by B C Ravenscroft The last three are English. A. F. J. Baur.

CARNĒGIEA (named for Andrew Carnegie, philanthropist). *Cactàceæ* The giant tree cactus of Arizona, California and Mexico

Large columnar plants, usually single, strongly ribbed, with numerous spines, those from flowering and sterile areoles quite different. fls borne from the upper areoles, diurnal, funnelform, petals white: fr. an oblong edible berry; seeds black and shining

gigantèa, Brit & Rose (*Cèreus gigantèus*, Engelm). Suwarro. (Plate III, Fig 819) A tree 20–60 ft high, usually single, but sometimes with one or more branches: ribs in mature plants 18–21 fr 2–3 in long B M 7222. A G. 11:451, 528 —In rocky valleys and on mountain-sides, S Ariz. and Sonora, with 2 stations in Calif. [reported, but probably not to be found, in Lower Calif]. This great cactus does not do well in cult, although large plants are often brought into greenhouses and grounds about railroad stations in the S W. It is not suited for small collections. The fr. is gathered in great quantities by the Indians of Ariz J. N. Rose.

CAROB: *Ceratonia.*

CAROLÍNEA: *Pachirà.*

CARPENTÈRIA (after Professor Carpenter, of Louisiana) *Saxifragàceæ* Ornamental shrub cultivated for its large fragrant white flowers.

Evergreen lvs opposite, petioled, usually entire: calyx 5-parted; petals 5; stamens numerous; ovary almost superior, 5–7-celled; styles 5–7, connate at the base, with linear-oblong stigmas. fr a many-seeded dehiscent caps. with numerous oblong seeds —One species in Calif

This is a highly ornamental evergreen plant, with rather large opposite leaves and showy white and fragrant flowers in loose and terminal corymbs. Hardy only in warmer temperate regions. It requires a well-drained, light and sandy soil, and sunny, somewhat sheltered position; it especially dislikes moisture during the winter, and its perishing is more often due to an excess of moisture than to the cold. Propagated by greenwood cuttings under glass in



819. Flower of Carnegiea gigantea. (×¼)

summer, and by suckers, which it produces freely; also, by seeds sown in spring.

californica, Torr. Shrub, 6–10 ft.: lvs. elliptic-lanceolate, entire or remotely denticulate, bright green above, whitish-tomentose beneath, 2–4 in long· fls pure white, 2½–3 in. diam., fragrant; petals orbicular, concave. June, July B M. 6911. Gn 31:100, 34, p 75; 36, p 26; 54, p. 248; 76, p. 376. G C II 26:113; III. 40:6, 7, 44:112 R H. 1884, p 365. J H III 29:251; 45·107; 59:61 M.D.G. 1913:121. G M. 31.25; 40 300 G 29:695. Gn.W. 4:569. ALFRED REHDER.

CARPET-BEDDING: *Bedding.*

CARPĬNUS (ancient Latin name). *Betulàceæ.* HORNBEAM. Trees cultivated for their handsome foliage, assuming bright autumnal tints, also for the light green attractive fruit-clusters.

Deciduous trees or rarely shrubs· winter-buds conspicuous, acute with many imbricate scales lvs alternate, petioled, serrate, with deciduous stipules· fls. monœcious; staminate catkins pendulous, each scale bearing 3–13 stamens, 2-forked at the apex; pistillate catkins terminal, slender, each scale bearing 2 ovaries, the bracts and bractlets of which develop into a large, leafy, more or less 3-lobed bract, embracing the small, nut-like fruit at their base.—About 20 species, most of them in Cent. and E Asia, 5 in Eu. and W. Asia and 1 in N and Cent Amer Monogr by Winkler in Engler, Pflanzenreich, Betulaceæ, hft 19, pp 24–43, quoted below as W. B

The hornbeams are trees usually with dense round head, rarely shrubby, with medium-sized, bright green ovate to lanceolate leaves and rather insignificant flowers appearing with the leaves and followed by pendulous catkins consisting of large bracts bearing a small nutlet in their axils The wood is very hard and close-grained, and much used in making tools and other small articles The handsome foliage is rarely attacked by insects, and assumes a yellow or scarlet color in fall. The most beautiful are *C cordata,* with large leaves, and *C japonica,* of graceful habit and with elegant foliage The European hornbeam bears severe pruning well, and is very valuable for high hedges, it was formerly much used in the old formal gardens for this purpose, it makes, also, an excellent game cover, as it retains its withered foliage almost throughout the winter.

The species are of comparatively slow growth and thrive in almost any soil, and even in dry, rocky situations, most of them are quite hardy North Propagated by seeds, sown usually in fall, germinating very irregularly; if they do not appear the first spring, the seed-bed should be covered until the following spring with moss or leaf-mold, to keep the soil moist If intended for hedges, the seedlings should be transplanted after the first year, and allowed sufficient space to prevent them from growing into slender tall plants, unfit for hedges. The varieties of rarer species are grafted in spring under glass, or in the open air on seedlings of one of the common species.

A. *Lvs with 7–15 secondary veins: mature catkins with spreading narrow bracts.*

caroliniàna, Walt (*C. americàna,* Michx. *C. virginiàna,* Michx. f.). AMERICAN HORNBEAM BLUE BEECH. Fig 820. Bushy tree, rarely 40 ft.. lvs ovate-oblong, usually rounded at the base, acuminate, sharply and doubly serrate, glabrous at length, except in the axils of the veins beneath, 2–4 in. long fr.-clusters peduncled, 2–4 in. long, bracts ovate or ovate-lanceolate, ¾–1 in. long, with 2 broad and short unequal lateral lobes, and a much longer middle lobe, usually serrate only on one margin. E. N Amer., west to Minn and Texas; also, in Mex. and Cent. Amer. S.S. 9:447. Em. 1:199. Gn. 24, p. 418.—Bushy tree, with dense, but slender and often somewhat pendulous branches, and dark bluish green foliage, changing to scarlet or orange-yellow in fall

Bétulus, Linn. EUROPEAN HORNBEAM Tree, to 60 or 70 ft lvs similar to those of the former, cordate or rounded at the base, ovate or oblong-ovate, of somewhat thicker texture, and the veins more impressed above fr.-clusters 3–5 in long bracts over 1½ in long, with ovate, lateral lobes, and much longer oblong-lanceolate middle lobe, the margins almost entire or remotely denticulate Eu to Persia H W 2·17, pp 31–33 W B 29 F S R. 3, p 153 Gn 24, pp 418, 419, 420.—The most remarkable of the garden forms are the following Var **incisa,** Ait (var *asplenifòlia,* Hort.) Lvs incised or lobed, smaller Gn 24, p 419 Var **pyramidàlis,** Dipp (var *fastigiàta,* Hort.) Of upright growth Var **purpùrea,** Dipp. Lvs purplish when young, green at length.—It grows into a taller tree than the American species, although the former is of more vigorous growth when young, the foliage turns yellow in fall, and remains on the tree throughout the winter.



820. *Carpinus caroliniana.* (×⅓)

AA *Lvs with 15–25 pairs of veins mature catkins with loosely appressed ovate and dentate bracts, of cone-like appearance.*

japónica, Blume (*C. Carpinus,* Sarg *Distegocárpus Carpinus,* Sieb & Zucc.) Tree, to 50 ft· young branchlets pubescent: lvs reddish brown when unfolding, oblong-ovate or oblong-lanceolate, 2–4 in. long, acuminate, rounded or subcordate at the base, unequally serrate, with 20–24 pairs of veins deeply impressed above, bright green and glabrous above, beneath brownish pubescent on the veins at first, finally glabrous or nearly so mature catkins ovoid-oblong, 2 in. long, slender-peduncled, bracts inflexed at the base inclosing the nutlet Japan G F. 6.365. R H 1895, p. 427 S I F. 1·24.—A very graceful species and quite hardy, sometimes cult under the name *C laxiflora,* which is an entirely different species with the lvs having only 10–14 pairs of veins

cordàta, Blume Tree, to 40 ft young branchlets hairy at first, soon glabrous lvs ovate or oblong-ovate, acuminate, distinctly cordate at the base, 3–6 in long, unequally serrate, with 15–20 pairs of veins deeply impressed above, pubescent on the veins beneath or glabrous mature catkins 2–3 in long, slender-peduncled; bracts not inflexed at the base, but with an opposite bractlet about as long as the nutlet. Japan, Manchuria, Korea G F 8.295 S I F 1:24.—A very handsome species and quite hardy.

C americàna, Michx.=*C caroliniana.*—*C duinénsis,* Scop.=*C orientalis.*—*C laxiflòra,* Blume To 50 ft lvs ovate or elliptic-ovate, long-acuminate, 2–3 in long, with 10–14 pairs of veins. Japan S I F 1.25.—Very attractive in fall, with its long and slender catkins Var *macrostáchya,* Winkl Lvs ovate-oblong fruiting catkins 2½–3½ in long W China H I 20 1989.—Recently intro.—*C orientàlis,* Mill Bushy tree, to 15 ft lvs ovate or oblong-ovate, 1½–2 in long, with about 10 pairs of veins S E Eu. to Persia Gn 24, p 418.—*C Paxii,* Winkl.=*C Turczaninowii.*—*C polyneùra,* Franch (*C Turczaninowii* var *polyneura,* Winkl.). Small tree young branchlets pubescent, soon glabrous lvs ovate-lanceolate, long-acuminate, usually rounded at the base, 1½–2½ in. long, with 15–20 pairs of veins, fruiting bractlets ovate to lanceolate, serrate W. China. W B 39.—*C Turczaninówii,* Hance (*C. Paxii,*

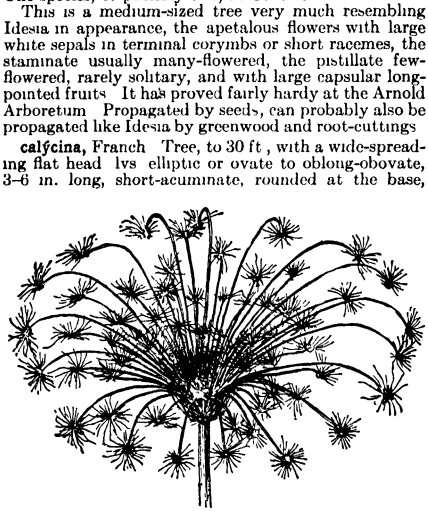
Winkl) Shrubby tree· lvs ovate, acute, 1–2 in long, with 10–12 pairs of veins N. China —*C. virginiana*, Mi hx f —*C. caroliniana* —*C. yedoénsis*, Maxim Small tree branchlets and lvs beneath pubescent lvs ovate-elliptic or ovate-lanceolate, with about 12 pairs of veins, 2–3 in. long Japan. S I.F. 2 11. ALFRED REHDER.

CARRIÈREA (after E. A. Carrière, prominent French horticulturist and botanist, died 1896). *Flacourtiàceæ*. Ornamental tree chiefly cultivated for its handsome bright green foliage

Deciduous: lvs alternate, long-petioled, serrate: fls dœcious; sepals 5, broadly ovate, pubescent outside; petals wanting; stamens numerous, shorter than the sepals, ovary 1-celled with numerous ovules, rudimentary in the staminate fls , styles 3–4, 3-lobed, short and spreading fr a dehiscent caps , seeds winged — One species, or possibly two, in Cent China.

This is a medium-sized tree very much resembling Idesia in appearance, the apetalous flowers with large white sepals in terminal corymbs or short racemes, the staminate usually many-flowered, the pistillate few-flowered, rarely solitary, and with large capsular long-pointed fruits It has proved fairly hardy at the Arnold Arboretum Propagated by seeds, can probably also be propagated like Idesia by greenwood and root-cuttings

calýcina, Franch Tree, to 30 ft , with a wide-spreading flat head lvs elliptic or ovate to oblong-obovate, 3–6 in. long, short-acuminate, rounded at the base,



821 Last year's umbel of wild carrot.

lustrous on both surfaces, glabrous, crenately-serrate: sepals broadly cordate-ovate about ¾in. long and nearly as broad, white caps 2–2½ in long, pubescent. Cent China R H. 1896, p 498 ALFRED REHDER.

CARROT (*Daùcus Caròta*, Linn) *Umbellíferæ*. Garden vegetable, grown for its elongated subterranean crown-tuber.

The carrot is native of Europe and Asia, and one of the bad introduced weeds of eastern North America (Fig 821) The improved succulent-rooted garden varieties are thought to be descended from the same stock, though this has been denied It seems probable that the horticultural improvement of the species was begun in Holland, and it is said that the cultivated forms were introduced thence into the gardens of England during the reign of Queen Elizabeth The carrot is now very generally, though not extensively, cultivated everywhere, both for culinary purposes and for stock-feeding. It is sometimes forced under glass, but to no great extent. Carrots are most useful in culinary practice for soups, stews, and salads, and as this class of cookery has never been reasonably popular in America, this vegetable has not received the attention it deserves

The carrot is hardy and may be planted as soon as the ground is in fit condition to be properly prepared for seeding. When grown as a market-garden or truck crop, this early seeding is essential to maximum returns The best soil for carrots is a medium to light loam, rich, friable and comparatively free from weeds. As the seed is slow to germinate, it is a good plan to sow some quick-germinating seed with the carrot seed so that the rows may be noticed in time to keep them ahead of weed growth. Lettuce serves well for this purpose When the carrots are thinned, this lettuce is pulled out The carrot seed is best sown in rows 12 to 15 inches apart, using enough seed to produce a plant every inch or two along the row. When the carrots are 3 to 5 inches high, they should be thinned to stand 3 inches apart in the row The only further culture necessary is frequent tillage to conserve soil-moisture and to prevent weed growth The early crop should be ready to pull and bunch for sale seventy-five days after sowing Early carrots are an important crop on the market-garden and truck-farm They are pulled as soon as they have attained sufficient size and tied into bunches of three, six or seven roots, according to the size of the roots and the market demands The earlier the crop and the more active the demand, the smaller the roots which may be salable A later sowing is made for the main or winter crop or for live-stock This may be from four to six weeks after the first sowing The crop is handled in the same manner as the early crop except that it is allowed to continue growth as long as the weather is suitable It is then pulled, the tops cut from the roots and the roots placed in frost-proof storage for winter sale

The expense of production of carrots is considerable, but the returns are usually satisfactory The fall crop should yield 500 to 1,000 bushels to the acre Truck-growers of the South ship many bunched carrots to the large northern markets in March, April and May, where they meet a ready demand at prices ranging from 35 cents to $1 per dozen bunches

There are several distinct market types of carrots, the variation being chiefly with respect to size and shape The smaller varieties, as they mature more quickly, are used to some extent for the early bunching, while the larger kinds are always more popular in the general market

The varieties of carrots differ chiefly in respect to size and grain, with differences in earliness closely correlated The following are now favorite varieties.

French Forcing (Earliest Short Horn) —One of the smallest and earliest; root small, almost globular, orange-red

Oxheart or *Guerande* —Small to medium in size, root 2 to 4 inches long, growing to a blunt point, of good quality and popular in some sections for an early bunch carrot

Chantenay —Large to medium in size, root 3 to 5 inches long, more tapering than Oxheart, of good quality and a better carrot for the bunched crop than the above

Danvers Half-Long —Six to 8 inches long, 2 to 3 inches in diameter, at top tapering to a blunt point; the most popular garden carrot grown

True Danvers —A long carrot, 8 to 12 inches; tapering to a slender point like a parsnip; grown more for live-stock or exhibition purposes The Half-Long has largely displaced it as a market sort chiefly because of the greater ease with which the latter strain is harvested.

Half-Long Scarlet —Top small, roots medium size, cylindrical, pointed; much used for bunching

Early Scarlet Horn.—Top small, roots half-long, somewhat oval, smooth, fine grain and flavor, a favorite garden sort.

Large White Belgian —Of much larger size than the above-named varieties, of less delicate flavor and coarser texture; a popular variety for live-stock.

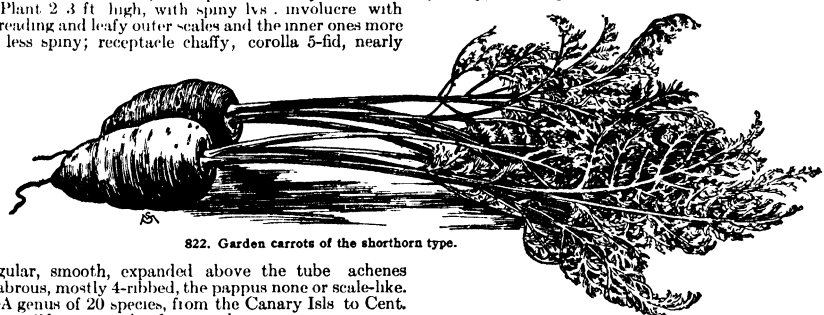
The variation in the different strains of carrot seed is marked and it is important to secure seed from carefully selected roots true to shape and color Carrot seed may be produced in any location in which the crop of roots is grown successfully.

The carrot may be successfully forced under glass and is grown in this way to a limited extent The small early varieties are used, such as French Forcing, Early Parisian, Early Scarlet Horn and Golden Ball. These will usually be grown as a catch-crop between tomatoes or cucumbers When grown in this way, the carrot is one of the most delicious of all vegetables, and deserves much wider popularity See *Forcing*

The field cultivation of carrots for live-stock differs little from the garden or horticultural treatment except that earliness is not desired, and the longer-rooted late-maturing kinds are mostly used; and less intensive cultivation is employed See Vol II, Cyclo Amer Agric, p 540 F. A. WAUGH and H F. TOMPSON.

CÁRTHAMUS (Arabic name, alluding to a color yielded by the flowers) *Compósitæ* Hardy annuals.

Plant 2–3 ft high, with spiny lvs; involucre with spreading and leafy outer scales and the inner ones more or less spiny; receptacle chaffy, corolla 5-fid, nearly regular, smooth, expanded above the tube achenes glabrous, mostly 4-ribbed, the pappus none or scale-like. —A genus of 20 species, from the Canary Isls to Cent. Asia Of easiest cult, from seed.



822. Garden carrots of the shorthorn type.

tinctórius, Linn (*Cárduus tinctórius*, Falk.). SAFFLOWER FALSE SAFFRON. One to 3 ft high, glabrous, branched lvs ovate, spiny-toothed, almost as broad as long fl-heads with upward-tapering involucre, and a globular crown of orange florets Asia —Florets used like saffron, they have diaphoretic properties and have also been used for dyeing, especially silks, and in making rouge N TAYLOR.†

CARUÈLIA *Ornithogalum.*

CÀRUM (probably from Caria, in Asia Minor). *Umbelliferæ* Glabrous annual or perennial herbs, some of which yield aromatic and edible garden products

Leaves pinnate fls white or pinkish, small, in compound umbels with involucres and involucels, the calyx-teeth small fr ovate or oblong, more or less ribbed, glabrous, or sometimes hispid: root usually tuberous or filiform —Twenty or more species, widely distributed in temperate regions The genus is variously defined and understood *C. Petroselinum*, the parsley, is here kept under the genus *Petroselinum*.

Cárvi, Linn CARAWAY (which see) St. slender but erect, furrowed, 1–2 ft: lvs. pinnately decompound, with thread-like divisions. Old World.—Sometimes runs wild.

Gàirdneri, Gray St solitary, 1–4 ft.: lvs. pinnate or the upper ones simple, with 3–7 linear lfts., the upper lfts usually entire, but the lower ones often divided: fr with long style Dry hills, in Calif. and Nev. and to Brit Col.—Intro in 1881, by Gillett, as an ornamental plant Roots tuberous and fusiform. L. H. B.

CARÚMBIUM: *Homalanthus.*

CÀRYA (*Karya*, Greek name for the walnut tree). Syn, *Hicòria. Juglandàceæ* HICKORY. Trees grown for their handsome foliage and strong habit, and some species for their edible nuts

Deciduous branches with solid pith. lvs alternate, without stipules, with 3–17 serrate lfts fls. monœcious, apetalous, appearing with the lvs; staminate fls in axillary, slender, pendulous catkins, each fl with 3–10 stamens, borne in the axil of a 3-lobed bract, pistillate fls in a terminal, 2–10-fld. cluster or spike, consisting of a 1-celled ovary inclosed by a 4-lobed involucre fr globular to oblong, with a husk separating into 4 valves and a bony nut, incompletely 2–4-celled —About 18 species of hickory, all in E N. Amer from Canada to Mex; the Chinese species recently described by Dode from nuts only is probably not a Carya See Rep Mo Bot Gard 7, pp 28–42, pls. 1–23, and Rep of U S Dept Agric, Div Pomol, Nut-Culture (1896), cited below as U S N C (the first number referring to the plate, the second and third to the figure) By some, Hicoria is considered to have priority, but Carya is retained as one of the "nomina conservanda" of the Vienna code of nomenclature, because of its long-established usage.

The hickories are hardy ornamental, usually tall trees with rather large, deciduous odd-pinnate leaves, small greenish flowers, the staminate ones in conspicuous pendulous racemes, and with rather large green dehiscent fruits inclosing a mostly edible nut The hickories are among the most beautiful and most useful trees of the American forest, and are all very ornamental park trees, with a straight, sometimes high and slender trunk and a large, graceful, pyramidal or oblong head of usually light green foliage, turning from yellow to orange or orange-brown in fall They are hardy North except *C. Pecan*, *C. aquatica* and *C. myristiciformis*, but *C. Pecan* thrives rarely in Massachusetts in sheltered positions. Most of the species have heavy hard strong and tough wood, much valued for many purposes, especially for handles of tools, manufacture of carriages and wagons, also for making baskets and for fuel. The nuts of some species, as *C. Pecan* and *C. ovata*, also *C. laciniosa* and some varieties of *C glabra* and *C. alba*, are edible, and are sold in large quantities, mostly gathered from the woods, though in later years orchards of improved varieties have been planted. A large number of insects prey upon the hickory, attacking the wood, foliage and fruit, for which see the Fifth Ann. Rep. of the U. S. Entom. Com, pp. 285–329. There are also some fungi sometimes causing an early defoliation of the trees.

The hickories generally thrive best in rich moist soil, but some, especially *C. glabra*, *C. alba* and *C. ovata*, grow equally well in drier localities. They are of rather slow growth, and difficult to transplant if taken from the woods, therefore the seeds are often planted where

the trees are to stand, but if grown in the nursery and transplanted several times when young, trees 6–10 ft. high may be transplanted successfully.

Propagation is usually by seeds stratified and sown in spring in rows about 3 inches deep; named varieties may be grafted in spring in the greenhouse, on potted stock of *C. cordiformis*, which seems to be the best species for this purpose, veneer- or splice-grafting being usually employed, sometimes also increased by root-sprouts. For further horticultural advice, see *Hickory-nut* and *Pecan*.

INDEX.

alba, 8, 10.	*illinoensis*, 1.	*olivæformis*, 1.
amara, 4.	laciniosa, 9	ovalis, 6
aquatica, 3.	*microcarpa*, 6, 10.	ovata, 10.
borealis, 6.	myristicæformis, 2.	Pecan, 1.
cordiformis, 4.	Nuttallii, 10	*porcina*, 5.
fraxinifolia, 10.	obcordata, 6.	*sulcata*, 9.
glabra, 5.	obovalis, 6.	*tomentosa*, 8.
Halesii, 10.	odorata, 6.	villosa, 7.

A. *Scales of buds valvate, 4–6: fr. with winged sutures; nut usually thin-shelled: lfts 7–15, usually falcate.*

B. *Nut mostly elongated, almost terete, husk thin, splitting to the base, kernel sweet; cotyledons entire or only notched at the apex.*

1. Pecán, Engler & Graebn. (*Júglans Pecán*, Marsh. *Hicòria Pecán*, Brit. *C. illinoénsis*, Koch. *C. olivæfórmis*, Nutt.). PECAN. Fig. 823. To 170 ft., with branches pubescent when young: bark deeply furrowed, grayish brown: winter-buds yellow: lfts. 11–17, short-stalked, oblong-lanceolate, acuminate, serrate or doubly serrate, tomentose and glandular when young, usually glabrous at length, 4–7 in. long: staminate catkins almost sessile: fr. 3–10 in clusters or spikes, oblong, 1½–3½ in. long; nut ovoid or oblong, smooth, brown, irregularly marked with dark brown, 2-celled at the base; kernel sweet From Iowa and Ind south to Ala and Texas; also in Mex. S.S. 7·338–9 A G 12 273–275 U S N C 1, 8, 9.—This species is the most important as a fr. tree, and many named varieties are cult in the southern states, but it is tender N The wood is less valuable than that of the other species Hybrids are known of this species with *C. cordiformis*, *C. alba* and *C. laciniosa*, for which see Rep Mo. Bot. Gard 7, pls. 20–23 and Gng 2.226 See *Pecan*.



823. Foliage and pistillate flowers of Carya Pecan.

2. myristicæfórmis, Nutt. (*Hicòria myristicæfórmis*, Brit.). NUTMEG HICKORY. Tree, to 100 ft, with dark brown bark, broken into appressed scales: winter-buds brown. lfts 5–11, short-stalked or almost sessile, ovate-lanceolate, the uppermost much larger and obovate, serrate, scurfy-pubescent beneath when young and with brown scales above, at length dark green above, silvery and lustrous beneath, 3–5 in long. staminate catkins peduncled: fr generally solitary, short-ovoid or obovate, about 1½ in long, nut ovoid, reddish brown marked with irregular spots and stripes, thick-shelled, 4-celled below, kernel sweet From S C to Ark and Mex S S 7 342-3 —A very decorative species on account of its handsome foliage, but not hardy N

BB *Nut usually so broad as long, compressed, with irregularly angled or reticulate surface, thin-shelled, 4-celled below, kernel bitter, cotyledons deeply 2-lobed.*

3 **aquática,** Nutt (*Hicòria aquática*, Brit.) WATER HICKORY BITTER PECAN Usually small tree, rarely to 100 ft, with light brown bark separating into long, thin plates winter-buds dark reddish brown lfts 7–13, sessile or short-stalked, lanceolate, long-acuminate, finely serrate, yellowish tomentose when young, glabrous at length: fr 3–4, ovoid to broadly obovate, 1–1½ in long; husk thin, splitting to the base, nut obovate, much compressed, irregularly angled and ridged, dull reddish brown, kernel very bitter From Va to Ill, south to Fla and Texas. S S. 7:344–5. U S N C 12, 7–8

4. cordiformis, Koch (*Hicòria minima*, Brit *C. amàra*, Nutt.) BITTERNUT SWAMP HICKORY Tree, to 100 ft bark grayish brown, broken into thin scales young branches and petioles glabrous: winter-buds bright yellow. lfts 5–9, ovate-lanceolate to lanceolate, acuminate, densely serrate, pubescent when young and glandular, almost glabrous at length, 3–6 in long fr 2–3, broadly obovate or subglobose, winged from the apex to the middle, ¾–1½ in long; husk thin, splitting somewhat below the middle; nut slightly compressed, roundish, abruptly contracted into a short point, smooth, gray, kernel bitter Que to Minn, south to Fla. and Texas S S. 7·340–1. Em. 226 —A valuable park tree, with handsome rather broad head, growing in cult more rapidly than other hickories.

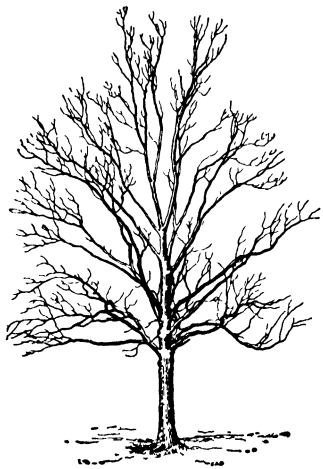
AA. *Scales of buds imbricate, more than 6: fr. not or slightly winged at the sutures; nut usually thick-shelled, 4-celled below: lfts 3–9, not falcate, the uppermost larger and generally obovate.*

B. *Buds small, ¼-½in. long: husk thin, nut slightly or not angled.*

C. *Lvs. glabrous or only slightly pubescent while young: nut not or only slightly angled, thin-shelled.*

5. glàbra, Sweet (*Hicòria glàbra*, Brit *C. porcìna*, Nutt.). PIGNUT. Figs 824, 825. Tree, occasionally to

120 ft., with usually dark gray fissured bark and slender, glabrous branchlets: lfts 3–7, almost sessile, oblong to oblong-lanceolate, long-acuminate, sharply serrate, almost glabrous, 3–6 in long· fr usually ovoid or obovate, the sutures usually slightly winged toward the apex and the husk splitting mostly only half way



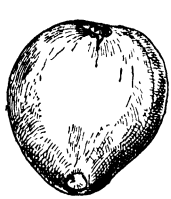
824. Characteristic growth of the pignut hickory, Carya glabra.

to the base; nut usually brownish, not angled; kernel mostly astringent Maine to Ont and south to Fla, Ala and Miss S T S 2 179 A G 11 386–7 U S N C 12, 5.—A very handsome park tree, with rather narrow-oblong head, and slender often pendulous branchlets A very variable tree

6. **ovàlis,** Sarg (*Júglans ovàlis*, Wang *Hicòria microcárpa*, Brit *H glàbra* var *microcarpa*, Trel) Small Pignut. False Shagbark Figs 826–829 Tree, similar to the preceding bark close and furrowed on young trees, shaggy on old trunks branches first hairy, soon glabrous: lfts 5–7, sessile, oval, oblong or ovate, 3–6 in long, acute or acuminate, rounded or narrowed and unequal at the base, coarsely and shallowly toothed, glabrous; terminal lft cuneate at the base, short-stalked· fr subglobose to short-oblong, ¾–1 in across, densely scaly and slightly winged, tardily splitting nearly to the base; nut slightly flattened, often broader than high and usually rounded at the apex, sometimes slightly angular, brownish, shell rather thin; kernel small and sweet Mass to Wis., south to Ga, Ala, and Miss. A G. 11. 381–388, 1, 2, 5, 8, 10. U S N C 12, 4, 6 Var. **obcordàta,** Sarg (*J. obcordàta*, Muhl *J. porcina* var. *obcordàta*, Pursh *C. microcárpa*, Darl) Fr nearly globose or ovoid; nut angled, broader than high, sometimes obcordate S S 7 354, figs. 5, 6, 7, 9. Var. **odoràta,** Sarg (*Hicòria glàbra* var. *odoràta*, Sarg.). Lfts generally broader, ovate or oblong-ovate, glandular: fr. subglobose or higher than broad, with distinctly winged sutures, splitting freely to the base; nut gray, very slightly ridged, slightly higher than broad. Conn. to Pa. and Mo. S S. 7:354, fig. 8. Var **obovàlis,** Sarg. Fr. obovoid, nut much compressed, pointed or rounded at the apex, and rounded at the base Mass to Va and Mo Var. **boreàlis,** Sarg (*Hicòria boreàlis*, Ashe *C. boreàlis*, Schneid) Bark scaly lfts. usually 5, lanceolate· fr ovoid, flattened, about ¾in long, very narrowly winged and often incompletely splitting; nut ovoid, ridged, whitish, kernel sweet Mich, Ont B T. 236



826 Fruit of C. ovalis, the false shagbark. (Natural size).



825. One form of pignut—C. glabra. (Natural size)

cc *Lvs hairy beneath· nut angled, thick-shelled.*

7. **villòsa,** Schneid (*Hicòria villòsa*, Ashe *H glàbra* var *villòsa*, Sarg *H pállida*, Ashe) Tree, to 20 or sometimes to 50 ft · branchlets slender, pubescent mixed with silvery scales, later glabrous lfts 5–9, usually 7, sessile or short-stalked, oblong to oblanceolate, 3–5 in long, acuminate, narrowed at the base, coarsely serrate, when unfolding glandular above, hairy below and with silvery scales, petioles pubescent and with tufts of brownish hairs, finally often glabrous fr subglobose to pear-shaped, ¾–1¾ in long, winged, husk thin, splitting to below the middle or nearly to the base, nut slightly angled, somewhat compressed, thick-shelled, pale or light brown, kernel small and sweet N J to Fla, Miss and E Texas S S 7 355 G F 10 305

BB *Buds large, ½–1 in long nut angled, kernel sweet*

C. *Bark not shaggy· branches and petioles tomentose. outer bud-scales falling in autumn husk not separating quite to the base*

8 **álba,** Koch (*Hicòria alba*, Brit *C. tomentòsa*, Nutt Not to be confounded with *C alba*, Nutt, which is *C ovata*) Mockernut Big-bud Hickory Tree, rarely attaining to 100 ft lfts 7–9, almost sessile, oblong-lanceolate, long-acuminate, usually finely serrate, glandular and tomentose beneath, very fragrant when crushed, 4–8 in. long fr globose to pear-shaped,



827. Carya ovalis, the false shagbark.

1½–2 in long; nut light brown, globular to oblong, slightly compressed, angled, narrowed toward the apex, thick-shelled, kernel small, sweet. Mass to Ont and Neb., south to Fla and Texas. S S. 7:350–1. U.S.N. C. 12, 1–3. Em. 222.

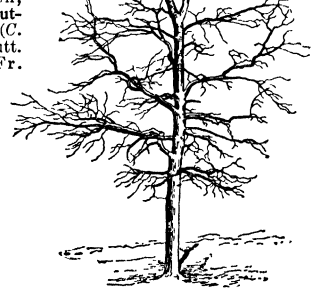


828. Twig of C. ovalis.

cc. *Bark shaggy, light gray branches and petioles glabrous or pubescent husk very thick, separating to the base: outer bud-scales persisting through the winter.*

9 **laciniòsa,** Engler & Graebn. (*Hicòria laciniòsa,* Sarg *H acuminàta,* Dipp *C. sulcàta,* Nutt.) Big or Bottom Shellbark Hickory King-Nut Tall tree, occasionally to 120 ft. branchlets orange-red lfts 7–9, oblong-lanceolate, acuminate, serrate, pubescent when young, usually glabrous at length, 4–8 in. long fr. generally oblong, 1¾–2½ in long, nut yellowish white, oblong, but sometimes as broad as long, slightly compressed and obscurely 4-angled, pointed at both ends; kernel sweet N Y to Iowa, south to Tenn and Okla S S. 7:348–9 U S. N C 11

10 **ovàta,** Koch (*Hicòria ovàta,* Brit *C. álba,* Nutt.). Shagbark Hickory Also Little Shellbark Hickory, although the latter name by some is applied to the preceding. Figs 830, 831 Tree, occasionally to 120 ft lfts generally 5, sessile, oblong or oblong-lanceolate, acuminate, serrate, densely fimbriate, pubescent and glandular when young, glabrous at length, 4–6 in long fr subglobose, about 1½-2½ in long, nut white, oblong to broadly obovate, 4-angled, kernel sweet From Que to Minn, south to Fla and Texas. S S. 7.346–7. Em 217 U S N C. 10 A G 11.386, 6, 9; 387, 3, 388, 11. Gng. 7·51. A F 14.339.—Next to Pecan the best as a fruit tree, especially for northern states, where the pecan is not quite hardy Several named varieties are in trade, of which probably var. **Hàlesii,** Hort., with large, thin-shelled nut, is the best known. An ornamental, often very picturesque tree; the stout branches forming a rather broad, usually somewhat open, head Var **Nuttàllii,** Sarg (*C. microcárpa,* Nutt. in part). Fr. smaller; nut rounded, usually obcordate, much compressed and prominently angled, about ½in across. Mass to Pa. and Mo Nuttall, Silv N. Am 1.13 Var. **fraxinifòlia,** Sarg Lfts. lanceolate or nearly oblanceolate, the terminal one 5–6 in. long anc 1¾–2 in wide. fr. generally smaller, ovoid, pointed 1¼ in long, nut long-pointed. W. N. Y.

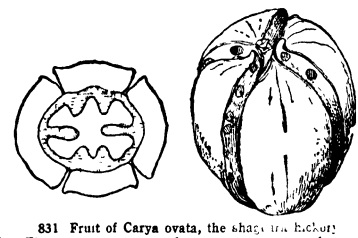


829. Habit of the small-fruited pignut, Carya ovalis.

C. arkansàna, Sarg. Allied to C glabra Tree, to 70 ft bark dark gray, scaly branchlets pubescent lfts 5–7, lanceolate, densely pubescent when unfolding, glabrous at maturity, 4–7 in long fr ovoid or obovoid, husk usually splitting to the middle, nut slightly obovoid, shell very thick and hard, kernel sweet, small Ark and Okla S F S 2 181.—*C Buckleyi,* Durand (C texana, Buckl., not DC.) Allied to C alba Tree, to 50 ft., with dark, furrowed bark lfts 7, lanceolate or oblanceolate, pubescent on the vein below, 3–6 in long fr subglobose or ovoid, 1½ in across, husk thin, splitting to the base, nut reddish brown, veined, shell hard, kernel sweet Texas to Okla and Ark S T S 2 182 *C. carolinæseptentrionalis,* Engler & Graebn (Hicoria carolinæ-septentrionalis, Ashe) Allied to C ovata Branchlets slender lfts 3–5, lanceolate, glabrous fr smaller, nut thin-shelled N C to Ga S S 14 720.—*C floridana,* Sarg Allied to C. cordiformis Buds valvate, brownish yellow lfts usually 5, elliptic-oblong to lanceolate, densely scaly beneath, 2–4½ in long fr obovoid, about 1 in long, husk tardily splitting to the base, nut obovoid or subglobose Fla S T S 2 177 *C. megacarpa,* Sarg Closely related to C glabra Bark close buds larger



830 Twig of Carya ovata.



831 Fruit of Carya ovata, the shagbark hickory The cross-section is to show structure, not to show a good horticultural fruit. (Natural size)

lfts to 8 in long fr broadly obovoid, to 1½ in long, husk thick, tardily dehiscent to the middle, nut obovoid, kernel small, sweet N Y to Mo and Fla S T S 2 180.—*C. myristicæformis,* Engelm Tree, with shaggy bark and tomentose-pubescent lvs fr depressed, with rather thick husk and broad, sharply 4-angled, white nut Mex The only species not native to the U S.—*C. texana,* DC (Hicoria texana, Le Conte) Similar to C Pecan, but lfts broader, less falcate, almost sessile nut smaller, much darker, with somewhat rough surface, kernel bitter Texas S S 14 719.—*C. texana,* Buckl. = C. Buckleyi.

Alfred Rehder.

CÁRYOCAR (from the Greek word for *nut*) *Caryocaràceæ,* formerly included in *Ternstræmiàceæ,* and by some referred to *Rhizobolàceæ* Trees, or rarely shrubs, of about 10 species in Trop Amer., one of which is well known for its large edible nuts Lvs opposite, digitately 3–5-foliolate, leathery, often serrate fls bractless, in terminal racemes; calyx deeply 5–6-parted, the lobes orbiculate and strongly imbricate; petals 5–6, imbricate; stamens many, somewhat joined at the base, ovary 4–6-celled. fr drupaceous, with a hard stone or stones and very large seeds **C. nuciferum,** Linn., produces the souari-nut or butternut of the American tropics Although native of Guiana, it is cult in some of the W Indies isls tree, attaining 100 ft or more, producing durable timber used chiefly in ship-building lvs trifoliolate, the lfts elliptic-lanceolate, glabrous fls large, purple, the stamens white and very numerous fr several inches in diam., nearly globular or becoming misshapen by abortion of the contents, containing 2–4 hard-shelled nuts the size of a hen's egg, and which are flat-kidney-shaped, warty and reddish brown; kernel or meat white, with a nutty or almond-like flavor, and yielding oil when subjected to pressure B M 2727, 2728 The nuts now and then appear in northern markets The closely allied *C. villosum,* Pers., of Guiana and Brazil, is reported as a notable timber tree; and the oily pulp surrounding the seed is eaten boiled and the kernel of the seed is eaten raw.

L. H. B.

CARYOPHÝLLUS, the clove tree, is now referred to *Eugenia*

CARYÓPTERIS (Greek for *nut* and *wing*). *Verbenàceæ*. Ornamental woody plants grown for their lavender-blue flowers profusely produced in autumn

Deciduous small shrubs. lvs opposite, short-petioled, serrate. fls in axillary cymes, calyx campanulate, deeply 5-lobed with lanceolate teeth, spreading and somewhat enlarged in fr; corolla 5-lobed, with short cylindric tube and spreading limb, 1 segm. larger and fringed, stamens 4, exserted, 2 of them longer, style slender, 2-parted at the apex fr separating into 4 somewhat winged nutlets.—About 6 species in E Asia.

These are glabrous, pubescent or tomentose shrubs with small blue or violet late flowers Free-flowering and very valuable for their late blooming season, not hardy North; even if well protected they will be killed almost to the ground, but the young shoots, springing up freely, will flower profusely the same season They require well-drained and sandy soil and sunny position; if grown in pots, a sandy compost of peat and leaf soil or loam will suit them, and they will flower in the greenhouse until midwinter Propagated readily by cuttings of half-ripened wood in summer or fall under glass, and by seeds sown in spring.

incàna, Miq (*C. Mastacanthus*, Schauer *C. sinénsis*, Dipp.) Fig 832. Suffruticose, 1–5 ft lvs petioled, ovate or oblong, coarsely serrate, pubescent above, grayish tomentose beneath, 2–3 in long cymes pedunculed, dense-fld, fls small, violet-blue or lavender-blue. Aug.–Nov China, Japan B R 32 2 B M 6799. R H 1892 324 R B 19 273 G C II 21 149, III 42 409 Mn 5 5 S H 2, p 89 G W 6, p 197 Gn. 24, p 523, 76, p 24 G M 43 7.—Known in the nursery trade as "blue spirea." Var **cándida,** Schneid. has white fls

C. mongólica, Bunge Lvs lanceolate, almost entire cymes with fewer but larger fls. R H 1872 150

ALFRED REHDER.

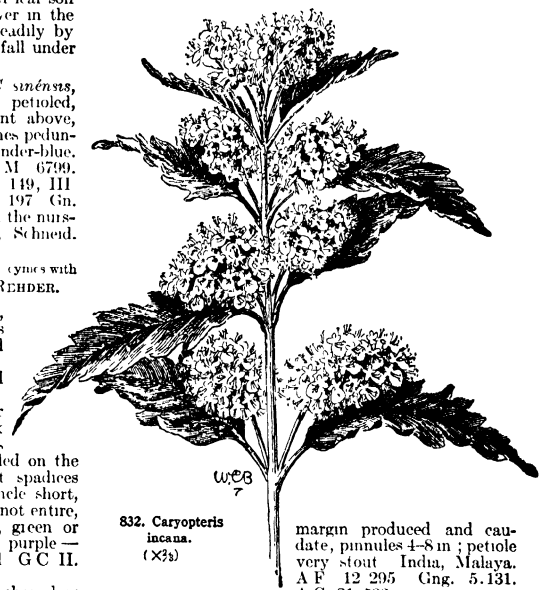
CARYÒTA (old Greek name) *Palmàceæ*, tribe *Arèceæ* FISH-TAIL PALM Spineless monocarpic palms, with tall stout ringed trunks, at length bearing suckers.

Leaves disposed in an elongated terminal fringe, ample, twice pinnately divided, segms dimidiate-flabelliform, or cuneate, entire, or split, irregularly dentate, pleate, folded back in the bud, midnerves and primary nerves flabellate, petiole terete below, sheath keeled on the back, fibrous along the margins ligule short spadices usually alternately male and female peduncle short, thick branches long, pendent spathes 3–5, not entire, tubular, bractlets broad fls rather large, green or purple. fr the size of a cherry, globular, purple.—Species, 9. Malaya, New Guinea, Austral G C II. 22.748

These palms are remarkable for the delta-shaped or fish-tail-shaped leaflets, which make the graceful, spreading fronds very attractive They are excellent warmhouse palms, very useful for decoration, particularly when young They are frequently planted out in protected places for the summer *C. urens*, the wine-palm of India, yields, when full grown, about twenty-four pints of wine in twenty-four hours The beverage is very wholesome and a valuable article of commerce. There being so many different genera to choose from in selecting plants for moderate-sized conservatories, the members of this genus are not very popular for providing small specimens. In a high, roomy structure, however, they are among the most ornamental of the tribe They are quick-growing, with large broad leaves, finely cut up, the small divisions resembling the tail of a fish, hence the name "fish-tail palm" After reaching maturity the plant begins flowering at the top, and continues downward until the vitality of the stem is exhausted Suckers are freely produced by some species, but these, as a rule, do not become so robust as the parent stem, owing probably to the soil becoming exhausted Seeds are offered by most dealers The young plants should be grown in a warm, moist atmosphere, the soil consisting of loam with about one-third of its bulk leaf-mold and sand in equal parts They sometimes lose their roots if kept too cool and wet in winter Prop. is by seeds and suckers. (G. W Oliver)

mitis, Lour (*C. sobolífera*, Wall *C. furfuràcea*, Blume) Caudex 15–25 ft high, 4–5 in diam., sobolíferous petioles, lf.-sheaths and spathes scurfy-villous: lvs 4–9 ft., pinnæ very obliquely cuneiform, irregularly dentate, upper margins acute, pinnules 4–7 in long. Burma to Malaya

ùrens, Linn WINE-PALM TODDY-PALM Caudex stout, even in cult specimens 60–80 ft high and 18 in. thick, much higher in the wild, not sobolíferous lvs. 18–20 by 10–12 ft., pinnæ 5–6 ft., curved and drooping, very obliquely truncate, acutely serrate, the upper



832. Caryopteris incana. (×⅔)

margin produced and caudate, pinnules 4–8 in.; petiole very stout India, Malaya. A F 12 295 Gng. 5.131. A G 21·533

Rumphiàna, Mart Lvs 2-pinnate, several feet long, the pinnules thick, sessile, 6 in long or nearly so, oblong Malaya Var **Álbertii,** Hort (*C. Albertii*, Muell.), is in the trade It is large and free-growing, the lvs being 16–18 ft long and two-thirds as broad; lf.-segms fan-shaped and oblique, toothed

C. Blancòi, Hort., from the Philippines, has been listed in the American trade It is probably a form of C urens

JARED G. SMITH.

CASAREEP: *Bligha*

CASCARILLA: *Croton.*

CASHEW: *Anacardium occidentale.*

CASIMIRÒA (named in honor of Cardinal Casimiro Gomez de Ortega, Spanish botanist of the eighteenth century) *Rutàceæ* Evergreen trees, one of which is grown for the edible fruits

Leaves alternate, long-petioled, digitate, 3–7-foliolate, lfts petiolulate, lanceolate, entire or slightly serrate, smooth or pubescent beneath fls regular poly-

gamo-dicecious; calyx 5-parted, small; petals 5, oblong, valvate, apex incurved, disk inconspicuous, circular; stamens 5, free; filaments subulate; anthers cordate; ovary sessile, on disk, globose, 5- or occasionally 6–8-lobed, 5-celled; stigma sessile, 5-lobed; ovules solitary in the cells, axillary: fr. a drupe, large, depressed-globose; pulp agreeable to taste, edible, seeds oblong, compressed, exalbuminose.—Four species in Mex and S.

edūlis, Llav. & Lex. WHITE SAPOTE COCHIL SAPOTA. Large tree: trunk ashen gray, with warty excrescences: lvs. dark green, glossy: fls. greenish yellow, small: fr. greenish yellow when ripe, with strong, thick epicarp, ½in. thick, about the size of an orange; seeds nearly 1 in long and half as wide. Mex.—The fr. of this species has a delicious flavor, similar to that of a peach. It is used in Mex as an aid in inducing sleep, and the lvs. as a remedy for diarrhea. It grows on the coast of Mex. to an altitude of about 7,000 ft. See *Sapote, White.*

H. J. WEBBER.

CASSABANANA: *Sicana.*

CASSANDRA: *Chamædaphne.*

CASSAVA: *Manihot.*

CASSEBEÈRA (from a German botanist). *Polypodiàceæ.* Small Brazilian ferns allied to the maidenhair, but rarely seen in cult. There are 3 species: sori terminal on the veins, oblong or nearly globular; indusium within the margin and distinct from it. They require hothouse conditions *C. pinnàta,* Kaulf., has fronds 6 in. long, pinnate, the pinnæ linear-oblong and crenate. *C. triphýlla,* Kaulf, has 3–5-parted fronds, the parts linear-oblong and crenate *C gleichenioides,* Gardn., has twice-pinnate fronds, the pinnules 4-cornered.

CÁSSIA (ancient Greek name) *Leguminòsæ* SENNA. Herbs, shrubs or trees, a few of which are in cultivation in America, as border plants and under glass.

Leaves even-pinnate: fls. nearly regular (not papilionaceous), with the nearly equal calyx-teeth mostly longer than the tube; corolla of 5 spreading, nearly equal clawed spreading petals, stamens 5–10, frequently unequal and some of the anthers abortive, the good anthers opening at the top: fr a stalked pod which is either flat or terete, containing numerous seeds and often partitioned crosswise.—Species nearly or quite 400 in the warmer parts of the globe, some of them in cool temperate regions. See page 3566

The cassias delight in a sunny exposure. Most of those cultivated in the United States are herbs or herb-like shrubs, attractive for the finely cut foliage and the showy flowers Some of them are cultivated only in the extreme South. *C corymbosa* is probably the best garden subject. Cassias are summer bloomers, for the most part. Propagation is mostly by divisions and seeds, the annual species always by seeds.

Senna leaves, used in medicine as a cathartic, are derived from various species, chiefly from *C. acutifolia* of Egypt, and *C. angustifolia* of India and other Old World tropics. The "Cassia lignea" of pharmacopœas is the product of a Cinnamomum Cassia pods of commerce, used in medicine, are the fruits of *C. Fistula.* Many of the species contribute to therapeutics. Some of them provide tanning materials

A. *Hardy border plants lfts 5 or more pairs*

marylándica, Linn WILD SENNA. Perennial, glabrous or nearly so, sts nearly simple: lfts. 5–10 pairs, oblong or lance-oblong and entire, short-acuminate or nearly obtuse: fls. in axillary racemes near the tops of the sts. and often appearing as if panicled, bright yellow, wide open: pods linear, flat. New England, west and south, mostly in wet soil.—Grows 3–4 ft. high, and has attractive light green foliage.

Chamæcrísta, Linn (*Chamæcrista nictitans,* Moench). PARTRIDGE PEA Annual, erect or spreading, 2 ft. or less high: lfts. 10–15 pairs, small, narrow-oblong, mucronate, sensitive to the touch: fls. large, 2–5 together in the axils, canary-yellow and 2 of the petals purple-spotted.—Dry soil, Maine, south and west. Sometimes known as Magothy Bay bean and sensitive pea, and formerly recommended as a green-manuring plant. See Cyclo. Amer. Agric., Vol. II, p. 309, for account and picture.

AA. *Tender plants, grown far south, or under glass: lfts. few or many.*

B. *Tree, with woody indehiscent pods.*

Fístula, Linn. PUDDING-PIPE TREE. GOLDEN SHOWER Lvs. large, the lfts. 4–8 pairs, and ovate-acuminate: fls. in long lax racemes, yellow, the pedicels without bracts: pods cylindrical, black, 3-furrowed, 1–2 ft. long, containing 1-seeded compartments India, but intro. in W Indies and other tropical countries. Sparingly cult. S.—Furnishes the cassia pods of commerce.

grándis, Linn PINK SHOWER. Lfts 10–20, oblong, abrupt at either end, more or less pubescent beneath and above· fls in long drooping axillary racemes, rose-colored, without bracts subtending the pedicels· pod 3 in. or less long, compressed-cylindrical, glabrous, transversely rugose Trop Amer ; offered in S. Calif , and grown in many tropical countries

BB. *Shrubs or herbs, with more or less dehiscent pods.*

Sophèra, Linn. (*C schinifòlia.* DC *C. Sophòra,* Auth.). Shrub, 6–10 ft · lfts 6–10 pairs, lanceolate-acute. fls yellow on many-fld axillary and terminal peduncles, which are shorter than the lvs . pod thin, tardily dehiscent Oriental tropics Intro in S Calif.

corymbòsa, Lam. (*C. floribùnda,* Bart) Shrub, half-hardy in middle states, 4–10 ft : lfts 3 pairs, oblong-lanceolate and somewhat falcate, obtuse or nearly so. fls yellow, in long-stalked, small axillary and terminal corymbs. Argentina. B M. 633. G C. III. 31:252. Gn. 50, p. 139 J.H III 61.139. G. 25:553. H.F. II. 3:252. G W. 3, p. 421, 6, p. 391 — The best-known garden species, being an excellent conservatory plant for spring, summer and autumn bloom It is an old favorite, now coming again into prominence (as *C. floribunda* and var. *A Boehm,* corrupted apparently into *C Boema*) as a pot-plant, as a tub specimen for lawns, or for plunging in the border; winters readily in a dormant state in a cellar, very free-flowering.

tomentòsa, Linn. Shrub, 10–12 ft.: lfts. 6–8 pairs, oval-oblong and obtuse, white-tomentose beneath: fls. deep yellow. Mex.—Said to be a good winter bloomer in S Calif , and naturalized in some parts.

artemisoìdes, Gaud. Bushy shrub, soft-canescent and gray all over: lfts. 3–4 pairs, very narrow-linear: racemes axillary, 5–8-fld., the fls. sulfur-yellow: pods flat, shining brown. Austral.—Intro. in S. Calif. Withstands drought.

bifìdra, Linn. Shrub, 4–8 ft.: lfts. 6–10 pairs, broad-oblong or obovate-oblong, very obtuse but mucronulate. fls large, yellow, on 2–4-fld. peduncles, which are shorter than the lvs: pod 3 in. or less long, oblong-linear or narrower, membranaceous. S. Amer. and W. Indies B M 810.—Sparingly cult. in greenhouses.

C. lævigàta, Willd Shrub, glabrous: lfts. 3–4 pairs, ovate-oblong or ovate-lanceolate, acuminate: fls. yellow in terminal and axillary racemes pod leathery, 2–3 in long, nearly cylindrical. Tropics — *C occidentàlis,* Linn HEDIONDA Annual or subshrubby, widely distributed in the tropics as a weed, the seeds used as a substitute for coffee, it is the "fedegosa" and "negro coffee" of Afr.: lfts. 4–12 pairs, ovate-lanceolate or lanceolate, acuminate, and a gland near the base of the petiole racemes short and few-fld.· pod glabrous, oblong-linear compressed or nearly cylindrical, the small seeds produced abundantly—*C. splèndida,* Vogel Shrub, 6–10 ft , much branched· fls bright yellow, very large S. Amer Recently catalogued in S. Calif —Others of the numerous species of Cassia are likely to appear in cult., particularly some of the native kinds; but as a whole, the genus is not rich in horticultural subjects.

L. H. B.

CASSÌNE (a name said to have been used by the Indians in Fla.; see *Ilex Cassine*). *Celastràceæ*. Some 20 or less erect or climbing glabrous shrubs of the Cape region in Afr, apparently not known in cult. in this country. Lvs opposite, thick, entire or serrate. fls. small, white, in axillary clusters; calyx 4–5-parted, minute; petals 4–5; stamens 4–5, on the disk, which encircles the ovary. fr. a 1–2-seeded drupe, with a hard pit or stone *C. Colpoon*, Thunb (or *C capensis* var. *Colpoon*) is the ladlewood of the Cape, the wood being used in the making of small articles *C. Maurocenia*, Linn (now placed in a separate genus, *Maurocenia capensis*, Sond) is the Hottentot cherry. H I. 6:55 **2.**

CASSÌOPE (Greek mythological name). *Ericàceæ*. Ornamental small shrubs sometimes cultivated for their handsome delicate flowers

Evergreen lvs very small, usually scale-like and opposite, rarely alternate and linear fls solitary, axillary, or terminal, calyx small, 5-parted; corolla campanulate, 5-lobed or 5-cleft; stamens 10, the anthers with recurved appendages; style included: fr. a 5-valved caps with numerous minute seeds.—Ten species in arctic regions and high mountains of N. Amer., N. Eu, N Asia and Himalayas Formerly included under Andromeda

Cassiopes are graceful, delicate plants, adapted for rockeries, flowering in summer They are of somewhat difficult culture, and require peaty and sandy moist but well-drained soil and partly shaded situation, though *C hypnoides* grows best in full sun, creeping amongst growing moss Drought, as well as dry and hot air, is fatal to them Propagated readily by cuttings from mature wood in August under glass; also by layers and by seeds treated like those of Erica

C fastigiata, Don (Andromeda fastigiata, Wall) Ascending: lvs imbricate, in 4 rows, with white-fringed margin fls. axillary, white Himalayas B M 4796 G C III 47 379 (habit) Gn 43, p 189 G 15 709 —*C hypnoides*, Don (Harrimanella hypnoides, Coville) Creeping lvs linear, alternate, crowded fls terminal, deeply 5-cleft Arctic regions B M 2936 L B C 20 1946 G C III 39 226 (habit) —*C Mertensiana*, Don Erect or ascending to 1 ft high lvs imbricate in 4 rows, carinate on the back fls axillary, white or slightly tinged rosy Sitka to Calif —*C tetragona*, Don (Andromeda tetragona, Linn) Similar to the former, but lower, and the lvs. with a deep furrow on the back Arctic regions. B M. 3181 M D G 1910 125, 137 (habit)

ALFRED REHDER.

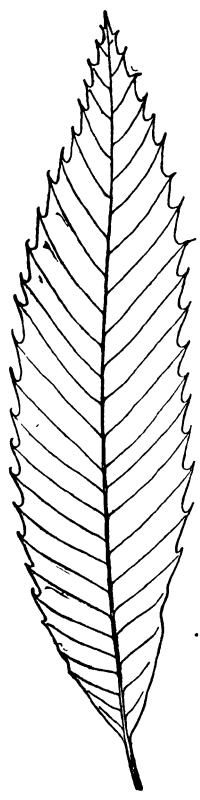
CASSIPOURÈA (a native name in Guiana). *Rhizophoràceæ* Perhaps a dozen or less species (if the African Dactylopetalum is included in the American Cassipourea) in Trop Amer and in Afr, one of which is now offered Glabrous trees or shrubs. lvs opposite or whorled, stalked, somewhat leathery, oblong or lanceolate, entire or somewhat crenate fls small or medium in size, white, solitary or fascicled in the axils; calyx 4–5-lobed, petals 4–7, fimbriate, linear or spatulate, inserted in the cup-like disk; stamens 10–30; ovary 2–4-celled caps ovoid, somewhat fleshy, tardily dehiscent, the cells 1-seeded **C. verticillàta**, N. E. Br., Natal, a handsome tree, with very shiny foliage: lvs. about 4 in long and half as broad, in 3's or 4's, lightly creno-serrate or almost entire; petals 5–7, exserted, very narrow; stamens 10–14.—A rare mangrove-like tree, found at considerable elevations away from the coast Offered in S. Calif. L. H. B.

CASTÀLIA: *Nymphæa*.

CASTÀNEA (ancient Latin name). *Fagàceæ*. CHESTNUT Fruit and ornamental trees, grown for their edible nuts and also for their handsome foliage and attractive flowers

Deciduous trees, rarely shrubs· lvs alternate, serrate, elliptic-oblong to lanceolate fls monœcious, the staminate ones with 6-parted calyx and 10–20 stamens, in long, erect, cylindrical catkins; the pistillate ones on the lower part of the upper catkins, usually 3 together in a prickly involucre; ovary 6-celled: fr. a large brown nut, 1–7 together in a prickly involucre or burr winter-buds with 3–4 scales: branchlets without terminal bud.—About ten species in the temperate regions of N. E. Amer., Eu., N Afr and Asia

The chestnuts are very attractive when in bloom. The handsome foliage is generally not injured by insects or fungi, but the whole tree is attacked by a serious disease known as the chestnut bark disease which has spread rapidly during the last years, chiefly in New York, Pennsylvania and the adjacent states. It was first discovered in 1904 It is caused by a fungus, *Endothia parasitica*, which penetrates the bark, develops its mycelium in bark and sapwood, finally girdles the branch or trunk and causes the death of the portion above the infected place. The presence of reddish pustules on the infected area is a sure sign of the presence of this fungus. The cutting and destroying of the infected parts seems so far the only way of checking the spreading of the disease This disease was without doubt imported with plants from eastern Asia, as the disease has been discovered recently in China on *C mollissima* The latter species and *C crenata* seem much more resistant than the American and European varieties and there is much hope for a successful selection and breeding of resistant varieties and for keeping this disease under control, as it is done successfully in China



833. Castanea dentata. (×½)

C dentata and *C sativa* are large-sized trees, while *C. pumila* and *C crenata* usually remain shrubby The coarse-grained wood is much used for furniture, railway ties and fence-posts, as it is very durable in the soil The chestnut is extensively cultivated in Europe and eastern Asia and also in this country for its edible fruit It grows best in well-drained soil on sunny slopes, and even in rather dry and rocky situations, but dislikes limestone soil. The American species is perfectly hardy North, while the European species is somewhat tenderer.

Propagated by seeds, sown in fall where there is no danger of them being eaten by mice or squirrels; otherwise they should be stratified in boxes and buried 1 or 2 feet deep in a warm soil until early spring, when they are sown in rows about 3 inches deep If growing well, they can be transplanted the following fall or spring 2 or 3 feet apart from each other, and planted after three or four years where they are to stand. They are also increased by layers in moist soil. Varieties are usually worked on seedling stock or on sprouts by whipgrafting above the ground when the stock is just beginning to push into leaf. Crown-grafting, root-grafting and budding are also sometimes practised, but no method gives wholly satisfactory results, and usually only one-half take well. See *Chestnut*.

A. Nuts 2 or more in one involucre and more or less compressed, usually broader than high.

B. Branchlets glabrous or at first with close white tomentum: lvs. usually glabrous at maturity, often with close white tomentum while young.

c. Lvs. glabrous or nearly glabrous even while young.

dentàta, Borkh. (*C. americàna,* Raf). Fig. 833 Tree, occasionally 100 ft : lvs. cuneate at the base, oblong-lanceolate, acuminate, coarsely serrate, nearly glabrous when young, 6–10 in long and somewhat pendulous: fls of heavy fragrance, in June or July nuts about ½in. wide. S. Maine to Mich , south to Ala and Miss. S S. 9:440–1. Em 187. G F. 10 373 F.E 14, p, 30; 29, p. 895 —The tallest, most vigorous-growing and hardiest species. The nuts, though smaller, have a better flavor than the European varieties Lvs. said to have sedative properties; used in whooping-cough; bark astringent, tonic, febrifuge.

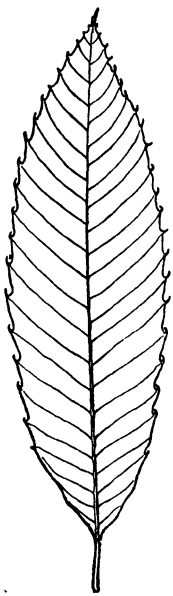
cc. Lvs. stellate-tomentose beneath while young.

sativa, Mill. (*C vésca,* Gaertn *C Castànea,* Karst. *C. vulgàris,* Lam.). Fig 834. Tree, 50–80 ft.: lvs. oblong-lanceolate, often truncate or rounded at the base, coarsely serrate, slightly pubescent or tomentose beneath when young, nearly glabrous at length, 5–9 in. long, erect nut over 1 in. wide June From S Eu and N. Afr to China. Gn 27, p 292, 50, p 389. Gng. 3:209. G W. 8, p 350, 385 —There are some garden forms with variegated lvs , and others, of which var. **asplenifòlia,** Lodd , with laciniately cut and divided lvs. is the most remarkable Of several varieties cult. for their fr., Paragon, a precocious kind, and Numbo, a variety with very large fr , are the most extensively planted in this country. See *Chestnut.*

crenàta, Sieb & Zucc. (*C. japónica,* Blume. *C. sativa* var *pubinérvis,* Makino) Fig 835 Shrub or tree, to 30 ft.: lvs elliptic or oblong-lanceolate, usually rounded at the base, acuminate, crenately serrate, or the teeth reduced to a long, bristle-like point, slightly pubescent when young, glabrous at length or only pubescent on the veins beneath, 3–7 in. long, erect. nut over 1 in. wide. Japan, China. S. I. F. 1·34 — Shrubby and very precocious; it usually begins to fruit when about six years old. Hardy as far north as Mass.



835. Japanese Chestnut—Castanea crenata. (×⅓)



834 Castanea sativa. (×½)

BB. Branchlets pubescent, with spreading hairs: lvs. soft-pubescent beneath, at least those toward the end of the shoots.

mollíssima, Blume. Tree, to 40 ft.: lvs. oval-oblong to oblong-lanceolate, acuminate or short-acuminate, rounded or truncate at the base, 3½–6 in. long, coarsely serrate, glabrous above, white-tomentose or nearly green, but soft-pubescent beneath, at least on the veins. petioles pubescent, with spreading hairs nu , about 1 in. wide; spines of the husk pubescent. N and W. China —Has proved perfectly hardy at the Arnold Arboretum and is to be recommended for its hardiness and large nuts.

AA. Nuts solitary, round, higher than thick.

pùmila, Mill. CHINQUAPIN. Shrub or small tree, rarely 50 ft.: lvs. cuneate, elliptic-oblong or oblong-obovate, acute, serrate, teeth often reduced to bristle-like points, white-tomentose beneath, 3–5 in long fr ovate. small, about ½in wide and ¾–1 in. long May, June From Pa. to N Fla and Texas S S 9 442–3 —Useful for planting on dry and rocky slopes, attractive when in fl , and again in fall with its abundant light green burs among the dark foliage The closely allied *C. alnifolia,* Nutt , in the southern states, grows only a few feet high, and has larger lvs. and fr.

Vilmoriniàna, Dode Tree, to 80 ft.: branchlets glabrous: lvs oblong-lanceolate to lanceolate, long-acuminate, usually rounded at the base, the teeth mostly reduced to slender bristles, quite glabrous even while young, 4–7 in. long· fr globose-ovate, about ½in thick and slightly longer. Cent China —A valuable timber tree. Recently intro. by the Arnold Arboretum.

ALFRED REHDER

CASTANEA of commerce: The nuts of *Bertholletia.*

CASTANÓPSIS (*Castanea* and *opsis,* chestnut-like) *Fagàceæ.* Ornamental trees or shrubs sometimes cultivated for their handsome evergreen foliage.

Closely allied to Castanea, but pistillate fls usually on separate catkins, sometimes solitary, ovary 3-celled fr. ripening the second year. involucre sometimes tuberculate; winter-buds with many scales, terminal bud present: lvs evergreen, entire or dentate —About 25 species, chiefly in the tropical and subtropical mountains of Asia, and 1 in W N. Amer., which is the hardiest, and is sometimes cult., also several Chinese species have been recently intro into cult , but their names have not yet been determined. For prop. see *Castanea.*

chrysophýlla, DC. (*Castànea chrysophýlla,* Hook.). Fig. 836 (adapted from Pacific R. R. Rep.). Tree, to 150 ft., shrubby at high elevations: lvs. ovate-oblong or oblong-lanceolate, narrowed at both ends, entire, dark green above, coated with minute golden yellow scales beneath, 2–6 in. long: nut about ½in. wide, usually solitary in the spiny involucre. Summer. Ore to Calif. S.S. 9:439. B.M. 4953. G.C. III. 22:411; 36:145. Gn. 76, p 634. F.S 12:1184 R.B. 7:240.—A highly

ornamental tree with beautiful foliage, hardy only in the warmer temperate regions, but the shrubby form is much hardier. ALFRED REHDER.

CASTANOSPÉRMUM (*chestnut seed*, because of the taste of the seeds). *Legumináceæ*. A genus of 2 species, one of which is a tall Australian tree, with odd-pinnate lvs, the lfts broad, thick, entire· fls. large, yellow-orange, in lateral or axillary loose racemes which are usually about 5 in long; petals 4; stamens free; ovary long-stipitate, many-ovuled· pod 8–9 in. long with 4–5 seeds larger than Italian chestnuts, globular. **C. austràle,** Cunn., is the species known locally



836. Castanopsis chrysophylla. (×¾)

as "Moreton Bay chestnut." The seeds are roasted and eaten. Into in S. Calif., but not common. The other species is New Caledonian, and apparently not in cult.

CASTILLÈJA (a Spanish botanist, D. Castillejo). *Scrophulariàceæ*. PAINTED-CUP. Herbs with showy bracts in a terminal head or spike, sometimes cultivated.

Flowers small, solitary, in terminal gaudy-bracted spikes; corolla tubular, sometimes flattened laterally, 2-lipped, lower lip smaller, more or less 3-toothed; stamens 4. lvs alternate, entire or cut—Upwards of 30 species in U. S. and Mex., and 1 in N. Asia. Castillejas are little known in gardens. They are more or less root-parasitic.

coccínea, Spreng. Biennial or annual, 1–2 ft., hairy: radical lvs. clustered, ovate or oblong, mostly entire; st.-lvs. lacinate or cleft, and the middle lobe of the bright scarlet bracts dilated. corolla pale yellow, about the length of the calyx. Low grounds and grassy places, Canada, south.

indivisa, Engelm. Annual, 1–2 ft.: lvs. lance-linear and entire (or sometimes 2–3-lobed): bracts not lacinate, bright red and showy. Texas.—Blooms early in spring.

affinis, Hook. & Arn. Perennial, 1–2 ft.· lvs. narrow-lanceolate, entire or the upper ones toothed at apex: fl.-bracts becoming short and broad, red· spike lax below. Calif., in moist soils.—Intro. 1891 by Orcutt.

foliolòsa, Hook. & Arn. White-woolly perennial, 1–2 ft., the base woody. lvs. small (1 in. or less long), narrow-linear, crowded or fascicled. bracts 3-parted; spike dense. Calif., in dry soils.—Intro. 1891 by Orcutt.

íntegra, Gray. Perennial, 1 ft. or less, tomentose lvs. grayish, linear, 3 in. or less long, entire· bracts of the short spike linear-oblong or obovate-oblong, entire or sometimes incised, red or rose. Texas to Ariz. and Colo.—Has been offered in Germany. L. H. B.

CASTILLÒA (for Castillejo, the Spanish botanist) *Moràceæ*. Laticiferous trees, of which *C. elastica* Cerv., is one of the important rubber-producing plants. There are 2 or 3 species, in Cuba and Cent. Amer. Lvs. alternate, short-petioled, often large, entire or toothed: plant monœcious, the sexes borne in the same cluster; sterile fl. with no perianth, stamens numerous and crowded, with scales intermixed, fertile fls. with 4-lobed perianth, including the short-styled ovary. fr. a crustaceous pericarp containing a pendulous seed. The cult. of *C. elastica* for rubber is described in Cyclo. Amer. Agric., Vol. II, p. 557.

CASTOR BEAN, CASTOR-OIL PLANT: *Ricinus*.

CASUARÌNA (said to be derived from *Casuarius*, the Cassowary, from resemblance of the branches to the feathers) *Casuarinàceæ*. BEEFWOOD. SHE-OAK. Odd slender-branched leafless trees and shrubs grown in warm regions and rarely seen under glass. They are thin-topped trees of striking appearance.

Casuarinas are usually classified near the walnut and hickory tribes, although very unlike them—or other known plants—in botanical characters. They are jointed and leafless plants, somewhat suggesting equisetums in gross appearance. Flowers are unisexual; staminate in cylindrical terminal spikes, each fl. consisting of a stamen inclosed in 4 scales, 2 of the scales being attached to the filament, pistillate fls. in dense heads borne in the axils, and ripening into globular or oblong cones, composed of 1-ovuled ovaries subtended by bracts. fr. a winged nutlet.—About 25 species in Austral., New Caledonia and E. Indies. The species fall into 2 groups, those having cylindrical and verticillate branches, and those having 4-angled and only imperfectly verticillate branches. The species bear small toothed sheaths at the joints.

Beefwood is planted in the extreme South for its very odd habit and also to hold sands of the seacoast. The wood burns quickly, and is very hard and durable. The redness of the wood has given the popular name, beefwood.—The species are remarkable for rapid growth. They grow well in brackish and alkaline soils. Propagated by seeds and by cuttings of partly ripened wood.



837. Casuarina equisetifolia. (×½)

equisetifòlia, Linn. Fig. 837. Tree, becoming 150 ft. high in favorable climates, and a most rapid grower. branches drooping, pale green, simple, terete or nearly so, the internodes very short (less than ¼ in.); sheath-teeth 7 (6–8) lanceolate and appressed: staminate cone nearly terete, pistillate cone short-peduncled, ellipsoidal, about ½-in. diam. Widely distributed in the farther Old World tropics, and the best-known species in this country (in S. Fla. and Calif. and south). Gn. M. 7: 21. L. B. C. 7: 607.—The wood is valuable for many purposes. The casuarinas are known as "oak" in Austral.

Cunninghamiàna, Miq. Tree with slender branches, much like *C. equisetifolia,* but cones smaller, about ½in. diam., globular and very irregular, with prominent valves. Austral.—Described as a rapid-growing tree in Calif., with strong and dense growth and numerous fine branches with very short internodes

stricta, Dry. (*C. quadrivàlvis,* Labill.). Becoming 20–30 ft. high: branches erect, simple, 6–7-angled, scarcely green, internodes short, as in the latter sheath-teeth usually 7, ovate-lanceolate and appressed staminate cone slender, pistillate cone nearly sessile, oblong (sometimes staminate above), about 14-sided, 1 in. diam. Austral. Gn M. 7 21.

torulòsa, Dry. (*C. tenuissima,* Sieber) Reaches 70 or 80 ft. branches erect, capillary, mostly terete, internodes short: sheath-teeth 4, very short, triangular appressed: staminate cones filiform; pistillate cones ellipsoidal, 8–10-sided. Austral

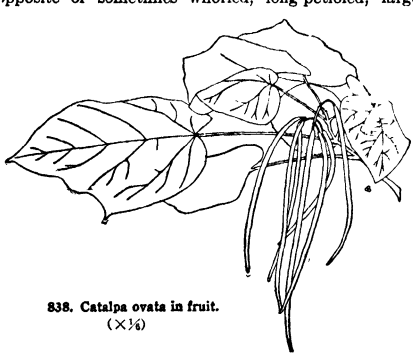
sumatràna, Jungh Shrub with dense very slender branches which are sharply angled, the internodes often very short, the sheath-teeth short. cone large, elliptical or globose, the valves thick and concave-truncate at apex. Sumatra.—Offered in England, and the branches said to be useful for bouquets, very much branched

L. H. B.

CATÁLPA (the Indian name of *C. bignonioides*) *Bignoniàceæ.* Ornamental trees, often cultivated for their handsome flowers appearing in large and showy panicles in summer, and for their heavy foliage

Leaves usually deciduous, opposite, long-petioled, entire or coarsely lobed: fls in terminal panicles; calyx splitting irregularly or 2-lipped, corolla campanulate, 2-lipped, with 2 smaller upper and 3 larger lower lobes; fertile stamens 2, curved, with diverging anther-sacs, not exceeding the tube of the corolla; style 2-lobed at the apex, slightly longer than the stamens: fr a very long cylindrical caps., separating into 2 valves, with numerous small oblong compressed seeds bearing a tuft of white hairs on each end.—About 10 species in N. Amer., W. India and E. Asia, of which 6 are hardy in the northern temperate regions

Catalpas are deciduous or rarely evergreen trees with opposite or sometimes whorled, long-petioled, large



838. Catalpa ovata in fruit. (×⅙)

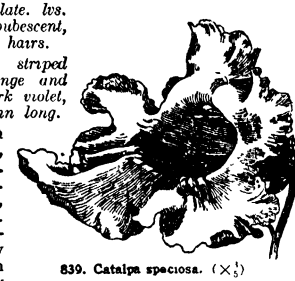
and simple leaves emitting in most species a disagreeable odor when bruised, and with white, pinkish or yellowish flowers in large and showy panicles followed by very long and narrow cylindric pods.

The coarse-grained and soft wood is very durable in the ground, and, therefore, much valued for fence-psts and railway ties. *Catalpa bignonioides* and particularly *C. speciosa* are sometimes planted as avenue trees. For formal gardens, if low round-headed trees are desired, *C. bignonioides* var. *nana* is to be recommended. They grow in almost any somewhat moist soil, and are hardy as far north as New England. Propagated by seeds sown in spring, in the North, best with slight bottom heat, or by cuttings from ripe wood, the varieties often by softwood cuttings in early summer or by grafting on seedlings or on roots under glass in spring, also increased sometimes by layers and root cuttings.

A. *Infl. paniculate. lvs. usually pubescent, with simple hairs.*

B. *Fls. yellow, striped inside orange and spotted dark violet, less than 1 in long.*

ovàta, Don (*C. Kæmpferi,* Sieb & Zucc *C. Hénryi,* Dode). Fig. 838. Tree, to 20 ft.: lvs. broadly cordate-ovate, abruptly acuminate, often 3-5-lobed, nearly glabrous at length, with reddish spots in the axils of the veins beneath, 5–8 in. long panicles many-fld., 4–7 in long, fragrant June China, much cult. in Japan B M 6611. I H. 9:319 L I 10 S I F 2 71.—Hardier than the American species



839. Catalpa speciosa. (×⅕)

BB *Fls. white, with 2 yellow stripes inside, and spotted purplish brown, 1½–2 in long*

bignonioides, Walt (*C. Catálpa,* Karst *C. syringifòlia,* Sims) Catalpa Indian Bean Tree, 20–50 ft: lvs. often whorled, cordate-ovate, abruptly acuminate, sometimes with 2 lateral lobes, pubescent beneath, 5–8 in. long, of unpleasant odor panicles many-fld; fls about 2 in diam, thickly spotted inside pod 6–20 in. long, ¼–⅓in thick June, July Southern states, north to Tenn., often naturalized elsewhere B M 1094 L B C 13 1285 S S 6 288–9 Gng 6 118–9. G F 3 537, 539 J H III 32 121 G C III 21 298, 29 167, 44 10, 312 F E 23 479 G W 7, p 88 G 23 481 G M 37 627 Gn 22, p 74, 26, p 164–5, 33, p 393, 36, p 239, 66, p 205.—Usually low tree, with very wide-spreading branches Not much used medicinally, but pods and seeds said to possess antispasmodic, cardiac, and sedative properties bark anthelmintic, alterative There are some garden forms Var **aùrea,** Lav Lvs. yellow G M 53 709 Var **nàna,** Bur (*C. Búnge,* Hort., not C A Mey.). Forms a dense, round bush, often grafted high Gng 3:195. M D.G. 1903.616. F E. 14, p 31

speciòsa, Warder Figs. 839, 840. (*C. cordifòlia,* Jaume, partly) Western Catalpa. Tree, to 100 ft: lvs. cordate-ovate, long-acuminate, pubescent beneath, 8–12 in long: panicles comparatively few-fld; fls about 2½ in. diam, inconspicuously spotted inside: pod ½–¾in. thick June From S Ill and Ind to La and Miss. S S 6:290–1 R H. 1895·136 M.D.G. 1903 229–30 (habit).—A very desirable ornamental tree, closely allied to the former, but taller and hardier. Properties similar to *C. bignonioides.* Var **pulverulénta,** Paul & Son. Lvs. freely dotted with white or cream color. G.M 53:30. G. 30.289 F E 31.319

hýbrida, Spaeth (*C. Teàsii,* Penhall. *C. Teasiàna,* Dode). Hybrid Catalpa. Hybrid between *C. bignonioides* and *C. ovata.* Large tree, intermediate between the parents: the lvs. resemble more those of *C. ovata,* and are purplish when unfolding, but much larger and slightly pubescent beneath, while the fls. are more like *B bignonioides,* but smaller and with the infl. often twice as long Originated at J. C. Teas' nursery at Baysville, Ind. G.F. 2·305. Gt. 47:1454. G.W. 3, p. 569.—A very valuable tree, flow-

ering profusely; of rapid growth and hardy. Seedlings usually resemble *C. ovata*. Var **japónica,** Rehd. (*C japónica*, Dode). Lvs broader and more abruptly acuminate, nearly glabrous beneath Var **purpùrea,** Rehd (*C. hybrida* var. *atropurpùrea*, Spaeth. *C. bignonioides* var *purpùrea*, Hort.). Lvs dark purple when young, green at length

AA. *Infl racemose, peduncls very slender, 1–1½ in. long, occasionally the lower ones with 2 or 3 fls*

B *Lvs pubescent or tomentose beneath, with branched hairs.*

Fárgesii, Bur Tree, to 60 ft : lvs ovate, acuminate, rounded at the base, entire, slightly pubescent above, densely beneath, 3–6 in long racemes pubescent, 7–10-fld ; fls. about 1½ in long, rosy pink with purplish brown dots in throat pod to 2 ft long, ¼–½in. thick. W China. Nouv. Arch Mus Paris III 6·3

BB *Lvs quite glabrous.*

Ducloùxii, Dode (*C sutchuenénsis*, Dode). Tree, to 80 ft lvs ovate, acuminate, usually rounded or subcordate at the base, with purple spots in the axils of the veins beneath, 5–8 in long and often 4 or 5 in broad: racemes 5–15-fld , the lower branches sometimes with 2 or 3 fls ; fls rosy pink with orange markings in throat, 1½–1¾ in long pod about 2 ft long and ¼–½in. thick. Cent China

Búngei, C A Mey. Small tree lvs narrowly triangular-ovate, entire or with 1 or few pointed teeth near the base, long-acuminate, truncate or sometimes broadly cuneate at the base, with purple spots in the axils beneath, 3–6 in long and not over 3 in wide· racemes 3-12-fld , fls white with purple spot, 1–1½ in. long pod 12–15 in long N China Nouv Arch Mus Paris III 6 4 —Has proved perfectly hardy at the Arnold Arboretum Var **heterophýlla,** C A Mey (*C. heterophylla*, Dode) Lvs. with several pointed teeth near the base. racemes 3–5-fld

C longissima, Sims Tree to 50 ft lvs oblong-ovate, coriaceous fls small, white W Indies, often planted as shade tree in Cuba

ALFRED REHDER.

CATANÁNCHE (Greek name, referring to ancient custom of using the plant in making love-philters) *Compósitæ*. Annual or perennial garden herbs, grown for the bloom.

Leaves crowded at the base of the st , and linear or lanceolate· head long-peduncled, blue or yellow, achene oblong, ribbed and usually villose or setose. pappus of 5–7 lanceolate long-acuminate scales —A half dozen species in the Medit region Of easiest cult in any garden soil, particularly if light Prop by seeds and division Useful for cutting

cærùlea, Linn Perennial, 2 ft.: lvs tomentose, lanceolate and few-toothed, 3-nerved. fl-heads 2 in. across, with wide flat-toothed blue rays, on long slender sts Blooms in June, July and Aug S Eu B M. 293. R H. 1890, p. 523. G 28:541 Gn. 42, p. 25; 55: 368. Var. **álba,** Hort , has white fls Gn. 55:368. Var. **bícolor,** Hort , has white margin and blue center Often used as everlastings. L. H B.

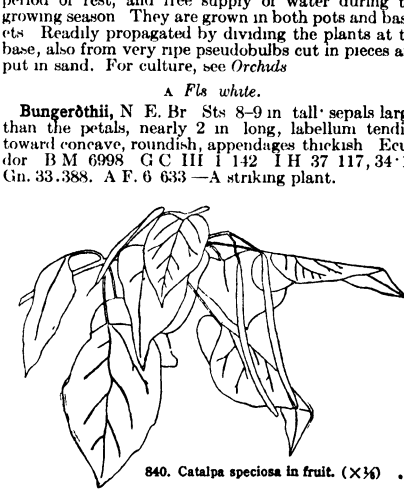
CATASÈTUM (Greek for *downward* or *backward*, and *bristle*). *Orchidàceæ*. Epiphytic or terrestrial orchids, requiring hothouse conditions

Stems short fusiform lvs plaited, membranaceous. scapes basal; fls. in racemes, globose or expanded; labellum fleshy, column erect, provided with sensitive appendages which, when touched, cause the pollen-masses to fly out; pollinia 2. The genus includes Monachanthus and Myanthus.—There are about 50 or 60 species in the American tropics.

The flowers are in racemes or spikes, firm in texture, and white or in shades of green, yellow, brown or purple. Catasetums are not much cultivated, since most of the species are not showy, but they are interesting to the botanist and amateur because of the striking ejection of the pollen-masses Gardeners often have trouble with catasetums, but they are not difficult to grow if given good care They need a high temperature, long period of rest, and free supply of water during the growing season They are grown in both pots and baskets Readily propagated by dividing the plants at the base, also from very ripe pseudobulbs cut in pieces and put in sand. For culture, see *Orchids*

A *Fls white.*

Bungerôthii, N E. Br Sts 8–9 in tall· sepals larger than the petals, nearly 2 in long, labellum tending toward concave, roundish, appendages thickish Ecuador B M 6998 G C III 1 142 I H 37 117, 34·10. Gn. 33.388. A F. 6 633 —A striking plant.



840. Catalpa speciosa in fruit. (×⅙)

AA *Fls. yellowish, more or less marked with brown or red*

macrocárpum, Rich (*C Clàveringi*, Lindl *C tridentàtum*, Hook) Fls large, nearly 3¼ in across; petals and sepals yellow, verging on green, spotted with reddish brown, labellum yellow Guiana B M 2559, 3329 I H. 33:619 Var **rùbrum,** Hort A red-fld. form

fimbriàtum, Lindl. & Paxt Pseudobulbs 2–3 in long raceme pendulous, 8- or more-fld ; fls 2½ in across, sepals whitish or pale yellow, closely barred with red Brazil B M 7158 A F 6 609 Var **aûreum,** Hort Fls pale green, slightly marked with rose, center of lip deep golden yellow

longifòlium, Lindl Pseudobulbs deflexed· lvs. narrow and glaucous, reaching 3 ft fls on drooping, compact spikes; sepals and petals greenish yellow tipped with dull red; lip helmet-like, orange-yellow. Guiana —Epiphyte.

AAA *Fls essentially red or brownish.*

decípiens, Reichb f Fls 1½ in across; sepals and petals lanceolate, red-brown and spotted; lip saccate, yellowish outside and red-brown inside Venezuela A F. 6.609

AAAA. *Fls. many-colored, grotesque*

Gnòmus, André Pseudobulb oblong-ovate and alternate, articulated fls in a long loose raceme on slender pedicels; sepals greenish and purple-barred; 2 lateral petals spreading, concave, purple; lip bluntly conical, olive-green spotted outside, ivory-white within, fringed above S. Amer. I H 24:270. A F. 12:293

C barbàtum, Lindl. Fls green, blotched with purple. Guiana. —*C callòsum*, Lindl. Odd: fls. with chocolate-brown, narrow-lanceolate sepals and petals, lip greenish, speckled with red Venezuela B M 4219, 6648 —*C Christyànum*, Reichb f Sepals and petals usually chocolate, lip greenish yellow, purple fringed S Amer (?) G C III 18 617 B M. 8007.—*C. Claesiànum*, Lind & Cogn Fls. greenish yellow, lip fringed along sides. Brazil G C III 44 211 —*C Cliftonii*, Hort. Probably a form of C Bungerothii G M. 54:593 (desc) —*C Colmanni*, Hort. Fine yellow fl with 3-lobed lip stained with deep crimson.—*C discolor*, Lindl Fls. purple. An old sort, now rarely seen. Brazil.—*C. eburneum*, Rolfe.

Fls. ivory-white; sac of lip deep yellow Colombia —*C. Garnettiànum*, Rolfe. Allied to C. barbatum Fls. small, sepals and petals very narrow, green, with large bars of red-brown; lip white, fringed Amazon. B M. 7069 —*C. imperiàle*, Lind & Cogn Sepals and petals ovate-acute, white, purple-spotted, lip orbicular-reniform, purple in center and white-margined. G C III. 17 329 S H. 1, p. 369 J H III. 30 25 —*C. labiàtum*, Rodr Scapes 1½ ft long, the male 10-fld, female 2-fld. Organ Mts *C Lindeni*, Cogn Fls large (as of C. Bungerothii), sepals and petals yellow, with purplish spots and bars, lip yellow, spotted at base G C III 17. 329 S H. 1, p 369 —*C. maculàtum*, Kunth Sepals acuminate, spotted with claret, petals broader, red-blotched, lip yellowish green outside, dark brown within Colombia and Nicaragua —*C murràbile*, Cogn Fls very large, the sepals and petals oblong-lanceolate, and yellowish, with purple spots and bars, lip kidney-shaped, bright yellow with 2 purple spots, toothed G C III 17 329 S H 1, p 369 —*C mónodon*, Kränzl Spike long with 6–8 greenish fls, lip flat, with fringes along border Brazil G C III 35 354 (desc) —*C pileàtum*, Reichb, var *aùreum*, Hort Fls creamy white, shaded with greenish yellow. G M 47 829, 831 — *C quàdridens*, Rolfe. Fls with pair of short, acute teeth situated at lower angles of abortive stigma.—*C. Rhamphàstos*, Hort Raceme few-fld, up to 10 in long, fls. pale green Andes of Colombia.—*C Schìrra*, Reichb f Compact fls fragrant, yellowish white, green-veined, lip 3-lobed Guiana G C II 7 304–5 —*C spinòsum*, Lindl (Myanthus spinosus, Hook) Lip spreading, with succulent hairs, bearing on upper side at base an erect 3-partite spine and a much larger one below the acumen Brazil B M 3892 —*C splèndens*, Cogn Intermediate between C Bungerothii and C macrocarpum Sepals greenish white with purplish center, petals white with many purple spots, lip cream-color, purple-marked Runs into many forms var. *àlbum*, Lind & Cogn, white or nearly so Var *Alcicæ*, Lind & Cogn Fls large, sepals and petals purplish, lip white, toothed Var. *aùreo-maculàtum* Bossch Yellow I H 43 54 Var. *atropurpùreum* Hort Blackish purple —*C tenebròsum*, Kränzl Fls almost black, very spreading Peru G C III 48 229 (desc) —*A Tracyànum*, Hort A provisional name for a distinct species with whitish green fls —*C virùli-fàrum*, Hook. Fls green, the lip conic, yellow inside Cent Amer B M 4017 — *C. Warscewiczii*, Lindl & Paxt. From Panama Now rarely seen.

OAKES AMES.
L. H. B.†

CATCHFLY: *Silene.*

CATECHU: *Acacia Catechu; Areca Catechu.*

CATERPILLARS. The worm-like pods of *Scorpìurus vermiculàta*, Linn., *S. subvillòsa*, Linn, and others (*Leguminòsæ*), are sometimes used as surprises in salads and soups; and for that purpose they are cultivated in parts of Europe, and seeds are sold in this country. They are sometimes catalogued as Worms. They are annuals of the easiest culture. The pods of *Medicàgo scutellàta*, Mill., and others are known as Snails The pods are not edible. European plants. A G. 13·681. L. H. B.

CATESBÆA (Mark Catesby, 1679–1749, author of natural histories of parts of N. Amer.). *Rubiàceæ*. Spiny shrubs of the W. Indies and one (*B. parviflora*) reaching the coast of Fla, of 6 species, one of which is offered in the trade: lvs small, opposite or fasciculate, mostly ovate or oblong: fls axillary and solitary, white, sometimes showy, 4-merous; corolla funnel-shaped, with short lobes, stamens 4, inserted deep in the tube: fr a globular berry. **C. spinòsa,** Linn, offered in Fla, is a slow-growing evergreen shrub from the W. Indies: lvs. ovate to obovate, nearly as long as the straight spines. fls. yellow, large and conspicuous, the corolla-tube tapering down to the middle and then very narrow or filiform, the segms. much shorter than the tube: berry ovoid, yellow, edible.—Recommended for hedges. L. H B.

CÀTHA (Arabian name). *Celastràceæ*. One evergreen spineless shrub of Arabia and Afr., and cult. in warm countries for the lvs., which are said to possess sustaining and recuperative properties and which are eaten by the Arabs or used in the preparation of a beverage. **C. edùlis,** Forsk. (*Celàstrus edùlis*, Vahl). KHAT. CAFTA. Glabrous, to 10 ft.: lvs. opposite, or on the leafy shoots alternate, thick, narrowly elliptic or oval-oblanceolate, serrate, narrowed to the short petiole, 4 in. or less long: fls small, white, in short axillary clusters; calyx 5-lobed, petals 5; stamens 5, borne on a disk: fr. an oblong or clavate caps., 3-valved, 1–3-seeded, ⅓in. long.—Recently offered in this country. The twigs and lvs. are an object of commerce in Arabia.
L. H. B.

CATMINT or CATNIP: *Nepeta.*

CATÓPSIS (Greek compound, of obscure application) *Bromeliàceæ*. Fifteen or more species in Trop. Amer, with strap-shaped or lanceolate mostly rosulate lvs and spikes or racemes of white or yellow fls terminating a scape, very little known in cult. sepals and petals separate to base, stamens shorter than the calyx; stigma subsessile They require the cultural conditions of the erect tillandsias *C. nìtida*, Griseb (*Tillàndsia nìtida*, Hook), from W Indies and S, is 6–18 in tall, with oblong-mucronate shining green lvs in rosettes, and white fls in slender spikes *C pendulifòra*, Wright. from Peru, is recently intro, with oblong-elliptic lvs. (6 in long) in a rosette and with thin denticulate margins, and white pendulous short-stalked fls. on a racemosely branched scape 1½ ft. high.

CAT-TAIL: *Typha.*

CÁTTLEYA (William Cattley, an early English horticulturist and naturalist) *Orchidàceæ* Epiphytic orchids, requiring intermediate temperatures

Pseudobulbs ovoid, clavate, fusiform or cylindric, short or elongated, smooth or furrowed, bearing 1–3 lvs lvs coriaceous: fls single or in clusters, borne usually at the apex of the pseudobulb, rarely on a leafy st. arising from the base of the pseudobulb, showy; sepals and petals similar or the petals much broader, membranous or fleshy, lip usually 3-lobed, lateral lobes commonly forming a tube inclosing the column, rarely the lateral lobes small; column clavate, fleshy, pollinia 4 —A genus of about 40 species, natives of continental Trop Amer, especially numerous in Brazil and in the Andean region Innumerable hybrids and horticultural forms have been named, those of the labiata group alone running into hundreds Showiest of all orchids, and of great commercial value.

The growing of cattleyas.

The cattleyas are indigenous to the western hemisphere only, Central and South America being the regions in which they abound, particularly in the latter, from the different countries of which large quantities are imported yearly During the last few years the collecting and importing of cattleyas into the United States has assumed large proportions, owing to a continually and steadily increased demand, not only by amateurs but also by the trade in general There are two particular reasons for this increased demand: first, the exquisitely beautiful flowers, combined with size and marvelous colors adapted for decorations at all sorts of functions, are never out of place, second, their easy culture. Florists and amateurs alike are beginning to realize that, after all, orchids are plants, and if only treated in a commonsense way they are by far easier to grow than a good many other plants, and especially so the cattleyas, provided some attention is paid to their requirements

Cattleyas, as a whole, delight in a genial atmosphere, with all the air possible when the outside temperature will permit. In summer, from May on to the end of October, air should be admitted day and night; thus there are no temperatures to be prescribed for these months. Later, when artificial heat has to be depended on, 50° to 55° at night is the best, bearing in mind that the earliest species to flower may be kept at the warmer end, and the later summer-blooming species, such as *C. Mossiæ* and *C. gigas*, may be wintered at the cooler end of the structure; thus beginning in autumn with *C. labiata*, *C. Percivaliana*, *C. Trianæ*, *C. Schrœderæ*, *C. Mossiæ*, *C. Mendelii;* and, last of all, *C. gigas*, in their regular order of bloom, these may be treated according to their season of flowering. One cannot change the



XXIII. Cattleya Lawrenceana.

time of blooming of a cattleya, that is to say force it as other plants may be forced, without injury to the plants and a poor quality of bloom, but they are often retarded by systematic cooler treatment.

The best potting material is the soft brown osmundine, used alone with no sphagnum moss unless it is possible to make this moss live, and even then it is of no value to the plants except as an index to the presence of moisture. Moss that is dead and inert is a detriment in the potting material of all orchids. The one imperative thing in the potting of cattleyas is that they be made perfectly firm in their receptacles; if loose potting is practised, the young roots are injured each time the plant is handled, and the material is like a sponge, holding too much moisture in suspension for the plants to do well, and, given a time when the roots do not dry out quickly, all will soon die.

Newly imported cattleyas, as they arrive from South America, are usually much dried up, due to the treatment given before shipment to avoid loss by decay or fermentation on the way. If the plants are washed well with soap and water, placed in an airy shaded house for a few weeks and allowed to plump up again, roots will soon be seen starting. At this time, pot each piece in a receptacle suitable to the size of the plant (never let it be too large, but always err on the minimum when in doubt), fill the pots half full of drainage if common flower-pots are used, and fill up with osmundine to the top, pressing this material in with a blunt-pointed stick so that the plant will be firm. Moisture from this time on for weeks may be applied by spraying overhead during bright days. If the pieces are large, baskets are preferable to pots, as there is more aeration through the material and the plants may be suspended and space economized. Newly established plants often bloom the first year, and one may get an idea of the infinite variety found among the plants, as no two are alike. Some districts known to collectors produce better forms than others, in fact, in certain localities, the plants found produce flowers of very inferior quality. It is becoming more difficult to collect orchids, especially cattleyas from their native habitats, transportation not having improved and the distance to travel being greater each time. In consequence of this, hybridizers are now turning their attention to the reproduction of fine forms true to themselves, with considerable success, and should the supply of wild plants fail, there cannot now, in view of the well-understood and successful methods of raising cattleyas, be a time when the plants will be unobtainable. Considering the variation found among the wild plants, it is to be expected that home-raised seedlings will vary; but if the best-known forms are used, and these only are worth the trial, one may expect a large measure of success.

In our climate there is no period when the cattleyas should be kept dry at the roots. The plants are either getting ready to bloom, in crop, or recuperating therefrom, and these three periods cover the year. One does not have to resort to drying to attain ripening as do the European cultivators, and failure here is often traceable to foreign training or text-books.

Established plants should be repotted at least every second year. This is as long as the osmundine will remain suitable for the roots to ramify in, and if the plants are grown in pots, immerse the same a day before if the roots are dry, or most of them will remain attached to the pots. Remove all decayed portions of material and roots, wash with clean water, and repot as with newly imported plants, remembering always that a size too large often proves fatal to success. Plants that have been newly potted must not be placed among others that have not received attention, but all should be put in a situation in which they can be treated to little water at the roots for several weeks until the weather is such that there is no danger of their becoming overwatered. Cattleyas should be attended to in this respect in the winter months, taking first *C. labiata*, as it is the first to start growing, then *C. Trianæ;* the later kinds may be potted before flowering with less injury than afterwards, if done with care.

In hot weather, cattleyas should always be watered in the evening or latter part of the day. A generous spraying overhead will supply the moisture at a time when the roots get most of it, as may be seen by an examination in early morning. There is no danger of injury if an abundance of air is supplied. One has only to be careful during such times as the atmosphere outside is surcharged with moisture, then it is wise not to use any moisture inside even for a week at a time. This is when the dreaded "black spot" disease is often seen. It usually begins at the union of leaf and bulb, and when first seen, amputation must be practised to a point below infection, and dry sulfur and powdered charcoal applied at once as an absorbent. A small can of this ought always to be ready to hand, for if the disease gets down to the rhizome, several bulbs will be affected at once, and it is often difficult to save the plant. The disease is also highly infectious and may easily be transmitted to a healthy plant by means of a knife used to cut off diseased parts of another.



841. Cattleya Mendelii

Apart from seeds, the propagation of cattleyas is a slow process to be accomplished only by the cutting of the rhizome between the bulbs, leaving at least three of the leading ones and separating the older ones according to their strength or the dormant buds at the base that are visible. A clean cut or notch that almost severs the rhizome is the best, leaving the parts where they are until new growth and roots are made, then potting in small receptacles, wiring or staking the little pieces firmly. Apart from the three last-made bulbs on the rhizome, the older ones are a source of weakness to the plants and are better removed, and in the case of valuable forms utilized as above. This is the way all duplicates of the many albino varieties have been obtained. There are many white cattleyas bearing the same name, as *C. Trianæ alba* or *C. Mossiæ Wagneri*, for many have appeared among importations, but these differ in each individual and unless a plant is increased by division one cannot be sure of the same thing.

Opinions are divided as to the "feeding" of orchids. It is certain that when rain-water is saved in cisterns for the plants, and these happen to be in the vicinity of cities where soot collects on the roofs of the houses, the

plants show unusual vigor and in consequence of this, many have practised the use of fertilizers in exceedingly dilute proportions in all the water used on the plants, and some have had surprising results. The temptation, however, is always present to feel that if a little is good, more would be better, and herein lies the danger. When plant-foods are used in solution, they should be considered only as sufficient to make the difference between rain-water and that which comes out of a pipe

The best twelve varieties of cattleyas for commercial purposes, and, indeed, for amateurs also, are the following: *C. Trianæ*, fls Jan.–March; *C. Schroederæ*, fls March, Apr; *C. Mossiæ*, fls. April, May; *C. Mendelii*, fls Apr., May; *C. Warneri*, fls. May, June; *C. gigas*, fls. June, July; *C. aurea*, fls. June, July; *C. Gaskelliana*, fls. Aug., Sept; *C. Harrisoniana*, fls. Sept., Oct.; *C. labiata*, fls. Oct, Nov; *C. Bowringeana*, fls. Oct, Nov; *C Percivaliana*, fls. Dec.

With a number of plants of each of the above kinds, it will be seen that it is possible to have a succession of flowers from one end of the year to the other.

E. O. Orpet and John E. Lager.

The following American trade names belong to Lælia: *C. crispa*, *C. lobata*, *C marginata*, *C pumila*. See, also, the list of hybrids at the close of *Cattleya*. For *C. aurantiaca*, see *Epidendrum*

The cattleyas enter into various generic hybrids: consult, for example, *Brassocattlælia*, *Brassocattleya*, *Brasso-Lælia-Cattleya*, *Epicattleya*, *Læliocattleya*.

Of several of the following species, there are named varieties in the American trade, varying in stature, habit and particularly in the color of the flowers.

INDEX.

Aclandiæ, 1, 31
alba, 9, 10, 12, 13, 14, 16, 17, 22 26, 27.
albescens, 12, 13.
Alexandræ, 9
Amesiana, 14
amethystina, 24
amethystoglossa, 20
Aquinii, 24
Arembergii, 26
atropurpurea, 12, 13.
aurea, 4.
aureola, 9
autumnalis, 14, 21.
Backhousiana, 13.
Bassettii, 10.
Bertii, 11
bicolor, 2
Blumii, 11.
boelensis, 9.
boetzelaeriensis, 13.
bogotensis, 13
Bowringiana, 21
Brandneriana, 13.
brunoyensis, 13.
bulbosa, 33
cærulea, 9, 13, 16.
candida, 13, 27.
Carrieri, 9.
chocoensis, 13.
chrysotoxa, 4.
citrina, 19.
cœlestis, 9
Cooksoniæ, 14.
coundoniensis, 9, 13.
crocata, 7
Dawsonii, 10.
delicata, 13, 26.
Dixonæ, 11.
dolosa, 3
Dowiana, 4
DuBuysoniana, 29.
dulcis, 9
elatior, 30
Eldorado, 7.
enfieldensis, 13.
flavida, 18.
Floryæ, 9
Forbesii, 32.
fulgens, 9.
Gardneriana, 33.
Gaskelliana, 16.
gigantea, 11, 19, 27.
gigas, 12.
gloriosa, 12
Goodsonii, 13.
Goosensiana, 9.
grandiflora, 15
granulosa, 29
grataxiana, 13
guttata, 20, 28, 30.
hackbridgensis, 11
Harrisoniæ, 27
Harrisoniana, 27.
Harrisonii, 27.
Hodgkinsonii, 16.
Holfordii, 18.
Holmesii, 13.
Holtzeii, 13
imperialis, 12.
innocens, 26
intermedia, 24, 26.
jensenana, 4
Karwinskii, 19
Keteleerii, 20
labiata, 4, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17.
Lachneri, 11
Lambeanana, 11.
Lawrenceana, 5.
Leeana, 13
Lemoniei, 14
Leopoldii, 28.
leucoglossa, 11.
lilacina, 13
Loddigesii, 24, 26, 27.
Lowiæ, 11
Luddemanniana, 10.
luteola, 18.
macrostana, 11.
maculata, 27.
majestica, 11.
Malouana, 10.
Mariæ, 13.
marginata, 24.
Massangeana, 13.
Maudeæ, 11.
maxima, 6.
Mendelii, 11.
Meta, 13.
Meyeri, 18.
modesta, 18.
Mooreana, 13.
Morganiæ, 11.
Mossiæ, 9.
Naldereana, 14.
nigrescens, 1.
nobilior, 34.
odoratissima, 25.
ovata, 24
pallida, 16.
Papeianiana, 27.
Parthenia, 24.
Peetersii, 9.
Percivaliana, 15.
Perrinii, 14.
Pietæ, 11
princeps, 33.
Prinsii, 20.
punctatissima, 24.
quadricolor, 13.
refulgens, 13.
Regnellii, 31.
Reineckiana, 9.
Rex, 8.
rochellensis, 12.
Roezlii, 10
Rolfeæ, 13.
rosita, 4
rouseleana, 9
Russelliana, 29.
Sanderæ, 20.
Sanderiana, 12.
saturata, 12
Schilleriana, 31.
Schofieldiana, 29.
Schomburgkii, 25.
Schroederæ, 13.
Skinneri, 21, 22
speciosissima, 10.
splendens, 25, 26.
Stanleyi, 10
summitensis, 15.
superba, 14, 25.
superbissima, 27.
tessellata, 13.
Trianæ, 13.
trilabiata, 17.
triumphans, 13, 21.
vera, 14.
vestalis, 32
Victoriæ-reginæ, 23.
violacea, 25, 27.
Wageneri, 9.
Walkeriana, 3, 33, 34.
Wallisi, 7.
Warneri, 17.
Warocqueana, 14.
Warscewiczii, 12.
Wellesleyæ, 13.
wisetonensis, 11.

KEY TO THE SPECIES.

A. *Infl. terminal.*
- B. *Lateral lobes of lip small or wanting, the column exposed.*
  - C. *Peduncles 1-2-fld., from a very short spathe or naked pseudobulb fusiform, short.* . . . 1. **Aclandiæ**
  - CC. *Peduncles many-fld, from a large spathe pseudobulbs long* . . 2 **bicolor**
- BB. *Lateral lobes of lip large*
  - C. *Corners recurved, exposing column.* 3 **dolosa**
  - CC. *Corners not recurved, concealing column*
    - D. *Pseudobulbs 1-lvd.*
      - E. *Plants large. pseudobulbs fusiform or clavate fls large*
        - F *Sepals and petals yellow, lip ample, rich purple, beautifully veined and reticulated with gold* . 4 **Dowiana**
      - FF. *Sepals and petals not yellow*
        - G. *Petals about twice as broad as the sepals which are markedly undulate*
          - H. *Tube narrowly cylindric, the limb not striped.* 5. **Lawrenceana**
          - HH. *Tube cylindric-funnelform, the limb bordered with white and streaked with darker color, with a median yellow line* 6 **maxima**
        - GG. *Petals 3 times or more as broad as the sepals which are not undulate or but slightly so*
          - H. *Lip with a large orange blotch in the center, surrounded by circles of white and purple in order* . . 7. **Eldorado**
          - HH. *Lip with other color arrangement*
            - I. *The lip about as wide as or wider than the petals.*
              - J. *Tube of lip yellow; sepals and petals white* 8. **Rex**
              - JJ. *Tube white or colored other than yellow*
                - K. *Border of limb white, the center bright purple variegated with violet* 9 **Mossiæ**
                - KK. *Limb without white border*
                  - L. *Throat with a yellow or white eye on each side* 10 **Luddeman-[niana**
                  - LL. *Throat without eye*
                    - M. *Color of tube white, or the same as petals, limb purple-crimson* 11 **Mendelii**
                    - MM. *Color of tube and limb bright purple, throat with 2 yellow spots* 12 **Warscewiczii**
            - II. *The lip narrower than petals.*
              - J. *Limb much shorter than the tube, the margin relatively but little crisped* 13 **Trianæ**
              - JJ. *Limb about as long as the tube, the margin much crisped.*
                - K. *Throat with a golden eye on each side* . 14. **labiata**
                - KK. *Throat without eye*
                  - L. *Margin of limb different in color from the center*
                    - M. *Petals longer than the sepals and lip; fls. 4½–5 in across.* . . . . . 15. **Percivaliana**

KEY TO THE SPECIES, continued

MM. *Petals about as long as sepals and lip; fls. 6–7 in. across*.....16. **Gaskelliana**
LL. *Limb not margined*..17. **Warneri**
BB. *Plants small pseudobulbs ovate or oblong fls small, yellow*..18. **luteola**
DD. *Pseudobulbs 2–3-lvd.*
E. *Peduncle pendent, bearing usually a single yellow fl.; lip entire* ..... 19. **citrina**
EE. *Peduncle erect, bearing 2–10 fls or more; lip usually 3-lobed*
F. *Ground-color of sepals and petals not green nor brown.*
G. *With large purple spots*....20. **amethysto-glossa**
GG *Not spotted*
H *Fls 5–10; sepals and petals not fleshy*
I. *Lip emarginate; blooms in fall* ..... .21 **Bowringiana**
II *Lip acute, blooms in spring* . . .... .22. **Skinneri**
HH *Fls 2–5; sepals and petals fleshy.*
I. *Middle lobe of lip much broader than tube* 23. **Victoria-regina**
II. *Middle lobe of lip not broader than tube.*
J. *Color of sepals and petals pale or white; petals the same width as dorsal sepal* 24 **intermedia**
JJ. *Color of sepals and petals marked, petals broader than dorsal sepal*
K. *Lateral lobes of lip and petals acute* 25 **violacea**
KK *Lateral lobes of lip and petals obtuse*
L. *Lip distinctly 3-lobed, the nerves of the disk smooth*.. 26. **Loddigesii**
LL. *Lip indistinctly 3-lobed, the nerves of the disk rugose-thickened* . 27. **Harrisoniana**
FF *Ground-color of sepals and petals brown* ..... 28 **Leopoldii**
FFF *Ground-color of sepals and petals green.*
G *Lip warty or papillate.*
H *Claw long* . .29 **granulosa**
HH *Claw short or wanting* 30. **guttata**
GG. *Lip not warty nor papillate.*
H *Middle lobe much broader than the tube, sepals and petals spotted* . 31. **Schilleriana**
HH. *Middle lobe not broader than the tube, sepals and petals not spotted* 32 **Forbesii**
AA. *Infl. from the base of the pseudobulb*
B. *Pseudobulbs 1-lvd lateral lobes of lip separated, exposing column*.. 33. **Walkeriana**
BB. *Pseudobulbs 2-lvd.: lateral lobes of lip forming a tube, concealing column*.....34. **nobilior**

1. **Aclándiæ**, Lindl. Sts. 4–5 in. tall, bearing 2 or 3 lvs 2–3 in. long: peduncle with 1 or 2 fls. 3–4 in. across; sepals and petals similar, obtuse, greenish yellow, marked with spots of black-brown; lip fleshy in the middle, somewhat fiddle-shaped, the lateral lobes small, curved over the column, the middle lobe large, broadly reniform, undulate, rose-purple with darker veins. Brazil. B.M. 5039. C.O. 23. There is a var. **nigréscens.**

2. **bícolor**, Lindl. Pseudobulbs cylindric, deeply striate, 1–3 ft tall, 2-lvd lvs. 4–6 in. long, oblong-lanceolate: peduncle with 2–6 fragrant fls. 3–4 in. across; sepals oblong, acute, usually olive or bronze-green, the lateral falcate; petals like the sepals but undulate; lip crimson-purple, sometimes white-margined, the lateral lobes wanting, the middle lobe recurved, oblong-cuneate, bilobed, channeled in the center. Brazil. B.M. 4909. C O. 10. O.R. 10:305.

3 **dolòsa**, Reichb. (*C. Walkeriàna* var. *dolòsa*, Veitch). Pseudobulbs 4–6 in long, usually 2-lvd , the lvs oblong: peduncle 1- or 2-fld.; sepals and petals acute, rose-purple to lilac, the sepals oblong-lanceolate, the petals cuneate-ovate, lip 3-lobed, the lateral lobes erect, the middle lobe reniform, emarginate, amethyst-purple. Brazil. G C II 5 430–1. V.O. 2:49. A G. 11:159.

4. **Dowiàna**, Batem (*C labiàta* var. *Dowiàna*, Veitch) Pseudobulbs up to 1 ft tall, furrowed, 1-lvd.: lvs. up to 1 ft. long: peduncle 2–6-fld ; fls. 6–7 in across; sepals and petals nankeen-yellow, the sepals lanceolate, acute, less than half as wide as the undulate petals: lip ample, about as long as the petals, the tube yellow, striped with purple, the limb crisped, velvety, dark purple, finely and beautifully veined with golden lines which radiate from the median lines R H 1869·30 A F. 25:593; 21.838, 30 1078. C L A 11·45, 19 343. Costa Rica, where it was discovered by Warscewicz — It was rediscovered in 1864 by Mr Arce, who sent plants to Eu., where they were purchased by Messrs Veitch & Son, in whose establishment they flowered for the first time Var **aùrea**, Williams & Moore (var. *chrysotòxa*, Hort), has the sepals and petals of a deeper yellow and the golden veins on the lip more copious and anastomosing Colombia A F 6 563, 12: 10 F R 1 76 C O. 2*a* O R 19 17 Var **jenseniàna**, Hort A large and handsome form. Var **rósita**, Hort. Sepals creamy white, tinged with purple, petals rose-purple, tinged with yellow

5 **Lawrenceàna**, Reichb Pseudobulbs 12–15 in. tall, fusiform-clavate, compressed, furrowed, 1-lvd.: lvs oblong, 6–9 in long peduncle 5–8-fld , fls. 4–5 in. across, sepals and petals pale rosy purple to almost white, the sepals linear-oblong, the petals elliptic-oblong, undulate, about twice as wide as the sepals; lip with a narrowly cylindric tube, colored externally like the sepals and petals, the limb purple with a maroon blotch. Brit Guiana B M 7133 R 1 12.

6 **máxima**, Lindl Pseudobulbs about 1 ft tall, claviform, furrowed, compressed, 1-lvd. lvs oblong, 5–10 in. long: peduncle 3–6-fld ; fls. 4–5 in across; sepals and petals lilac or pale rose, acute, the sepals lanceolate-ligulate, the petals about twice as broad as the sepals, undulate or crisped; lip as long as petals, the limb crisped, pale rose or crimson-purple with a median yellow stripe, from which radiate darker lines, the border white. Ecuador and Peru. B M. 4902. F.S. 20.2136. F R. 1:298 C O. 13.

7. **Eldoràdo**, Lind (*C labiàta* var. *Eldoràdo*, Veitch)· Pseudobulbs 6–8 in tall, stout, 1-lvd. lvs oblong, 8–12 in long: peduncle with 1–3 fragrant fls. 5–6 in. across, sepals and petals pale rosy lilac passing to white, the sepals lanceolate, acute, the petals oval-rhomboid, obtuse, undulate; lip longer than lateral sepals, externally the same color as petals, the limb crisped, emarginate, a large central orange blotch surrounded by zones of white and purple Brazil. F S. 18.1826. C O. 26. Var. **crocàta**, Hort. Sepals and petals white or pale rose, the orange spot of lip extended in a broad line to the base. Var. **Wállisii**, Rand. (*C. Wallisii*, Lind.). Fls. pure white except golden spot on lip C O. 26*a*.

8. **Rex**, O'Brien. Pseudobulbs 8–14 in. tall, claviform or fusiform, furrowed, 1-lvd.: lvs. up to 1 ft long, oblong: peduncle with 3–6 fls 6–7 in. across; sepals and petals cream-white, the sepals acutish, linear-oblong, the petals obtuse, as long as sepals but 3 times their width, oval-rhomboid, undulate; lip about as long as lateral sepals, the tube yellow, veined with purple, the limb crisped, the front part margined white surround-

ing a crimson center veined with a lighter shade. Peruvian Andes. B.M. 8377. R.H. 1894:228. C.O. 22.

9. **Mŏssiæ,** Hook. (*C. Carrièri*, Houll. *C. labiàta* var. *Mŏssiæ*, Lindl. *C. Peètersii*, André). Pseudobulbs fusiform, compressed, furrowed, 12–15 in. tall, 1-lvd.: lvs. 6–8 in. long, oblong: peduncle with 3–5 fls. 6–7 in. across; sepals and petals rose, of equal length, the sepals lanceolate, the petals oval-elliptic, crisped, especially on upper margin; lip with the tube colored like petals, the limb ample, emarginate, strongly undulate-crisped, the center purple, variegated with violet, the margin white, the throat yellow lined with purple-crimson. La Guayra. B M. 3669. R H 1857, p. 322. S.H 1:149. O R. 18.241 C.O. 9. A G. 14:70. A.F. 6:563. Var **cærŭlea,** Cogn., has the sepals and petals and spot on the limb a pale blue-violet. C.O. 9e. Var. **Reineckiàna,** O'Brien (*C. Reineckiàna*, Reichb.), has the sepals, petals and external of tube white, the limb a mauve-lilac, bordered white, the throat yellow, veined purple-violet. C O 9*b*. Var. **Wăgeneri,** Veitch (*C. Wăgeneri*, Reichb.), has fls white except the small yellow spot on lip. O R p 24. Var **rouseleàna,** Hort., has rosy fls. Var **coundoniénsis,** Hort Fls large and richly colored. Var. **dúlcis,** Hort Fls rose-tinted; lip orange in center, rich rose-crimson in front, finely crimped. Var **boelénsis,** Hort Dark-colored form. Var. **cœléstis,** Hort. Fls. lavender-tinted Var. **fúlgens,** Hort. Fine fls in shape and color Var **Alexándræ,** Hort Fls pure white with tinge of rose-pink on lip. Var. **álba,** Hort. Fls. white Var **Goosensiàna,** Hort. Lip deep reddish violet, with white crimped margin; sepals and petals white Var. **aureòla,** Hort. Fls. large, white. Var. **Flŏryæ,** Hort. Fls. pure white.—A variable group

10. **Luddemanniàna,** Reichb. f. (*C labiàta* var *Luddemanniàna*, Reichb f *C. Dáwsonii*, Warner *C speciosissima*, Hort *C Roèzlii*, Reichb f *C. Malouàna*, Lind *C. Bássettii*, Hort) Pseudobulbs clavate, 8–12 in. tall, 1-lvd: lvs. oblong, 6–10 in long: peduncle 2–5 fld; fls 5–6 in across; sepals and petals rose-purple, suffused with white, the sepals oblong, acute, the petals elliptic, undulate; lip with the tube of same color as petals, the front lobe crisped, emarginate, amethyst-purple, the throat with 2 yellow or white blotches, separated by lines of amethyst-purple. Venezuela. C.O. 21. Var.



842. Cattleya Warscewiczii var. **gigas** (×⅓).

álba, Hort. Fls. white. O.R. 16:201. Var. **Stánleyi,** Hort Fls. white, disk of lip yellow, front lobe lined with purple.

11. **Méndelii,** Backh. (*C. labiàta* var. *Méndelii*, Reichb. f. *C. Mórganiæ*, Williams). Fig. 841. Pseudobulbs 12–16 in tall, compressed, furrowed, 1-lvd · lvs. oblong, 6–10 in long: peduncle with 2 or 3 fls. 7–8 in. across; sepals and petals white, or often tinted pale rosy mauve, the sepals oblong-lanceolate, the petals obliquely oval, obtuse, crisped; lip with the tube white or colored like petals, the front lobe much crisped, rich crimson-purple abruptly passing into the yellow throat which is reddish streaked. Colombia. O R. 1.273; 10:233. S H 2:413. C.O. 19. Var. **Blúntii,** Hort., has the fls white, except a small yellow spot on lip. Var. **Maŭdeæ,** Hort. White with rose markings on the lip. Var. **gigantèa,** Hort., has a very large lip Var. **hackbridgénsis,** Hort. Petals blotched with crimson. Var. **Bértii,** Hort. Fls. white tinted with rose Var. **leucoglóssa,** Hort. Sepals blush tinted. Var. **Lôwiæ,** Hort. Lip white, pale purple at apex. Var **wisetonénsis,** Hort. Lip rich rose-purple, delicately veined, throat yellow veined with reddish purple. Var. **macroziàna,** Hort. Fls. very large. R H. 1903, p. 253 (desc) Var **Láchneri,** Hort. Lip curiously colored, front lobe having a broad marginal band of dark purple sparingly blotched with white and an inner band of lighter purple Var. **Piètiæ,** Hort Fls. nearly white, lip marked with pink. Var. **majéstica,** Hort. Fls large, white Var. **Díxonæ,** Hort Attractive blush-pink form. Var. **Lambeanàna,** Hort. Fls. white.

12. **Warscewíczii,** Reichb. f. (*C. labiàta* var. *Warscewíczii*, Reichb. f *C. gloriòsa*, Carr. *C. imperiàlis*, Wallis). Pseudobulbs 1 ft or more tall, stout, compressed, furrowed, 1-lvd: lvs. oblong, 8–10 in. long peduncle with 2 or 3 fls. 7–9 in. across; sepals and petals rosy mauve, the sepals lanceolate, acute, the petals oval, obtuse, undulate; lip entirely bright purple except 2 yellow spots and lines of the same color in the throat, crisped, the front lobe ample. Colombia. O R. 12·241. G C III. 22:163; 42:312. Gn. 33, p 18. C.O. 1. Var. **gigas,** Hort (var. *Sanderiàna*, Hort. *C. gìgas*, Lind. & André. *C. Sanderiàna*, Hort. *C. labiàta* var *Sanderiàna*, Hort) Fig 842 A noble form, the sepals and petals dark rose, with a deep purple-magenta lip, the fls. larger than those of any other form of the labiata group. Colombia I.H 21.178. Gn. 45, p 445. G F 1.437. A G. 19 July 23, suppl. F R. 1.77, 674. F.E. 10.892. C L A. 11.42, 44 The following forms of this variety occur· *álba*, fls pure white, the rarest of all cattleyas (O R 18.232); var *albéscens*, sepals and petals white, with faint blush, the lip rose-purple, fringed; var. *atropurpùrea*, of deeper color, var. *rochellénsis*, sepals and petals white, the lip with the faintest trace of color Var. **saturàta,** Hort. Fls. bright rose, with ruby-crimson lip.

13. **Triànæ,** Lind. & Reichb f. (*C. labiàta* var. *Triànæ*, Duch. *C. Leedna*, Sander. *C. Rollissoniàna*, Moore. *C. quadricolor*, Batem. *C Massangeàna*, Reichb. f. *C bogoténsis*, Lind.). Fig. 843. Pseudobulbs about 1 ft. tall, clavate, 1-lvd: lvs. oblong, 6–8 in. long: peduncle bearing 2 or 3 fls. about 6 in across; sepals and petals a delicate rose to white, the sepals oblong-lanceolate, the petals much broader than sepals, obtuse, oval-rhomboid, crisped; lip narrower than in the other related forms, the tube rose, the front lobe purple, less crisped than in most of the related species, emarginate, the throat yellow, often streaked with deeper color. Colombia. O R. 6:145. B.M. 5504. R.H. 1860, pp. 406–7. A.G. 17:177. Gng. 3:151. A F. 6:607; 13:715. F.E. 9:325. F.R. 1:672–3. C.O. 5.

S.H. 1:11, 27; 2:403, 405. Var. **álba,** Hort. Fls. white, except yellow blotch in throat C O. 5*a*. Var **atropurpùrea,** Hort. Fls. crimson-purple. Var. **Backhousiàna,** Hort Sepals and petals rose-purple, the petals strongly marked with amethyst-purple at the apex, the tube of lip rose-purple, the front lobe purple-magenta. C O 5*e*. Var. **chocoénsis,** Hort. Fls. very fragrant, not fully expanding, the sepals and petals white, sometimes flushed pale lilac I H. 20·120 A F. 6: 563 Var **delicàta,** Hort. Sepals and petals white, faintly flushed pale amethyst-purple, the deeper lip with a pale yellow spot F M. 1·8 Var **Schrœderæ,** Hort (*C. Schrœderæ*, Reichb f) Fls fragrant, the sepals and petals a delicate blush, faintly suffused with white, the petals and broader lip much more crisped than in other forms of this species G C III. 20 73 A G 15 211 O R 11:177. C L A 11.45 F E 9·331 The following forms of this variety occur *álba*, the fls pure white, *álbescens*, the fls nearly white; *cærùlea*, the lip a bluish color, *Mèla*, sepals and petals pink, the throat bright yellow, *lilacìna*, lilac, *refúlgens* Var **grataxiàna,** Hort A large and richly colored form Var **cándida,** Hort Fls snow-white, lip with faint violet spot Var **coundoniénsis,** Hort Purple-rose sepals and petals Var **Máriæ,** Hort Silvery white sepals and petals veined with pink, front of lip deep magenta-crimson, with 2 yellow blotches on throat Var **triúmphans,** Hort Sepals and petals rose-colored, lip rich purple with an orange-yellow tube Var **enfieldiénsis,** Hort Fls white, tip of lip blush-pink Var **boetzelæriénsis,** Hort Rose-colored form Var **tessellàta,** Hort Large rose-colored form curiously marked Var **Brandneriàna,** Hort Anterior part of lip dark purple-violet Var **Hòltzei,** Hort Lip dark Var. **Wéllesleyæ,** Hort A pretty white form Var **Mooreàna,** Hort Sepals and petals light rosy lilac, lip ruby-claret color, orange at base Var **Hòlmesii,** Hort Broad petals and rich rose-purple lip Var. **brunoyénsis,** Hort Sepals and petals mauve Var. **Goodsònii,** Hort Richly colored, petals flushed with deep rose.



843. Cattleya Trianæ (×½)

14. **labiàta,** Lindl (*C. Lemoìnei*, Lindl. *C. Naldereàna*, Reichb. f *C. Pérrinii*, Endl. *C. labiàta vèra*, Veitch *C labiàta autumnàlis*, L Lind *C labiàta* var. *Warocqueàna*, Rolfe *C Warocqueàna*, L Lind). Pseudobulbs claviform, compressed, furrowed, 4–8 in. tall, 1-lvd. lvs 5–7 in long, ovate or oblong· peduncle, from a double spathe, bearing 3–5 fls about 6 in across; sepals and petals usually rose-lilac, the sepals lanceolate, the petals undulate, lip with the tube colored usually like the petals, the front lobe deeply emarginate, undulate-crisped, commonly a violet-purple with deeper veins, the color running in streaks to the yellow throat which has an orange spot each side The color-variations of this species are numerous Brazil B R 32·35, 1859 O R. 16.281. B M. 3998. Gt. 5:146. F.S. 1893–4. P M 4·121. A G. 17 65; 19:811. G C III.. 19·13. A F. 6:607. F R. 1:8; 2:531.—Intro from the Organ Mts in S. Brazil in 1818 Var. **álba,** Hort Fls. white, except yellow throat. C O. 3 Var. **Amesiàna,** Hort. Sepals and petals white, the lip lilac. Gn. 62, p. 401 Var. **Cooksònіæ, Hort.** Fls. white, except the crimson-purple lip with a narrow white margin. Var. **supérba,** Hort. Sepals and petals deep rose, with a deep crimson-purple lip.

15. **Percivaliàna,** O'Brien (*C. labiàta* var *Percivaliàna*, Reichb f) Pseudobulbs up to 1 ft. tall, clavate, strongly furrowed when old, 1-lvd.. lvs. oblong peduncle bearing 2 or 3 fls 4–5 in across; sepals and petals commonly rose-lilac, tinted purple-amethyst, the sepals linear-lanceolate, the petals longer than the sepals, crisped, lip rather small, shorter than the petals, the tube of the same color as petals, tinged with yellow, the front lobe purple-crimson, shaded with maroon, the undulate border lilac, the throat yellow to orange, streaked with purple Venezuela C O 7. F R. 1 297 J H III 32·179 Var. **grandiflòra,** Hort Fls larger, the sepals and petals bright rose, the petals strongly crisped above, the lip with the tube yellow-orange variegated with rose, the front lobe maroon-purple with a bright rose border, the throat orange-yellow C O 7*a* Var **summitènsis,** Hort Sepals and petals a pale delicate pink

16 **Gaskelliàna,** Reichb f (*C. labiàta* var *pùllula*, Williams *C. labiàta* var. *Gaskelliàna*, Sander) Pseudobulbs 8–12 in tall, oblong-fusiform, compressed, furrowed, 1-lvd · lvs 8–12 in long, oblong· peduncle bearing 2 or 3 lfts 6–7 in across, sepals and petals of equal length, commonly purple-violet, suffused with white, the color sometimes deeper and more uniform, rarely marked with a median band of white, the sepals lanceolate, the petals oval, undulate, lip as long as the petals, the tube of same color as petals, the front lobe emarginate, undulate, purple-violet, with a pale border, the throat yellow streaked with darker yellow, bordered on each side with a zone of yellowish white Brazil and Venezuela I H 33·613. A F. 6:185; 30 662 Var. **álba,** Williams Sepals and petals pure white, the lip cream-white, the throat a pale yellow streaked with darker yellow C.O 20*a*. Var. **cærùlea,** Hort Fls pure white with bluish spot on base of lip. Var **Hódgkinsonii,** Hort Sepals and petals white; front of lip crimson.

17 **Wárneri,** Moore (*C. trilabiàta*, Rodr. *C. labiàta* var *Wárneri*, Veitch). Pseudobulbs 4–8 in. tall, cylindric or fusiform, furrowed, 1-lvd.: lvs. oblong, 6–7 in. long peduncle with 3–5 fls. 6-8 in across; sepals and petals rosy mauve, the sepals lanceolate, the petals oval, lip shorter than lateral sepals, the tube the color of the petals, the front lobe strongly crisped, emarginate, bright purple-violet, the throat yellow-orange, streaked with white or pale lilac Brazil. C O. 12. A F 6·563 —Very like *C. labiata*, but flowering in late spring and early summer Var **álba,** Hort. Fls. white, except the pale yellow throat, streaked with orange-yellow. C O. 12*a*.

18 **lutèola,** Lindl (*C. Hòlfordi*, Hort. *C. flàvida*, Klotzsch. *C. Mèyeri*, Regel. *C. modèsta*, Mey). Dwarf· pseudobulbs 2–3 in. long, ovoid, 1-lvd.. lvs. 3–4 in. long, elliptic-oblong: peduncles bearing 2–5 fls. about 2 in. across; sepals and petals similar, yellow, oblong-lanceolate; lip nearly orbicular when spread

out, yellow, the middle lobe crisped, whitish on margin, the side lobes sometimes streaked purple inside. Brazil. B.M. 5032. F S. 23:2479.

19. **citrina,** Lindl. (*C. Karwinskii,* Mart.). Fig. 844. Pseudobulbs 2–3 in. long, ovoid, 2–3-lvd.: lvs. 4–7 in. long, ligulate, acute, glaucous: peduncle pendent, bearing usually a single fragrant fl., rarely 2 or 3 fls, yellow except the white border of front lobe of lip; sepals oblong, acute, the petals cuneiform-oblong; lip longer than the petals. Mex. B M. 3742 J H III 30:399. Gn 33, p 535 C O 6. F S. 16·1689 Gt 27·931 R 1:20. Var. **gigantèa,** Hort. Fls. large and intensely colored.



844 Cattleya citrina. (×¼)

20 **amethystoglóssa,** Lind & Reichb f. (*C., guttàta* var *Prinzii,* Reichb *C. Prinzii,* Hort *C. guttàta* var *Keteleèrii,* Houl). Pseudobulbs 1½–3 ft , cylindric, 2-lvd : lvs 6–12 in long, elliptic-oblong. peduncles 5–8-fld ; fls 3½–4½ in across; sepals and petals white, suffused with rose-purple, spotted amethyst-purple, especially on the upper half, the dorsal sepal linear-oblong, the lateral falcate, the petals obovate, rounded at apex, lip much shorter than petals, the lateral lobes erect, purple at apex, the middle lobe broader than long, emarginate or 2-lobed, violet-purple, the radiating ridges papillose Brazil B M 5683 R H 1869: 210 G C III 38·105 Var. **Sánderæ,** Hort. A creamy white form

21 **Bowringiàna** Veitch (*C. autumnàlis,* Hort *C. Skinneri* var *Bowringiàna,* Kranzl). Pseudobulbs 10–20 in tall, stout, fusiform above, 2-lvd . lvs 6–8 in. long, oblong· peduncle bearing 5–12 fls. 2½–3 in across, sepals, petals, and tube of the lip rose-purple, the sepals acute, oblong, somewhat undulate, the petals oval-oblong, obtuse, undulate; lip shorter than the lateral sepals, the front lobe emarginate, the throat with a large white spot, surrounded by a zone of bright maroon and bordered with deep purple. Honduras R B. 21:37. R.H.1890:300. G.C III. 39·114. A F 19:651;34·804. C O. 24. O R. 12.361;16.337. Var. **triúmphans,** Hort. Fls. rich purple.

22. **Skinneri,** Lindl. (*Epidéndrum Hugelìanum,* Reichb.). Flower of St. Sebastian. Pseudobulbs 5–10 in. tall, 2-lvd.: lvs. 6–8 in. long, oblong-oval: peduncle bearing 5–10 fls. 3½–5 in across, rose-purple except the white throat of the lip, the sepals elliptic-lanceolate, acutish, the petals oval-oblong, broader than the sepals; lip with the front lobe acute Guatemala to Costa Rica B.M. 4270. P M 11:193. R.B. 22:201. G.C. III. 20·6. G.F. 3 201. C.O. 30. Var. **álba,** Hort. Fls. white.

23. **Victòria-regìna,** O'Brien. Pseudobulbs 1–1½ ft tall, somewhat compressed and clavate, 1–2-lvd : lvs 3–6 in long, oblong or elliptic-oblong. peduncle bearing 2–5 fls., rarely more, 5–6 in across; sepals purple a little tinged with yellow, striated with darker purple, oblong-lanceolate, obtuse, the petals purple tinged with violet, obliquely striated with darker purple, elliptic-oblong, obtuse, undulate; lip distinctly 3-lobed, the lateral lobes exteriorly white or flushed with rose, violet-purple at the obtuse apex and inside, the front lobe reniform, bright rose-violet, crisped, the disk yellow streaked purple. Pernambuco. G C. III. 11:808. O.R. 3:17; 8.361. R. 2.85. C.O. 3.—Said to grow wild in company with *C. labiata* and *C. Leopoldii* var. *pernambucensis,* and considered by some a natural hybrid between the two The variability of 1 or 2 lvs. on a pseudobulb points in this direction

24. **intermèdia,** Graham (*C amethýstina,* Morr. *C. ovàta,* Lindl. *C. maritima,* Lindl. *C. Lóddigesii* var. *amethýstina,* Lem *C Aguínii,* Rodr) Pseudobulbs up to 1½ ft tall, cylindric, somewhat furrowed, 2-lvd.: lvs. 5–6 in. long, oblong. peduncle bearing 3–5 fls. 4–5 in across, sepals and petals equal, pale rose or white, acute, oblong, the lateral deflected, the petals somewhat falcate, lip a little shorter than the lateral sepals, distinctly 3-lobed, the tube the same color as the petals, the lateral lobes rounded, the front lobe bright rose-purple, orbicular, strongly crisped S Brazil B M 2851. O R 8 73; 15.156. P M. 1·151 J F 4 379. C O. 8. B R. 1919 V O 2 39 Var. **Parthènia,** Reichb. f. Fls pure white C O 8*a* Var **punctatíssima,** Sander. Sepals and petals spotted and dotted with deep rose C O 8*b*

25 **violàcea,** Rolfe (*C. supérba,* Schomb *C Schombúrgkii,* Lindl *C odoratíssima,* P N Don) Pseudobulbs 8–12 in tall, clavate, somewhat compressed, 2-lvd lvs 3–5 in long, oval or oval-oblong peduncle bearing 3–5 fragrant fls 4–5 in across, sepals and petals bright rose-purple, the sepals oblong-lanceolate, acute, the petals oblong-rhomboid, acutish, undulate, broader than sepals; lip fleshy, distinctly 3-lobed, deep purple-violet except the yellow disk streaked with purple, the lateral lobes triangular, acutish, the front lobe nearly orbicular, crisped N S Amer B M 4083 P M. 9·265 J H III 31·321 A F 11 1351 C O 28. Var. **spléndens,** Hort , has paler fls

26. **Lóddigesii,** Lindl (*C Arembérgii,* Scheidw *C. intermèdia* var *variegàta,* Hook) Pseudobulbs 8–12 in tall, cylindric, 2-lvd lvs 4–5 in long, oblong-elliptic peduncle bearing 2–5 fls 3–4½ in across, sepals and petals rose-lilac, oblong-elliptic, the lateral sepals somewhat falcate, the petals a little broader than the sepals, undulate, lip shorter than the lateral sepals, distinctly 3-lobed, the tube externally colored like petals, internally whitish, the lateral lobes rounded, undulate, the front lobe nearly orbicular, pale amethyst, strongly crisped, the disk whitish passing into yellow at the base Brazil C O 18 O R 15 145 — There is a white form Var **álba,** Hort Var **delicàta,** Hort Fls. bluish white Var **innocéns,** Hort Fls. milky white. Var. **spléndens,** Hort Fls with bright purplish rose sepals; lip white inside, pale lilac outside; disk and side lobes pale yellow

27 **Harrisoniàna,** Batem (*C Hárrisoniæ,* Paxt *C Papeiansiàna,* Morr *C. Hárrisonii,* Beer *C Lóddigesii* var *Hárrisoniæ,* Veitch *C Lóddigesii* var *Harrisoniàna,* Rolfe) Pseudobulbs 8–16 in tall, cylindric, 2-lvd . lvs 4–6 in long, oblong-lanceolate. peduncle bearing 2–5 fls 4–4½ in. across, sepals and petals similar, oblong, bright rose-lilac, the lateral sepals falcate, the petals undulate, a little broader than sepals; lip shorter than lateral sepals, 3-lobed, the tube the same color as the petals, the front lobe crisped, rose-purple, the disk yellow-orange. Brazil. P.M. 4:247. C O. 17 Gn 48 380 Var. **álba,** Beer Fls. white, or sometimes faintly tinged with rose or yellow. C O 17*a*. Var. **cándida,** Hort Fls white except yellow disk of lip Var. **gigantèa,** Hort A large form Var. **maculáta,** Hort Fls purple-dotted. Var. **superbíssima,** Hort. Fls. large, the sepals and petals dark rose, the lip creamy white Var **violàcea,** Hort. Fls. deeper colored

28. **Lèopoldii,** Versch. (*C guttàta* var. *Lèopoldii,* Lind. & Reichb. f) Pseudobulbs 15–30 in tall, fusiform, 2–3-lvd.: lvs. 6–8 in. long, oblong-elliptic peduncle bearing 10–25 fls 3–4 in across, sepals and petals brown, oblong-cuneate, purple-spotted, the lateral sepals somewhat falcate, the petals undulate and a little broader than the sepals; lip strongly 3-lobed, the

lateral lobes acute, the front lobe broadly cuneate-obcordate, undulate, bright amethyst-purple, the tube paler, the disk covered with small tubercles and elevated papillate lines. S. Brazil. C O. 15. F.S. 14:1471–2.

29. **granulòsa,** Lindl. Pseudobulbs 1–2 ft. tall, rather stout, cylindric, 2–lvd.: lvs. 5–6 in long, lanceolate-oblong: peduncle bearing 5–9 fls. 3–4 in across; sepals and petals obtuse, olive-green, red-spotted, the lateral sepals strongly falcate and deflected, the petals obovate-oblong, a little wider than sepals, undulate; lip deeply 3-lobed, the tube white externally, internally yellowish or rose, the lateral lobes acute, the terminal lobe white, crimson-papillate, undulate, round-reniform, emarginate, the long claw yellow, marked with crimson. Guatemala. B R. 28 1 Gn M. 9 30 C O. 14. Var. **Du Buysoniàna,** Hort (*C. Dubuysoniàna,* Hort.). Sepals and petals yellow, often spotted with rose. Var. **Russelliàna,** Lindl. Lvs. broader fls larger with broader sepals and petals, the lateral lobes of lip orange-yellow internally, the front lobe spotted with small crimson-purple papillæ. Brazil. B R 31 59 B·M 5048. Var. **Schofieldiàna,** Veitch (*C. Schofieldiàna,* Reichb. f.). Sepals and petals yellow-brown, densely spotted with crimson-purple, the lateral lobes of lip cream-white externally, yellow, purple-marked internally, the front lobe with numerous purple-magenta papillæ, and a broad white border. Brazil. C O. 14*a*.

30 **guttàta,** Lindl (*C. elàtior,* Lindl.). Pseudobulbs 18–30 in tall, cylindric, 2-lvd : lvs. 5–9 in. long, oblong-elliptic peduncle bearing 5–10 fls. 3–4 in. across; sepals and petals yellowish green, spotted deep purple, the sepals obtuse, the lateral somewhat falcate, the petals undulate, broader than sepals; lip 3-lobed, the lateral lobes white externally, acute, the front lobe amethyst-purple, obcordate, papillate. S. Brazil. B.R. 1406.

31. **Schilleriàna,** Reichb. f. (*C. Regnéllii,* Warner. *C. Acláudiæ* var. *Schilleriàna,* Jenn.) Pseudobulbs 5–6 in. tall, clavate, furrowed, 2-lvd.: lvs 2½–6 in. long, oblong-elliptic. peduncle bearing 1–3 fls 4–5 in across, sepals and petals olive-green tinted with brown and spotted with black-purple, oblong-ligulate, undulate, especially in the petals; lip a little shorter than the lateral sepals, deeply 3-lobed, the lateral lobes whitish outside, pale yellow marked with purple inside, the front lobe reniform, sessile, crimson, lined and margined with white, undulate, the disk yellow with 5 sunken lines. Brazil. B.M. 5150 F S. 22:2286 A F. 6·563. C O 16.

32 **Fórbesii,** Lindl. (*C. vestàlis,* Hoffm.). Pseudobulbs 8–12 in. tall, cylindric, 2-lvd lvs 4–5 in long, oblong peduncle bearing 2–5 fls 3–4 in across, sepals and petals a pale yellowish green, obtuse, undulate, sepals oblong-ligulate, the petals oblong-lanceolate, lip distinctly 3-lobed, the tube pale yellow outside, inside a bright yellow streaked with red, the terminal lobe small, sessile, orbicular, undulate, pale yellow, with a bright yellow center marked with purple. S. Brazil. B.M. 3265 C O. 11. B R. 953

33. **Walkeriàna,** Gardner (*C. bulbòsa,* Lindl *C. Gardneriàna,* Reichb. f. *C princeps,* Rodr.). Pseudobulbs 2–5 in. tall, oval-fusiform, furrowed, 1-lvd : lvs. 2–5 in long, oblong-elliptic: fls 1–3, very fragrant, 3–5 in. across, on a scaly st. arising from the base of the pseudobulb; sepals and petals pale rose-lilac or a deep purple-rose, the sepals oblong-lanceolate, acute, the petals about twice as wide, oval-rhomboid, undulate; lip a little shorter than sepals, fleshy, 3-lobed, the lateral lobes rose, separated, exposing the column, the front lobe nearly orbicular, emarginate, crisped, violet-purple, the disk yellow, streaked with bright purple. Brazil B.R 33:42.

34. **nobilior,** Reichb f (*C. Walkeriàna* var. *nobilior,* Veitch) Pseudobulbs 3–5 in. tall, ovate-fusiform or nearly clavate, furrowed, 2-lvd.: lvs. 2–4 in. long, elliptic-ovate: fls. 1 or 2, on a scaly st. arising from the base of the pseudobulb, very fragrant, 3–4½ in across; sepals and petals purple-lilac, acute, the sepals oblong, the petals ovate-rhomboid, about twice the width of the sepals; lip fleshy, about as long as lateral sepals, deeply 3-lobed, the tube the same color as the petals, the front lobe broadly reniform, emarginate, scarcely undulate, the disk yellow, many-costate. Brazil. G C. II. 19:729. I.H. 30:485

The following are some of the many hybrid forms· *C. Ádula*=C bicolor×C. Hardyana, *C Albertii*=*C* intermedia×C violacea, *C. atáldata*=C Leopoldii×C Warscewiczii **gigas,** *C Ballantiàna*=C Trianæ×C. Warscewiczii, *C blesensiæ*=Lælio-cattleya, C *Brabántiæ*=C Aclandiæ×C Loddigesii, *C. Brymeriàna*=supposed natural hybrid between C violacea×C Eldorado (C O 1), *C Cassándra*=Lælio-cattleya, *C Chamberlainiàna*=C. Leopoldii×C. Dowiana, *C Dietrschiàna*=C Schilleriana×C Trianæ, *C Dormanoana*=Lælio-cattleya, *C Düchesnei*=C bicolor×C. Harrisoniana (R B 30 3), *C Düsseldorffii* var *Undinæ*=C intermedia×C Mossiæ alba (O R 18 309), *C eromènias*=Lælio-cattleya, *C faústa*=Lælio-cattleya, *C Fowlerı*=C Leopoldii×C Hardyana (C O 5); *C germánia*=C granulosa×C Hardyana, *C Hardyana*=C Dowiana×C Warscewiczii (C O 2) O R 4 241, 5 363, 8 248, 11 336, 337), *C Hárrisii*=C Leopoldii × C Mendelii, *C Heléniæ*=C. Forbesii×C Mossiæ, *C hybrida picta*=C guttata×C Loddigesii, *C interglòssa*=C amethystoglossa×C intermedia, *C Krameriàna*=C Forbesii×C intermedia, *C Lourydna*=C Forbesii×C intermedia, *C Mánglesii*=C Loddigesii×C Luddemanniana, *C. Mántinii*=C Bowringiana×C Dowiana (C O 7 O R 10 337), *C Márdellii*=Lælio-cattleya, *C Mártersoniæ*=C labiata×C Loddigesii, *C Measuresiæ*=C Luddemanniana×C velutina, *C Minàrii*=C Loddigesii×C Warscewiczii gigas, *C málliæ*=C Gaskelliana×C violacea, *C O'Brunana*=considered by some a natural hybrid between C Loddigesii×C dolosa (C O 8), *C Pittiæ*=C Dowiana×C Harrisoniana, *C Pittiana*=C Dowiana×C granulosa (C O 28), *C Portia*=C Bowringiana×C labiata, *C Thayeriana*=C intermedia×C Schroederæ (O R 12 49), *C weedonénsis*=C granulosa×C Mendelii, *C Whitei*=C Schilleriana×C. Warneri (B M. 7727), *C Zenobiæ*=Lælio-cattleya.

C Abeliana, Hort fls creamy yellow, speckled with purple on the lip Peru —*C Forgetiàna,* Rolfe Somewhat resembling C Lawrenceana Scape bearing 2 fls, sepals and petals rose-purple. Brazil —*C Grósii,* Hort, var *pállida* A nearly white form, sepals slightly tinged with green, lip pale rose —*C Hardyàna,* Hort, var *aúrea* Lip deep yellow —*C Jénmanii,* Rolfe Allied to C Gaskelliana, but lvs broader and fls smaller British Guiana. —*C margaritàta,* Paxt =Lælia pumila —*C velùtina,* Reichb Sts slender, the fragrant fls with the sepals and petals orange, spotted purple, the lip orange and white, veined violet. Brazil G C III. 24 333 C O 29*a*.

GEORGE V. NASH.

CAULIFLOWER (*Brássica oleràcea,* Linn, var. *botrýtis,* DC.) A form of the common cabbage species, producing an edible head of malformed and condensed flowers and flower-stems (the word cauliflower means stem-flower), it will hybridize with the cabbage and form some very interesting freaks. See *Forcing*

A perfect "curd" or head of cauliflower is one in which the parts are so adjusted to one another that it looks almost homogeneous This condition is most often found in the young or partly developed heads As soon as segmentation begins to take place, the curd has reached full development and maturity from the market-gardeners' standpoint. The breaking-up of the curd is an indication of the formation of floral parts. The value of the curd depends upon its symmetry and form, and the length of time that it will hold without beginning to break up into distinct parts.

Not all plants produce perfect curds. Growers recognize a peculiar form which is known as the "ricy" curd illustrated at *a* in Fig 845. Another form, which is equally undesirable is a segmented curd between the segments of which leaves appear, known as a "leafy" curd shown at *b* A head in perfect condition is shown at *c*. Segments are apparent in *c*, but the development of the curd is almost ideal and the head as a whole is very nearly perfect It is the aim of the seed-grower as well as of the gardener to produce plants which will return curds of the type shown at *c*.

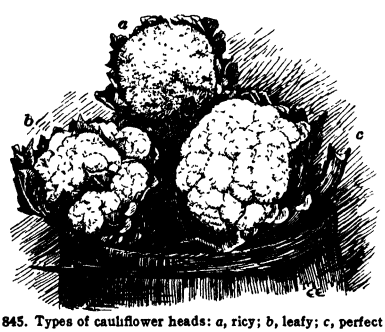
Cauliflower is the most fastidious and exacting member of the cabbage family. It is less tolerant of adverse soil and climatic conditions than any of its near relatives. This accounts, in a great measure, for its limited cultivation and the fact that it is grown only in certain localities. When well grown, however, it is one of the most profitable market-garden crops. Because of its

intolerance to heat, it is grown in the open so as to take advantage of the cool seasons of early spring and autumn. It is one of those crops, therefore, which is less adaptable than those having a greater range of heat-endurance. If the season happens to be favorable the amateur may have good luck, but if the season proves severe the most expert grower may fail

A rich loamy soil, thoroughly charged with available plant-food is suited to this plant Light thin sandy soils or those extremely heavy and retentive are, as a rule, not well suited for this crop The soil should be one which does not dry out quickly but which will furnish the plants a constant supply of moisture. High-grade cauliflower is quite as dependent upon careful handling of the plants and a constantly available supply of moisture as high-grade celery Among the fertilizers, none is better than well-decomposed manure from the horse-stable, thoroughly incorporated with the soil at the time of preparing it for the crop

If commercial fertilizers are necessary, quick-acting ones are most desirable, except it is thought that sulfate of potash is preferable to muriate The nitrogen-content of the fertilizer, however, should be in the form of nitrate of soda or sulfate of ammonia rather than in a slow-acting form If a fertilizer is to be used, a portion of it should be scattered over the field before the plants are set An application of 500 pounds to the acre at this time, applied broadcast, and a side dressing about the time "buttons" begin to form, will prove an advantage. The side dressing may be at the rate of 500 pounds, making a total application of 1,000 pounds to the acre A good fertilizer is one carrying 3 to 4 per cent of nitrogen, 6 to 8 per cent of phosphoric acid and about 10 per cent of potash

Cauliflower plants in northern latitudes are handled so as to prepare them either for an early or a late crop. The early crop should be started at the same time as early cabbage, or a few days later Cauliflower plants cannot, however, be started in the autumn and successfully wintered in coldframes, as can early cabbage plants Plants so handled are less likely to give a desirable product. The best early-crop plants are produced from hotbed or greenhouse propagated stock started in a mild temperature and grown so as to produce a sturdy broad-leaved plant to be set in the field a few



845. Types of cauliflower heads: *a*, ricy; *b*, leafy; *c*, perfect

days later than the early crop of cabbage Young cauliflower plants are less hardy than young cabbage plants and, for this reason, planting in the open must be somewhat delayed.

For the late cauliflower crop in the North, seed-beds are prepared on the shady side of a building or in a partially shaded situation and handled in same manner as seed-beds for late cabbage, the late crop in the Long Island region being placed in the open the last days of June or early in July.

The early crop is usually grown on a smaller scale than the autumn crop. Plants grown in the hotbed are usually transplanted and the transplanted plants carried and set in the field by hand The distance between the rows should be sufficient to permit of cultivation with horse-power implements, but the plants need not be set more than 18 inches apart in the row

The late crop, however, is frequently transplanted during the drier parts of the season and, largely on this account, growers prefer to use a transplanting machine so as to water the plants at the same time they are set A convenient distance between the rows is 3 feet, with the plants 20 to 24 inches apart in the row, depending upon the variety grown

The old adage that "cabbage should be hoed every day" applies with equal force to cauliflower Cultivation should be of such character as to prevent the formation of a crust and to discourage the development of weeds. The maintenance of a soil-mulch by shallow cultivation which shall not disturb or severely prune the roots of the plants is desirable

Cauliflower is subject to the same enemies and diseases as cabbage Clubroot and mildew are two of the most annoying diseases The aphis, root-maggot and both the green cabbage-worm and the cabbage-looper are annoying pests The delicacy of the curd requires that the plants be kept perfectly free from insects which devour any portion of the plant

Cauliflower requires more careful field attention than that required by any other garden crop except those that are blanched either by tying or banking The young curd of the cauliflower, as soon as it has reached the size of a hen's egg, should be carefully protected from the elements by adjusting the leaves in such a manner as to prevent discoloration by the action of sun or rain. The expert growers accomplish this and at the same time indicate the stage of maturity of the plants by different methods of folding the leaves together over the curd or by tying them with different tying materials, a different method being used each time the field is gone over To illustrate the earliest developed curds may be protected by tying the leaves together with rye straw, the next later size may be indicated by folding the leaves together over the plant, while the third may be indicated by tying the leaves with raffia Usually three operations will be sufficient to care for the entire season's crop. As soon as the curds have reached the desired market size, which varies greatly with different producers and somewhat also with different varieties and is to a degree dependent upon the season and fertility of the land, the plants are harvested by cutting the heads with at least two or three whorls of leaves attached

After the heads have been cut and a sufficient number assembled in one place to justify packing, they are trimmed by using a large knife to sever the leaves just above the edge of the curd so as to form a border or "ruche" of leafstalks with a part of the blade attached about the curd This border of stiff green leafstalks about the white curd gives it a very attractive appearance

After the curds have been properly trimmed, which varies somewhat with different operators, they are protected by the use of tea paper, either white or brown, placed over the head in such a manner as to protect it from dirt and contact with its neighbors The curds are then packed in crates or barrels, the California and Florida product being largely packed in crates holding one dozen heads in a single layer If the heads are to be packed in barrels, a layer of excelsior is first placed in the barrel and the wrapped heads, curd down, are carefully placed so as to form a layer resting upon the excelsior over the bottom of the barrel. The next row of curds is placed stem end down and curds up; on top is placed another cushion of excelsior and the operation repeated until the barrel is filled in such a manner as to

leave the last row with the stem end upward, over which a cushion of excelsior and a burlap cover are placed. Ventilated barrels are ordinarily used for this purpose, but for long-distance shipment the smaller crates holding a single layer of heads have proved most advantageous.

During late years, the marketing of this crop has been very greatly facilitated and the returns to the growers considerably enhanced by a cooperative method of sale which has taken into consideration a more extended distribution of the crop than formerly. In this the Long Island Cauliflower-Growers' Association and the California Vegetable-Growers' Union have both been very helpful

One of the handicaps in the cultivation of cauliflower has been the entire dependence of the American growers on foreign seed, little or no cauliflower seed having been produced in this country and that in the open only in the Puget Sound region The seed has been expensive and not always to be depended upon. The greatest care should be given to securing a perfectly reliable stock of seed.

Broccoli

Broccoli, which is a long-season cauliflower, is in all respects like cauliflower except that its vegetative parts are somewhat coarser, the heads somewhat smaller, and it does not form an edible curd early in its life as does cauliflower

Broccoli is cultivated only in climates having a mild winter, when it can be planted the summer before and carried through the winter to form heads early the following spring It is a popular plant in all parts of France and particularly in England It is undoubtedly the parent type of the cauliflower, the cultivated varieties of cauliflower being short-season forms.

For best results, the seed should be sown at the same time as that of autumn cabbage and the plants transplanted to the field about the same time, so that they will make their vegetative growth during the late summer and autumn Where winters are mild, the plants can be left in the open, but in more rigorous climates at the approach of cold weather, a small number of plants can be lifted with earth adhering to the roots, stored in a suitable root-cellar, and the following spring transferred to the open to form heads

L. C CORBETT.

CAULOPHÝLLUM (Greek, *stem-leaf*) *Berberidàceæ* BLUE COHOSH Two species of perennial herbs (sometimes combined with Leontice), one in E. Amer and the other in Asia, the former sometimes removed from the woods to cult grounds Rhizomatous· sts erect, very smooth: lf 1, large, triternately compound and sessile· fls small, yellow-green, paniculed; sepals 6, subtended by 3 or 4 bracts; petals 6, much smaller than the sepals and appearing like glands or scales; stamens 6; ovary soon bursting, freeing the 2 ovules which develop into depressed-globular berry-like seeds (without pericarp) **C. thalictrioides,** Michx, Fig. 846, is the American species, a smooth or glaucous plant of rich woods from Canada south, 2–2½ ft. high. The plant is always attractive because of its trim growth and interesting habit; in Sept. and later, when the foliage is dead, the drupe-like seeds stand erect on the dry stalks and afford one of the richest and best of deep blues.

L. H. B.

CAUTLÈA (Sir P. Cautley, 1802–1871, British naturalist). *Zingiberàceæ.* About a half-dozen Himalayan species closely allied to Roscoea, differing in the spherical rather than narrow fr, and the spicate infl. Probably not in cult. in this country. *C. lùtea,* Royle (*Roscòea lùtea,* Royle. *R. grácilis,* Smith). Erect or leafy perennial herb, 1½ ft or less. lvs. narrow-lanceolate, slender-tipped, reddish underneath: fls. 2 in. or less long; corolla yellow; calyx reddish purple, the linear segms. prominent, the lateral ones spreading or reflexed and the dorsal one erect and with an incurved erect staminode under it.—Treatment of Alpinia and Roscoea.

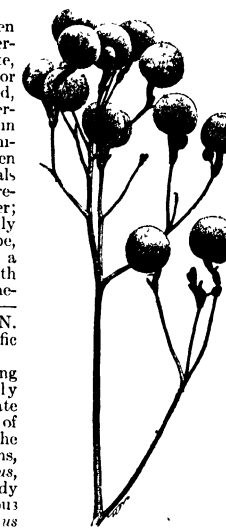
CAVAN: *Acacia Cavenia.*

CAYENNE PEPPER: *Capsicum.*

CAYRÁTIA JAPÓNICA: *Cissus japonica.*

CEANÒTHUS (ancient Greek name) *Rhamnàceæ.* Ornamental woody plants grown for their profusely produced white, blue or pink flower-clusters

Deciduous or evergreen shrubs or trees. lvs alternate or sometimes opposite, short-petioled, serrate or entire, usually 3-nerved, with small stipules. fls perfect, small, 5-merous, in small umbels forming panicles or racemes; sepals often incurved, colored; petals clawed, spreading or recurved, filaments slender; disk annular; ovary partly adnate to the calyx-tube, 3-celled; style 3-cleft fr a 3-celled drupe, dry at length and separating into 3 one-seeded dehiscent nutlets — Nearly 50 species in N. Amer, chiefly in the Pacific coast region.



846. Seed-berries of blue cohosh, Caulophyllum thalictroides. (×½)

These are free-flowering shrubs, some especially valuable for their late flowering period Many of them are hardy only in the warmer temperate regions, but *C. americanus, C. ovatus,* and *C. Fendleri* are hardy North, while the numerous hybrids of *C. americanus* are only half hardy, and even if protected they are killed to the ground in the North, but the young shoots will usually flower the same season. The safest way, however, to have good free-flowering plants of these beautiful hybrids will be, in the North, to dig them up in fall, store them away in a frost-proof pit or cellar, and plant them out again in spring Pruning of the late-flowering species will be of advantage; about one-half of last year's growth may be taken away They grow in almost any soil, but best in a light and well-drained one, and most of the Californian species prefer a sunny position Propagated by seeds sown in spring and by cuttings of mature wood in autumn, inserted in a cold-frame or greenhouse; softwood cuttings also grow readily if taken in early spring from forced plants Sometimes increased by layers, and the varieties and hybrids by grafting on roots of *C. americanus* under glass in early spring; the cions must be fresh and with leaves, taken from plants kept in the greenhouse during the winter.

INDEX.

albo-plenus, 4.
americanus, 1.
arboreus, 7.
Arnouldii, 4.
atrocæruleus, 4.
azureus, 8.
bicolor, 8.
cæruleus, 8
cuneatus, 14.
divaricatus, 12
Fendleri, 10.
hirsutus, 9
hybridus, 4
integerrimus, 11.
intermedius, 1.
Lobbianus, 5.
Orcutti, 9.
oreganus, 3
ovalis, 2.
ovatus, 2.
pallidus, 4.
prostratus, 15.
roseus, 4.
sanguineus, 3.
spinosus, 13.
thyrsiflorus, 5.
Veitchianus, 5.
velutinus, 6, 7.

A. *Lvs. alternate. (Nos. 1–13.)*

B. *Margin of lvs. serrate or crenate.*

C. *Foliage glabrous beneath or slightly pubescent.*

D. *Fls. white: lvs. thin, deciduous.*

E. *Peduncles slender, at the end of the new growth.*

1. **americānus,** Linn. Fig. 847. Low, erect shrub, to 3 ft.: lvs. ovate, usually acute, finely and irregularly serrate, bright green and dull above, paler and pubescent or nearly glabrous beneath, 1½–3 in. long: fls. in terminal and axillary panicles on slender peduncles, forming large, corymbose panicles. July–Sept From Canada to S. C and Texas. B M 1479. Gt. 61, p. 92 Gn. 56, p 137.—Common in dry woods and making a profusion of bloom, which, however, is short-lived. Many hybrids have been raised from this species in Eu. (see *C. hybridus*). Var. **intermēdius,** Trel. (*C. intermēdius,* Pursh), has smaller, ovate or ovate-lanceolate lvs. and the fls in small, very slender-peduncled, short racemes or panicles Tenn to S C.



847. Ceanothus americanus. (×½)

2 **ovātus,** Desf. (*C. ovālis,* Bigel.). Low shrub: lvs elliptic to elliptic-lanceolate, obtuse or acute, crenulate-serrate, nearly glabrous, glossy above, 1–2 in long. infl. like the former, but usually smaller. New England to Colo. and Ala.

EE. *Peduncles usually stout, from lateral buds of the old wood.*

3. **sanguíneus,** Pursh (*C. oregānus,* Nutt.). Tall shrub, with purple or reddish glabrous branches: lvs. orbicular to ovate or obovate, obtuse, serrate, nearly glabrous, 1–3 in long: fls in rather long, narrow panicles, on stout, leafless peduncles, axillary, from branches of the previous year. May, June. Brit. Col. to Calif. B.M. 5177.

DD. *Fls. blue or pink, rarely white: lvs. usually half-evergreen.*

4. **hȳbridus,** Hort. Hybrids of garden origin, chiefly between *C. americanus* and *C. thyrsiflorus,* between *C. ovatus* and *C. thyrsiflorus* and between *C. americanus* and *C. azureus;* the hybrids of the first group may be classed under *C. roseus,* Koehne, of the second under *C. pallidus,* Lindl., and those of the third group under *C. Arnouldii,* Hort Some of the most distinct are: *diplēnus,* with double white fls.; *atrocærùleus purpùreus,* fl. blue, foliage purple when young; *Arnouldii,* fls. sky-blue, in large panicles; *Gloire de Versailles,* with bright blue, large panicles (M.D.G. 1903:485); *Gloire de Plantières,* fls. dark blue, in large panicles; *Victor Jouin,* fls. deep blue, darker than in the preceding, one of the hardiest hybrids; *Crèl de Provence,* fls. deep blue, profusely produced (R.H. 1903:332); *Marie Simon,* fls. flesh-colored; *rōseus,* fls. pink (R.H. 1875:30); *pallidus,* fls. pale blue, lvs. green and pubescent below (B.R. 26:20).

5. **thyrsiflōrus,** Esch. Shrub or small tree: lvs. oblong, obtuse, crenate-serrate, nearly glabrous, 1–1½ in. long: fls. blue, rarely white, in narrow panicles, about 3 in. long. May–July. Ore. to Calif. B.R. 30:38. S.S. 2.64. G.C. III. 20:363; 37.179, 41:221. Gn. 74, p. 303. G.M. 50:430.—A very fine, free-flowering species of beautiful blue color. Probably natural hybrids of this species are *C. Veitchiānus,* Hook. (*C. thyrsiflorus* × *C. rigidus*), with deep blue fls. in dense panicled clusters (B M. 5127; F S. 13·1383), and *C. Lobbiānus,* Hook. (*C. thyrsiflorus* × *C. dentatus*), with deep blue fls, in oval, peduncled, solitary clusters. B. M. 4810 (4811 by error). F.S. 10·1016.

CC. *Foliage tomentose or densely pubescent beneath: half-evergreen or evergreen (see also C. hybridus).*

D. *Branchlets and the veins beneath nearly glabrous: lvs. very obtuse. fls white.*

6. **velūtinus,** Douglas Tall shrub· lvs. persistent, broadly elliptic, mostly subcordate, obtuse, serrate, dark green and glabrous above, canescent beneath, but the veins glabrescent, 2–3 in long fls in large, compound panicles at the ends of the branches. June, July. Brit. Col. to Colo and Calif. B M. 5165

DD *Branchlets and the veins tomentose or pubescent lvs. mostly acute fls. usually blue*

E. *The lvs. glabrous or puberulous above, whitish or tawny tomentose beneath.*

7. **arbŏreus,** Greene (*C velūtinus* var *arbŏreus,* Sarg). Small tree, with whitish bark branchlets at first angled and pubescent, later glabrescent and glossy: lvs elliptic-ovate, obtusish or acutish, rounded or subcordate at the base, closely serrate, with close white tomentum beneath, 1½–3 in long fls pale blue to white in panicles 2–3 in. long. Spring Isls off the Calif. coast. S S. 2.65.

8. **azūreus,** Desf. (*C bicolor,* HBK. *C. cærùleus,* Lag.). Tall shrub· branchlets terete, densely tomentose: lvs. oblong-ovate or oblong, acute or obtuse, rounded at base, serrate, with villous tawny tomentum beneath, 1–3 in long fls deep blue, in slender panicles 2–4 in long Spring Mex L B C 2.110 B R. 4 291. P.M. 2·74. Gn. 61, p 223 —Under this name, a hybrid species with *C. americanus* is often cult.

EE. *The lvs. villous or hirsute on both sides, usually green beneath*

9. **hirsūtus,** Nutt Shrub or small tree, with villous branches: lvs. broadly elliptic or ovate, rounded or cordate at the base, obtuse or acute, with glandular teeth, ½–2 in. long: fls. deep blue to purplish, in narrow panicles 1–2 in long. April, May Calif.—Called "wild lilac" in Calif Var **Órcuttii,** Trel (*C. Órcuttii,* Torr.). Fls. blue, paler. fr. loosely villous.

BB. *Margin of lvs. entire or nearly so (sometimes serrate on vigorous shoots).*

C. *Shrub prostrate· fls. white.*

10. **Fēndleri,** Gray. Low, prostrate and spiny shrub: lvs. oval, rounded or nearly acute at both ends, entire, rarely finely serrulate, grayish green, minutely tomentose beneath, ½–1 in. long: fls. white, in short racemes, terminal, on short, lateral branchlets. June, July. From S. D. to New Mex. and Ariz. R.H 1901, p 423. M.D.G. 1908 208; 1912:499.—A very graceful and free-flowering shrub of almost creeping habit, well adapted for covering dry, sandy banks; half evergreen and hardy N.

CC. *Shrubs tall, upright.*

D. *Branchlets terete or slightly angled, rarely spiny.*

11. **integérrimus,** Hook. & Arn. **Tall,** erect shrub, with glabrescent branches: lvs. broadly elliptic or ovate, obtuse, sparingly hairy or glabrous, bright green beneath, 1–3 in. long: fls. blue, sometimes white, fragrant, in 3–6 in. long, narrow panicles. April–June. Wash. to Calif. and S. E. Ariz. B.M. 7640.

12. divaricàtus, Nutt. Tall, erect shrub, with usually glaucous branches and often spiny: lvs ovate, obtuse or nearly acute, glaucous and glabrous or grayish tomentose below, ½–1 in. long: fls. pale blue, sometimes whitish, in 2–3 in. long, narrow panicles. April–June. Calif. Gn. 74, p. 425 (habit).

DD. *Branchlets angled, spiny.*

13. spinòsus, Nutt. Tall shrub, sometimes arborescent: branchlets glabrous: lvs. elliptic to oblong, thinly coriaceous, rounded or broadly cuneate at the base, very obtuse or emarginate, scarcely 3-nerved, glabrous, ½–1½ in long. fls light blue to almost white in large terminal panicles 4–6 in. long. Spring. Cent. and S. Calif., Coast Range and down to sea-level. S S. 13.621.

AA. *Lvs. opposite, persistent.*

14. cuneàtus, Nutt. Tall, much-branched shrub: lvs. spatulate or cuneate-obovate, mostly obtuse, entire, minutely tomentose beneath, ¼–1 in. long: fls white, in small clusters along the branches. March–May. Ore to Calif. B.H. 8. 170

15. prostràtus, Benth Procumbent shrub: lvs. cuneate, obovate or spatulate, coarsely and pungently toothed, sometimes only 3-pointed at the apex, often minutely silky when young, ½–1 in long: fls. blue, in clusters, terminal on short branchlets. Spring. Wash. to Calif

C africànus, Linn =Noltea africana —*C dentàtus,* Torr & Gray. Low shrub lvs oblong, penninerved, dentate, glandular-papillate above, loosely hairy fls blue, in peduncled clusters Calif F S 6 567, 2. B H 3 101 —*C dentàtus* var *floribundus,* Trel (C. floribundus, Hook) Fl-clusters numerous, nearly sessile lvs smaller B M 4806 F S 10 977 I H 7 238 B H 5 120 —*C. foliòsus,* Parry Low shrub lvs small, broadly elliptic, glandular-toothed, slightly hairy, pale or glaucous beneath fls deep blue, in numerous small clusters Calif —*C lævigatus,* Douglas Tall shrub: lvs broadly elliptic, serrate, glabrous, glaucous beneath fls yellowish white, in large panicles Calif —*C microphyllus,* Michx Low shrub. lvs very small, obovate or elliptic, nearly glabrous fls white, in small, short-peduncled clusters —*C papillòsus,* Torr & Gray Low shrub. lvs. narrow-oblong, dentate, glandular-papillate above, villous beneath fls deep blue, in peduncled, axillary oblong clusters Calif B M 4815 F S 6 567, 1 P F G 1, p 74 R H 1850 321 —*C Párryi,* Trel Large shrub lvs elliptic or ovate, denticulate, cobwebby beneath fls deep blue, in peduncled, narrow panicles Calif —*C rígidus,* Nutt Rigid, much-branched shrub. lvs opposite, cuneate-obovate, denticulate, usually glabrous, small: fls blue, in small, nearly sessile, axillary clusters Calif. B M 4660 (as C verrucosus) and 4664 J F. 3 310, 4 348 —*C verrucòsus,* Nutt Low shrub. lvs mostly alternate, roundish obovate, emarginate, denticulate, nearly glabrous, small fls white, in small, axillary clusters along the branches. Calif.—*C verrucòsus,* Hook.= C. rigidus.

ALFRED REHDER.

CEARA RUBBER: *Manihot.*

CÉBATHA: *Cocculus.*

CECRÒPIA (from Greek word referring to use of the wood of some species in making wind instruments) *Moràceæ* Milky-juiced trees, with peltate leaves, sometimes planted in grounds in tropics and warm countries.

Leaves large, alternate, long-petioled, the blade circular in outline; segms. or lfts. 7–11: dicœcious; fls. very small, sessile in cylindrical heads or receptacles, which are arranged in umbels; calyx tubular and petals 0; sterile fls with 2 stamens; fertile fls. with free ovary and divided stigma: frs small 1-seeded nuts combined into short spikes.—Species about 40, from Mex. to Brazil. *C. peltata,* Linn., is the trumpet-tree of the W. Indies and S. It is a middle-sized tree with lvs. 1 ft. across; hollow branches used for the making of wind instruments. The juice of some species yields rubber. The hollow stems are often perforated by ants, which nest and rear their young in them.

palmàta, Willd. Fig. 848 A characteristic tree of the farther W Indies (and planted somewhat in S. Fla.), with a single long weak thin trunk and at the top a few horizontal or deflexed awkward branches bearing at their ends large palmate lvs. with divisions like thumbs, the trunk and branches partitioned at the nodes: lvs 7–11-lobed to the middle, white-tomentose beneath, the lobes oblong-obovate and blunt —The tree attains a height of 50 ft.; wood soft, branches more or less hollow; grows rapidly, like an herb; often covering areas that have recently been burned over.

L. H. B.

CEDAR: *Cedrus, Juniperus.*

CEDAR, WHITE: *Thuya, Chamæcyparis.*

CEDAR, WEST INDIAN: *Cedrela.*

CÉDRELA (from *Cedrus,* the wood resembling that of Cedrus). *Meliàceæ.* Including *Toòna.* Ornamental trees, grown for their handsome foliage; some are valuable timber trees.

Trees with alternate, usually abruptly pinnate lvs., without stipules lfts petioled, entire or slightly serrate: fls. inconspicuous, whitish, usually perfect, 4–5-merous, in large, pendulous, terminal panicles; calyx short, 4–5-parted, the petals forming a tube with spreading limb, below partly adnate to the disk; stamens shorter than petals; ovary 5-celled, style simple, with capitate stigma, somewhat longer than the stamens fr a caps , dehiscent, with 5 valves not splitting to the base, with many flat. winged seeds —Nine species in Trop Amer. and S, forming the subgenus Toona, in E India and Austral. Toona is often considered a distinct genus, distinguished from Cedrela by the disk being much longer than the ovary and by the seeds being winged above or at both ends, while in Cedrela the disk is as long or shorter than the ovary and the seeds are winged below. The first 3 species below belong to the subgenus Toona, the others are true cedrelas

Cedrelas are tall ornamental trees with large pinnate foliage, well adapted for avenues *C sinensis* is hardy as far north as Massachusetts, the others are hardy only in southern California and in the Gulf states except *C. odorata,* which is tender even there The wood of some species, particularly of *C odorata,* is known as cedar wood, and much valued for making furniture and boxes. They thrive best in rich loam, and are propagated by seeds or by cuttings of mature wood, and, also, by root-cuttings, all with bottom heat



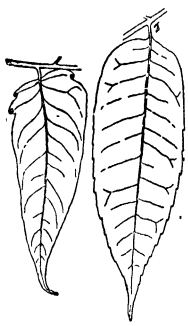
848. Cecropia palmata.

A. *Lfts. 10–25.*

B. *Lvs. quite glabrous.*

C. *Margin of lvs. more or less serrate: panicles very long, pendulous: seeds winged above.*

sinénsis, Juss. (*Toòna sinénsis,* Roem *Ailánthus flavéscens,* Carr). Tree to 50 ft : lvs long-petioled, 10–20 in. long; lfts. 10–22, oblong or oblong-lanceolate, acuminate, slightly and remotely serrate, light green beneath, 4–8 in. long: fls white, in very long, pendulous panicles, ovary glabrous; 5 subulate staminodes alternating with the stamens: fr. oblong or obovate, about 1 in. long. June. China. R H 1891, p. 574–5, 1875, p 87. Gng. 4:1. M D G 1902:495 F. 1876, p 175 F E. 13, p 1 — Ornamental tree, with large feathery foliage, very valuable for avenues; similar to ailanthus, and nearly of the same hardiness, but of more regular and dense growth, and without the disagreeable odor when flowering Ailanthus can be easily distinguished by the few coarse teeth near the base of the lfts., each bearing a large gland beneath (Fig. 849)



849 Leaflets of Cedrela and Ailanthus. Cedrela on the right. (×⅓)

serràta, Royle (*Toòna serràta,* Roem) Tree, to 70 ft : lvs usually odd-pinnate, 15–20 in. long, lfts. 15–25, ovate-lanceolate or ovate-acuminate, irregularly serrate, glaucous beneath panicles longer than the lvs , pendulous; fls fragrant, often 6-merous; ovary glabrous Himalayas, to 8,000 ft altitude Royle, Ill 25 Collett, Flor. Siml 82 —This is probably the hardiest of the tropical species. Sometimes united with *C Toona*

CC *Margin of lvs entire: panicles shorter than the lvs.*

Toòna, Roxbg (*Toòna ciliàta,* Roem) Tree, to 70 ft , nearly evergreen lvs. abruptly pinnate; lfts. 10–20, usually opposite, lanceolate or ovate-lanceolate, sometimes undulate, 3–6 in. long fls. white, honey-scented, 5-merous; ovary hairy; seeds winged at both ends Himalayas Wight , Icon 161. Brandis, Forest Fl. 14.

odoràta, Linn. WEST INDIAN CEDAR Tree, to 100 ft.: lvs 10–20 in long; lfts 12–20, ovate-lanceolate, acuminate, entire, bright green on both sides, 4–6 in. long. panicles shorter than the lvs : fr oblong, 1½ in. long; seeds winged below. W. Indies.—The cedar wood comes mostly from this species. Wood brown, fragrant, the source of the cigar-box wood of commerce. It is a very durable wood, and is much prized in the W. Indies in the manufacture of cabinets, furniture, canoes, and other articles. In the W. Indies known as "cedar"

BB *Lvs densely pubescent beneath.*

fissilis, Vell Tree. lvs 10–15 in long, abruptly pinnate; lfts. 18–24, opposite, nearly sessile, oblong-lanceolate, acuminate panicles pubescent, longer than the lvs , calyx pubescent outside, petals fulvous tomentose; ovary glabrous Brazil, Paraguay St Hilaire, Fl Brazil 2 101 —According to Franceschi it does better at Santa Barbara than any other species of this genus

AA *Lfts 6–10, finely ciliate*

Dugèsii, Wats Tree. lvs 10–15 in long, lfts cuneate, ovate-lanceolate, long and slender acuminate, nearly entire, shining above, pale green and glabrous or nearly so beneath, 4–6 in long panicles rather compact, much shorter than the lvs. Mex ALFRED REHDER

CEDRONÉLLA (*a little cedar,* from the odor of *C. triphylla,* a species from the Canary Islands sometimes called "Balm of Gilead") *Labiàtæ* Herbs or shrubs, sometimes planted in borders in the middle and southern parts of the United States

Four species allied to Dracocephalum, to which the first 2 belong according to Bentham Engler and Prantl consider the genus monotypic, containing only the third species below The 2 native kinds described below are compact, free-flowering border perennials, with aromatic lvs and numerous showy purplish pink fls with blue stamens, and borne in dense whorls on long racemes or spikes calyx a trifle oblique, 5-toothed, corolla-tube exserted, the limb 2-lipped, stamens 4, the anthers 2-celled —They are not quite hardy N , and should have a sheltered sunny position, or some winter protection The first 2 prop by division of the root, the last by cuttings

càna, Hook Height 2½–3 ft sts hard, square, subshrubby branches numerous, especially at the base, opposite, hoary with a minute pubescence upper lvs. small, ½–1½ in long, entire, hoary, numerous near the fls , ovate, lower lvs larger, cordate-ovate, dentate-serrate spikes numerous, whorls dense, 15- or more-fld ; corolla 1 in long, limb 5-cleft, the lowest lobe largest, crenate, revolute June–Oct Mex and New Mex B M. 4618



850. Cedrus atlantica.

mexicàna, Benth. (*Gardòquia betonicoìdes,* Lindl) Height 1–3 ft. root creeping: lvs 1½–2½ in long, ovate-lanceolate (the lower ones cordate), crenate-dentate, becoming purplish below, petioled fls very like the above, bright pink. Mex , Mts S. Ariz B M. 3860 —Rarer in cult than above; lvs larger, longer and fewer. Intro into cult. in 1839.

triphýlla, Moench (*Dracocéphalum canariénse,* Linn). BALM OF GILEAD Shrubby, 3 to 4 ft : lfts. 3, oblong or lanceolate: fls. purple or

white, in loose spicate whorls. Aromatic plant from Canary Isls.

C pállida, Lindl. Similar to C mexicana, but differing in having shorter, pale red fls. B R. 1846 29. It is sometimes confused with C. mexicana N TAYLOR.†

CÉDRUS (*Kedros*, ancient Greek name). *Pinàceæ.* CEDAR Trees grown for their persisting foliage and striking habit, they are also valuable timber trees.

Large evergreen trees, with quadrangular, stiff, fascículate lvs: fls monœcious, the staminate forming cylindrical catkins, cones ovate or ovate-oblong, thick, 3-5 in long, with broad, closely imbricate, bracts, attaining maturity in 2 or 3 years, seeds winged — Three closely allied species in N Afr, Asia Minor and Himalayas

The cedars are large ornamental conifers, with widespreading branches, very distinct in habit from most other conifers They are usually considered tender, but a hardy race of *Cedrus Libani* has been recently introduced by the Arnold Arboretum from the highest elevation where the species occurs in Asia Minor, the plants have stood all the winters since 1902 unprotected at the Arnold Arboretum and have proved perfectly hardy. It is very gratifying that one is now able to grow so far north the famous cedar of Lebanon which, aside from its beauty, is of peculiar interest for its historic and religious associations The race of *Cedrus Libani* commonly cultivated is rather tender, more tender than *C atlantica* which may be grown as far north as New York in sheltered positions, while *C. Deodara* can be grown safely only in California and southern states. The very durable and fragrant wood of all species is highly valued.

The cedars prefer well-drained, loamy soil, and will also grow in sandy clay, if there is no stagnant moisture Propagated by seeds sown in spring; the varieties by veneer grafting, in late summer or in fall, on seedlings of *C atlantica;* or, in warmer regions, on *C. Deodara;* they grow also from cuttings, if the small shoots are selected which spring occasionally from the old wood. Plants of this genus are the true cedars; but trees of other genera are often called cedar. See *Chamæcyparis, Juniperus,* and *Thuya;* also *Cedrela.*



851 Cedars on Mt Lebanon, Cedrus Libani.

A. *Branches stiff, not drooping cones truncate, and often concave at the apex.*

atlántica, Manetti. Fig. 850. Large, pyramidal tree, to 120 ft, with upright leading shoots: lvs mostly less than 1 in long, usually thicker than broad, rigid, glaucous green· cones 2–3 in long, light brown. N Afr. Gng 2:163. G. F 9 417 R H. 1890, p 32 G. W. 6, p 498. Gn. 37, p. 195. Gt 61, p. 449. Var. **glaùca,** Carr. Foliage glaucous, with silvery hue; a very desirable and vigorous form. Gng. 8: 275. Var **fastigiàta,** Carr. Of upright columnar habit. R H. 1890, p. 32.

Líbani, Loud. Fig 851. Large tree, with widespreading, horizontal branches, forming a broad head when older, leading shoot nodding: lvs. 1 in. or longer, broader than thick, dark or bright green, sometimes bluish or silvery: cones 3–4 in. long, brown. Lebanon, Taurus, S. Anatolia and N Afr. Gng. 5·65. Mn 1 39. G F 8 335; 2·149 (adapted in Fig. 851). Gn 48, p 237, 66, pp. 124–5, 178 G C. III. 34·265. F S.R. 2, pp. 291–4. Var. **brevifòlia,** Hook. With shorter lvs and smaller cones Cyprus Var. **glaùca,** Carr. (var *argéntea,* Veitch) Foliage of blue or silvery hue. Var **nàna,** Loud. Dwarf form.

AA. *Branches and leading shoot pendulous: cones obtuse.*

Deodàra, Loud Tall tree, of pyramidal habit, to 150 ft · lvs 1–2 in. long, dark bluish green, rigid, as thick as broad· cones 3½–5 in long, reddish brown Himalayas Gng 2·8. G C III 25·139; 34·400 F. 1876, p 103 Gn 28, p 223 V 20.185 Var. **robústa,** Carr. Lvs. about 2 in long, rigid. Var. **péndula,** Beissn. (var. *recurvàta péndula,* Hort.). With long pendulous branches

or prostrate if not supported. G.W. 14, p. 413 Var. **fastigiàta,** Carr. Of columnar habit. Var **verticillàta,** Rehd. (var *verticillàta glaùca,* Tutenberg). A compact form with the lvs whorled at the base of the shoots: foliage bluish white the hardiest form of the species. G W. 11, p 89. Var. **vfridis,** Knight. Lvs.



852. Ceiba Casearia, the great silk-cotton tree at Nassau.

bright green. Var. **argéntea,** Carr Foliage of silvery hue Var **nívea,** Annesley. Young growth white. G C III 25 399 Var **álbo-spica,** Annesley (var *álbo-spicàta,* Beissn) Young growth green, becoming later white at the tips G.W 11, p 89 Var. **aùrea,** Beissn. Foliage golden yellow. G.W. 11, p. 87.

ALFRED REHDER.

CÈIBA (aboriginal name) *Bombacàceæ* SILK-COTTON. KAPOK. CEIBA. Trees, one of which is widely known in the tropics for its great size as a shade tree, and for the "cotton" of its seed-pods. Eriodendron is a more recent name.

Leaves digitate, with 5–7 entire lfts · fls medium to large, rose or white, on 1-fld. peduncles, solitary or fascicled; calyx cup-shaped, truncate or irregularly 3–5-lobed; petals oblong, pubescent or woolly, staminal tube divided at the apex into 5 or 10 parts, each part bearing a stamen, ovary 5-celled fr a coriaceous caps , pubescent within and bearing obovoid seeds embedded in a wool-like or cotton-like fiber.—Allied to Bombax and Adansonia, from which it differs in having 5 parts in the staminal body or column, rather than a much more divided column bearing many stamens on each division. Ten or more species, mostly in Trop Amer , extending to Asia and Afr.

Caseària, Medic. (*C. pentándra,* Gaertn. *Bómbax pentándrum,* Linn. *B guineénse,* Schum & Thoun. *Eriodéndron anfractuòsum,* DC. *E occidentàle,* Don. *E. orientàle,* Kostel *Xylon pentándrum,* O Kunze). SILK-COTTON TREE CEIBA POCHOTE Figs 852, 853. Great tree, reaching 100 ft and more, and having immense horizontal far-spreading branches and widelung thin buttresses or flanges· trunk spiny when young; branches verticillate. lfts. 7, arising from a nearly circular plate or disk at the top of the petiole, lanceolate-acuminate, undulate, smooth, each 4–6 in. long: fls. white or rose, the corolla 2–3 in. long, petals oblong-obtuse, hairy outside: caps. 4–8 in. long, 5-valved, bearing many woolly seeds Tropics of Asia, Afr , and Amer. B M. 3360 —One of the characteristic and well-known trees of tropical countries The wings of some of the old trees run far in all directions, sometimes being prominent 30 ft. or more, note the picture (Fig 852) of the well-known tree at Nassau on the island of New Providence. The wood is used to some extent in interior construction, but is soft, white and brittle The cotton-like material in the pods is used in beds and pillows and for stuffing life-buoys, but it cannot be spun into threads, it is the "kapok" of commerce. Offered in S Calif and Fla., as a tree of rapid growth.

grandifiòra, Rose Tree, 15–20 ft , 8–12 in diam., the branches with short prickles: petioles 2–4 in. long, lfts 3–5, glabrous, oblong, cuneate at base. entire or slightly serrulate, 2–3½ in long petals white, silky, 4–5 in long, strap-shaped, stamens 5, the filaments 3½ in long and each with 2 anthers. caps oblong, 4½ in long. Trop W Mex —The fls. are fleshy, they change to brown Listed in S Calif.

L H B.

CELÁSTRUS (*Kelastros,* ancient Greek name) *Celastràceæ.* Woody plants grown chiefly for their brightly colored fruit, some also for their handsome foliage

Shrubs, usually climbing, with alternate, petioled, usually deciduous and serrate glabrous lvs fls. polygamous, 5-merous, inconspicuous, greenish white, in axillary or terminal panicles or racemes, calyx 5-parted, petals small, oblong-ovate, disk entire or crenate, stamens short; ovary superior; style short with 3-lobed



853. Leaves and fruits of Ceiba Casearia, the silk-cotton tree. (×¼)

stigma: fr. a caps. dehiscent into 3 valves, each containing 1 or 2 seeds, inclosed in a fleshy crimson aril. —More than 30 species in S. and E. Asia, Austral. and Amer. The species with perfect fls. in axillary cymes and with evergreen lvs, being rigid and often spiny shrubs, are now included under *Gymnosporia*, which see.

These shrubs are hardy and ornamental, very effective with their bright-colored fruit remaining usually throughout the winter; *C angulatus* is also worth growing for its large handsome foliage. They are very valuable for covering trelliswork, trees or rocks and walls: they grow in almost any soil and situation, and as well in shaded as in sunny positions. Propagated by seeds, sown in fall or stratified, and by root-cuttings or layers, suckers are freely produced, and become sometimes a nuisance in nurseries; they also can be increased by cuttings of mature and of soft wood.

A *Under side of lvs green.*

B *Lvs 2–4 in long branchlets terete.*

C *Fls. and fr in axillary few-fld cymes along the branches*

orbiculàtus, Thunb (*C. articulàtus*, Thunb). Fig. 854. High-climbing shrub: lvs cuneate, suborbicular to oblong or obovate, acute or acuminate, crenate-serrate, 2–3 in long: fr globular, orange-yellow, with crimson seeds. Japan, China. B M 7599. G F 3 550 (adapted in Fig 854). A F 9 534. G C. III 23 29, 43 242. Gng 5 119. M D G 1902 306. Var **punctàtus,** Rehd (*C punctàtus*, Thunb.). A less vigorous grower, with smaller, elliptic lvs.—*C orbiculatus* is of more vigorous growth than the following species, and fruits very profusely, but the frs are hidden by the foliage, and are not very conspicuous until the lvs have fallen, while *C scandens* bears its frs above the lvs.

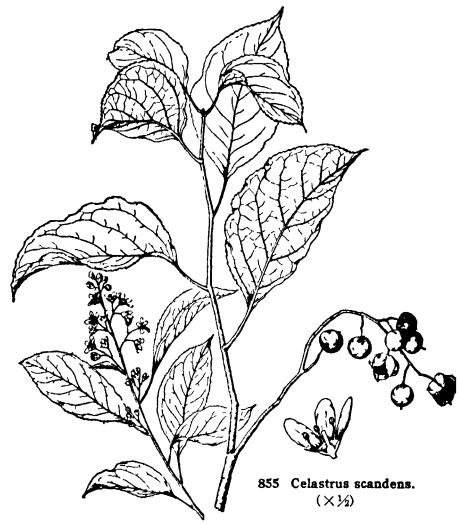
CC. *Fls. and fr. in terminal panicles.*

scándens, Linn. False Bitter-sweet. Wax-Work. Fig. 855. High, climbing to 20 ft. lvs. cuneate, ovate to ovate-lanceolate, acuminate, crenate-serrate, glabrous, 2–4 in. long. fls. in terminal, many-fld. panicles or racemes 2–4 in. long. fr. about ⅓in. diam., orange-yellow, with crimson seeds. Canada to S. D. and New Mex. Em. 545. A G. 11 29, 31. G F. 5.569 (adapted in Fig. 855). Gng. 5·119. A F. 9 534. V. 3 315. Gn. 33, p. 393 (habit).



854. Celastrus orbiculatus. (×½)

paniculàtus, Willd. (*C. dependens*, Wall.). Branches brown with numerous small white lenticels, pendulous: lvs. ovate-oblong or obovate, sometimes to 5 in. long: fls. in terminal pendulous panicles 4–8 in. long. Himalayas.—Not hardy N.



855 Celastrus scandens. (×½)

BB. *Lvs 4–6 in long and 3–5 in. broad: branchlets angular.*

angulàtus, Maxim. (*C latifòlius*, Hemsl.). Glabrous shrub, climbing to 20 ft.: branchlets angular, finely lenticellate. lvs. broadly ovate or roundish, abruptly short-acuminate, crenately serrate: terminal panicles 4–6 in. long. fr. subglobose, nearly ½in. thick, on thick short stalks, yellow with orange seeds. N. W. and Cent. China. H I 23 2206.—Even without fr. effective on account of its large foliage, has proved hardy at the Arnold Arboretum.

AA. *Under side of the lvs bluish white.*

hypoleùcus, Warb (*C. hypoglaùca*, Hemsl. *Erythrospérmum hypoleùcum*, Oliver). Glabrous shrub with terete brown branches scarcely lenticellate: lvs. elliptic or oblong-elliptic, 2–4 in. long, short-acuminate, remotely serrulate. terminal panicles 2–5 in. long, loose: fr. about ⅓in. thick on slender stalks, ⅓–½in. long. Cent. China. H I 19 1899.

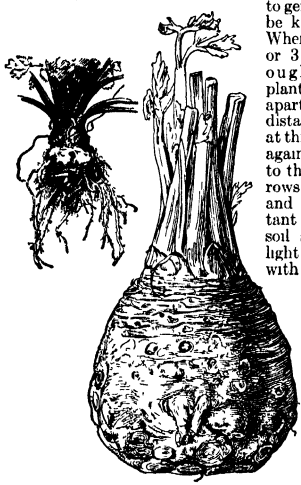
C. flagellàris, Rupr. Allied to C. orbiculatus. Branches with persistent spiny stipules, sometimes rooting. lvs. ovate or oval, small, finely serrulate, slender-petioled. fr. axillary, small. N. China, Korea, Japan. Quite hardy, but not so handsome as *C. orbiculatus*.—*C. nùtans*, Hort. Reasoner, not Roxbg. =Quisqualis indica.—*C. Orìza*, Sieb. & Zucc. =Orixa japonica.

Alfred Rehder.

CELERIAC (*Apium graveòlens*, Linn., var. *rapàceum*, DC.). *Umbellíferæ*. Fig. 856. An offshoot of the celery species, producing an edible root-part instead of edible leaves.

Celeriac is very little grown in this country, and to Americans is almost unknown, but it is much prized in Europe. Here it is cultivated chiefly where there is a foreign population. Fifteen or twenty varieties are mentioned in the seed catalogues, but there is very little difference in the various sorts, some seedsmen even making no distinction between varieties, but cataloguing the plant simply as celeriac.

In general, the culture is the same as for celery, except that no blanching is required, since it is the enlarged root that constitutes the edible part Sow the seed during the spring in a well-prepared seed-bed, preferably in a more or less shaded location A coldframe or a spent hotbed is a good place. The seed is slow to germinate, and must be kept well watered. When the plants are 2 or 3 inches tall, they ought to be transplanted, about 3 inches apart each way is a good distance to place them at this handling Later, again transplant them to the open ground, in rows about 2 feet apart and 6 or 8 inches distant in the row The soil should be a rich light loam well supplied with moisture. (The seed may be sown where the plants are to remain, and thinned to the required distance, but stronger, more stocky plants are secured by transplanting as directed) Plants thus treated will be ready for fall and winter use If they are desired for earlier use, the seeds may be sown in a mild hotbed and transplanted to the open



856. Celeriac trimmed for market (×½); also an untrimmed root, on a smaller scale.

Aside from frequent tillage, celeriac requires but little attention during growth It is a frequent practice with growers to remove a little of the earth from about the plants after the root has become well enlarged, and to cut off the lateral roots This tends to make the main root grow larger, smoother and more symmetrical in shape For winter use, the plants may be protected with earth and straw to keep out frost, or packed in moist sand and placed in a cool cellar.

The principal use of celeriac is for the flavoring of soups and stews, but it is also served in several other ways It may be boiled and eaten with a white sauce, like cauliflower, as a salad, either first being cooked as beets or turnips, or else cut up into small pieces and used raw; when boiled, sliced and served with oil and vinegar, it forms the dish known as "celery salad" An extract may be obtained from it which is said to have medicinal properties

Just how long celeriac, or turnip-rooted celery, has been in cultivation is unknown Its history as a garden vegetable can be traced definitely as far back as the middle of the seventeenth century, although writers for a century or more previous to this time made references which would seem to relate to this vegetable, but the identity is obscure. Its origin was probably the same as that of the common garden celery, of which it is doubtless a state wherein the root has become enlarged and edible. This form is supposed to be the one most remotely removed from the wild state.

H. P. GOULD.

CELERY (*Apium graveolens*, Linn). *Umbelliferæ.* A major garden vegetable, grown for its blanched leaf-stalks which are eaten raw and also used in cookery.

Biennial, sometimes annual, plants· lf.-stalks 6–15 in. long, bearing 3 pairs and a terminal lft. coarsely serrated and ternately lobed or divided. The fl -stalks are 2–3 ft high, branched and leafy; fls. white, inconspicuous and borne in compound umbels; seeds very small, flattened on the sides, broader than long. An acrid, pungent flavor characterizes the wild plants.

The genus Apium is variously understood. As mostly accepted, it comprises some 15 or 20 species of annual or perennial glabrous herbs with pinnate or pinnately compound lvs , and small greenish white fls. in compound umbels; calyx-teeth wanting, petals ovate or rounded The species are distributed widely in temperate regions and in the mountains in the tropics. *A graveolens* is the one important species to the horticulturist. Var. *rapaceum* is celeriac, a form or race in which the crown of the plant is thickened and turnip-like (see *Celeriac*) The wild celery plant is not stout, nor are the lf -stalks thickened, as they are in the domesticated races It grows 1–2 ft high when in bloom, in marshy places near the sea, on the coasts of Eu , Afr , and Asia, and it has run wild from cult in some parts of N. Amer.

Celery probably was not cultivated until after the Middle Ages, and the varieties now grown so extensively have been developed within the past thirty-five years It is not many years since this vegetable was regarded as a luxury and sold at prices that could be paid only by the wealthy, but today it is one of the standard vegetables and is produced in enormous quantities for the city markets. The industry is often highly profitable on muck areas, and thousands of acres of this land are used for celery-culture in Michigan, Ohio, New York, Florida and California Intensive market-gardeners of the North regard it as one of their most profitable crops, and results are especially satisfactory if the land can be irrigated When good markets are available, celery is an excellent crop to follow early garden crops, such as peas, beans, beets, bunch onions, radishes and other vegetables that mature in ample time to allow the after-planting of celery to mature Soils that have been previously cropped the same season should be manured liberally before celery is planted.

Types and varieties

The methods of cultivation and handling of celery depend so much on the variety that this part of the subject should be discussed at the outset Celery may be classified into two general groups—green varieties, and the so-called self-blanching varieties Formerly, the green kinds were grown almost exclusively, but commercial growers soon discovered that the self-blanching varieties possess certain cultural advantages that make them highly desirable from a business point of view They are more easily blanched, and this is probably the most important consideration when the crop is to be grown for commercial purposes This is particularly advantageous in the summer crop, and equally appreciated by those who plant large areas for the late market. When boards are used for blanching, more than twice as many plants may be set on an acre as when green varieties are employed and the crop bleached with earth. It is



857. The Boston ideal.

universally conceded, however, that the light-colored varieties are somewhat inferior in quality to the green sorts. For this reason it is a mistake to rely wholly on self-blanching varieties in the home garden. Many home gardeners plant the light-colored kinds for summer use only, and green varieties for fall and winter use.

In some regions, a plant with a much-branched base is desired as in Fig 857; but in general a less spreading or a lighter plant is grown, as in Fig. 858. These differences are mostly matters of the way in which the plants are grown, as to room in seed-bed and field.

White Plume is one of the best known of the self-blanching varieties It is vigorous in growth and attains a greater height than Golden Self-blanching and, for this reason, does not meet with as great favor among commercial growers The quality is also inferior to Golden Self-blanching

Golden Self-blanching is by far the most popular of American varieties It is a favorite with amateurs and constitutes probably 90 per cent of all the celery grown in the United States The plants attain a height of 14 to 20 inches, and are compact and stocky The stems are short, thick, easily blanched to a creamy white, and the foliage is abundant

Rose-ribbed Golden Self-blanching has a tinge of rose-color on the ribbing of the stems, which makes the variety attractive for the home garden It is not grown largely for commercial purposes.

Giant Pascal is an old green-stem variety that is not surpassed in quality In rich moist soils the plants attain a height of 30 inches or more It is a favorite of home gardeners who take pride in producing tall, tender stalks of the highest quality

Winter Queen is a more popular green variety among commercial growers than Giant Pascal It does not attain such a great height and grows more compactly, so that less space is required between rows, and the crop is more convenient to store

French Success is a very stocky compact winter variety that possesses excellent keeping qualities

Boston Market is famous for its excellent quality It is grown extensively about Boston in the home gardens and for commercial purposes It is low, compact, crisp, tender and of the best flavor

Many other varieties are planted to some extent, but the most important have been mentioned

Soils

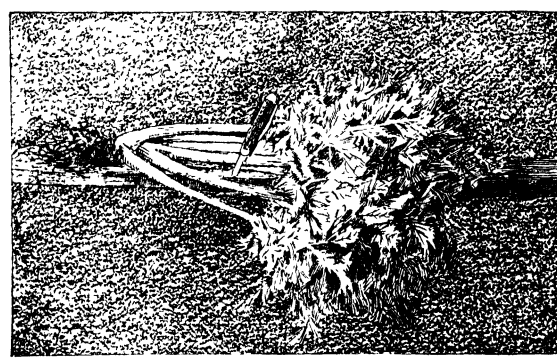
As previously stated, great commercial plantations are on muck soils, although the business is not confined to such lands The mucks usually provide ideal conditions for the culture of celery The plant thrives in soils abounding in vegetable matter, and as mucks contain 60 per cent or more of organic matter this requirement is fully met. A Kalamazoo (Michigan) muck soil, used extensively for celery, analyzed as follows:

	Per cent
Sand and silicates	19 16
Alumina	1 40
Oxide of iron	3 94
Lime	6 09
Magnesia	0 81
Potash	0 34
Soda	0 38
Sulphuric acid	1 31
Phosphoric acid	0 88
Carbonic acid	1 95
Organic matter (containing 2 53 per cent of nitrogen)	63 76
Water	6 51

Properly prepared mucks are loose and friable, and this is a great advantage in transplanting and in performing all tillage operations. The land is easily plowed, harrowed, leveled, marked and cultivated, and the work of ridging the plants is accomplished with the greatest ease. The depth of the water-table in muck lands varies greatly, but about 3 feet is considered most favorable; at this depth the plants never suffer from drought.

While it is universally conceded that muck soils provide the best conditions for the extensive cultivation of celery, the crop is grown with entire success on a great variety of soil types. In fact, the plants thrive in any friable soil which is adequately provided with moisture, plant-food and vegetable matter Near all the northern cities of the United States may be found plantations of limited area that return excellent profits. This is particularly true in sections devoted to the most intensive types of market-gardening, when stable manure and commercial fertilizers are used almost lavishly. With this system of soil-management, the ground soon changes its physical properties and in some cases approaches the muck soils in mechanical composition It is not uncommon to find small areas on various types of soil, cultivated intensely, which make a gross return of $1,000 or more to the acre. These results indicate the great possibilities of the home garden for the production of celery. There is no reason why every gardener, whatever his type of soil, should not be fully successful in growing a bountiful supply of the choicest celery for the home table.

The reclaiming of new muck lands is often an expensive undertaking The land must be cleared of brush and sometimes timber. Drainage must be provided



858 A good celery plant in the general market.

by means of tile or open ditches The land is often acid, and lime should be employed to correct the acidity For a year or two other crops than celery should be planted to get the land in the proper physical condition The first plowing should be done in the fall so that the land will be exposed to frost during the winter Corn is an excellent crop to plant the following spring. There should be repeated cultivation throughout the summer to destroy any other vegetation that may start

Other types of soil should be prepared as in the usual way for the small garden crops. Fall plowing, after large quantities of manure have been added, is often desirable when an early crop is to be started the following spring Smoothing harrows and plank drags should be used to make the soil fine and smooth preparatory to planting. All preparatory tillage operations should be conducted with a view to conserving soil-moisture, which is exceedingly important to celery throughout the period of growth.

Fertilizing.

As previously stated, it is important for land that is to be planted in celery to abound in vegetable matter. There must also be an abundance of available plant-food in order to secure a rapid and vigorous growth. When applying either manure or commercial fertilizer, the grower should bear in mind that this is a shallow-

rooted plant and the materials should not be placed at great depths.

All classes of growers, whether they are producing on a garden or field scale, and whatever their type of soil may be, recognize stable-manures as the best fertilizer that can be applied for this crop. Stable-manures are the most satisfactory because they furnish both organic matter and plant-food. It is often desirable to supplement stable-manures with commercial fertilizers, but the success of this crop will be far more certain if reliance is placed on barn-manures rather than chemical fertilizers.

An effort should be made to have the manures near the surface of the ground, and this can be accomplished by applying rotten or composted manure after plowing and working into the soil with a disc-harrow. If coarse fresh manure must be used and partially decayed manure is not available, it is preferable to apply it before plowing Market-gardeners often apply thirty to forty tons to the acre, although smaller quantities give excellent results, especially if fertilizers are used in addition to the manure. Ten tons of manure on muck land is a decided advantage over no manure, even when fertilizers are used in large quantities.

Probably no commercial grower of celery should attempt to produce this crop without the use of at least some commercial fertilizer. When stable-manures are used lavishly, a little acid phosphate, nitrate of soda or potash will often give increased profits.

When stable-manure is not used at all, or perhaps in very small amounts, commercial fertilizers should be used with freedom Two tons of a high-grade fertilizer to the acre is not an unusual application, and some of the most intensive growers use larger amounts In the smaller areas, from which a gross return of $800 to $1,200 to the acre is expected, there should be no hesitancy in spending $100 to $125 an acre for manure and fertilizer. Celery requires much nitrogen and the mixed fertilizer applied before planting, or afterwards as a side-dressing, should contain not less that 4 per cent of this element There should also be an abundance of potash and phosphoric acid. A fertilizer containing 4 per cent of nitrogen, 8 per cent phosphoric acid and 10 per cent potash should meet the requirements of this crop in all soils, when applied in sufficient quantity.

Some growers have found it highly desirable to apply nitrate of soda or complete fertilizer as side-dressings after the crop is well started. These applications may vary from 100 to 200 pounds to the acre and should be made at intervals of about three weeks.

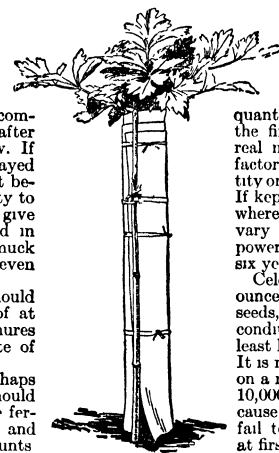
Starting the plants.

The greatest care should be exercised in procuring seed, for inferior seed may result in pithy or hollow



859. Celery planted thick, and the patch edged with boards. The "new celery-culture."

stalks, a poor stand of plants in the seed-bed, seedlings of low vitality, or a large percentage of seed shoots. Only the most reliable dealers, those who have a reputation for furnishing first-class seed of the varieties desired, should be patronized. To make certain of securing good seed, some careful growers import their seed directly from foreign producers, which, however, is unnecessary if the proper precautions are taken in the selection of a responsible seedsman. Practically all of the seed of the self-blanching varieties is grown in France, while most of the seed of green varieties is produced in California. As there is never absolute certainty of securing entirely satisfactory seed, some growers follow the excellent practice of buying in large amounts, sufficient to last several years. Only a small quantity of the seed is planted the first year to determine its real merit, and if found satisfactory there is sufficient quantity on hand to last several years If kept in sealed jars in a room where the temperature does not vary greatly, the germinating power will be retained at least six years.



860. Blanching celery by wrapping it with paper.

Celery seed is very small. An ounce contains about 70,000 seeds, and with the very best conditions should produce at least half this number of plants It is not safe, however, to count on a much greater number than 10,000 plants to the ounce, because many of the seeds usually fail to germinate and the plants at first are very small and easily perishable The seeds are slow to germinate They should be planted in fine soil which, if possible, should be kept constantly moist but never wet

Seed for the early crop is seldom sown before the first of March If checked in growth at any time, there is great danger of the plants producing seed shoots which renders them unsalable Plants started the first of March will, with proper care, be ready for market in August Earlier sowing is possible and sometimes desirable, but adequate facilities must be provided to avoid crowding the plants, which invariably results in checking the growth. Some gardeners have found it to be profitable to start the plants the latter part of February, finally transplanting into frames, where the crop is matured.

Seed for the early crop may be sown in the beds of the artificially heated frame or greenhouse Many growers use flats or shallow plant-boxes, which are placed in the hotbed or greenhouse While broadcasting of the seed is often practised, it is better to sow in drills 2 inches apart. The furrows should be very shallow, as the seeds should not be covered with more than ⅛ inch of earth Muck mixed with a small amount of sifted coal-ashes, sand and a little bone-meal, is most excellent for starting plants under glass After sowing and lightly covering the seed, place a piece of burlap over the bed, and water it. Keep the bed covered with burlap or a piece of cloth until the plants begin to come up Do not water more than necessary to keep the bed moist. When the plants appear they will need plenty of light, sunshine and fresh air. A temperature of 70° to 75° is most favorable to germination, but 10° lower should be maintained if possible after the plants are up. Higher temperatures, however, will do no harm if the proper attention is given to ventilation.

When the rough leaves appear, the seedlings should be transplanted into beds or preferably flats, spacing the plants 1½ inches apart each way. Stronger plants will be developed if they are set 2 inches apart. The flats may be about 2 inches deep and half filled with

rotten manure, the remainder of the space being filled with good rich soil. The manure will furnish ideal conditions for the roots of the young seedlings and make it possible to transplant them to the open ground with blocks of earth and manure so that there will be practically no check in growth If earliness is an important consideration, this method of treatment is highly important. Young celery plants require considerable nursing, and it will not do to take them from warm greenhouses or hotbeds to coldframes before the season is well advanced. They will suffer even more than tomato plants from low temperature. One of the most successful of our American growers invariably plants from the greenhouse to the open ground, beginning about May 10 .

Spraying the seedlings several times with bordeaux mixture may be the means of avoiding loss from fungous diseases

Seed for the late crop should be sown in the open ground or in protected beds as soon in the spring as the soil can be prepared Delay in starting the plants is often responsible for a failure of the late crop It is not so easy to control moisture in the outdoor seedbeds If overhead irrigation lines are available, there will be no difficulty in this matter The beds are often shaded with brush or lath screen Small beds may be kept covered with moist burlap. When starting on a large scale, the rows may be a foot or more apart Thinning is often necessary to secure stocky plants The plants may be set where they are to mature any time after they have attained a height of about 3 inches Ordinarily seedlings started out-of-doors are transplanted directly to the permanent bed or field without an intermediate shift, although this is an advantage in developing stronger plants with better roots If the plants attain a height of 5 inches or more before they are set in the field, the tops should be cut back before transplanting.

Planting in the field.

As previously indicated, plants for the early crop should not be set in the open ground until about May 10 in the latitude of Philadelphia and New York There is danger of injury from hard frosts if transplanted before this time, and such injury may result in a large percentage of the plants producing seed shoots, thus rendering them unsalable Seedlings for the late crop may be transplanted in permanent quarters any time after June 20

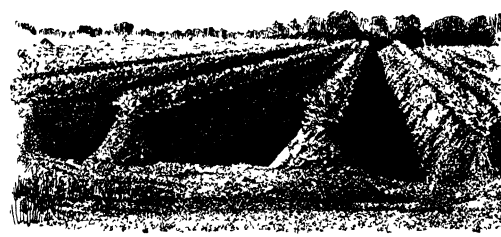
The time of planting in the field will depend largely on the varieties to be used For example, Golden Self-blanching may be set out three or four weeks later than Giant Pascal and have time to mature fully before hard freezing weather is likely to occur. Many commercial growers do not transplant the late crop until nearly the first of August In most parts of the North, it is better to transplant early in July The date of transplanting, however, is not so important as to have the plants, as well as the ground, in proper condition before transplanting is started. Plants that are 3 to 5 inches high are much more likely to live and thrive than taller ones. The ground should be smooth, fine and moist. It is exceedingly important to have the rows perfectly straight and this can be accomplished by the use of a marker. A line may be used for this purpose, but transplanting may be accomplished much more rapidly by using a rope-and-peg marker

There is the greatest variation in the planting distances for celery Some of the most intensive growers plant 7 or 8 inches apart each way. Others prefer to space the rows about a foot apart and have the plants stand 4 inches apart in the row. When such close planting is followed, it is known as "the new celery-culture" (Fig. 859). The plants stand so close together when this method is used that they blanch themselves and it is unnecessary to use boards or other devices "The new celery-culture" is better adapted to greenhouse and coldframe use, where the plants can be watered by sub-irrigation When plants stand so close together, there is little circulation of air and heart-rot or other diseases are likely to occur in hot moist weather. The possibilities of a small area by use of this method are very large and the system appeals to growers who have only small tracts of land to cultivate.

A more common practice is to space the rows 18 inches to 2 feet apart and to set the plants 4 or 5 inches apart in the row This method is now almost universally employed for Golden Self-blanching when boards are to be used for blanching the crop When transplanted 4 by 24 inches apart, about 60,000 plants are required to set an acre If horse implements are to be used in planting, it is better to allow at least 28 inches between rows.

Some growers prefer to plant Golden Self-blanching in double rows 6 inches apart, placing the plants 4 or 5 inches apart in the row This plan is not universally popular because it is not favorable to the full development of every plant. Boards are also used for blanching when this system of planting is followed.

When soil is to be used for blanching, more space



861 The last earthing-up or banking of celery

must be allowed between rows Formerly the almost universal practice was to allow 5 feet between rows. With tall-growing varieties, such as Giant Pascal, this is not too much space to provide sufficient soil for blanching When lower-growing varieties, such as Winter Queen, are used, the rows need not be more than 4 or 4½ feet apart to give sufficient space for blanching with earth. The larger varieties of the green type should not be planted quite so close together in the row as Golden Self-blanching; for the best development of the plants, it is better to space them 5 or 6 inches apart in the row

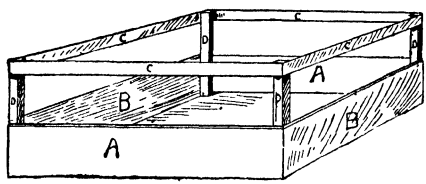
Growers who plant both early and late varieties often alternate the rows The early variety is removed first, of course, and then there is 4 feet or more of space between the rows of late varieties which are blanched with earth Transplanting should proceed as rapidly as possible without undue exposure of the roots to the air If the plant-beds are watered twenty-four hours in advance of transplanting, the plants may be removed with less injury.

Subsequent tillage practice in the North.

Celery is often inter-cropped with other vegetables. One of the most common plans is to plant five rows of onions about a foot apart as early in the spring as the ground can be prepared The fifth rows are pulled for bunching, and celery is planted instead of the onions. This is a most excellent combination for muck soils where good markets can be found for both crops. Radishes are also excellent to precede celery. If desired, the small button-shaped varieties may be

used, every fifth row to be planted in celery and later-maturing varieties of radishes in the four rows between.

Frequent tillage is necessary for the best results with celery. As it is a shallow-rooted plant, tools that run at considerable depth should be avoided. For horse tillage, there is nothing superior to the spike-tooth cultivator in general use. If the plants are small, great care should be exercised to avoid throwing dirt on top of the hearts. If the ground contains many



862. Water-holding celery crate.

weeds, more or less hand work will be required between the plants in the rows.

The mulching of soils with horse-manure has been a very popular and profitable practice in recent years. It has been shown in the laboratory as well as in field practice that a fine mulch of 3 or 4 inches of horse-manure conserves moisture more perfectly than the most thorough tillage. The mulching of celery in the field not only conserves moisture but it reduces the labor of tillage and also furnishes nourishment to the plants. The rains carry liquid food to the roots and a more rapid growth invariably follows. Considerable hand labor is required, of course, to place the manure between the rows, but this is probably no greater than the labor needed to till the crop when a mulch is not used. It is customary to use fresh horse-manure, which has been aerated in thin layers for a few days before making application. The ground is completely covered, although the manure is not allowed to touch the plants. The mulch may be applied immediately after planting or, as some prefer, the plants may be tilled for ten days or two weeks and the mulch then applied. Very few weeds will appear if 3 or 4 inches of horse-manure is used.

Irrigation makes the crop more certain, and it is also a means of securing larger and more vigorous growth and consequently better quality. Most of the intensive growers of the East are prepared to irrigate. Various methods are employed. Some who cultivate very small areas use the hose or other sprinkling device. The method that is now in most common use is the overhead system of irrigation, providing for parallel pipe lines about 50 feet apart (see *Irrigation*). These are turned at will by means of levers at the ends and the water is thrown out at any desired angle through small nipples placed about 4 feet apart on the lines. It is important to do the watering if possible in the evening or at night so that the foliage may be as dry as possible during the day. It is also important to make thorough applications, as it is not advisable to water more frequently than absolutely necessary.

Blanching.

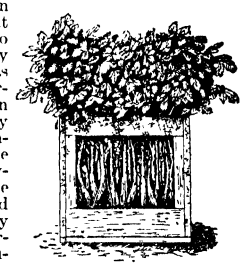
All American markets demand celery with creamy white stalks. This light color is secured by causing the plants to grow with the stalks in the dark, or nearly so, which prevents the development of chlorophyl. When boards, earth, paper, tile or other means are used, most of the leaves are not covered, and growth is not hindered in the least.

Green varieties are blanched almost exclusively by the use of earth. There should be no ridging until the weather is cool and, therefore, this operation is not usually undertaken until early in September at the North. At first the ridging should be only a few inches high, but later should extend to the full height of the stems. Finally, the rows are ridged so that only the tops protrude above the ridges, as shown in Fig. 861. Special tools are available for this operation and the work may be done very rapidly.

The early crop is blanched mostly by means of boards, although paper (Fig. 860) and other devices are sometimes used. Hemlock, pine and cypress lumber are used for this purpose in various parts of the country. The boards need not be more than 10 inches wide, although 12-inch boards are commonly used. They may be of any convenient length, say 14 to 16 feet long. To prevent warping and splitting, cleats about 3 inches wide and ½inch thick should be nailed at each end and in the middle of the boards. The boards are placed on edge, one on each side of the row and brought as close together as convenient at the upper edge and secured by means of wire hooks. Sometimes stakes are driven at the sides, although wire hooks are more convenient. The hooks should be 6 or 7 inches long and may be made of heavy fence wire. From ten days to two weeks is required for proper blanching with boards. As the crop is sold, the boards are shifted from place to place so that they may be used several times during the season. When not in use, the boards should be stored under cover or stacked in piles with strips between them. With good care, boards that are sound when purchased will last fifteen years.

Harvesting and marketing.

The harvesting of the celery crop when grown in coldframes usually occurs in the month of July. If the climate is not too severe, it is possible to have celery ready for market the latter part of June. The late crop, which is produced without the use of boards, is not usually ready for market until August. It is lifted with forks or perhaps cut with a sharp knife just beneath the surface and conveyed to the packing-house where it is prepared for market. In some sections the roots are not trimmed at all, the plants being tied in bunches of a dozen and packed in a standard crate such as is shown in Fig. 862. These crates are 24 by 24 inches at the base, and contain six to sixteen dozen plants, depending on the size of the celery. The height of the crate may be varied to suit the height of the celery. Another form of celery crate is shown in Fig. 863. In some regions, the roots are trimmed into tapering cubes as shown in Fig. 864. A very convenient method of bunching is to place three plants side by side, tapering the roots as indicated, tying the tapering roots tightly and then securing the tops. Formerly twine was used almost entirely for bunching, while in recent years many growers have found it desirable to use either blue or red tape, which gives the celery a more attractive appearance on the market. Michigan growers and other producers of celery in the Great Lake district use small crates of very thin lumber. These vary in size and range about as follows: 6 by 12 by 24 inches; 6 by 16 by 24 inches; 2 by 20 by 24 inches; 6 by 26 by 24 inches and 6 by 30 by 24 inches. The number of bunches in the crates depends on the size of the celery and of the crate, but varies from four to twenty-four dozen. For local markets, the plants may be tied in bunches of the most popular size and packed in any crate of convenient form and size.



863. Celery crate

Storage.

A large percentage of the late celery crop is placed in city cold-storage houses. It is packed with the roots on, and there is very little trimming. Golden Self-blanching keeps fairly well in cold storage, or at least the hearts are presentable when they come out of storage. This is the product that now meets the general demand of the large cities until celery begins to arrive from Florida.

In the North, this crop is very commonly stored in trenches. The trenches are dug in well-drained ground and must be deep enough to accommodate the plants so that the tops will not extend more than about 2 or 3 inches above the trenches. The celery will keep better if the trenches are not too wide. Ordinarily they are dug 10 to 14 inches wide. The plants are lifted and stood as close together in the trench as possible. Some growers prefer to place a little earth over the roots, although this is not necessary. If the tops of the plants are dry when stored, and if the plants are not permitted to wilt by being in the sunshine, they should keep in perfect condition in the trenches. Boards are nailed together in the form of a trough and placed over the trenches as rapidly as they are filled. Early in the season, and especially if the weather is quite warm, it is an advantage to provide additional ventilation by placing stones or blocks under the edges of the trough. As the season advances and the weather becomes colder, these should be removed and when necessary, earth, or, better, manure, thrown over the boards to give additional protection. Four or 5 inches of manure will protect the crop thoroughly in most sections until Thanksgiving and perhaps Christmas, depending on the weather. Two kinds of trench storage are shown in Figs. 865, 866.



864. Celery plant trimmed for market

The late crop is often stored in coldframes of sufficient depth to receive the plants. The frames are usually covered with boards lapped in roof fashion, and straw or marsh hay is placed over the boards when necessary to give additional protection.

Ordinary house cellars, which are well ventilated and not too warm, may be used for storing a limited quantity of celery. Various types of houses have been built for keeping the crop. Cement or brick structures are perhaps the most serviceable. It is important to provide ample ventilation in structures of this kind. In some regions, as around Boston, pits are constructed. The sides of these should be about 2 feet high and the roof may be constructed in an even-span form or simply a shed roof against some other building. Boards are also used for the roofs and covered with straw or hay to give protection during cold weather.

Enemies.

Celery does not have any serious insect enemies. Diseases are much more destructive and difficult to control. The most important diseases are the blights (*Cercospora apii* and *Septoria petroselini* var *apii*), leaf-spot (*Phyllosticta apii*), and rust (*Puccinia bullata*). The application of bordeaux mixture in the seed-bed will help to control some of these diseases. Many growers also find it necessary to make frequent applications of bordeaux mixture in the field in order to prevent serious losses. The complete control of diseases in the field may be the means of avoiding loss in storage. The earlier applications of bordeaux mixture are regarded as the most effective. Rotation is also desirable in preventing losses from disease.

R. L. Watts.

Celery-growing in the South.

The method of raising celery seedlings is not the same in the South, and especially in Florida, as it is in the North. Sowing is done in July, August, and September, at a time of the year when there is continued warm weather, and frequent beating rain.

A place is chosen for the seed-bed near the celery field,—usually a plot at the edge. The size of the field to be planted will determine the extent of the seed-bed. The width of the seed-bed varies from 18 to 36 inches. Rows are sown across it, making it possible to weed and keep the earth worked from both sides. Immediately after sowing, pieces of heavy burlap (usually old fertilizer sacks) are placed over the beds to conserve the moisture, cool the soil, and to protect the seeds against the beating of heavy rains. The seed-beds are sprinkled as often as is necessary to keep the surface moist.

After the seeds have germinated and the seed-leaves have pushed their way through the ground, the sacking is removed and a screening of cheese-cloth is placed over the bed. Some beds may be covered with cheese-cloth parallel to the surface of the soil. In other cases, a wire is run lengthways over the middle of the bed, and the cheese-cloth is placed over the wire and secured at the sides like a roof. The covering is about 8 to 12 inches above the bed, which gives room for the circulation of air. The beds are kept moist by repeated watering, applied directly through the cheese-cloth.

As soon as the plants are 2 or 3 inches high and are well greened, they will be strong enough to stand direct sunlight and will shade the ground sufficiently to keep it from drying out rapidly.

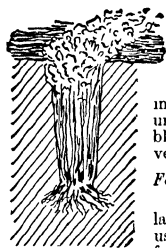
The best variety.

Formerly nearly all varieties of which seeds were offered by seedsmen were planted. In recent years, however, all have been nearly eliminated except the Golden Self-blanching. The seed of this variety is very high in price and, in years of scarcity, seed supplied under this name is often found to be more or less untrue to type. Seed of low-germinating quality is often found to contain many plants that will make unwelcome vegetables, probably because the undesirable green and red strains that may occur in the Golden Self-blanching variety are more resistant to deterioration than the true type.

Planting and blanching.

Blanching is secured entirely by the boarding-up method. For this purpose, second- or third-grade cypress boards are used; these low-grade boards usually have defective parts or are filled with worm-holes so as to be obtainable rather cheaply. The expense of the lumber, notwithstanding, is so great that it becomes necessary to plant the celery in double rows. Two rows are planted 8 or 10 inches apart, and the plants set 6 or 8 inches apart in the row. By alternating the settings in the two rows, additional space is secured for the plants.

A space of 30 to 40 inches is allowed between the sets of double rows. As soon as the celery has reached the proper stage of growth, or the market has arrived at a condition in which it is thought wise to ship the celery, the boards are placed alongside the plants and held in place by stakes driven into the ground. Further to exclude the air and light, a small quantity of soil is plowed against the bases of the boards, although this is unnecessary when the soil is sufficiently mellow. The tops of the boards are placed firmly together so that only a part of the foliage extends above them With the Golden Self-blanching variety, it is only a few days until the celery is sufficiently blanched and crisp to make a good vegetable.



865 An old method of growing celery in trenches. It is yet sometimes stored for winter in such trenches.

Fertilizer.

In the preparation of the field, large quantities of fertilizer are used Stable manure is not a favorite, unless it can be applied to the land early enough to become thoroughly rotted before the plants are set out The quantity obtainable, however, is usually so small and the price so high in the South that commercial fertilizers have largely replaced it. The quantity of fertilizer applied may range up to $80 or even $125 worth per acre (of the formula given on page 704.)

Irrigation.

In the most productive celery regions, sub-irrigation systems (as described under *Irrigation*) are established. The laterals are laid 15 to 25 feet apart, according to the contour of the land, and the notion of the grower The irrigation system at the same time serves as a drainage system This makes it especially convenient, since abundant artesian water is present in nearly all the celery-growing sections far south The system has been found so convenient that a large amount of damage has been done by over-irrigation, not only in carrying off much soluble fertilizer, but also by water-logging the soil and thus driving the roots of the celery plants so near the surface as to be constantly liable to injury. In the hands of careful celery-growers, however, the system is the best that has been invented

P. H. Rolfs.

Celery-growing in California.

There are two principal celery-growing districts in California,—Orange County, which is situated in the swamp lands south of Los Angeles; and the northern district, which includes the peat or swamp lands along the Sacramento and San Joaquin Rivers between Sacramento and Stockton.



866. A good form of trench storage.

Several varieties of celery have been tested in this state, but the Golden Self-blanching is most popular and profitable.

Seeding.

In California the seed is sown in the open ground, but, owing to its extremely small size, it is difficult to get a good stand unless the ground is well pulverized. It is commonly estimated that enough plants may be grown on 1 acre of seed-bed to plant 20 acres in the field. To produce healthy, vigorous plants, heavy watering is the rule at first, but as soon as the plants have begun to grow the quantity of water is reduced, and it should never be allowed to stand on the surface of the bed In order to accomplish this the land must be well drained. The seed is usually sown in March, April or May.

Irrigation and drainage

Although not nearly so much water is required for the plants in the field as in the seed-bed, celery plants cannot stand drought at any stage of their growth; a well-controlled irrigation system is imperative, except where the water-table is close to the surface

Good drainage is as important as irrigation, for, if water is allowed to stand in the field even for a short time, the plants will suffer seriously As most of the California celery land is low and the ordinary drainage is poor, an extended system of tile drainage has been laid in nearly all celery fields, especially in Orange County, to prevent losses from standing water.

Subsequent tillage.

When the plants are large enough to be transplanted, they are pulled from the seed-beds, placed in tin pans and hauled to the field, where they are planted 6 inches apart in the furrows 3½ feet apart The depth of the furrows in which the plants are set is somewhat varied, depending on the soil-moisture, and the size of the plants The average depth is from 3 to 5 inches

After the plants have been set in the field for about three weeks or a month and have recovered from the transplanting, the field is "crowded" This operation consists in moving the earth away from the young plants so that they will have more air around them and to kill what weeds have grown so close to the plants that it is impossible to reach them with the cultivator

As the earth between the rows of plants is left in a ridge after the plants have been "crowded," a large wooden roller, which extends across several rows, is now used to flatten down these ridges and to pack the soil more firmly The roller is used only when the plants are small, otherwise they would be injured by being crushed If the plants have grown so large that there is danger of injury by this rolling of the middles, the ridges are smoothed down by the cultivator

When the plants are 12 to 15 inches tall, earth from between the rows is drawn up to them This is termed "splitting." This should be done carefully, for, if the earth is put too close or too high up on the plants, they will become tender and weak, especially if the weather is hot The object of "splitting" is gradually to encourage the plants to grow tall and straight instead of spreading out This operation is repeated twice in the season, the first time when the plants are 14 to 16 inches tall and the second time just before banking. This last "splitting" also aids blanching.

Blanching.

Practically all the celery grown in California is banked with earth for blanching. Banking is done when the celery is reaching its maturity and is nearly ready for shipment This is the last field operation before the crop is cut. When the celery is banked for the first time, the earth is not drawn very high on the plants, but each time the field is banked the soil is drawn higher so as firmly to hold the leaves together and in an upright position If celery that has been banked for the last time is not harvested shortly, it will soon become "punky." The length of time that it can safely be left in the bank depends upon the character of the soil, the weather conditions, and upon the condition of the plants themselves. Celery on sandy soil will keep much longer in the bank than on heavy clay loam or peat soil. If the celery has not matured or if the weather is hot or moist, its keeping quality

will be injured. Holding too long in the bank will result in a wilted and "punky" product.

Harvesting and shipping.

When the celery is ready to harvest, a cutting machine is used which cuts off the plants just below the crown, leaving a few roots attached. The plants are then lifted and shaken from soil, trimmed and thrown in piles by laborers, who are usually Japanese. Another gang of men then place the plants in crates, marking on each crate the number of dozens it contains. More men follow, nail the crates securely, load them on wagons which transport them to the railroad siding, where they are ready for shipment and distribution to the various markets in the United States and Canada.

The celery is packed in the fields in crates 22-by-24-inch base and 18 to 24 inches in height, according to the quality One of these crates holds from five to ten dozen celery plants An ordinary car holds from 160 to 165 of these crates The shipping of the crop starts in October and continues through March, but the bulk of the crop is harvested during November, December and January The earlier shipments come into competition with celery from Michigan and other middle western states, and the later shipments come into competition with celery from Florida A very efficient system of marketing has been developed by means of various associations of the growers which have representatives in the leading markets in the United States so that the celery is shipped to points of greatest demand.

Enemies.

The most important disease in California is the late blight (*Septoria petroselini* var. *apii*), which has done an immense amount of damage in the past but is now handled successfully by most of the growers Spray with bordeaux mixture For early blight (*Cercospora apii*) keep plants growing thriftily and spray with bordeaux (For a detailed account of the diseases of celery in California see Bulletin No 208, published by the University of California) STANLEY S ROGERS.

CELMÍSIA (a name in mythology) *Compósitæ*. More than 40 New Zealand perennial herbs, and 1 in Austral and Tasmania, some of which may be expected in botanic gardens and collections Lvs. radical and in rosettes, or densely imbricated if borne on the sts, usually tomentose heads large and solitary on a long or short scape, with imbricate pubescent or glandular bracts in several or many series; rays in a single row, always white The celmisias are characteristic plants of New Zeal, covering the mountain slopes and valleys, especially in the South Isl, with the showy daisy-like fls. Probably none is regularly in cult. L H. B.

CELÒSIA (Greek, *kelos*, burned; referring to the burned look of the flowers in some species). *Amarantàceæ*. COCKSCOMB Popular garden annuals, grown for the showy agglomerated flower-heads and sometimes for colored foliage

Alternate-leaved annual herbs, the lvs. entire or sometimes lobed, mostly narrow. fls in dense terminal and axillary spikes, the spikes in cult. forms becoming densely fasciculed and often the sts. much fasciated; perianth very small, 5-parted, dry, the segms. oblong or lanceolate, erect in fr, stamens 5, the filaments united at base· fr a circumscissile utricle, with 2 to many seeds —About 35 species, all tropical, in Asia, Afr. and Amer

There are two main types of celosias, the crested form and the feathered or plumy ones. The crested cockscomb is very stiff, formal and curious, while the feathered sorts are less so, and are used to some extent in dried bouquets. The plumy sorts are grown abroad for winter decoration, especially under the name of *C. pyramidalis*, but to a small extent in America. The crested cockscomb is less used as a summer bedding plant than formerly, but it is still commonly exhibited in pots at small fairs, the object being to produce the largest possible crest on the smallest plant

For garden use, the seeds are sown indoors in early spring, and the plants set out May 1 to 15. If the roots dry out, the leaves are sure to drop off. The cockscomb is a moisture-loving plant, and may be syringed often, especially for the red-spider, which is its greatest enemy. A light, rich soil is needed.

A *Spikes crested, monstrous.*

cristàta, Linn. COCKSCOMB Fig 867. Height 9 in. or more: st very glabrous· lvs petiolate, ovate or somewhat cordate-ovate, acute, glabrous, 2–3 in long, 1 in. wide: spikes crested, subsessile, often as wide as the plant is high· seeds small, black, shining, lens-shaped. Tropics Gn 13, p 231 R H 1894, p 58.—There are 8 or 9 well-marked colors in either tall or dwarf forms, the chief colors being red, purple, violet, crimson,



867 Celosia cristata.

amaranth and yellow The forms with variegated lvs. often have less dense crests *A. japónica*, Mart, little known to botanists, is said to be a distinct garden plant with branching, pyramidal habit, each branch bearing a ruffled comb

AA *Spikes plumy, feathery, or cylindrical.*

argéntea, Linn Taller than the above lvs shorter-stalked, narrower, 2–2½ in long, 4–6 lines wide, linear-lanceolate, acute. spikes 1–4 in long, erect or drooping, long-peduncled, pyramidal, or cylindrical India —This species is considered by Voss (in Vilmorin's Blumengartnerei) to be the original one from which the crested forms are derived He makes 9 botanical forms, to one of which he refers *C. cristata* The range of color is even greater in the feathered type than in the crested type The spikes are very various in form and habit Various forms are shown in Gn 6, p 513, 9, p. 149; 17, p 331 (all as *C. pyramidalis*) R H. 1857, p. 78, and 1890, p 522 (as *C. pyramidalis*)

Hüttoni, Mart Height 1–2 ft · habit bushy, pyramidal st. sulcate-striate lvs reddish or crimson, lower ones lanceolate, subsessile· spikes red, cylindrical, oblong, obtuse, 1½ in long; perianth-segms oblong (not lanceolate, as in *C. argentea*) Java —A foliage plant, and less common than the 2 species above.

C. spicata, Hort =(?) Not the C spicata, Spreng, perhaps some form of C cristata —*C. Thómpsonii magnífica*, Hort, is a trade name and apparently without botanical standing

WILHELM MILLER.

CÉLSIA (Olaus Celsius, 1670–1756, a Swedish orientalist). *Scrophulariàceæ* Herbs, with yellow fls. in terminal racemes or spikes, closely allied to Verbascum, but has only 4 stamens, and they are of 2 sorts. About 40 Old World species, mostly from the Medit. region.

Only **C. crética,** Linn. f., is known in Amer., and that very sparingly. It is a hardy or half-hardy biennial, with alternate lvs., of which the lower are slightly pinnate and lanceolate, and the upper ovate-lanceolate, toothed and clasping: fls. large (nearly 2 in. across), and somewhat as in Anturrhinum, yellowish, with dark markings in the center and conspicuous deflexed stamens. Stout hairy plant, 3–6 ft. high, from Crete. B M. 964.—A very showy plant well worth much wider cult. See page 3566

C. póntica, Hort. Has whitish lvs. and pure white fls.

N. TAYLOR.†

CÉLTIS (ancient Latin name). *Ulmàceæ.* NETTLE-TREE. Woody subjects grown chiefly as shade or lawn specimens.

Trees or rarely shrubs, sometimes spiny: lvs. alternate, petiolate, stipulate, deciduous or persistent, usually oblique at the base and 3-nerved: fls. polygamous-monœcious, inconspicuous, apetalous, 4–5-merous, axillary, the staminate in small clusters on the lower part of the branchlets, the fértile solitary in the axils of the



868. Celtis occidentalis (×½) (Detail ×¼)

lvs. on the upper part of the branchlets, with a 1-celled superior ovary crowned by a 2-parted style and with 4–5 short stamens: fr a 1-seeded, small drupe, edible in some species; embryo with broad cotyledons — Seventy species in the temperate and tropical regions of the northern hemisphere, of which a few hardy ornamental species are cult.

The nettle-trees are valuable as shade trees or as single specimens on the lawn, mostly with wide spreading head and light green foliage, which is rarely seriously injured by insects or fungi, they thrive in almost any soil and even in dry situations, they are of vigorous growth when young, and are easily transplanted. The straight-grained wood is light and elastic, easily divided, and much used for the manufacture of small articles and for furniture; that of *C. australis* is valued for carving. Propagated by seeds, sown after maturity; also by layers and cuttings of mature wood in fall; rarer kinds are sometimes grafted on *C. occidentalis.*

A. *Lvs. entire, or rarely with few teeth, thin, at length glabrous.*

mississippiénsis, Bosc (*C. lævigàta,* Willd. *C. integrifòlia,* Nutt.). Tree, 60–80 ft.: lvs. unequally rounded or cuneate at the base, oblong-lanceolate or ovate, acuminate, usually falcate, smooth above, 2–4 in. long: fr. orange-red, nearly globular, ¼in. thick, on slender pedicel, longer than the petiole; stone pitted. From S. Ill. to Texas and Fla., west to Mo. S.S. 7:318. G.F. 3:41, figs. 9–11. Mn. 7:225, 227.

AA. *Lvs. serrate, sometimes entire and pubescent.*

B. *Ovary and fr. glabrous.*

C. *Branchlets usually and lvs. more or less pubescent, at least when young.*

D. *Fr.-stalks slender, longer than petioles: lvs. usually rough above stone pitted*

E. *Under surface of lvs glabrous at maturity.*

occidentàlis, Linn Fig. 868 Large tree, occasionally 120 ft.: branchlets glabrous or slightly pubescent lvs. oblique and rounded at the base, ovate-acuminate, pubescent when young, usually rough above, sometimes smooth at maturity, usually entire toward the base, light green, 2–6 in long fl orange-red, ½–½in. long, on slender pedicel, longer than the petiole. S S. 7:317. G F. 3:40 (adapted in Fig 868) and 43. Em. 304 Mn 7:231, 233. A G 20 240, 531 —Very variable species Var **crassifòlia,** Koch (*C crassifòlia,* Lam), has firm, very rough and large lvs , to 5 in long, usually cordate at base and more strongly serrate Michx. Hist. Arb 3:228

EE. *Under surface of lvs pubescent.*

australis, Linn Tree, to 60 ft lvs oblique, broadly cuneate or rounded at the base, ovate-oblong, long-acuminate, pubescent beneath, 2½–5 in long. fr. over ½in long, dark purple, sweet, pedicels 2–3 times longer than the petioles Medit region to Persia. H W. 3.40, p 11 —Not hardy N

Hélleri, Small. Tree, to 30 ft branchlets pubescent. lvs ovate or ovate-oblong, obtuse or acute, truncate to subcordate at the base, rough above, grayish and pubescent or tomentose, and reticulate below, 2–3 in. long fr ½in thick, light brown, on pubescent pedicels about ½in long and rather stout Texas —Sometimes planted as a street tree in Texas

DD *Fr.-stalks rather stout, as long or slightly longer than petioles: lvs grayish green beneath stone smooth*

sinénsis, Pers (*C japonica,* Planch) Tree, to 30 ft lvs usually rounded or cordate at the base, broadly ovate to oblong-ovate, acuminate, serrate-dentate, pubescent when young, pale or glaucescent and prominently reticulate beneath, 2–4 in long fr dull orange-red, pedicels rather stout, not much longer than the petioles China, Japan S I F 1 36 —Has proved hardy at the Arnold Arboretum.

CC. *Branchlets and lvs quite glabrous stone smooth.*

D. *Foliage bluish or grayish green.*

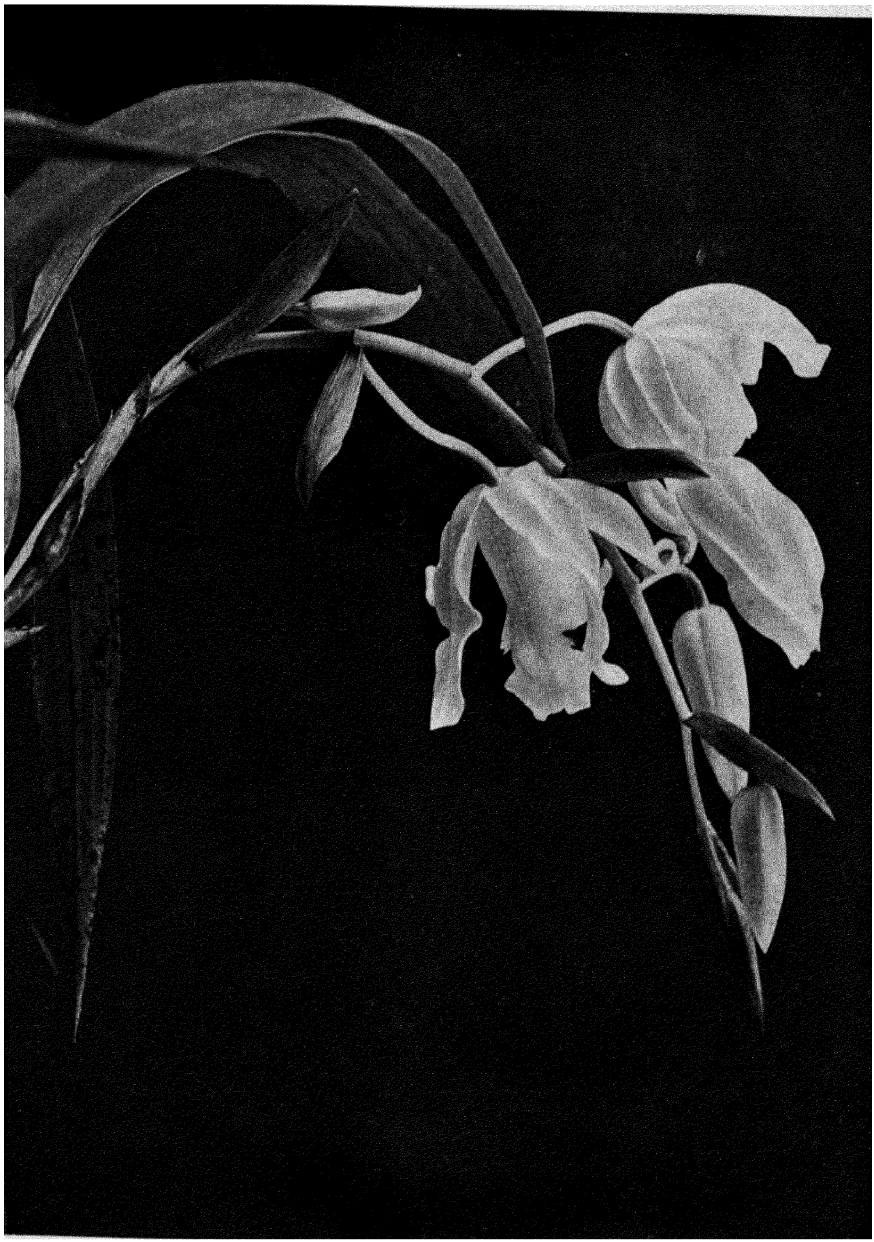
Tournefórtii, Lam. (*C orientàlis,* Mill , not Linn). Tree, to 20 ft , or shrub. lvs ovate, acute, usually rounded or subcordate at the base, 1½–3 in. long, of firm texture, not reticulate, sometimes pubescent. fr. reddish yellow, about ½in. across, its stalk about as long as petiole, ½in long or somewhat less. Greece, Sicily and Asia Minor —Not quite hardy N.; attractive on account of its bluish green foliage.

DD. *Foliage bright green, lustrous*

Bungeàna, Blume Tree: lvs. usually rounded at the base, ovate, acuminate, crenate-serrate, nearly glabrous when young, green and shining on both sides, 1½–2½ in.: fr. purplish black, small; pedicels longer than the petioles. N China.—Hardy, and a very distinct species, with dark green and glossy foliage.

BB. *Ovary and fr. pubescent; subtropical, tender tree.*

Kraussiàna, Bernh. Tree: lvs. oblong-ovate, usually rounded at the base, acuminate, crenate-serrate, pubes-



XXIV. Cœlogyne cristata, one of the popular and easily grown orchids.

cent on the veins beneath, semi-persistent: ovary tomentose: fr. mostly pubescent, slender pedicelled. S. Afr. to Abyssinia. Sm, Forest Fl. Cape Colony, 134. —Hardy only S.

C. Bióndi, Pampanini. Lvs. broader than in C Bungeana, grayish below frs dark blue, small. Cent China.—*C. caucásica*, Willd Allied to C australis. Lvs broadly rhombic-ovate, somewhat smaller: fr. smaller, reddish brown Caucasus, N Persia —*C. Davidiana*, Carr Allied to C Bungeana Small tree lvs. ovate-oblong or elliptic-oblong, often sparsely hairy on the veins below, 2–5 in. long N. China Incompletely known —*C. georgiana*, Small Allied to C occidentalis Shrub or small tree branchlets pubescent: lvs. ovate, acute, entire or sharply serrate, 1–2 in long, fr ¼in across, short-stalked Md to Fla, Ala. and Mo —*C. orientalis*, Linn = Treema orientalis —*C orientalis*, Mill = C Tournefortii —*C reticulata*, Torr (C mississippiensis var reticulata, Sarg) Small tree, to 50 ft branchlets pubescent lvs ovate, usually cordate, entire or serrate, rough above, pubescent and reticulate below, 1½–3 in long: fr. ½in. thick, orange-red Colo to Texas and Ariz —*C. Smallii*, Beadle. Allied to C mississippiensis. Lvs lanceolate or oblong-lanceolate, thin, sharply serrate, 2–4 in long fr ½in thick, slender-stalked. N. C. and Tenn. to Ga. and Ala

ALFRED REHDER.

CEMETERY GARDENING. Treated under Landscape Gardening

CÊNCHRUS (an ancient Greek name). *Gramíneæ*. Mostly annual grasses with simple racemes of burs that become detached and adhere readily to clothing and animals Spikelets as in Panicum, but 2–6 together in a spiny involucre or bur **C. carolinianus,** Walt. (*C. tribuloides* of American authors), SAND-BUR, is a common weed in sandy soil. Dept. Agric. Div. Agrost 20:40.

A. S. HITCHCOCK.

CÈNIA (Greek for *empty*, in allusion to the hollow receptacle) *Compósitæ* Low herbs from S Afr, with the aspect of mayweed Head small and rayed, the ray-fls pistillate, the disk-fls compressed and 4-toothed, the receptacle gradually enlarged from the top of the peduncle, and hollow About 8 species, none of which are of much horticultural value **C. turbinàta,** Pers. (*C. pruinósa*, DC), is a common weed in Cape Colony, and it is occasionally seen in American gardens. It is annual, diffusely branched, and a foot or less high, with finely dissected, soft, almost moss-like foliage, and long-peduncled, small, yellow heads Of easy cult. United with Cotula by Hoffmann in Engler & Prantl.

L. H. B.

CENTAURÈA (a *Centaur*, famous for healing). *Compósitæ*. CENTAURY. DUSTY MILLER. BACHELOR'S BUTTON CORNFLOWER KNAPWEED Annuals or hardy and half-hardy perennials with alternate leaves, useful for bedding, vases, baskets and pots, and for borders and edgings, species many and various.

Involucre ovoid or globose, stiff and hard, sometimes prickly. receptacle bristly marginal florets usually sterile and elongated, making the head look as if rayed Differs from Cnicus in having the achenes obliquely attached by one side of the base or more laterally.—Species about 500, much confused, mostly in Eu, Asia and N Afr, 1 in. N Amer., 3 or 4 in Chile. Several Old World species have become weeds in this country J H. 43:76. The species are of simple cult., coming readily from seeds Many of the perennial species make excellent border plants, and their blue and purple heads are welcome additions to the horde of yellow-flowering composites.

INDEX.

alba, 6, 14.
Amberboa, 6.
americana, 10.
argentea, 3
atropurpurea, 17.
babylonica, 18.
calocephala, 17.
candidissima, 1.
Cineraria, 1.
citrina, 14.
Clementei, 4.
Cyanus, 5
dealbata, 15.
declinata, 13.
depressa, 2
flore-pleno, 5.
glastifolia, 7.
gymnocarpa, 3.
imperialis, 6.
leucophylla, 13.
macrocephala, 11.
Margaritacea, 8.
Margaritæ, 6.
Marix, 6.
montana, 14.
moschata, 6.
nana, 5.
nervosa, 16.
nigra, 12.
odorata, 6.
plumosa, 3.
rosea, 14.
rubra, 6.
ruthenica, 9.
splendens, 8.
suaveolens, 6.
sulphurea, 14.
variegata, 12.

A. DUSTY MILLER —*White-tomentose low plants, used for bedding or for the sake of their foliage.*

1. **Cinerària,** Linn (*C. candidissima*, Lam) Fig. 869. Perennial: sts erect, 3 ft, branched, the entire plant white-tomentose: lvs almost all bipinnate (except the earliest), the lower petioled, all the lobes linear-lanceolate, obtuse: scales of the ovate involucre appressed, with a membranous black margin, long-ciliate, the apical bristle thicker than the others: fls purple S Italy, Sicily, etc.—Much used as a bedding plant, not being allowed to bloom The first lvs of seedlings are nearly entire (as shown in Fig 869), but the subsequent ones become more and more cut Grown both from seeds and cuttings. Seedlings are very apt to damp off unless care is taken in watering.

2. **depréssa,** Bieb. A flat, almost prostrate perennial: st floccose-tomentose and much branched lower lvs. scarcely denticulate, the upper oblong-linear, entire. bracts of the involucre white- or black-margined fls showy, the blue rays about ½in. long. Persia, Caucasus July.

3. **gymnocárpa,** Moris & DeNot (*C. argéntea*, Hort. *C. plumósa*, Hort.). Fig. 870 Perennial: entire plant covered with velvety white pubescence: sts 1½-2 ft. high, erect: lvs. bipinnatisect; segms linear, entire, acute: fl-heads small, in a close panicle, mostly hidden by the lvs, fls. rose-violet or purple. Caprea. V. 4:337.—Very ornamental on account of its velvety finely cut lvs. Much used, like No. 1, for low foliage bedding: lvs. more compound, and usually not so white.



869. Lower leaf from a young plant of Centaurea Cineraria. (×½)



870. Radical leaf of Centaurea gymnocarpa. (×½)

4. **Cleméntei,** Boiss. Perennial, the entire plant densely white-woolly sts erect, branching, with few lvs root-lvs petioled, pinnate, the lobes ovate-triangular, sharp-pointed, st-lvs. sessile: fl-heads terminal on the branches, globose; involucre scales with scarious, ciliate margins, scarcely spiny; fls yellow. Spain.

AA. CORNFLOWER, OR BACHELOR'S BUTTON —*Tall-growing annual, with very narrow lvs, grown for the showy fls.*

5. **Cyanus,** Linn. (*Cýanus arvénsis*, Moench.) BLUEBOTTLE BLUET BACHELOR'S BUTTON (see also *Gomphrena*) CORNFLOWER. RAGGED SAILOR FRENCH PINK. Fig 871 Annual, slender, branching, 1–2 ft. high, woolly-white when young: lvs. linear, entire or the lower toothed, sometimes pinnatifid: fls. blue, purple, pink or white, the heads on long, naked sts.: involucral bracts rather narrow, fringed with short, scarious teeth. S. E Eu Gt. 38, p. 641; 39, p. 537. V. 5, p 44; 13:361 —One of the most popular of garden fls., variable. It is perfectly hardy, blooming until frost

and coming up in the spring from self-sown seed. The following are varieties of this: *Pure White; Victoria*, a dwarf, for pots and edgings (Gn. 40, p 147), *Emperor William*, fine dark blue; *flore pleno*, with the outer disk-fls. converted into ray-fls; *nana compacta*, dwarf (Gt. 44, p 150) *Centaurea Cyanus* is one of the "old-fashioned flowers," everywhere well known and popular. It often escapes from gardens.

AAA. SWEET SULTANS —*Straight-growing smooth annuals or perennials, with dentate lvs., grown for the large fragrant heads.*

6 **moschàta,** Linn (*C suavèolens*, Linn. *C. odoràta*, Hort *C Amberbòa*, Mill *Amberbòa moschàta*, Less.). SWEET SULTAN Fig 872. Annual sts 2 ft high, branching below, erect whole plant smooth, bright green. lvs. pinnatifid, the lobes dentate. fl.-heads long-peduncled; involucre round or ovate, smooth, only the innermost of the involucral scales with scarious margins: fls. white, yellow or purple, fragrant. Orient Mn. 4, p 149. Gn. 54 · 372. I H. 42, p 106 Gng 4:147. G 5: 289; 16:267; 25.71.



871 Centaurea Cyanus (×⅛)

Var. **álba,** Hort. (*C Margaritæ*, Hort.). Fls white Gn. 19, p 337; 54:372 A G 13: 607. This form, known as *C. Margaritæ*, is pure white and very fragrant. It was intro. by an Italian firm in 1891. Var. **rùbra,** Hort Fls red. Gn 54. 372 —A popular, old-time garden fl, with long-stalked heads; of easy cult. It does not bear transplanting well —*C imperiàlis*, Hort, is said to be the offspring of *C. moschata* and *C. Margaritæ*, intro into the American trade in 1899 Gn M. 13:74. Plants are said to inherit the vigorous free growth of *C. moschata*, being of the same easy cult. and forming clumps 3–4 ft. high. The fls. resemble *C. Margaritæ*, but are twice as large and abundantly borne on long sts. from July until frost. They range through white, rose, lilac and purple, are fragrant, and if cut when first open will keep 10 days *C. Màræ*, Hort, intro. 1899, resembles *C. imperialis*, but the fls. open sulfur-yellow, become lighter, and are tipped with rose All sweet sultans do best if the bloom is secured before very hot weather.

7. **glastifòlia,** Linn. A strong-growing border perennial with a rough much-branched and winged st.. lvs. oblong, entire, decurrent, the basal lvs petiolate, sometimes divided. fls. yellow, the heads solitary, without bracts, and quite smooth. Cent Eu. B.M. 62. June–Sept.

AAAA. OTHER CENTAUREAS *of various kinds, occasionally grown in hardy borders, for their fls. or imposing stature.* See page 3567.

B. *Foliage green on both sides.*

C. *Lvs pinnate or bipinnate.*

8. **spléndens,** Linn. (*C. Margaritàcea*, Ten.). Perennial: sts. erect, branched: lvs. smooth, the lowest bipinnate, the upper pinnate, all with very narrow, linear, entire, acute lobes· fl.-heads subglobose; scales of the involucre with a rounded almost entire rather lax tip; fls. purple Spain, Italy.

9. **ruthénica,** Lam. Hardy perennial about 3 ft.: st. erect, branching, smooth: lvs. pinnatisect, the lobes linear-toothed, sharply narrowed at both ends, the base often somewhat decurrent: fl-heads usually solitary, the pale-yellow rays about ¾in. long; pappus double: achenes glabrous. Cent. Eu. July. G. 26:630.

CC. *Lvs. entire or dentate, not pinnatisect.*

10. **americàna,** Nutt. (*Plectocéphalus americànus*, Don). BASKET FLOWER Fig 873 Hardy annual, nearly smooth: sts. stout, simple or sometimes a little branched, 2–5 ft, thickened under the naked head. lvs. mostly entire, oblong-lance-shaped, mucronate involucre ½–1½ in diam, its bracts all with fringed scarious appendages· fls. rose or flesh-colored, sometimes purplish; disk 1–3 in diam; narrow lobes of the ray-fls. often 1 in long Mo. and Ark. to La and Mex F S. 4 327 S H. 2 223 A F 16: 1644 (*alba*). Gng 9:341 (*alba*). —Very attractive.

11 **macrocéphala,** Puschk. Perennial· sts simple, erect, swollen below the fl-head, leafy, 2½–3 ft high: lvs ovate-lanceolate, slightly decurrent, scabrous, acute, somewhat serrate, gradually diminishing upwards to the base of the single terminal head head subglobose, larger than a hen's egg, often 3–4 in diam; involucre of 8–12 rows of appressed, scarious-margined, rusty, fringed scales, fls yellow, the marginal and disk alike Armenia B M. 1248 J H III 33 331, 52: 547; 63 · 319 —Often grown from seeds

12. **nigra,** Linn. KNAPWEED. HARDHEADS. Perennial, 1–2 ft. high: sts. branching, rough pubescent: lvs. lance-shaped and entire or lower sparingly toothed or lobed, but not pinnatifid involucral bracts with pectinate-ciliate-fringed black appendages fls all alike, the disk and marginal ones of the same size Eu Var **variegàta,** Hort. Lvs. edged with creamy white, tufted A very striking border plant; useful in dry or open places.

BB. *Foliage white or tomentose, at least beneath (often green above).*

C. *Sts. low, weak, not strict.*

13. **leucophýlla,** Bieb (*C. declinàta*, Bieb). Perennial: sts short, decumbent, with very few lvs · root-lvs. petioled, tomentose-woolly on both sides, pinnate, the ovate lobes undulate, sparsely cut-lobed or sinuate-toothed. fl.-head with few bracts, solitary, terminal; scales of the ovate involucre lanceolate, acuminate, brown, long-ciliate; fls. purple. Caucasus.

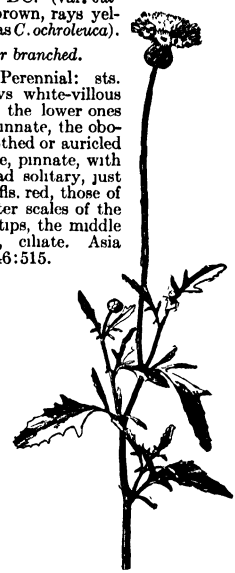
14. **montàna,** Linn. MOUNTAIN BLUET. Perennial: sts. low, stoloniferous, unbranched, 12–16 or rarely 20

in high: lvs. decurrent, the young ones silvery white, oval-lance-shaped: involucre of 4 or 5 rows of scales, black-ciliate along the margins: fls. blue, the marginal ones 1 in. long; disk-fls. very short, becoming purple. Eu. B.M. 77. G.M. 47:243. Var. **álba,** Hort. Fls. white. G. 25:71; 29:109. G.M. 51:162. Var. **rósea,** Hort. Fls. rose-colored. Var. **citrina,** DC. (var. *sulphùrea,* Hort.). Disk-fls. brown, rays yellow. Armenia. B.M. 1175 (as *C. ochroleuca*).

cc. *Sts. erect, simple or branched.*

15 **dealbàta,** Willd Perennial: sts. sub-erect, 8–24 in high: lvs white-villous beneath, glabrous above, the lower ones 1–1½ ft. long, petioled, pinnate, the obovate lobes coarsely cut-toothed or auricled at the base; st.-lvs. sessile, pinnate, with oblong-lance lobes. fl.-head solitary, just above the uppermost lf.; fls. red, those of the disk rosy or white; outer scales of the involucre with lanceolate tips, the middle rounded, deeply fringed, ciliate. Asia Minor, Persia. J H III. 46:515.

16. **nervósa,** Willd. A stout perennial about 2–2½ ft. tall with a simple unbranched rough st.: lower lvs glandular, usually slightly toothed, the st.-lvs clasping by the auriculate base; heads solitary, the rays deep purple. A branched and numerous-fld. form is known in the wild but not to the trade. Cent. Eu. July, Aug



872. Centaurea moschata. (×½)

17. **atropurpùrea,** Waldst & Kit (*C. calocéphala,* Willd.) Perennial sts. erect, branched, about 2–3 ft high, the branches white-woolly at the summit lvs bipinnate, lobes linear-lanceolate, acuminate, lowest lvs. petioled, uppermost pinnatifid. fl.-heads without bracts; involucral scales with fringed ciliate white lanceolate tips, the innermost ones rounded, scarious-margined; fls. black-purple Hungary

18 **babylónica,** Linn Silvery white perennial: sts. simple, stout, erect, 6–10 or 12 ft high lvs. long, coriaceous, strongly decurrent on the st., the radical lyrate, the lower st.-lvs oval or oblong-acute, entire or undulate, the upper lance-acute. fls. yellow, the globular heads almost sessile in the axils of narrow bract-like lvs.; one-third to half of the st fl.-bearing; involucre-scales with a short, recurved tip Asia Minor, Syria. Gn. 2, p. 73; 8, p. 263. R.H. 1859, pp 540–1 —Tall, stout and striking plant.

C. alpina, Linn Lvs downy beneath, prickly fl.-heads yellow; scales of involucre ovate, obtuse hardy herb, 3 ft., from Eu., sometimes seen in collections —*C. crióphora,* Linn A low plant with a spiny calyx and silvery lvs., is cult in England Not known in Amer —*C. pulchérrima,* Willd (Æthecopappus pulcherrimus, Hort.). A stout hardy perennial about 2½ ft. with brilliant rose fls. is known in the trade.—*C. rigidifólia,* Hort. Stout perennial, 2½ ft., with crimson heads is apparently C. orientalis, Linn —Not much known in U. S

N. TAYLOR.†

CENTAURÍDIUM: *Xanthisma.*

CENTAURY: *Sabatia.*

CENTRADÈNIA (Greek for *spurred gland,* alluding to the anther glands). *Melastomaceæ.* Tropical herbs or sub-shrubs grown in warmhouses for their showy-colored leaves and pretty flowers.

Branches angled or winged: lvs. petiolate, opposite, lanceolate or ovate, entire, ribbed: fls. with 4-lobed calyx, 4 petals, 8 stamens, and a 4-loculed ovary, pink or white, in axillary or terminal clusters.—Species 4–6, in Mex. and Cent Amer They fall into 2 groups,—those with very unequal stamens, and *C. floribunda* with nearly equal stamens.

Centradenias are very showy and desirable plants. The stems are often colored. They like rich leaf-mold with sharp sand, and brisk heat Give a light but shady position. Strong plants are much benefited by liquid manure, and such applications give better colors in both flowers and fruit.

grandifólia, Endl Branches 4-winged: lvs. ovate-lanceolate, strongly 3-nerved, brilliant red beneath, long-pointed and curving at the end. cymes many-fld., shorter than the lvs., the fls light rose, rotate, the petals very obtuse, the stamens unequal Mex. B M. 5228 — The plant grows 2 ft high, and blooms in winter Very showy, and the species usually cult. The cut branches hold their color a long time, making the plant useful for decorations

inæquilateràlis, Don (*C. rósea,* Lindl.). Lvs. ovate-lanceolate, unequal-sided, entire, ciliate, reddish beneath· fls. pink, in terminal corymbose racemes: dwarf. Mex B.R 29.20.

ovàta, Klotzsch. Lvs. ovate-acute, smooth and shining, pale beneath, 3-nerved: fls. pink in large terminal clusters. Cent Amer.

floribúnda, Planch Branches obscurely angled, pubescent, red· lvs narrow-lanceolate, tapering below, 3-nerved, red-nerved below: fls. pink, in terminal panicles. Mex. F.S. 5.453.

L. H. B.†

CENTRÁNTHUS (Greek, *spurred flower*). *Valerianàceæ* CENTRANTH. Annual and perennial herbs, one of which is frequent in old gardens

Leaves opposite, entire, dentate, or pinnatisect· fls. in dense clusters, small, red or white, terminating the branches; calyx cut into 5–15 narrow divisions, enlarging after flowering, corolla slender-tubed, 5-parted, spurred at the base, stamen 1; fls. with a pappus-like crest.—About a dozen species in the Medit. region, some of them sometimes half shrubby *C. ruber,* the common garden species, sometimes escapes and becomes more or less spontaneous.

rùber, DC RED VALERIAN. JUPITER'S BEARD. Perennial, 1–3 ft, smooth and glaucous, forming a compact and floriferous bushy plant· lvs ovate to lanceolate, some of them toothed at base but mostly entire· fls. numerous, deep crimson to pale red, fragrant Eu, E —A very handsome old garden plant, too much neglected; blooms all summer; excellent for cutting. Increased by division; also by seeds. There is a white-fld. form (var. *álbus*).



873. Centaurea americana. (×⅓)

angustifólius, DC. Perennial, glaucous, to 2 ft, simple or somewhat branched: lvs. linear-lanceolate or linear, very entire, nearly perfoliate: fls clear rose, fragrant. S. Eu.—There is a white-fld. form (var. *albus*).

macrosìphon, Boiss. Annual, of easy cult. in any good soil: 1–2 ft.: lvs. ovate, glaucous, toothed: fls. larger than in the last, deep

rose. Spain.—There are white-fld. (var. *álbus*) and dwarf (var. *nánus*) forms. Excellent for rockeries and borders; also for lawn vases. L. H. B.

CENTROPÒGON (Greek *kentron*, spur, and *pogon*, beard, referrng to the fringed stigma). *Campanulàceæ.* Sub-shrubs or shrubs, often scandent, grown under glass.

Plants with alternate mostly dentate lvs., and axillary, long, tubular fls. which are violet, purple, red, or orange, and usually borne singly on long peduncles: corolla 2-lipped, the tube incurved: bracteoles very small or wantng.—More than 100 species in Trop. Amer. Warmhouse perennials useful for hangingbaskets, prop. by cuttings which it is better to put under a bell-jar

Lucyànus, Houll. Height 1–2 ft.: st. somewhat woody. lvs. short-petioled, finely toothed: fls. rose, hemispherical, with lanceolate segms recurved at the tips. R.H. 1868:290. Native country unknown — Described from a cult specimen and said to be a hybrid of *C. fastuosus* and *Siphocampylus betulæformis*, but seems to show little influence of the latter, which has longer petioles and peduncles, more coarsely toothed lvs., longer calyx-segms , and a yellow-tipped corolla.

fastuòsus, Schnidw. Lvs peach-like, oblong, acute, bordered with glandular teeth, very glabrous, short-petioled: fls rose-colored, winter; calyx hemispherical, with 5 lanceolate denticulate segms. Mex R H. 1853: 181. WILHELM MILLER.

CENTROSÈMA (Greek, *spurred-standard*) *Leguminòsæ.* BUTTERFLY-PEA. Twining or trailing herbs, one of which is sometimes cultivated

Leaves pinnate, 3-7-foliolate fls in the axils, showy, white or reddish, papilionaceous, the standard spurred on the back, the keel broad, and the style bearded at the apex: pod long and narrow, many-seeded, with 2 thick-edged valves —Species about 30 in Trop. Amer. and 2 in U. S Centrosema is a more recent name than Bradburya of Rafinesque, but it is thoroughly established in usage and is retained in the "nomina conservanda" of the Vienna Congress.

virginiànum, Benth (*Bradbùrya virginiàna*, Kuntze). Roughish, climbing, 2–6 ft · lfts ovate to linear, shining, stipitate. fls. 1–4 in the axil, 1 in long, violet and splashed, showy: pod straight and long-pointed, 4–5 in. long. N. J. and S , in sandy lands. A G 13:649.— Intro. to cult many years ago, but again intro. in 1892 (as *C. grandiflorum*), and much advertised. It is a hardy and desirable perennial vine, blooming the first season from seed; easily grown. There is a white-fld. form. L. H. B.

CENTURY PLANT: *Agave.*

CEPHAÈLIS (Greek-made compound, referring to the fls. being borne in heads). *Rubiàceæ* Tropical shrubs, sub-shrubs or herbs, one of which yields ipecac, some of them sometimes rarely seen in growing collections. As the genus is commonly delimited, it comprises perhaps 75 species of both the eastern and western hemispheres. Engler & Prantl and others, however, unite it with the Linnæan Uragoga Lvs. opposite, usually ovate, oblong or obovate: fls mostly small, white, collected in an involucrate head; calyx 4–7-toothed and persistent; corolla trumpet-shaped or salver-shaped, the short limb 4–5-lobed; stamens 4 or 5, inserted in the throat of the corolla· fr. a dry or fleshy 2-seeded drupe. *C. Ipecacuánha*, Willd (*Psychòtria Ipecacuánha*, Muell.-Arg. *Uragòga Ipecacuánha*, Baill), from the root of which the commercial ipecac is produced, is a low creeping herb (4–8 in. high) with oblong-ovate entire lvs. which are pubescent beneath: heads becoming pendulous: root slender, knotty; it is exported in large quantities from Brazil. L. H. B.

CEPHALANDRA: *Coccinia.*

CEPHALANTHÈRA (Greek for *head* and *anther*). *Orchidàceæ.* About 10 species of small temperate-region terrestrial orchids, allied to Epipactis and Pogonia. Some of them are western N. American, and others are European. Sepals 3; petals small, ovate; lip saccate· lvs (sometimes wanting) lanceolate or oblong: fls. mostly small (sometimes showy), in an open spike. The species are scarcely known in cult , but 2 Japanese species have been offered by importers. These are **E. falcàta** Blume, yellow, and **E. erécta,** Blume, white.

CEPHALANTHUS (Greek, *head* and *flower;* flowers in heads). *Rubiàceæ.* BUTTON-BUSH. Bush grown for its attractive white flower-heads appearing in summer

Shrubs with opposite or whorled entire stipulate lvs · fls. small, tubular, white or yellowish, 4-merous, with included stamens and long exserted style, in globular heads; ovary 2-celled· fr dry, separating into 2 nutlets —Five species in Amer. and Asia, of which only the one N. American species is cult. hardy ornamental shrub, with handsome glossy foliage and very attractive with its fl- balls appearing late in summer. It thrives in any good garden soil, best in a sandy, somewhat moist one; naturally it grows in swamps and on the borders of streams and ponds, often with the sts. partly submerged Prop by seeds or by cuttings of ripened wood in fall, and also by greenwood cuttings taken from forced plants early in spring.



874. Cephalanthus occidentalis. (×⅓)

occidentàlis, Linn Fig 874. Shrub, 3–12 ft , sometimes tree-like: lvs long-petioled, ovate or oval, acuminate, glossy above, glabrous or slightly pubescent below, 3–6 in. long heads about 1 in diam , long-peduncled, 3 or more at the end of the branches July–Sept From New Brunswick south, west to Ont. and Calif. Em. 394. R.H 1889, p 280. S S. 14:711. Var. **angustifòlia,** André Lvs oblong-lanceolate, usually in 3's. R.H. 1889, p. 281.

C natalénsis, Oliv Branchlets hairy lvs. ovate, acuminate, 1 in. long fls green, in solitary heads: fr. edible S Afr. B M. 7400. ALFRED REHDER.

CEPHALÀRIA (Greek for *head*, alluding to the capitate flower-clusters). *Dipsàceæ* Coarse annual or perennial herbs planted to some extent in herbaries.

Much like Dipsacus, but the heads less spiny and mostly smaller: heads terminal, ovoid or globular, bearing many 4-parted yellowish, whitish or bluish florets; stamens 4, perfect; style filiform: fr. a 4–8-ribbed achene, the calyx-border often remaining on its summit.—About 30 species in the Medit. region, N. and S. Afr and W. Asia; also in Abyssinia. Lvs. entire, dentate, or lobed. They are not much planted in Amer., but they make striking subjects for summer bloom, and the long sts make them useful for cut-fls. The bloom is something like that of scabiosa. Of simple cult.; grown readily from seeds.

alpìna, Schrad. Perennial: tall and widely branched, 5 or 6 ft.: lvs. pubescent and pinnatifid, the segms. cut

and decurrent: fl.-heads sulfur-yellow; involucre with 8 aristate teeth. S. Eu.—A good coarse plant for summer bloom. Hardy N.

leucántha, Schrad. Perennial: lvs. pinnate-parted, the lobes linear or oblong: fls. in subglobose heads, creamy white, in autumn. S. Eu. Variable.

transylvánica, Schrad. Annual, slender, 2–3 ft.: lower lvs. lyrate; the segms. serrate and the terminal one large, upper lvs. pinnate-parted into linear-lanceolate divisions fls in globular heads on long peduncles, the ray-corollas bluish and disk-corollas whitish (fls. said to be yellow, in trade lists, to bloom June–Aug and plant perennial). Greece and eastward.

tatárica, Schrad Perennial, 6 ft , rank, with striate sts., suited to the rear border, where strong effects are desired, with showy cream-white, flat heads in July and Aug.. lvs pinnate, the lfts broad-lanceolate and serrate. Russia, Asia Minor and E —Grows readily, and is increased by seed or dividing the clumps

L H B.

CEPHALOCÈREUS (referring to the crown of long hair) Syn *Pilocèreus Cactàceæ* Mostly large columnar plants, single or branched, usually characterized by an abundance of wool or long white hair developing at the top or on one side near the top fls nocturnal, small, thick, fleshy, naked fr small, globular berry, naked: seeds black –Some 16 or more species are known.

The culture of the species is similar to that of the arborescent species of Cereus The species of Cephalocereus are well suited only for large collections and are rarely seen elsewhere, except in the case of *C senilis,* of which enormous quantities are shipped to Europe by commercial dealers See *Succulents*

senilis, Pfeiff (*Pilocèreus senilis,* Lem). Old Man Cactus. Columnar, reaching a height of 35 ft and a diam of 1 ft , branching at the very base, the branches becoming parallel with the parent ribs 20–30, very little elevated, areoles bearing 20–30 white, wavy bristles 2–5 in long, later appear also, at first 1, then 3–5 strong, yellowish spines fls very numerous in the cephalium, nearly 4 in long, red outside, reddish white within fr violet, 2 in long Cent Mex. R.H. 1889, p 568, 1890, p 128

Sartoriànus, Brit & Rose (*Pilocèreus Houlletii,* of authors, not of Lem) Tree-like, attaining 40 ft in height branches divaricate cult plants usually 3–4 in diam ribs 6–8, rounded, glaucous. radial spines 7–9, spreading, ½in long, honey yellow, central twice as long and stronger areoles of the sterile st with more or less hairs, which in the fruiting area are very numerous, making a shaggy tract sometimes 1 ft long fls 3 in long, imbedded in the wool, turbinate, greenish-red outside, rose-red within· fr dark red, depressed-globose Mex R H. 1862, pp 427–30.

Róyenii, Brit & Rose (*Pilocèreus Róyenii,* Rumpl. *P floccòsus,* Lem) Columnar, branching, reaching 15 ft height, 2–3 in diam ribs 9–10, obtuse, bluish, prunose. spines 12–16, rigid, divaricate, bright amber-yellow, the inner ones larger, nearly an inch long on the sterile branches long hairs are found on areoles, on the fertile bract these are more numerous and aggregated: fls and fr as in the last species, but lighter in color. Isl. of St Croix.

Hoppenstédtii, Schum. (*Pilocèreus Hoppenstédtii,* Web). Columnar, simple, slender, reaching a height of 30 ft : ribs numerous, more than 16: radial spines 14–18, very short; centrals 5–8, the lower longest one reaching 3 in ; all the spines at first yellowish, then white cephalium of 1–2 in. long tufts of yellowish hairs, forming a narrow bract on the north side of the plant: fls. 3 in. long, bell-shaped, whitish, with rosy tips. Mex.

polylòphus, Brit. & Rose (*Pilocèreus polylòphus,* Salm-Dyck. *Cèreus Nickelsii,* Hort.). Columnar, attaining a height of 50 ft. and a diam. of 1½ ft., rarely branching. ribs 10–22, sharp-angled, shallow, the old sts perfectly cylindrical· spines small and bristle-like, less than ½in. long, radials 5–6, central usually 1; spines of the flowering area 2–3 in long, crowded· fls large, trumpet-shaped, dark red. fr. red, scaly. Mex

scopàrius, Brit & Rose (*Pilocèreus scopàrius,* Poselg) Tree-like, richly branched, 25 ft. high, 1 ft. diam radial spines 12–15, very short; centrals 7–8, not much longer, in the flowering branches the spines change to longer stout bristles and the areoles are closer together, forming a bristly cephalium fls small, bell-shaped, reddish. fr. size of a hazelnut. Near Vera Cruz, Mex

exèrens, Rose (*Pilocèreus exèrens,* Schum *P. vèrens,* Lem) Branching at base, 3–4 ft high, 2–3 in. diam , tapering above· ribs 4–6, obtuse, the sterile shoots with short, sparse, woolly hairs at the top: spines commonly 7. radials, very short, 1–3 centrals 4 times as long, woolly hairs much more abundant on the blooming plant· fls. about 3 in long, trumpet-bell-shaped, without wool or spines Brazil —Not common, if occurring at all, in cult in U S.

The following species have been reported or may be expected in cult , but none is as yet at all common *C chrysocánthus,* Brit & Rose, *C comètes,* Brit & Rose, *C lanuginòsus,* Brit & Rose, *C Russellianus,* Rose (Cereus Russellianus, Rümpl) *C noblis,* Brit & Rose.

J N. Rose.

CEPHALOSTÀCHYUM (Greek, *head* and *spike*). *Gramineæ* A few species of grasses of the bamboo tribe in E Indies and Madagascar, one of which (*C. pergracile*) has been offered in this country Tall shrubs spikelets in dense solitary heads at the ends of the branches or in scattered glomerules, the heads bristly with the subtending lvs , stamens 6, empty glumes 1-2, style long, 2-3-cleft fr elongated and beaked. **C. pergrácile,** Munro Forty ft , sts 2–3 in thick· lvs. 14 in or less long an elegant species, growing in clumps. Burma It is offered in S Calif In Fla , it loses most of its lvs in winter, but the new growth in spring and summer is very attractive, it is said not to do well there on high dry pine land, preferring moderately moist soil, it needs much water in summer, and responds readily to fertilizer

L H B

CEPHALOTÁXUS (Greek, *head, Taxus*-like plant, with fls in heads or clusters). *Taxàceæ.* Yew-like plants, grown for their handsome evergreen foliage

Trees or shrubs, with evergreen linear pointed lvs. with 2 broad, glaucous lines beneath, arranged in 2 rows fls dioecious, staminate in 1–8-fld , short-stalked clusters, pistillate consisting of a small cone with several bracts, each bearing 2 naked ovules: seed inclosed in a fleshy envelope, drupe-like, about 1 in long, reddish or greenish brown From allied genera it may be easily distinguished by the resin-canal in the center of the pith, and by the glaucous lines beneath from Taxus, which has the lvs yellowish green beneath; and from Torreya by the glaucous lines being broader than the 3 green lines, while in Torreya the glaucous lines are narrower than the green ones —Six closely allied species from Himalayas to Japan.

These are ornamental evergreen shrubs, in appearance very like a yew, but of more graceful habit Not hardy North, or only in very sheltered positions They thrive best in a somewhat moist but well-drained sandy loam, and in partly shaded situations. Propagated by seeds, stratified and sown in spring, imported seeds usually do not germinate until the second year, increased also by cuttings in August, under glass, and by veneer-grafting in summer, on one of the species or on *Taxus baccata.* For cions and cuttings, terminal shoots should be chosen, which form regular plants with whorled branches like seedlings, while cuttings from lateral branches grow into irregular, low, spreading shrubs.

A. *Lvs. 2–3 in.: branchlets yellowish green, pendulous.*

Fórtunei, Hook. Lvs tapering gradually into a sharp point, usually falcate, dark green and shining above: fr greenish brown, obovate. N China, Japan. B M. 4499. F S 6 555. R H 1878, p 117.—This is the most graceful species, with long and slender branches, attaining in its native country 50 ft in height, in cult. usually remaining a shrub.

AA. *Lvs. 1–2 in. long.*

B. *Base of lvs. cuneate; lvs. loosely 2-ranked.*

Harringtònia, Koch (*C. pedunculàta*, Sieb. & Zucc. *C drupàcea* var. *Harringtònia*, Pilger). With spreading, often somewhat pendulous branches, dark green when young lvs to 2 in. long, narrowed into a sharp point, shining and dark green above: staminate fls distinctly peduncled: fr ovoid, rounded at both ends, rarely globular Japan, China. G C II 21 113; III 18.716, 33:228 —In Japan, tree to 25 ft, usually shrub in cult A remarkable form is var. **fastigiàta,** Silva Tarouca (*C. pedunculàta* var *fastigiàta*, Carr. *Podocárpus koraiàna*, Sieb & Zucc.), of columnar habit, with upright branches and spirally arranged lvs G C. II 21.112; III. 33 229 S.H. 2:450. Gng 2.341. Var. **sphæràlis,** Rehd., (*C. pedunculàta* var. *sphæràlis*, Mast), has globose fr.: lvs. falcate, subacuminate, 1½–2 in. long G.C. II. 21:117.

drupàcea, Sieb. & Zucc. Branches spreading, stiff, usually light green when young lvs about 1 in. long, abruptly pointed, narrow and straight, often upturned. staminate fls. very short-stalked: fr usually obovate, narrowed at the base Japan G.C III 18 717, 33: 227. B.M. 8285 —The dwarfest species Var. **sinénsis,** Rehd & Wilson Shrub, to 12 ft. lvs linear-lanceolate, tapering to sharp point. Cent. and W. China.

BB. *Base of lvs. truncate; lvs. very closely set*

Óliveri, Mast. Shrub or small tree lvs strictly 2-ranked, rigid, broadly linear, spiny-pointed, about 1 in. long, bright green with 2 broad white bands beneath, the midrib scarcely elevated fr ovoid or obovoid, shortly apiculate, about ½in long Cent. China. H I 1933 (as *C Griffithii*) G C. III 33 226 —Differs from the other species in the very closely set rigid lvs

ALFRED REHDER.



875 Cephalotus follicularis.

CEPHALÒTUS (Greek, *head-shaped*, in reference to the knob-like swelling behind each anther). *Cephalotàceæ*, a monotypic family near *Saxifragàceæ* The one species **C. folliculàris,** Labill (Fig 875), is abundant at King George's Sound and Swan River in S. W. Austral From there it has frequently been intro into cult., and is now met with in American collections The short creeping rhizomes form 2 sets of lvs. each season: a set of 4–6 flat spatulate lvs., and later as many dainty pitchered lvs. that are richly colored green, crimson or purple, and white The pitchers are ½–1½ in. long, are covered externally with minute alluring glands, and these with the coloring attract insects They slip from the smooth-ribbed rim into the cavity, and there are digested by ferment liquids poured out by special glands The erect scape bears an interrupted spike of small white apetalous fls, each with a 6-parted calyx, 12 stamens, and 6 separate 1-seeded carpels The plant grows best under a bell-jar, and in a pot amongst fine sandy loam that is covered by sphagnum moss The lower part of the pot should stand in a vessel with about ½in. of water, and the whole should be placed in a cool greenhouse near the light, when the pitchers assume richest colorings Prop is easily effected by separation of small pieces of rhizome that bear 1 or 2 lvs, also by seeds that mature not unfrequently under cult R B 23, p 233 I H 27.391 F S 3 290. G 23 340 G W. 8.390. J H. III 35 260

J. M. MACFARLANE



876. Cerastium arvense

CERÁSTIUM (Greek for *horn*, alluding to the shape of the pod). *Caryophyllàceæ* MOUSE-EAR CHICKWEED Decumbent annuals or perennials, used in rockeries or for bedding and borders

Pubescent or hirsute herbs, rarely glaucous lvs small, opposite, entire fls white, borne in terminal, dichotomous cymes, sepals 5, rarely 4, petals as many, emarginate or 2-cleft, stamens 10, rarely fewer; styles 5, rarely 4 or 3, opposite the sepals caps cylindric, often curved, dehiscing at the top by 10, rarely 8, teeth.—About 100 species of world-wide distribution according to the largest delimitation of the genus, by some authorities reduced to 40 or 50 species

Cerastiums are of easy culture in ordinary garden soil They are propagated by divisions or by cuttings taken after flowering and planted in a shady place They are more or less used for edgings and in rockeries

A *Lvs green, merely pubescent.*

arvénse, Linn (var *oblongifòlium*, Holl & Brit). STARRY GRASSWORT Fig 876 Perennial, low, much branched and matted sts 8–12 in long lvs oblong or lanceolate, pale green, pubescent, obtuse, ½–1½ in long, ¼in wide fls very numerous, appearing in Apr and May, petals 5, deeply bifid caps twice as long as the calyx —A species of very wide range, growing mostly in dry rocky places from Labrador to Alaska and south to Ga and Calif, also in Asia and Eu Gn 71, p 504 —Recommended as a bedding plant, for its mat-like habit, covered with white bloom Var. **compáctum,** Hort, is hardy in S. E. Canada.

purpuráscens, Adams Perennial, hairy, pubescent, cespitose, about 4 in high lower lvs oblong, narrowed into the petiole; upper lvs linear-lanceolate: cymes dichotomous or often simply umbelliform, fls. white; petals twice as long as calyx, ovate-oblong: caps. cylindric, twice as long as calyx Asia Minor.—Hardy.

AA. *Lvs. silvery or grayish.*

B. *Caps equaling the calyx.*

grandiflòrum, Waldst. & Kit. (*C. argénteum,* Bieb). Creeping perennial. lvs linear, acute, the margins reflexed infl. dichotomous; fl.-sts 6–8 in. high; petals oval, 2-parted, transparent white, twice as long as calyx. E. Eu.

BB *Caps. much longer than the calyx.*

Biébersteinii, DC Perennial: sts. 6 in , creeping, diffuse, branched: lvs ovate-lanceolate, tomentose-woolly peduncles erect, dichotomous, fls. white: caps. ovate-cylindrical Tauria. B M. 2782. Gn. 59, p. 470. —Like *C. tomentosum,* but with larger lvs. Fine for edgings

Boissiéri, Gren Perennial, low: lvs silvery, ovate-lanceolate, acute, entire, sessile· peduncles 4–12 in. high, infl a dichotomous cyme, fls. large, white. Spain.

tomentòsum, Linn SNOW-IN-SUMMER Perennial, low, creeping, branched lvs oblong, spatulate, grayish woolly, upper lvs lanceolate peduncles 6 in high, erect, dichotomous, fls white caps cylindrical Eu. G 29 555 Gn. 69, p. 143 —Much used for edgings.

E. Z B.†

CÉRASUS (from *Cerasunt* or *Cerasonte,* a place in Asia Minor on the Black Sea, whence cherries are said to have been brought to Italy before Christ) CHERRY. *Rosàceæ* Tournefort in 1700 founded the genus Cerasus, but by general usage it is now combined with Prunus inasmuch as no single important character holds clearly between the two groups The name is sometimes kept distinct in trade lists, representing the cherries as distinct from the plums Botanically, the group is distinguished from Prunus proper (the plum group) in having conduplicate vernation (young lvs. with the halves folded together) rather than involute vernation, fls more characteristically in umbels or racemes, fr mostly lacking bloom and pubescence, and the stone not corrugated or pitted. See *Prunus.*

L. H. B.

CERATÌOLA (Greek, *a little horn,* referring to the four-branched, serrate stigma) *Empetràceæ.* A heath-like evergreen, from the sand barrens of South Carolina to Florida and Alabama; rarely cultivated North, but not hardy

Branches often whorled as are the lvs , which are narrow, strongly revolute and thus almost tubular: fls dœcious, 2–3-whorled in the axils, sessile; sepals, petals and stamens, each 2 —Only 1 species

ericoìdes, Michx Height 2–8 ft branches subverticillate, marked with scars of numerous fallen lvs , the younger and upper ones only retaining foliage· lvs. crowded, ½–¾in long, linear, rigid, shining, pale: fls. inconspicuous reddish, whorled in the axils· drupe round, orange-yellow, berry-like. B M 2758

N. TAYLOR †

CERATÓLOBUS (Greek for *horned pod*). *Palmàceæ,* tribe *Calámeæ.* Low or creeping pinnate palms allied to Calamus, and not as yet common in the American trade.

Stems and lf -stalks spiny but not the lf -blades: sts. frequently 30 ft or more long and armed with stout spines an inch long: lvs pinnate, often as much as 7 ft long, with numerous alternate or opposite lfts , which are crenate-dentate towards the apex fls polygamous-monœcious, in a paniculately branched spadix: fr. drupe-like, 1-seeded.—There are only 3 wild species and 2 species known in horticultural literature, the botanical status of which is doubtful All the wild species come from Java or Sumatra For cult , see *Calamus* to which Ceratolobus is closely related, differing in having rhomboid, not linear lfts. G C. II. 23:338.

glaucéscens, Blume. St. up to 30 ft. and about as thick as one's wrist· lvs. 6–7 ft long, of 14–18 sessile, erect or spreading lfts. which are 8–10 in long, 2½–3½ in. wide, opposite above, alternate below spadix from the axils of the upper lvs.. spathes 2-horned, 4–6 in long. Java.

C cóncolor, Blume. Similar, with 10-14 lfts , relatively broader than in C glaucescens Sumatra —*C Findleyànus,* Hort Lvs 2–4 ft long, clear pale shining green Hab (?) A G 15 169 —*C. Micholitziana,* Hort Very elegant palm, the st and lf -rachis with scattered spines lvs. oblong, the lfts remote, linear-oblong, acute, pale on the under surface.—Horticulturally the most attractive of the group.

N TAYLOR.

CERATÒNIA (Greek for *horn,* in reference to the large pod). *Legumìnòsæ.* CAROB. A handsome evergreen tree, bearing large pods that are used somewhat for human food but chiefly for forage

One of the Cassia tribe· calyx-tube disk-bearing, somewhat top-shaped, the segms 5 and short; petals 0; stamens 5 pod long (4–12 in), compressed, thick and coriaceous, indehiscent, filled with a pulpy substance, bearing obovate transverse seeds **C. Siliqua,** Linn. (Figs 877, 878), the only species, is now widely distributed in warm countries, being grown both for shade and for the edible pods It reaches a height of 40–50 ft : lvs pinnate, shining, the 2–3 pairs of lfts oval and obtuse. fls in small lateral red racemes, polygamo-dœcious, the trees said to be variable in sexuality at different ages It thrives well in S Calif and S Fla. The dry pods are occasionally seen in the fruit stands in northern markets. There are many varieties, differing in the size and shape of pod. The Ceratonia is known also as Algaroba, Karoub, Caroubier, and St. John's Bread The last name records the notion that the seeds and sweet pulp are respectively the locusts and wild honey which St John found in the wilderness The dry valves or pods have been supposed to be the husks that provided the subsistence of the prodigal son. See G F. 3 318, 323. The seeds are said to have been the original carat weight of goldsmiths



877. Ceratonia Siliqua.

L H B

The carob is of much importance as a farm crop throughout the Mediterranean basin and other hot and semi-arid regions According to Alphonse de Candolle, its original home was about the eastern end of the Mediterranean, including the southern coast of Asia Minor and Syria and perhaps Tripoli Its cultivation began in historic times, and was diffused by the Greeks in Italy and Greece and was carried by the Arabs west as far as Spain and Morocco. In all these countries the large pods, rich in protein and sugar, are a very important forage crop, being eaten with avidity by all kinds of stock, besides furnishing considerable sustenance to the poor in times of scarcity, and are also used for the manufacture of syrups and different fermented drinks Carob pods were the main sustenance of Wellington's cavalry in the Peninsular campaign and at the present time are the chief food of the British army horses on the island of Malta and the horses of the tramways in the cities of southern Italy. They form one of the principal exports of Palestine, Syria and especially of the island of Cyprus. Thousands of tons are annually imported into England where they are ground for stock-feed. A. Aaronsohn, Chief of the

Jewish Experiment Station in Palestine, says that an acre of carob trees on arid soil yields a much greater quantity of food matter than an equal area planted with the best alfalfa He gives the sugar content at 40 per cent and in some varieties even higher, and the protein content as 7 to 8 per cent The French and Portuguese writers give somewhat lower percentages, but this seems to be much a matter of climate and varieties The analysis published by Rivière and Lecoq points to a high digestive coefficient, and nutritive value a little higher than oats, it is estimated that 147.5 kilos of carobs equals 100 kilos of wheat (a kilo is nearly 2¼ pounds)

The first introduction of the tree into this country on a considerable scale was by the U S. Patent Office from Alicante, Spain, in 1854 and from Palestine in 1859 About 8,000 plants, grown from seed in Washington, were distributed during the spring of 1860, mostly in the southern states Some of these plants probably found their way to California, as a number of old trees are growing in various parts of that state from San Diego on the south to Napa and Butte counties on the north The latest importation was in June, 1911, from Valencia, Spain, by the Office of Foreign Seed and Plant Introduction of the Department of Agriculture This shipment consisted of cuttings of six of the leading varieties grown in that district which are now being propagated by budding at the Chico (California) Introduction Field Station and will soon be available for distribution

Centuries of cultivation have given rise to a large number of varieties, differing in quality of pods, vigor and productiveness and adaptability to various soils. The species is either dioecious or monoecious All trees in California are of course seedlings and, as far as examined by the writer, monoecious, although Aaronsohn states that the best kinds in Palestine are dioecious, and a sufficient number of staminate trees, therefore, must be planted with those varieties to pollinate the female trees In the province of Algarvia, Portugal, seventeen named varieties are cultivated and about as many in France and Spain. The best of these should be introduced into this country.



878 Pods of Ceratonia Siliqua.

The carob tree thrives only in a warm climate, the range being about the same as that of the orange, but with a little protection for two or three winters, the range can be considerably extended At the Government Field Station at Chico, several varieties have survived temperatures of 18° to 22°, while others when young have been killed to the ground by the same degrees of frost The old trees scattered about the Pacific Coast States show that a large area is adapted to it

In France, Spain and Portugal, the carob grows in most kinds of soil, except in stiff clay or wet ground, and even in gravel if fertile and permeable to the roots. The crop is sufficiently valuable to make it worthy of the best soil and treatment.

The carob is usually grown from seed and afterwards budded to the best varieties. It can be raised from cuttings, but requires bottom heat and careful treatment. At the Chico Field Station, where thousands of seedlings are grown, the best success is had by planting under glass. Quicker germination is secured by soaking the seed in water for three or four days or until they begin to swell The tree is difficult to transplant and usually fails unless moved with a ball of earth The best results are had by growing the plants in pots or in "flats" in tenacious soil, as is the practice with eucalyptus, when the trees are cut apart and lifted with squares of earth attached At Aleppo, in Syria, the growers make pots of a mixture of clay and cow-dung which, dried in the sun, are strong enough to hold the earth in which the seeds are planted. When ready to put into the orchard the pot is sunk where the tree is to stand. As soon as the pot becomes moist from contact with the earth, it is readily permeable by the roots.

While the carob is a rather slow grower, it lives to a great age and should be planted not less than 35 to 40 feet apart, with interplanting of peaches or other growths for income until the carobs begin to bear In Algiers and Tunis, it is often planted as a border tree, for which its beauty and utility admirably fit it When well established, the seedlings are budded with the best varieties If buds are taken from bearing trees, fruit may be expected in three or four years In California seedlings bear when six to eight years of age. While it is eminently a dry-climate tree, two or three summer irrigations will greatly aid the development, hasten fruiting and increase the yield It will respond to the same good treatment that is given to a well-kept fruit orchard

The crop matures in September and October and, as with most other fruit trees, it is most abundant every second year When ripe, the pods turn brown and begin to fall Those that fail to drop are easily knocked down with bamboo or other poles

Aaronsohn gives the crop in Palestine in good years at an average of 450 pounds to the tree, and states that he has seen wild stocks fifteen to eighteen years after grafting give a yield of 900 to 1,000 pounds of pods Du Breuil gives the yield in southern France at 220 pounds and mentions single trees at Valencia, Spain, that produce as high as 1,380 kilos, or 3,040 pounds Rivière and Lecoq report the yield of trees in Algiers at 100 to 300 kilos, or 220 to 660 pounds Francis de Mello Lotte gives the crops of mature trees on deep fertile soil in Algarvia, Portugal, at 300 to 750 kilos, or 660 to 1,650 pounds each. As the pods are equal in nutrients to barley and superior to oats for feeding and fattening cattle, sheep, hogs and horses, and the yield is from three to four times the weight per acre of grain, it is evident that few crops will give the farmer an equal value In the mild climate of the Gulf States, especially the coastal regions of Texas, the southern parts of New Mexico and Arizona and the greater part of California, this beautiful and valuable evergreen tree, when once appreciated, is bound to become a staple addition to farm crops for the nourishment of both man and beast.

G. P Rixford

CERATOPÉTALUM (Greek, *horned petal*). *Cunoniàceæ*, by some, *Cunoniaceæ* is included in *Saxifragaceæ*. Greenhouse trees or shrubs

Glabrous and resinous trees and shrubs lvs opposite, compound, with 1–3 digitate lfts · fls small, white, rose or yellow, in terminal branching cymes or panicles; calyx-tube short, 5-lobed; petals 0, or, if present, laciniate; stamens 10, with connectives: fr a small and hard achene-like body, with persistent calyx-lobes, 1-seeded —Two or 3 species, in Austral.

gummíferum, Smith Tree, 30–40 ft . lfts 3, lanceolate, serrulate, narrowed at base, shining and strongly nerved: petals deeply 3–5-lobed, not exceeding the calyx.—Said to thrive in a peaty soil, and to prop. by cuttings of half-ripened wood under glass. L. H. B.

CERATÓPTERIS (Greek, *horned fern*). *Ceratopteridàceæ* Very succulent tropical ferns, forming also a distinct family. They are the only truly aquatic plants among true ferns and grow floating or rooted under water in the mud or sometimes only occasionally flooded. The lvs. are borne in rosettes, the sterile



879. Ceratopteris pteridoides. (×⅓)

spreading, often floating, the fertile more erect, 2–4-pinnate, with very slender rolled-up pod-like segms.: sporangia very large, borne separately along the veins and covered by the revolute margins somewhat as in Pteris —Species very few Best grown by planting in pots, slightly submerged Reproduced by buds which arise from all parts of the lvs New plants must be developed each season Useful in ponds and aquaria

pteridoides, Hook Fig 879 Sterile lvs broadly deltoid, short-stalked, the margins irregularly lobed, floating, the fertile lvs taller, completely divided into long whip-like segms sporangia with a very small annulus, and containing 32 spores Fla to S Amer

thalictroides, Brongn Sterile lvs narrowly deltoid, long-stalked, 1-2 pinnatifid into deltoid segms not floating, fertile lvs similar but with linear segms annulus well developed Old World tropics

R C Benedict.

CERATOSTÍGMA (Greek, *horned stigma*). *Plumbagināceæ* Diffuse glabrous perennial herbs or subshrubs, one of which is in cultivation as a bedding and border plant

Ceratostigma differs from Plumbago in having no glands on the calyx, stamens adnate to the corolla-tube, fls in dense clusters rather than spicate, and other technical characters. lvs alternate, lanceolate or obovate, more or less ciliate fls. mostly in terminal heads, blue or rose; calyx tubular, deeply 5-parted, the lobes narrow; corolla salver-shaped, the tube long and slender, the limb spreading and with 5 obovate obtuse or retuse lobes; stamens 5, attached on the corolla-tube fr a 5-valved caps inclosed in the calyx —Species 4 or 5, in N. China, Himalayas, Abyssinia

plumbaginoides, Bunge (*Plumbàgo Lárpentæ*, Lindl. *Valorădia plumbaginoìdes*, Boiss.). Herb, 6–12 in., the st red and branchy· lvs entire, strongly ciliate on the edges fls with a deep blue limb, the 5 lobes minutely toothed, collected in dense heads or umbels China. B M 4487 F S 4 307 —A hardy bedding plant, producing profusely of its deep blue fls late in fall, very valuable Needs covering in winter in the N.

Under the name *C. Pólhilli*, a dwarf and creeping shrub, with delicate lavender fls., is mentioned in British journals as coming from high elevations in W. China and giving promise as an outdoor subject

L. H. B.

CERATOTHÈCA (Greek for *horned capsule*). *Pedalìaceæ* Tropical African glasshouse herbs.

Leaves opposite, ovate. calyx 5-parted; corolla 2-lipped, the lower lip very long in proportion to the upper fls in pairs in the axils caps. 2-horned —Five species **C. triloba,** Mey., is occasionally grown in S. Fla., and it may be adapted to glasshouses It is a tall herb (5 ft.), with the habit of foxglove, probably biennial, hairy and rather fleshy lower lvs. stalked, broadly ovate or almost round, the upper sometimes broadly angular and even 3-lobed, both kinds crenate-dentate corolla 3 in. long, blue or violet-blue, pubescent, deflexed, the lower lobe prolonged Handsome B M 6974.—Could be grown in temperate house N. in sandy loam.

N. Taylor.†

CERATOZÀMIA (Greek, *horned Zamia*, referring to the horned scales of the cones, which distinguish this genus from Zamia) *Cycadàceæ* Handsome Mexican foliage plants, with cycas-like leaves, but less cultivated in American palm-houses than Cycas.

Trunk erect in age, crowned by a whorl of pinnate cycas-like lvs which are petiolate and unarmed: fls in cones borne from among the lvs, the cones often stalked seeds rare and little known. —Six species Best raised from young imported plants, but rarely prop by seeds, or by offsets from the slow-growing trunk Burn out the center of the plant with a hot iron, and a number of offsets will spring from the trunk and the crown; these may be used for prop

mexicàna, Brongn Fig 880 Trunk thick, short, covered with the remains of fallen lf.-stalks lvs rich, dark green, pinnate, on prickly petioles 5–6 in. long, which are shaggy when young, lfts very numerous, 6–12 in. long or more, lanceolate cones produced annually on separate plants, female cones 9–12 in. long, 4–6 in. thick, the scales 2-horned, male cones narrower, longer, on a hairy stalk, the scales with 2 small teeth Mex. Gn 9, pp 308–9 —An excellent decorative plant, best grown in sandy loam Give freely of water and heat in spring and summer, but keep cooler and drier in winter Somewhat tender although grown in Cent. Fla

C. Muquchana, Wendl A plant with 20–30 pairs of lfts and a lf.-stalk 18 in. long fr. not known certainly Cult. in botanic gardens and worthy of wider use Mex and W. Indies

N. Taylor †

CERCIDIPHÝLLUM (*Cercis* and *phyllon*, leaf, the lvs. resemble those of Cercis) *Trochodendràceæ*. Tree grown for its handsome foliage and habit.

Leaves deciduous, usually opposite, petioled and palmately nerved fls. dioecious, inconspicuous, apetalous, solitary, staminate nearly sessile, bearing numerous stamens with slender filaments, pistillate pedicelled,



880. Ceratozamia mexicana —Young plant (fertile)

consisting of 3–5-carpels, ending in long, purplish styles and developing into about ¾in. long, dehiscent pods, with many seeds —One species in Japan and W China. Hardy, ornamental, shrubby tree of pyramidal and, when young, almost fastigiate habit, with handsome, light green foliage, purplish when unfolding, turning bright yellow or partially scarlet in fall It prefers rich and moist soil, and grows rapidly when young. Prop. by seeds, sown in spring, and by greenwood-cuttings, taken from forced plants in early spring, or by layers; cuttings from half-ripened wood in summer, under glass, grow also, but not very well



881. Cercidiphyllum japonicum (×⅛)

japónicum, Sieb. & Zucc Fig 881. Bushy tree, commonly with several trunks, usually 20–30 ft, but sometimes rising to 100 ft., with slender, glabrous branches: lvs. opposite, occasionally alternate, slender-petioled, cordate, orbicular or broadly ovate, obtuse, crenate-serrate, glabrous, glaucous beneath, 2–3 in. long. Japan. G F 7·106, 107, and 6.53 Mn. 3:74 Gng. 5:135 F E. 32 211 (habit) P G 2 105 S I F 1:41. —A very desirable tree, one of the best introductions from Japan Var **sinénse,** Rehd & Wilson. Tree, to 120 ft, usually with a single trunk petioles shorter, about ¾in long, somewhat hairy on the veins beneath: caps gradually narrowed at the apex, ½in long. W. China —This recently intro. variety is perhaps still more desirable than the type It is the largest of all broad-lvd trees known from China; the trunk is sometimes free of branches for nearly 50 ft above the ground and attains to 25 ft or exceptionally to 55 ft. in girth

ALFRED REHDER

CÉRCIS (*Kerkis*, ancient Greek name) *Legumindsæ.* JUDAS TREE RED-BUD Trees or shrubs grown for their pink flowers profusely produced early in spring before the leaves, very interesting, also, in mode of branching, as seen in mature trees

Leaves deciduous, alternate, petioled, palmately nerved, entire fls papilionaceous, pedicelled, pink or red, appearing before or with the lvs, in clusters or racemes from the old wood; calyx 5-toothed, red; petals nearly equal, the uppermost somewhat smaller· pod compressed, narrow-oblong, narrow-winged on the ventral suture, many-seeded.—Seven species in N Amer, and from S. Eu to Japan

These trees and shrubs are very ornamental, with handsome distinct foliage and abundant showy flowers in spring, very effective by their deep pink color They are well adapted for shrubberies or as single specimens on the lawn, and attain rarely more than 20 or 30 feet in height, forming a broad, irregular head when older. Only *C. canadensis* is hardy North, while *C. chinensis* can still be grown in sheltered positions near Boston, but is occasionally injured in severe winters; the others can not be grown successfully farther north than New York. They grow best in rich sandy and somewhat moist loam, and should be transplanted when young, as older plants can hardly be moved with success. Young plants, four or five years old, produce flowers freely and may be recommended for forcing, especially *C. chinensis* and *C racemosa*, which are the most beautiful of all. Propagated by seeds, sown in spring, best with gentle bottom heat; sometimes increased by layers, or by greenwood cuttings from forced plants in early spring, *C. chinensis* grows also from greenwood cuttings in summer under glass.

A *Lvs. abruptly and short-acuminate.*

B. *Fls in clusters: lvs. usually pubescent only beneath near the base.*

canadénsis, Linn Fig 882. Tree, to 40 ft.: lvs. roundish or broadly ovate, usually cordate, 3–5 in. long: fls. rosy pink, ½in. long, 4–8 in clusters· pod 2½–3½ in long. From N. J. south, west to Mo. and Texas. S S. 3·133–4. A.F. 13:1370 Gng 6 290. F E. 9 593. Mn. 2, p. 139. M.D.G. 1899:434–5 (habit) Gn. 25, p. 347.—A very desirable ornamental tree for the northern states Var. **álba,** Rehd Fls. white Var. **plèna,** Schneid Fls. double —Recently *C. canadensis* has been split by Greene into several new species (see Fedde, Rep Spec Nov Veget. 11:110).

chinénsis, Bunge (*C. japónica*, Sieb.). Fig 883. Tree, to 50 ft, shrub in cult. lvs deeply cordate, roundish, with a white, transparent line at the margin, subcoriaceous, glabrous, shining above, 3–5 in long fls. 5–8, purplish pink, ¾in. long pod 3–5 in long, narrow. China, Japan F S 8.849. Mn. 2·139 G F 6:476 — A very beautiful species, with the fls nearly as large as those of *C. Siliquastrum* and more abundant.

BB. *Fls in pendulous racemes.*

racemòsa, Oliv Tree, to 30 ft: lvs broadly ovate, truncate or subcordate at the base, pubescent beneath,



882 Cercis canadensis. (×⅓)

2½–4 in long: fls. rosy pink, about ½in. long on slender pedicels of about equal length, in many-fld. racemes 1½–3 in long: pod 2½–4 in long. Cent China. H I. 1894 —The handsomest of all. Young plants have not proved hardy at the Arnold Arboretum, but it is perfectly hardy in S. England

aa. *Lvs. rounded or emarginate at the apex, usually broader than long.*

occidentàlis, Torr. (*C. califórnica*, Torr.). Shrub, to 15 ft.: lvs. cordate, roundish, glabrous, about 2 in. wide: fls rose-colored, ½in long. pod 2-2½ in. long. Calif Torrey in U S Explor. Exped. 1838–1842, 17, pl. 3.—A closely allied species is *C. reniformis*, Engelm. (*C. texénsis*, Sarg.). Small tree: lvs. subcoriaceous, 3–5 in wide, sometimes pubescent beneath pod 2–4 in. long Texas, New Mex. S S 3:135.



883. Cercis chinensis. (Natural size)

Siliquástrum, Linn. Tree, to 40 ft. lvs. roundish, deeply cordate, glabrous, 3–5 in. wide: fls 3–6, purplish rose, ¾in. long. pod 3–4 in long S Eu, W Asia B M 1138 Gn 25, pp. 346, 347, 350; 33, p. 416; 42 342, p. 343; 44, p. 379, 52, p 5. G C III. 52 6 (habit) G 25 209. R H. 1899 469 (abnormal form). Var **álba,** Carr (var *álbida*, Schneid) with white fls.

CERCOCÁRPUS (Greek, *tail* and *fruit;* the fruit with a long, hairy tail). *Rosàceæ.* MOUNTAIN MAHOGANY. Small trees or shrubs but rarely grown for their attractive evergreen or half-evergreen foliage and the peculiar feathery tailed achenes

Leaves alternate, persistent, rather small fls. inconspicuous, apetalous, whitish or reddish, in the axils of fascicled lvs; calyx-tube cylindric, elongated, abruptly expanded at the apex into a cup-shaped deciduous, 5-lobed limb bearing 15-30 stamens with short filaments, ovary 1-celled, inclosed in the calyx-tube, with a long exserted style fr a 1-seeded achene, surmounted by the persistent, long and hairy style.—Small genus of about 10, mostly rather local species, in the Rocky Mts. from Mont south to Mex. and in Calif

The cercocarpuses are not particularly ornamental, yet they are attractive with their small evergreen dark foliage and their feathery tailed fruits; they are adapted for planting on dry rocky or gravelly slopes in arid temperate regions, as they thrive under very unfavorable conditions The very heavy and close-grained wood is manufactured into small articles, and valued as fuel and for making charcoal *C. ledifolius* and *C. parvifolius* are the hardiest and stand frost to zero, while *C. Traskiæ* can be grown only in southern California. They may be cultivated in any well-drained soil in sunny positions, and propagated by seeds or by cuttings of half-ripened wood under glass.

A *Margin of lvs toothed fls 2–5 in a cluster.*

B. *Lvs oval to suborbicular, usually rounded at the base.*

Tráskiæ, Eastw Tree, to 25 ft. lvs. coarsely sinuate-dentate above the middle, lustrous above, tomentose below, 1–2½ in long: achene with the style 2–2½ in. long Santa Catalina Isl, Calif S S 13:635.

BB. *Lvs usually cuneate-obovate, smaller.*

parvifòlius, Nutt Bushy tree, to 25 ft: lvs. dull green and pubescent above, pubescent or tomentose beneath, ½–1½ in long, with 4–5 pairs of veins style 2–4 in. long From Neb and Ore to Low Calif. and W. Texas. S S 4 166. H I 4 323.—D M Andrews, of Colo., who handles this shrub, writes of it as follows "Mountain mahogany, 6 feet A nearly evergreen rosaceous shrub of peculiar and attractive habit of growth Fls. white, early, followed by the long, plumose achenes, which are 3–5 in long, strangely curled and twisted, arranged above and on each side of the slender branches, so that at a little distance they have an appearance suggestive of ostrich plumes. Easily transplanted, and thrives anywhere"

betulæfòlius, Nutt (*C. parvifòlius* var. *glàber*, Wats. *C. parvifòlius* var *betuloides*, Sarg) Small tree, to 30 ft.. lvs thinner, bright green and glabrous above at maturity, pubescent or glabrescent beneath, ½–2 in. long, with 5–6 pairs of veins style 2–4 in long. Calif. W G Z 4, pp 554–5 H I. 4 322

AA *Margin of lvs entire, revolute fls solitary or in pairs.*

ledifòlius, Nutt Tree, to 40 ft lvs lanceolate, coriaceous, lustrous and glabrous above at maturity, pubescent below, resinous, ½–1 in long, veins obscure: style 2–3 in long From Wyo and Wash to S Calif. and New Mex. S S 4:165 H.I 4·324

ALFRED REHDER.

CEREALS (*Ceres*, goddess of agriculture) The agricultural grains, properly those of the grass family: maize or Indian corn, kafir, wheat, emmer, spelt, rice, oats, barley, rye, sorghum (for grain); popularly held to include buckwheat, but not accurately so Consult Vol II, Cyclo Amer Agric.

CÈREUS (from the Latin, but of uncertain application) *Cactàceæ.* Usually arborescent, columnar cacti with the surface covered with spiny ribs

Flowers large, borne singly along the sides of the st; fl-tube slender and, as it decays, cutting off from the ovary, petals numerous, stamens numerous, style single, thick fr a large, naked, fleshy berry; seeds small, black The genus Cereus, as it has generally been treated, contained more than 100 species which differed greatly in habit, armament, fls and fr, and was one of the most complex and difficult of the family As now understood, it contains species of uniform habit, with similar fls and frs, while a number of species of very different habit have been referred elsewhere Even as here treated, more than half of the species are anomalous. Until the fls and frs have been studied, it seems best to leave them in Cereus. The species are all from S. Amer

Only a few species of true Cereus are grown in this country, and most of these are grown under glass. The flowers do not compare in size and attractiveness with those of the so-called night-blooming Cereus, which is described elsewhere under the genus Selenicereus. Several of the species have cristate and other abnormal forms which make them desirable to certain growers. *C. lepidotus* is a rather common cultivated species in certain of the West India Islands, where it grows to considerable height, and several of the species are grown in Europe along the Riviera, where they reach great size. With us, however, they do not grow very rapidly. They are easily propagated from seed or by cuttings. See *Succulents*

The species treated in the first edition of this work that are not here given may be looked for under the following genera: Acanthocereus, Aporocactus, Bergerocactus, Carnegiea, Cleistocactus, Escontria, Harrisia, Heliocereus, Hylocereus, Lemaireocereus, Lophocereus, Myrtillocactus, Oreocereus, Pachycereus, Rathbunia, and Selenicereus

INDEX.

Alacriportanus, 11
atropurpureus, 22.
azureus, 19
Bonplandii, 21.
Bridgesii, 18
cærulescens, 17.
cæsius, 20
candicans, 2.
Cavendishii, 15.
chalybæus, 13.
chiloensis, 5.
euphorbioides, 6.
fernambucensis, 24.
formosus, 24.
grandis, 21.
Hankeanus, 9.
isogonus, 14
Jamacaru, 12
lageniformis, 18
lamprochlorus, 3.
Landbeckii, 17
macrogonus, 10.
Martianus, 23.
Martinii, 23
monacanthus, 23
monoclonos, 11
Olfersii, 6.
Pasacana, 1.
pernambucensis, 24.
peruvianus, 11.
Pitajaya, 24,
platygonus, 16.
Roezlii, 7
Seidelii, 19.
Sepium, 7.
Spachianus, 4.
splendens, 15.
tetracanthus, 8.
tortuosus, 22.
validus, 12
variabilis, 24.

A. *Sts. erect, 2 in or more diam.*

B. *New growth green, not prunose or covered with a bloom.*

C. *Ribs of st. 10 or more.*

1. **Pasacàna,** Web. A gigantic species, reaching a height of 20–30 ft, and sometimes even 50 ft, and a diam of 12–16 in; sparingly branching above; in new growth dark green, becoming gray or blush: ribs 15–20, or in young plants only 9–10. areoles ⅜–¾in apart, large, brown, becoming yellowish and finally gray: radial spines 10–13, about 1 in long, the under one or lowest pair straight, subulate, the others curved, centrals mostly 4, the under and upper ones the longest, reaching 2 in length, straight or curved, the young spines are clear brown, often with alternating rings of light and dark tissue, later gray, bulbose at the base: fls. from the lateral areoles about 6 in long, white. Argentina.—This is the giant cereus of the Argentine desert, as *Carnegiea gigantea* is of the certain N. American deserts It is not a true Cereus.

2 **cándicans,** Gillies Sts upright, low, cylindrical, bright green, 2½–3 ft. high by 6–8 in diam.; freely branching from the base ribs 10, obtuse-angled areoles ⅝–¾in apart, large, depressed, white, becoming gray. radial spines 11–14, spreading, at first thin, needle-form, later stronger, stiff, straight, about ¾in long, central solitary or later 3–4 additional ones appearing above, stronger, reaching a length of 1¼ in, sometimes somewhat curved, all the spines horn-colored, with tips and bases brown, later becoming gray: fls long, funnelform, resembling those of Echinopsis, 10 in long by 6 in diam.. fr spherical to ellipsoidal, about 3 in diam, red, somewhat spiny, flesh white. Argentina.—Not a true Cereus

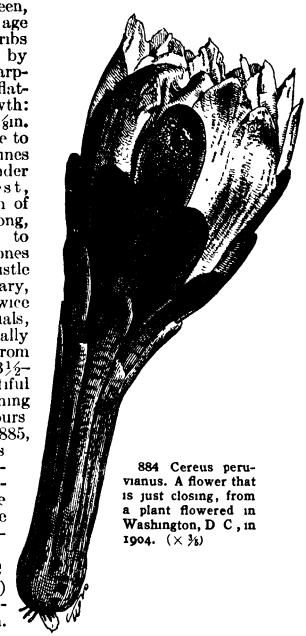
3. **lamprochlòrus,** Lem Related to *C candicans,* of a taller growth, cylindrical, 3–6½ ft high by about 3 in diam, at first simple, but later branching at the base; in new growth bright green, later dirty green. ribs 10–11 or occasionally 15, conspicuously crenate, later blunt and but little crenate areoles medium size, about ½in apart, yellowish white, becoming gray, above each areole 2 radiating grooves form a letter V· radial spines 11–14, spreading, straight, sharp-pointed, about ⅜in. long, clear to dark amber-color; some are strong and rigid, while others are bristle-form; centrals mostly 4, somewhat longer, stronger and deeper colored, with brown bases, becoming dark gray, about ¾in. long: fls. from the previous year's growth, about 8–10 in. long by 6 in. diam., white. Argentina.—Not a true Cereus.

4. **Spachiànus,** Lem. Sts. upright, at first simple, later profusely branching at the base, branches ascending parallel with the main st, 2–3 ft high by 2–2½ in. diam, columnar: ribs 10–15, obtuse, rounded: areoles about ½in. apart, large, covered with curly yellow wool, becoming white: radial spines 8–10, ¼–⅜ in long, spreading, stiff, sharp, amber-yellow to brown; central solitary, stronger and longer; all the spines later becoming gray: fls. about 8 in. long by about 6 in. diam., white. Argentina.—Not a true Cereus.

5. **chiloénsis,** DC. (*Cáctus chiloénsis,* Colla). Sts. strong, upright, simple (so far as known), about 2½ ft. high by 3½–5 in. diam., cylindrical to somewhat clavate, bright, clear green: ribs 10–12 obtuse: areoles about an inch apart, large: radial spines straight, sharp, rigid, at first 9, but later 4 others appear above these; centrals mostly 4, seldom but a single one, bulbose at the base; the young spines are brown honey-yellow, becoming white, with dark tips, and finally gray. fls. from the upper lateral areoles about 6 in. long, white, resembling those of Echinopsis. Chile.—This is not a true Cereus.

CC. *Ribs of st. 7–9.*

6. **euphorbioides,** Haw. (*C. Olfersii,* Otto). Columnar, simple, 10–16 ft high by about 4½ in. diam., in young growth pale green, changing with age to gray-green· ribs 8–10, separated by sharp grooves, sharp-angled, becoming flattened in older growth: areoles about ¾in. apart, small, white to gray radial spines mostly 6, the under one the longest, reaching a length of over an inch, strong, yellowish brown to black, the upper ones shorter and bristle form, central solitary, in young plants twice as long as the radials, all the spines finally become gray fls from near the crown, 3½–4 in long, beautiful flesh-red, remaining open for 21 hours Brazil. R H 1885, p. 279.—This plant is insufficiently understood; it may be a form of some species of Cephalocereus.



884 Cereus peruvianus. A flower that is just closing, from a plant flowered in Washington, D C, in 1904. (× ⅓)

7 **Sèpium,** DC (*C Roèzlii,* Haage) Upright, columnar, about 3 in. diam ribs 9, separated by sharp, somewhat serpentine grooves, obtuse, above the areoles, 2 radiating, slightly curved grooves form a letter V areoles ½–¾in. apart, comparatively large, slightly sunken, yellowish, later gray radial spines 9–12, radiate, nearly ½in long, straight, subulate, tolerably sharp, slightly thickened at the base, clear brown, with darker stripes, central solitary, reaching 1½ in long, straight, porrect, later somewhat deflexed, clear brown; later all the spines become gray. Andes of Ecuador.—Near Borzicactus; needs further critical study.

8. **tetracánthus,** Labour. Upright, arborescent or bushy, freely branching, young branches leaf-green, later gray-green. ribs 8–9, low, arched: areoles medium-sized, slightly sunken, about ½in. apart, white to gray. radials 5, later 7, radiate, about ⅜in. long, straight, subulate, stout, white, with brown tips and bases, later ashy gray; centrals 1–3, under one largest and porrect, when young yellow and translucent, later gray· fls resemble those of *C. tortuosus* Bolivia —This species should doubtless be referred to Eriocereus.

ccc. *Ribs of st. 3–6.*

9. Hankeànus, Web. Upright, robust, not branching (so far as known), young growth bright green, later dark green, about 2 in diam.: ribs 4–5, compressed, about 1¼ in high, conspicuously crenate, with an S-form line passing from each areole toward the center of the st areoles, ⅜–1 in apart, horizontally elliptical to heart-shaped, brown, becoming gray below and yellow above: radial spines 3, needle-like, stout, sharp-pointed, about ⅜in long, amber-colored when young, turning to brown, central solitary, straight, porrect, ⅝in. long, stronger than the radials, horn-colored; later all the spines become gray: fls. 4–5 in. long, white. S. Amer.

bb. *New growth blue, white- or gray-prunose.*

c. *Ribs of st comparatively broad and low: st. more or less triangular in cross-section.*

10 **macrogònus,** Otto Arborescent, sparsely branching, reaching a height of 20 ft (in cult., 6 ft high by 3–5 in diam.), branches columnar: ribs mostly 7, seldom 8–9, thick, slightly undulate, obtuse and with convex faces, about 1 in high bluish green, frequently having a depressed line near the areole areoles about ½in apart, large, gray radial spines 6–9, radiate or spreading, strong, subulate, ¾in long, horn-color, later black, central spines 1–3, somewhat stronger and longer than the radials, more or less conspicuously porrect: fls from the lateral areoles near the end of the branches, 2½–3 in long, tolerably fleshy, white fr. depressed-globose, 2 in diam. by little more than 1 in. long. Brazil

cc *Ribs of st strongly compressed laterally.*

11 **peruvìanus,** Haw (*C. monoclònus,* DC.). Hedge Cactus Fig 884 Tall, 30–50 ft, branching freely toward the base, columnar, 4–8 in diam, new growth dark green and glaucous, becoming a dull green with age, and, in old sts becoming corky ribs 5–8, compressed: areoles ½–1 in apart, in new growth covered with conspicuous, curly brown wool, becoming gray: radial spines about 6–7, about ⅜–½in long; central solitary, reaching a length of 2½ in, the number of spines increases with age to as many as 20, all are rigid, brown: fls. abundant, from the lower part of the st., white, nocturnal, 6–7 in long by 5 in. diam. S Amer. G C. III. 24 175 (var *monstrosus*).

Var **Alacriportànus,** K Schum (*C. Alacriportànus,* Mart.) Of somewhat weaker growth, low, and less conspicuously prunose in the new growth, which is consequently nearly clear green. S Brazil

12 **Jamacàru,** Salm-Dyck (*C váludus,* Haw.). Sts. upright, robust, rigid, 12–16 ft high by as much as 6 in. diam., young growth azure-blue, turning dark green with age, glaucous ribs 4–6, thin, compressed, crenate: radial spines 5–7, stiff, needle-like, clear yellow with brown points, or brown and finally black, about ½–¾ in. long, centrals 2–4, somewhat stronger, porrect, ¾–3 in long fls large, 10 in long by 8 in. diam., white, nocturnal Brazil, Venezuela.

13. **chalybæus,** Otto Sts upright, branching above, arborescent, azure-blue and prunose, later dark green, 1½–4 in diam ribs 6, in young growth very much compressed, later depressed till the st. is nearly cylindrical areoles about ⅜in apart, dark gray-brown: radial spines mostly 7, about ½in. long, centrals 3–4, similar but somewhat stronger and a little longer; all the spines are pointed, stiff, when young are black, later brown to gray with black tips, bulbose at the base: fls very similar to those of *C. cærulescens.* Argentina.

aa. *Sts. erect, less than 2 in diam.*

b. *Ribs of st 10 or more.*

14. isogònus, K. Schum St upright, columnar, about 1–1¼ in. diam., in young growth light green to yellow-green, later darker. ribs 15–16: areoles approximate, white, turning gray: radial spines as many as 20, spreading, at first clear or dark yellow, becoming white, and finally gray, bristle form, flexible, about ⅜in. long; centrals 6–8; two of these are somewhat stronger and stiffer, about ¾in long, one directed upward and one downward, yellowish brown to dark honey-color; later gray, as in the radials. S Amer.

15. spléndens, Salm-Dyck Columnar, slender, short, rigid, more or less branching from the base, reaching a height of about 2 ft and about 1–1½ in. diam., light to yellowish green ribs about 10–12, rounded areoles prominent, about ¼in apart, tawny, becoming white, tomentose: radial spines 8–12, radiating, yellow and light brown, becoming gray, centrals 1–3, scarcely larger than the radial, yellowish to white; all the spines slender, bristle form, about ¼–¾in long. —*C Cavendishii* has been referred to this species, but with some question.

bb. *Ribs of st. 3–10.*

16. platygònus, Otto. At first upright, later somewhat reclining, branching, at the base about 1 in. diam., tapering in the new growth: ribs 8, low, arched: areoles about ¼in apart, very small, yellow, becoming gray, subtruded by a small 3-angled bract: radial spines 12–15, spreading, bristle form, little more than ¼in long, central solitary, slightly longer and stronger; all the spines at first yellow-brown, changing to white or gray with age.

17 **cæruléscens,** Salm-Dyck (*C Lándbeckii,* Phil.). Arborescent or shrubby, 3–5 ft. high: sts. 1–1½ in. diam: ribs usually 8, obtuse areoles approximate, white bud soon becoming black spines rigid; radials 9–12, ¼–½in long, black; centrals 4, ¾in long, stronger, black or white. fls from the side of the st., slightly curved, 6–8 in long by 6 in diam., tube bronze-green, corolla white or occasionally rose-pink: frs. ellipsoidal, pointed at both ends, about 3 in long and half that in diam., bright red, with blue glaucous covering Argentina. B M 3922

18 **Brídgesii,** Salm-Dyck Upright, tall, columnar, simple or later branching at the base, bright green when young, becoming blue to gray-green, 1½–2 in diam: ribs 5–7, very broad and low areoles ½–¾in apart, yellowish to gray spines 3–5, radiating, the under one, or seldom the upper one, the longest, 1½ in long, stiff, sharp, straight, dark honey-yellow, with brown tips, becoming gray with age Bolivia

Var **lagenifórmis,** K Schum. (*C lagenifórmis,* Forst.). Spines more numerous, somewhat longer.

19. azùreus, Parm. (*C. Seidelii,* Lehm.) St upright, tall, slender, columnar, branching from the base, in the young, fresh bluish green, later dark green with gray, glaucous covering, about 3–4 ft high and about 1 in diam ribs 5–7, rounded, enlarged at the areole. areoles about ¾–1 ft apart, elevated, large, abundantly woolly when young spines 8–18, nearly alike, about ⅛–⅜in long, stiff, slender, needle-form to bristle-like, black; the 2–4 central ones somewhat longer fls 8–12 in long, obliquely attached to the st., slightly curved, white Brazil

20 **cæsius,** Otto Upright, columnar, branching at the base, somewhat tapering above, in new growth, beautiful light blue, prunose, later, light green to slightly bluish, about 1½ in diam: ribs 5–6, separated by sharp grooves, about ½in high, compressed, faintly crenate, becoming depressed in older growth areoles about ⅜in apart, small, yellow at first, later becoming white and finally gray radial spines 8–10, sometimes more appear later; radiate, light amber-color, brown at the base, the lower pair the longest, mostly about ½in. long, centrals 4–7, like the radials but usually somewhat stronger, longer and darker; all the spines thin, needle-form, flexible, sharp; later, light, horn-color, finally gray. S Amer.(?).

AAA. *Sts. weak, clambering over rocks & other plants, and without aerial roots.*

21. **Bŏnplandii,** Parm. Sts. at first upright, later clambering over rocks and bushes, about 1–1¼ in diam., branching and spreading, in new growth commonly of a bluish or purplish green, later gray-green: ribs 4–6, sharp, compressed, crenate, separated by broad, concave faces; later the ribs become much depressed, so that the st is sometimes nearly cylindrical; the ribs commonly run spirally around the axis of the st. areoles ½–1½ in apart, at first considerably depressed, later shallower, white, becoming gray radial spines 4–6 (later 1–4 more appear), straight, spreading, the largest about ½–1 in, stout, subulate, pointed, the under one needle-form and shorter, central solitary, straight, stronger, 1 in long, deflexed or porrect; the stronger spines are white, with tips and bases brown, when young beautiful ruby-red, later all are gray, with black tips and bulbous bases. fls from the lateral areoles about 10 in long, white, nocturnal: fr nearly spherical, about 2 in. diam, mammate, dark carmine-red. Paraguay, Brazil, and Argentina

22. **tortuōsus,** Forbes (*C atropurpŭreus,* Haage). Sts. slender, weak, at first upright, but later reflexed, reaching a length of 3–4 ft, and 1–1½ in. diam · ribs commonly 7, sometimes but 5, rounded, low, separated by regular serpentine grooves areoles about 1 in apart, large. radial spines 5–8, about ⅜–1 in long, centrals 1–4, about ¾–1½ in. long, all the spines slender, rigid, red-brown when young, becoming ashy with age fls. from the previous year's growth, about 6 in long, trumpet-shaped, tube olive-green and spiny, in the axils of the reddish green scales, outer petals pale green, tinted with brown, inner petals clear white· fr. spherical, brilliant red without and white within, mammate, bearing a few spines on the summits of the lower mammas Argentina.

23 **Mártinii,** Labour (*C. monacánthus,* Hort) At first upright, later requiring a support, freely branching from the base, branches long, reaching nearly 5 ft, ¾–1 in. diam, slightly tapering, dark green· ribs 5–6, separated by serpentine grooves, contracted between the areoles, sometimes the ribs are not evident, when the st. is cylindrical areoles about 1–1½ in apart, white· radial spines 5–7, reddish, short, bristle-form, with bulbous bases or short conical, usually about ½in long, central solitary, mostly deflexed, ½–1 in long (in young growth, frequently not longer than the radial), subulate, robust, light brown or white, with bases and tips black. fls from the older growth sts, 8–9 in. long, clear white, nocturnal fr spherical (very similar to *C. tortuosus*), pointed, dark carmine-red, about 2 in. diam., mammate, a few spines on the mammas, toward the base of the fr. Argentina. R.H. 1860, pp 658–9.—This species is commonly sold under the name of *C. platygonus.*



885. Cereus setosus. (×½)

24. **Pitajàya,** DC (*C. pernambucénsis* [*fernambucénsis*], Lem *C. formōsus,* Salm-Dyck *C. variābilis,* Pfeiff) By recent authorities referred to the genus Acanthocereus St at first simple, later branching, in young growth light green, turning grayish green with age, pointed, ¾–1¼ in diam ribs 3–5, commonly 4: areoles about 1 in. apart, large, bearing a conspicuous amount of curly hair, about ½in long, in new growth: radial spines 5–7 and a solitary central one, uniform, about ⅜–⅝ in long, amber color to brown and finally gray fls. from the older growth, large, about 8 in long, slightly curved, white, nocturnal Uruguay, Brazil, Colombia B.M 4084 —*C. grandis,* Haw , according to Weber, is but a larger form of this species.

AAAA. *Sts more or less climbing by means of aerial roots*

25 **Martiànus,** Zucc Of bushy growth, branching, reaching a height of 3 ft and more branches slender, provided here and there with aerial roots, cylindrical, about ¾in diam : ribs commonly 8, straight, separated by sharp grooves, very low areoles ¼–⅜in. apart, small, white· radial spines 6–10, bristle-form, spreading, clear honey-yellow, at base brownish, later whitish and becoming gray, about ¼in long, centrals 3–4, similar, only somewhat stouter and darker: fls. usually abundant, straight or slightly S-shaped, 4–5 in. long, scarlet-red fr. spherical, reddish green, covered with bristles S Mex B M 3768.

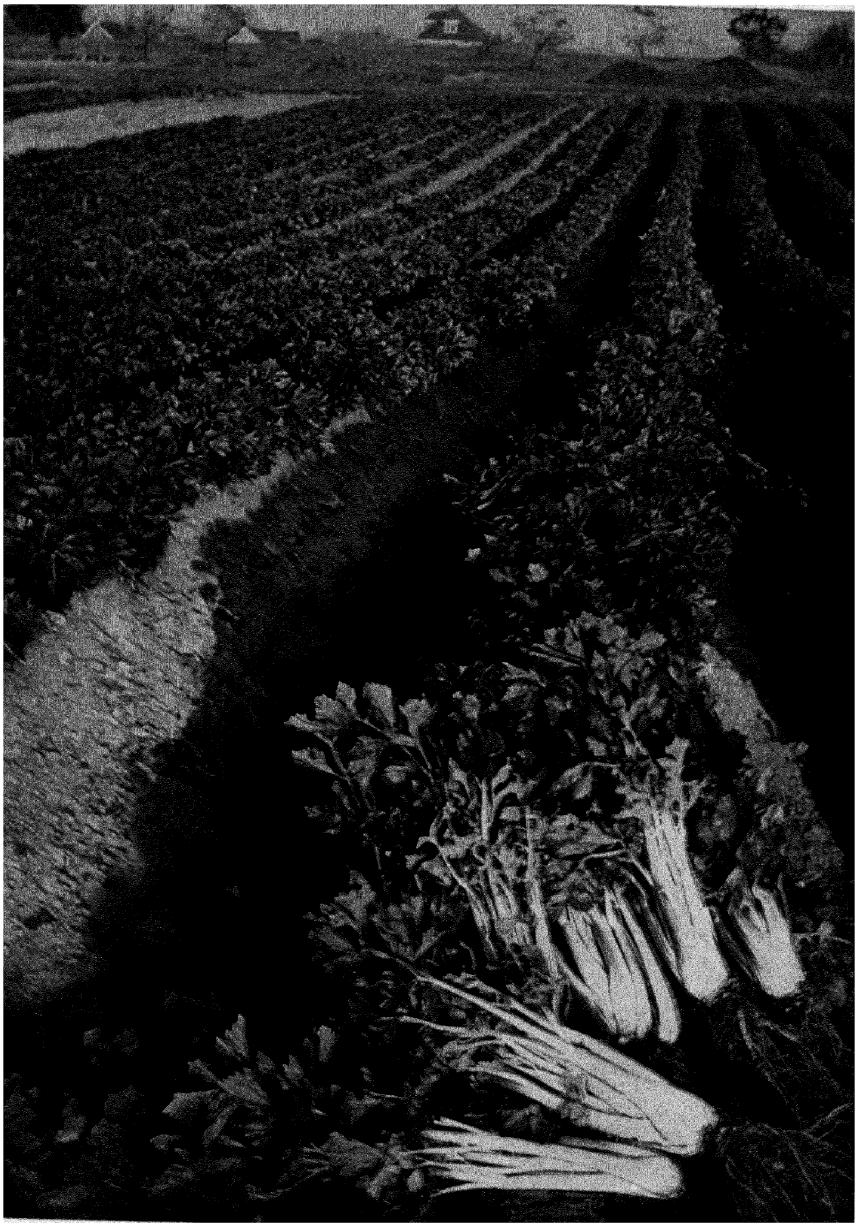
C ventimiglia, Vaupel (Borzicactus ventimiglia, Riccob) St slender, 8- or 9-ribbed spines in clusters of 8–10, spreading perianth-tube elongated, opening into a large throat, petals red-violet fr small, globular, bearing few bracts This species apparently does not belong to the true Cereus, and is probably much nearer Cleistocactus, as suggested in the Kew Bulletin It was described from plants flowering in the Botanical Garden at Palermo, Italy, and which are said to have come from Ecuador Borzicactus is a recently described genus, not yet intro into American collections

C alamosénsis=Rathbunia alamosensis —*C Baumannii*=Cleistocactus Baumannii —*C Berlandiéri*=Echinocereus —*C exsptōsus*=Echinocereus —*C candelabrum*=Lemaireocereus Weberi —*C Chiotilla*=Escontria Chiotilla —*C chlorānthus*=Echinocereus.—*C coccineus*=Echinocereus —*C Cochal*=Myrtillocactus Cochal —*C. conoideus*=Echinocereus —*C ctenoides*=Echinocereus —*C. cylindraceus*=Opuntia —*C diacanthus*=Echinocereus —*C. Donkelæri*=Selenicereus Donkelaeri —*C dúbius*=Echinocereus —*C Dumortièri*=Lemaireocereus Dumortieri —*C eburneus*=Lemaireocereus griseus —*C Émoryi*=Bergerocactus Emoryi —*C Engelmanni*=Echinocereus —*C enneacánthus*=Echinocereus —*C eruca*=Lemaireocereus eruca —*C erūbéscens*=Hylocereus extensus —*C Fendleri*=Echinocereus —*C flagelliformis*=Aporocactus flagelliformis —*C geometrizans*=Myrtillocactus geometrizans —*C gigantèus*=Carnegiea gigantea —*C gonacánthus*=Echinocereus —*C grandiflōrus*=Selenicereus grandiflorus —*C Greggii*=Peniocereus Greggii —*C gummōsus*=Lemaireocereus gummosus —*C hamātus*=Selenicereus hamatus —*C inérmis*=Selenicereus inermis —*C longirōstus*—Echinocereus —*C Mallisonii* is a hybrid —*C MacDónaldiæ*=Selenicereus MacDonaldiæ —*C marginātus*=Pachycereus marginatus —*C Maynardi*=Selenicereus —*C mexicānus* is probably a hybrid —*C mojavénsis*=Echinocereus —*C napoleōnis*=Hylocereus napoleonis —*C Nickelsii*=Cephalocereus —*C nycticalus*=Selenicereus nycticalus. —*C paucispinus*=Echinocereus —*C pectinātus*=Echinocereus —*C pharnāceus*=Echinocereus —*C princeps*=Acanthocereus pentagonus —*C procumbens*=Echinocereus —*C queretárénsis*=Pachycereus queretarensis —*C Rétzii*=Selenicereus hystrix —*C repándus*=Harrisia gracilis —*C Rótteri*=Echinocereus. —*C. Scheèri*=Echinocereus —*C sénilis*=Cephalocereus —*C serpentinus*=Nyctocereus serpentinus —*C speciōsus*=Heliocereus speciosus —*C. spinulōsus*=Selenicereus spinulosus —*C stellātus*=Lemaireocereus stellatus —*C stramineus*=Echinocereus —*C Thùrberi*=Lemaireocereus Thurberi —*C triangulāris*=Hylocereus tricostatus. —*C. tuberōsus*=Wilcoxia —*C viridiflōrus*=Echinocereus.

J N. Rose.†

CERÍNTHE (Greek, *keros,* wax; *anthos,* flower· the ancients thought that the bees visited the flowers for wax) *Boraginàceæ.* Annual or perennial herbs from Europe and Asia Minor, with alternate glaucous leaves and showy purple bracts

Calyx deeply divided, the tubular corolla with 5 very small reflexed lobes, usually differently colored from



XXV. Celery.—The cultivation under field conditions, at the hilling-up or banking stage.

the tube.—About 6 species. The best species is *C. retorta*, which has a unique appearance in the garden, and is strongly recommended for more general cult. It is a hardy annual of easy cult.

retórta, Sibth. & Smith. HONEYWORT. Fig. 885. Height 1½–2 ft: lvs. glaucous, often spotted white or red; lower lvs. obovate-spatulate, upper lvs. amplexicaul, with 2 round ears, on the flowering branches gradually becoming smaller and closer together until they pass into purple bracts, which form the chief attractive feature of the plant fls when full-blown protruded beyond the bracts; corolla tubular-club-shaped, yellow, tipped purple, with 5 small, spreading teeth: frs smooth but not shining. Greece B M. 5264 Gn. 41.212. For a garden review of the other honeyworts, see Gn 41, p 212.

C. májor, Linn. A showy annual 6–15 in. high: lvs. clasping the st., very rough and ciliate: fls. with showy bracts, the corolla yellow below, purplish at the top: fr. smooth, shining and brown-spotted. Medit. region. B M 333.

WILHELM MILLER.
N. TAYLOR.†

CEROPÈGIA (Greek, *wax* and *fountain*, the flowers having a waxy look). *Asclepiadàceæ*. Greenhouse vines of Africa and Asia.

Stems fleshy, erect and twining among the other plants in nature, or pendulous: lvs. opposite, sometimes in the S. African species wanting: fls. medium-sized, the corolla more or less inflated at the base, straight or curved, corona something as in our common milkweeds, double.—A genus of 100 species, a dozen of which are known in Old World collections but only the following in Amer. Many of them have tuberous roots, and need a season of rest and dryness. May be grown in a compost of loam, leaf-mold or peat, and sand. Temperate house is the best for the two following. Prop. by cuttings in spring over bottom heat. Odd and handsome.

Woódii, Schlecht. With many slender prostrate or trailing sts.: lvs. fleshy, about 1½ in. long, almost rotund: fls. in pairs, axillary on stalks, 3–7 in. long; corolla slightly curved, about ¾ in. long, pink or with dark lines below, the upper part sometimes purplish. Natal. G C III. 22: 357, 37:244 (desc.). B M. 7704.

Sándersonii, Decne. St. twining, fleshy and thick: lvs. about 1¾ in. long, ovate-lanceolate. fls. cymose, 3–4 at a node, the greenish white corolla about 1½–2 in. long, curved and with an obvious inflation at the base. Natal. B M 5792. G C III. 40.383. R.H. 1901, p. 111.

C. barbertonénsis, N. E. Br. Lvs. somewhat variegated with pale green along the veins: fls. similar to *C. Woodii*. Transvaal.—*C. Brównii*, Ledger. Corolla-tube pale green with dark blotches, lobes greenish with a zone of white and dark purple in the middle. Uganda.—*C. dinerela*, N. E. Br. Tuberous: tube whitish, dark-veined, lobes pale yellow at base, purple-green at apex. Madras.—*C. fusca*, C. Bolle. Many succulent sts.: corolla dull reddish brown: coronna light yellow. Canary Isls. B M. 8066.—*C. gemmífera*, K. Schum. A tall climbing species: fls. solitary. W. Trop. Afr.—*C. Lugárdæ*, N. E. Br. Lvs. thin, 1–2 in. long: tube 1 in. long, abruptly curved immediately above inflated base, dilated at apex into funnel-shaped mouth. Bechuanaland. G C III. 30: 302 (desc.).—*C. Réndallii*, N. E. Br. A small species with fl. having an umbrella-like canopy surmounting the corolla: twining. Transvaal.—*C. simúla*, N. E. Br. In cult. as C. Thwaitesii. Corolla-lobes white or pale green at base, ciliate. G C III. 40: 384. *C. Thórncroftii*, N. Br. Sts. twining: cymes axillary, many-fid., corolla white, with purple blotches. Transvaal. B M. 8458.

N. TAYLOR.

CERÓPTERIS (Greek, *wax fern*). *Polypodiàceæ*. Hothouse ferns of rather small size, interesting for the powdery covering on the leaves.

A rather small group somewhat related to Pteris, characterized most conspicuously by having the under surface of the lvs. covered with a colored powder, often silver, white or bright yellow (so-called silver and gold ferns). The sporangia are borne in indefinite lines and are unprotected by any indusium. The species of Ceropteris have in the past been classified under the generic name Gymnogramma, but fern students are now generally agreed in separating it as a distinct genus.

INDEX.

argentea, 4.
argyrophylla, 7.
calomelanos, 6.
chrysophylla, 2, 6.
decomposita, 5.
gigantea, 2
Laucheana, 2.
magnifica, 6
peruviana, 7.
pulchella, 9.
sulphurea, 3.
tartarea, 8
triangularis, 1.
viscosa, 1
Wettenhalliana, 9.

A. *Powder commonly yellow: lvs. about as broad as long*

1 **triangulàris,** Underw. (*Gymnográmma triangulàris*, Kaulf.) Fig. 886. Lf.-blades 2–5 in. wide and long, on stalks 6–12 in. long, dark green above, below deep golden yellow, or occasionally white; lower pinnæ much larger than the others, deltoid, the upper lanceolate. Calif. to Brit. Col. Gn 48, p. 444.—A white-powdered variety with a viscous upper surface and coarser cuttings (var. **viscòsa,** D. C. Eaton) is found in S. Calif.



886. Ceropteris triangularis. (×⅓)

AA. *Powder yellow: lvs. lanceolate, several times as long as broad.*

B. *Lvs. scarcely more than bipinnate.*

2. **chrysophýlla,** Link (*Gymnográmma chrysophýlla*, Kaulf.) Lvs. 12–18 in. long, with blackish stalks and rachises, the segms. slightly pinnatifid at the base: powder golden yellow. W. Indies to Brazil. R H. 1856.201. G C III. 23:373.—Often considered a var. of *C. calomelanos*. Var. **Laucheàna** (*Gymnográmma Laucheàna*, Hort.), has triangular lvs. except in its sub-variety *gigantea* Gn 48, p. 437.

BB. *Lvs. tripinnatifid to quadripinnate.*

3. **sulphùrea,** Fée (*Gymnográmma sulphùrea*, Desv.). Lf.-blades 6–12 in. long on chestnut-brown stalks, the pinnæ long, tapering, less than 1½ in. wide at base, the pinnules compact, with 3–7 divisions: powder sulfur-yellow. W. Indies.

4. **argéntea,** Kuhn (*Gymnográmma aùrea*, Desv.). Lvs. 6–12 in. long, 7–10 in. wide, deltoid, pinnæ deltoid, 2–3 in. wide at base, the ultimate divisions cuneate. Madagascar.—By some this is referred to *Gymnográmma argentèa*, Mett., a similar fern with white powder.

5. **decompósita,** Baker (known only under the name *Gymnográmma decompósita*, belongs in Ceropteris). Lvs. 1½ ft. long, 1 ft. broad, deltoid, quadripinnate or even 5-pinnate; pinnæ close, lanceolate, with the ultimate divisions linear and 1-nerved: powder rather scanty. Andes. F R 2:25. G C. III. 11:365. F. 1874, p. 148.

AAA. *Powder white: lvs. lanceolate.*

B. *Segms. acute.*

6. **calomélanos,** Underw. (*Gymnográmma calomélanos*, Kaulf.). Fig. 887. Stalks and rachises nearly black: lvs. 1–3 ft. long, with lanceolate pinnæ, segms. often with a large lobe-like auricle at the upper side of the base. W. Indies to Brazil. A G 14.303.—The most variable species of the genus. *C. magnífica*, Hort., is probably one of the many garden varieties. Var. **chrysophýlla,** is here considered a distinct species. (See No. 2.)

BB. *Segms. obtuse, rounded.*

7. **peruviàna,** Link (*Gymnográmma peruviàna*, Desv.). Lvs. 6–12 in. long, 3–5 in. wide, with dark

chestnut-brown stalks; pinnæ somewhat regularly pinnatifid on both sides below. Mex. to Peru. By some considered a var of *G. calomelanos* Var. **argyrophýlla** (*G. argyrophylla*, Hort.) is silvery on both sides.



887. Ceropteris calomelanos. (×$\frac{3}{10}$)

8 **tartàrea,** Link (*Gymnográmma tatárica*, Desv *G tatárica*, Hort). Lvs. 9–18 in. long, 2–5 in. broad, with closely set pinnæ, tapering gradually to a point, pinnules scarcely divided or cut, mostly merely crenate. Trop Amer from Mex southward.

BBB *Segms fan-shaped or wedge-shaped.*

9. **pulchélla,** Link (known only under the generic name, *Gymnogramma;* belongs in *Ceropteris*). Lvs. 6–12 in long, 4 in wide, the lower pinnæ much the largest; pinnules imbricated, texture rather thin. Venezuela. Var **Wettenhalliàna,** Moore (*G Wettenhalliàna,* Hort), is a garden variety, with pale sulfur-yellow powder.

L M. UNDERWOOD.
R. C. BENEDICT.†

CERÓXYLON (Greek, *wax* and *wood,* i.e , wax-tree). *Palmàceæ* WAX-PALM. Tall palms with ringed stems and pinnate leaves.

Spineless, the trunk covered with wax lvs clustered at the top, 15–20 ft. long when full grown, equally pinnate, pinnæ long, rigid, sword-shaped, bases recurved and tips pointed, dark green above and glaucous beneath, the petiole very short and sheathed fls. mostly unisexual, on spikes nearly or quite covered by the simple spathe, fl -parts 3; stamens 9–15 seed as large as a hazel-nut, round, bony, inclosed in a soft or crumbling integument —Perhaps 4 or 5 species in the Andes of Colombia and Ecuador

andícolum, HBK. (*Iriártea andícola,* Spreng *I. Klopstóckia,* Hort *Klopstóckia cerífera,* Karst *Beethovènia cerífera,* Engl). The celebrated wax-palm of the Andes, and a good greenhouse subject said to reach nearly 200 ft : trunk slender, swollen at the middle· lvs 6–8 in , the crown, the under sides silvery-scurfy.—The waxy covering of the trunk gives it a marble-like and columnar appearance The wax, used as an ingredient in the making of candles, is an article of commerce It is said that *Diplothemium caudescens* (*Ceroxylon nveum,* Hort) is sometimes sold for the wax-palm by plant dealers. *C ferrugíneum,* Regel, is probably referable to Iriartea It appears not to be in the trade. *C. andícolum* is a free grower under cult., and is a very ornamental subject It thrives in a warm moist house, and the seeds also germinate well under similar conditions.

L. H. B.

CESPEDÈSIA (named in honor of Juan Maria Cespedes, priest of Bogota). *Ochnàceæ.* Tall handsome glabrous trees, sometimes grown in the juvenile state in hothouses

Leaves alternate, large, coriaceous, mostly obovate to lanceolate and narrowed at base, entire, or crenate: fls. yellow, showy, in large terminal bractless panicles; sepals 5, small and deciduous; petals 5; stamens 10 to many: fr. a 5-valved caps ; seeds very small.—Species probably 6–10, in S Amer and Panama

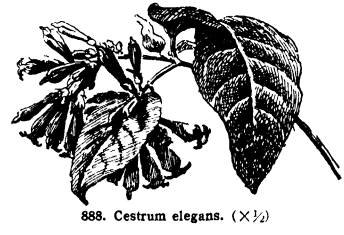
díscolor, Bull Lvs large, lanceolate, drooping, handsomely colored on young growths in bright brown or tan tinted with rose and veined with yellow. Gn. W. 20.618.—A comparatively recent intro. to cult. in England.

L. H. B.

CÉSTRUM (old Greek name). Incl., *Habrothámnus. Solandceæ.* Greenhouse shrubs (or low trees) some of them with a climbing habit, and grown in the open in southern California and elsewhere South

Leaves alternate and entire, usually rather narrow: fls tubular, in axillary or terminal cymes, red, yellow, greenish or white, often very fragrant, corolla salver-shaped or somewhat trumpet-shaped, the long tube often enlarged at the throat, 5-lobed, exceeding the bell-shaped or tubular 5-toothed calyx, stamens mostly 5, all perfect, attached in the tube. fr a scarcely succulent mostly reddish or blackish berry, derived from a 2-celled stipitate ovary and seeds few or reduced to 1 —Probably 150 species, in Trop and Subtrop Amer. They are much grown in warm countries, where they bloom continuously. For a monograph of the West Indian species (about 20) see O E Schulz, in Urban, Symbolæ, Antillanæ, vi, p 249–279 (1909–1910).

Cestrums are among the most useful of bright-flowering shrubby greenhouse plants, and they may be grown either as pot-plants, or planted against the back wall or supports of a greenhouse, where, if given a light position, they will produce an abundance of flowers from January to April The Mexican species will do well in a winter temperature of 45° to 50°, but the species from Central America require stove temperature They are propagated by cuttings taken in February or early in March and inserted in sand in a warm temperature, keeping them somewhat close until rooted, when they should be potted in a light soil, after which they may be grown in pots, shifting on as often as required, or planted out in the open ground toward the end of May in a sunny position, where, if kept pinched back to induce a bushy growth and attention is paid to watering, they will make fine plants by the first of September. They should then be lifted and potted in a light rich soil and kept close and shaded for a few days, and then transferred to their winter quarters After flowering, the plants should be given a rest for a month or six weeks, gradually reducing the supply of water to induce the leaves and wood to ripen, after which they should be cut well back, the old soil shaken



888. Cestrum elegans. (×½)

off, and the roots trimmed back, and then either potted again or planted out for the summer While in the greenhouse, cestrums are very subject to the attacks of insects, especially the mealy-bug. (E. J. Canning.)

A. *Fls red.*

élegans, Schlecht. (*Habrothámnus élegans,* Brongn). Fig 888. Tall and slender, half-climbing, the branches pubescent: lvs. ovate, lanceolate, long-acuminate, of medium size, pubescent beneath. fls. red-purple, swollen

near the top of the tube, in loose clusters which nod at the ends of the branches, the lobes ciliate. Mex. F S. 2:82.—One of the old-fashioned greenhouse shrubs, blooming almost continuously. There is a form with variegated lvs. Var. **Smíthii** (*C. Smíthii*, Hort. Bull.) has beautiful blush-rose fls., profusely produced through summer and autumn. Gn 62, p 242, desc.

fasciculàtum, Miers Spring bloomer, with larger fls. than those of *C. elegans*, and more compact, nearly globular fl.-clusters, the cluster subtended by small lvs. as if an involucre lvs ovate Mex. B M. 4183 (and probably the *C elegans*, B.M. 5659.).

Néwelli, Nichols (*H. Néwelli*, Veitch). Fls. bright crimson, larger and more brilliant than those of *C. elegans* and *C fasciculatum*. Gn 34·106.—A free-growing plant, originating from seed by Mr. Newell, Downham Market, England Evidently an offshoot of one of the preceding species.

AA *Fls. orange or yellow.*

aurantìacum, Lindl. Of half-climbing habit: lvs. oval to ovate, more or less undulate. fls sessile in a panicle, orange-yellow. Guatemala. R H 1858, p. 238.

Pseùdo-Quìna, Mart Glabrous· lvs. membranaceous, ovate, obtusish or acute, narrowed at base: peduncles articulated at apex, axillary or in congested 4–8-fid terminal racemes, corolla slender with acute lobes, much longer than the toothed calyx Brazil.—Said to have marked medicinal qualities Differs from *C Parqui* in having glabrous filaments and pedicillate fls.

AAA. *Fls. white, greenish, or cream-yellow.*

Párqui, L'Her Shrub, half-hardy, nearly glabrous. lvs lanceolate to oblong, petioled, short, acuminate· fls sessile, long, tubular, with a wide-spreading limb, in an open panicle, greenish yellow, very fragrant at night Chile B M 1770 Adventive in Fla

diúrnum, Linn Quick-growing evergreen shrub, minutely pubescent or glabrous lvs oblong and short-acute, thickish and glabrous, shining above fls white, very sweet-scented by day, in axillary long-peduncled spikes; corolla-lobes roundish and reflexed berry nearly globular; filaments erect and not denticulate W Indies

noctúrnum, Linn NIGHT-BLOOMING JESSAMINE Shrub, 4–12 ft.: branches brownish, very slender or flexuose, glabrous or nearly so lvs thinner, ovate or elliptic, prominently acuminate: fls creamy-yellow, very fragrant by night, corolla-lobes ovate and blunt: berry ovoid-oblong; filaments denticulate. W Indies.

pùbens, Griseb Sts and lvs. woolly-pubescent: fls. greenish, much like those of *C. nocturnum* and also fragrant at night Argentina.

laurifòlium, L'Her Glabrous shrub· lvs. ovate to oblong, glossy, thick fls. greenish yellow and changing color (sometimes described under cult as pure white), in erect heads, slightly fragrant; corolla-tube club-shaped, tapering gradually; corolla-lobes ovate-roundish and blunt; filaments toothed. berry ovoid W Indies, S. Amer —Much planted in S. Calif. L H B

CHÆNÁCTIS (Greek, *gaping ray:* the marginal corollas often ray-like) *Compósitæ*. West American low herbs or undershrubs sometimes planted in the open for ornament.

Leaves alternate and mostly dissected: fls. yellow, white or flesh-colored on solitary peduncles or in loose cymes; florets of one kind, but the marginal ones with a more or less enlarged limb, involucre campanulate; receptacle flat and generally naked: pappus of toothed or entire scales (wanting in one species) —About 20 species, of which 3 have been intro as border plants; but they are little known to gardeners. Of easy cult. Prop. by seeds or division.

A. *Pappus of entire or nearly entire persistent scales.*

tenuifòlia, Nutt Small, tufted annual, white-pubescent when young but becoming nearly or quite glabrous: 1 ft: lvs. once or twice pinnately parted, the lobes linear or filiform. heads ⅓in. high, lemon-yellow. S. Calif.

Douglasii, Hook & Arn. Perennial, 3–15 in high, usually white-woolly when young. lvs. broad, bipinnately parted into short and crowded, obtuse lobes: heads ½–¾in high, white or whitish, usually in crowded, cymose clusters Mont south and west.—Variable Var. **achilleæfòlia,** A Nelson, is often sold for the type. It has more finely divided lvs.

AA. *Pappus of fimbriate and deciduous scales, or even wanting*

artemisiæfòlia, Gray Tufted annual, 1–2 ft., rusty pubescent and somewhat sticky on the under side of the lvs., glandular hairy above lvs twice or thrice pinnately parted into short-linear or oblong lobes: heads ½in. high, the involucre viscid, the florets white or cream-color. S Calif. N. TAYLOR †

CHÆNOMÈLES (Greek *chaineín*, to gape, to split, and *melea*, apple· the fruit was supposed by Thunberg to split into five valves) *Rosàceæ*, subfamily *Pòmeæ*. Woody plants, grown chiefly for their handsome brightly colored flowers appearing early in spring; formerly commonly included in Cydonia

Shrubs or small trees, sometimes spiny· lvs. subpersistent or deciduous, alternate, short-petioled, serrate fls solitary or fascicled, before or after the lvs., sometimes partly staminate, calyx-lobes entire or serrate, petals 5, stamens numerous; styles 5, connate at the base fr 5-celled, each cell with many seeds —Four species in China and Japan. See page 3567

These are ornamental plants, nearly hardy North except *C sinensis*, which can be grown only South *C japonica* and *C Maulei*, with handsome glossy foliage and abundant flowers in early spring, varying in all shades from pure white to deep scarlet, are highly decorative, and especially adapted for borders of shrubberies and for low ornamental hedges The fruit of all species can be made into conserves They thrive in almost any soil, but require sunny position to bloom abundantly Propagated by seeds, usually stratified and sown in spring, also readily increased by root-cuttings made in fall or early spring, and rarer kinds or less vigorous-growing varieties are grafted in the greenhouse in early spring, on stock of the Japanese or common quince, they grow also from cuttings of half-ripened or nearly mature wood, under glass, and from layers.

A. *Fls solitary, with reflexed serrate calyx-lobes, with or after the lvs stipules small.* (*Pseudocydonia*)

sinénsis, Koehne (*Pyrus sinénsis*, Poir *Cydònia sinénsis*, Thouin *Pseudocydònia sinénsis*, Schneid.). Shrub or small tree lvs elliptic-ovate or elliptic-oblong, acute at both ends, sharply and finely serrate, villous beneath when young, 2–3 in long fls light pink, about 1½ in across· fr dark yellow, oblong, 4–6 in long. May China B R 11 905 R H 1889·228 A G. 12:16. B M. 7988.—The lvs assume a scarlet fall coloring Not hardy north of Philadelphia, except in favored localities. See also *Quince*.

AA *Fls in leafless clusters, nearly sessile, before or with the lvs., calyx-lobes erect, entire. stipules large.* (*Chænomeles proper*)

B *Lvs. lanceolate or narrow-lanceolate, pubescent beneath while young.*

cathayénsis, Schneid (*Pyrus cathayénsis*, Hemsl. *Cydònia cathayénsis*, Hemsl.). Shrub, to 10 ft. lvs lanceolate or oblong-lanceolate, acute, finely and sharply serrate, 2½–4½ in. long and ½–1½ in. broad;

petioles about ½in. long. fls. in clusters, red, 1½ in. across; styles pubescent at the base; petals distinctly clawed. fr. oblong-ovoid, 6–7 in. long, with a cavity at each end. Cent. China. H.I. 27.2657, 2658.—Closely related to the following species, but lvs. much narrower, less hardy.

BB *Lvs. elliptic-oblong to obovate, glabrous.*

japónica, Lindl. (*Pyrus japónica,* Thunb. *Cydònia japónica,* Pers. *Chænomèles lagenària,* Koidzumi). JAPAN QUINCE JAPONICA Fig 889 Shrub, 3–6 ft., with spreading, spiny branches· lvs ovate or oblong, acute, sharply serrate, glabrous, glossy above, 1½–3 in. long. fls in 2–6-fld. clusters, scarlet-red in the type, 1½–2 in across fr globular or ovoid, 1½–2 in. high, yellowish green March, April China, Japan R.B. 1 260 L B C 16:1594 Gn 33, p 491, 40:126; 50, p 106 (frs.), 71, p 262 (habit). G C III 34:434. B H. 1 260 (frs.) R.H 1876.330 (fr.) G M. 35, suppl Nov. 12 V. 4.38.—Many garden forms in all shades from white to deep scarlet, and also with double fls Some of the best are the following Var **álba,** Lodd. Fls. white, blushed L B C 6 541. Var. **álbo-cíncta,**



889. Chænomeles japonica, the Japan or flowering quince. (×½)

Van Houtte Fls. white with pink margin F.S. 14:1403. Var. **álbo-rósea,** Spaeth Fls white, partly pink. G W. 7:113 Var **atrosanguínea plèna,** Hort Fls. deep scarlet, semi-double Var **Báltzii,** Spaeth. Fls beautiful rosy pink, very floriferous G W 7·113 Var. **cándida,** Hort. Fls pure white Var. **cardinàlis,** Carr. Fls large, deep scarlet. R H 1872 330, f. 1 Var. **ebúrnea,** Carr Fls. pure white, rather small R H. 1872 330, f. 4 Var. **Gaujárdii,** Lem. Fls. salmon-orange. I H 7:260. Var **grandiflòra,** Rehd (*C álba grandiflòra,* Carr.). Fls. nearly white, large R. H. 1876:410 Gn. 13:144. Var. **Mállardii,** Carr. Fls. rose, bordered white. R H 1872 330, p 2. I H 4:135. G.Z. 1.208. Var. **Moerlodsei,** Versch. Fls white, striped pink I H 3:107. F S 5 510 Var. **Papeleùi,** Lem. Fls yellow, bordered pink. I H 7.260. Var. **péndula,** Temple & Beard, with slender, pendulous branches. Var **rósea plèna,** Hort. Fls. rose, semi-double Var. **rùbra grandiflòra,** Hort Fls. large, deep crimson. Var **sanguínea plèna,** Hort. Fls. scarlet, double. Var **serótina,** André Fls in stalked leafy clusters in autumn R.H 1894, pp. 424, 425; 1903, p. 20. Var **Simonii,** André Fls dark crimson, semi-double. low and upright G W 7.113 Var. **sulphùrea,** Hort (var *sulphùrea perfécta,* Van Houtte). Fls. yellowish. Var **umbilicàta,** Sieb. & De Vries. With rose-red fls., and large frs. umbilicate at the apex. F.S. 5:510.

Maùlei, Schneid. (*Pyrus Maùlei,* Mast *Cydònia Maùlei,* Moore. *C alpìna,* Koehne). Low shrub, 1–3 ft.: branches spiny, with short, rough tomentum when young: lvs roundish oval to obovate, obtuse or acute, coarsely crenate-serrate, glabrous, 1–2 in. long. fls bright orange-scarlet, 1–1½ in across. fr yellow, nearly globular, about 1½ in across. March, April Japan B.M. 6780 G C II 1:757 and 2:741; III. 34:435. Gn. 13:390, 33, p. 490; 50, p 106; 55, p. 354. F 1875.49. R H. 1875 195 F M 1875 161. H B 26 241 —A very desirable hardy shrub, with abundant fls of a peculiar shade of red Var. **alpìna,** Schneid (*C japónica* var *alpìna,* Maxim *Cydònia Sárgentii,* Lemoine). Dwarf spiny shrub, with procumbent sts. and ascending branches. lvs roundish oval, ½–1 in long flowering and fruiting profusely R H 1911 204 Var. **supérba,** Hort Fls deeper red Var **tricolor** Hort. Dwarf shrub, with pink and white variegated lvs — By some botanists this species is considered to be the typical *C japonica,* and the preceding species is called *C. lagenaria* ALFRED REHDER.

CHÆNÓSTOMA (*gaping mouth,* in allusion to the shape of the corolla) *Scrophulariàceæ* African herbs or sub-shrubs sometimes planted in greenhouses, or in the open in mild climates

Leaves simple, mostly opposite· fls axillary or terminal-racemose, showy, stamens attached to the throat of the corolla, more or less exserted, style filiform and club-shaped, and obtuse at the apex, corolla tubular, swollen in the throat, with a 5-lobed spreading limb: fr. a caps with numerous seeds —Recent authorities combine this genus with Sutera, which, in the enlarged sense, comprises more than 190 species in Afr and the Canary Isls Chænostoma, as separately limited, has 25–30 S African plants with white, yellow or reddish fls. axillary or in terminal racemes, lvs usually opposite, mostly dentate, 4 didynamous stamens which are exserted rather than included as in typical Sutera and the top of the style club-shaped and stigma obtuse rather than 2-lobed

híspidum, Benth (*Sùtera brachiàta,* Roth) Small perennial, sometimes an under-shrub, with opposite, oval or oblong, toothed lvs, and blush-white or rosy white star-like fls ¼in across, in dense clusters S. Afr J H III 33 636 —An old and deserving greenhouse or pot-plant, but rarely seen at present It blooms almost continuously, the fls sometimes hiding the foliage Prop by seeds or cuttings, either in fall or spring Begins to bloom when 4–6 in high To be recommended for windows, and for summer vases It has been listed as *Schænostoma hispidum* In S Calif, it is a half-hardy dwarf shrub (12 to 20 in high and withstanding 4–6 degrees of frost), recommended for edgings N TAYLOR †

CHÆROPHÝLLUM (Greek-made name, referring to the agreeably scented foliage). *Umbellíferæ* Scented herbs, annual, biennial or perennial, glabrous or hirsute, often tuberous-rooted, of 30–40 species in the northern hemisphere, one of which is cult Lvs pinnately or ternately decompound, the segms also toothed or cut fls small, white, in a compound many-rayed umbel, calyx-teeth 0. carpels with 5 more or less apparent ribs, the beak 0 or much shorter than the body. **C bulbósum,** Linn, of Cent Eu and the Caucasus, biennial, is the turnip-rooted chervil (See *Chervil*) St hairy, at least below, 3–5 ft tall, branching, swollen below the joints, the root tuberous (and edible). lvs much compound, the ultimate divisions very narrow. L H B

CHÆTOSPÉRMUM (from Greek, *hair* and *seed*). *Limonia* § *Chætospermum,* Roemer. *Rutàceæ,* tribe *Citreæ.* A small spiny tree, proposed as a stock for citrus fruits.

Chætospermum bears hard-shelled frs : lvs. persistent, trifoliate: fls pentamerous with 10 free stamens; ovary 8–10-celled, with numerous ovules in each cell, cells filled with spongy vesicular tissue; seeds hairy, the cotyledons aerial in germination· first foliage lvs. opposite.—Only one species is known.

glutinòsa, Swingle (*Limònia glutinòsa,* Blanco. *Ægle decándra,* Naves *Ægle glutinòsa,* Merrill) TABOG. Fig. 890. Petioles margined, lateral lfts small, sessile, scarcely one-third as long as the terminal one, spines slender, straight, sharp, axillary usually in pairs in the axils of the lvs.. fls rather large, occurring singly, or in few-fld. clusters on long slender pedicels in the axils of the lvs : fr. oblong, 2–3 x 1½ in. with a thick leathery rind longitudinally ribbed, 8–10-celled; it contains numerous flattened hairy seeds, ⅜ to ½in. immersed in a watery tissue Native to the Isl of Luzon, Philippine Archipelago Ill Blanco, Fl Filip ed. III, pl. 124 Vidal y Soler, Sinop de fam Fil pl. 25. Bull. Soc Bot Fr 58, Mem 8d pl 5.—The tabog is a rapid-growing tree when young, and in a warm greenhouse shows a vigorous root-growth. This species is being tested as a stock for use in commercial citriculture Experiments have shown that oranges, lemons, grapefruits and kumquats grow well when budded or grafted on young tabog plants WALTER T SWINGLE.

CHÁLCAS (from Greek for *copper,* as the wood has a copper-colored grain) *Murrèa* of Koenig *Rutàceæ* Small spineless trees or shrubs, suggested as a stock for citrus fruits

Leaves pinnate, alternate fls large, 4–5-merous, solitary or in terminal or axillary cymes; ovary 1–5-celled, with 1 to several ovules seeds white, woolly or glabrous, cotyledons aerial in germination. first foliage lvs opposite

exótica, Millsp (*Murrèa exótica,* Linn) ORANGE JESSAMINE A small tree with pale bark, twigs and petioles usually puberulous lvs pinnate; lfts usually 5–9, ovate, obtuse or obtusely acuminate, often emarginate, dark green above, paler below fls fragrant, campanulate, 5-parted, petals white, stamens 10, free, ovary 2-celled, style deciduous fr subglobose, ⅝–½in long, pointed, red Ill Beddome, Outlines Bot, pl vii, Wight, Ic, pl Ind I, pl 96.—The orange jessamine is commonly grown in greenhouses on account of its abundant and very fragrant fls These are often to be seen along with the mature red fr, which makes a striking contrast with the panicles of white fls and delicate foliage The root-growth of this species is remarkably vigorous under greenhouse conditions. Lemons can be budded on it and make a rapid growth. It is being tested as a stock for the common citrus fruits in situations in which a vigorous root-system is desired WALTER T. SWINGLE.

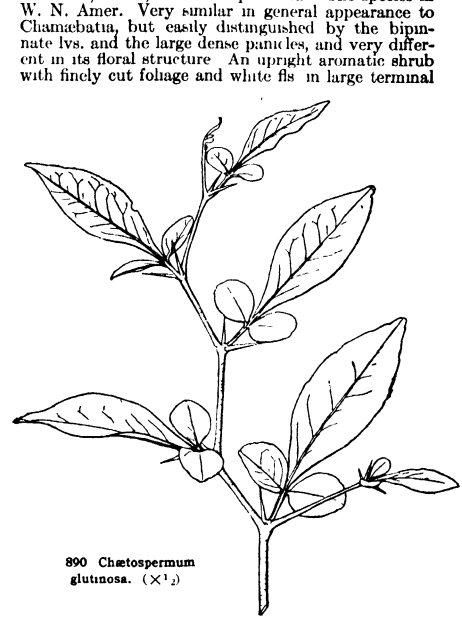
CHAMÆBÀTIA (Greek, *dwarf,* and *bramble,* alluding to its bramble-like flowers). *Rosàceæ.* A woody plant, grown for its handsome white flowers and for the finely divided aromatic foliage

Low shrub, clothed with glandular pubescence: lvs. alternate, stipulate, tripinnatifid, persistent: fls. in terminal corymbs, white; calyx-tube broadly campanulate; petals 5; stamens numerous; pistil solitary, with short style and decurrent stigma· fr. a small achene inclosed by the persistent calyx.—One species in Calif. Ornamental shrub of agreeable aromatic odor, with graceful foliage and showy white fls. in June and July. It can be grown only in warmer temperate regions, and thrives best in sandy well-drained soil and sunny position Prop by seeds sown in spring and by greenwood cuttings under glass.

foliolòsa, Benth. Two to 3 ft.: lvs. nearly sessile, oval or ovate-oblong, closely tripinnately dissected, 1½–2½ in. long: fls. white, ¾in. wide, in 4–8-fld. corymbs. B.M. 5171. G. 29:29 B.H. 10, p. 295 H F. 1861:9. Gn. 3, p. 27. ALFRED REHDER.

CHAMÆBATIÀRIA (in allusion to the similarity of this plant to *Chamæbatia*). *Rosàceæ.* Shrub grown for its handsome white flowers and the finely divided foliage, allied to the spireas

Deciduous, with glandular aromatic pubescence: lvs alternate, bipinnate, with numerous minute segms.; stipules lanceolate, entire fls in terminal panicles; calyx turbinate, with 5 erect lobes, petals 5, suborbicular, stamens about 60 carpels 5, connate along the ventral suture, at maturity dehiscent into 2 valves: seeds few, terete, with a simple testa.—One species in W. N. Amer. Very similar in general appearance to Chamæbatia, but easily distinguished by the bipinnate lvs. and the large dense panicles, and very different in its floral structure An upright aromatic shrub with finely cut foliage and white fls in large terminal



890 Chætospermum glutinosa. (×1/2)

panicles, one of the first shrubs to burst into leaf. It is hardy as far north as Mass., but, like other plants from the same region, it dislikes an excess of moisture, particularly during the winter, and is likely to be killed by it. It prefers a sunny position and a well-drained soil, and likes limestone, but grows nearly as well without; it is not a plant for dense shrubberies Propagated by cuttings of half-ripened wood taken with a heel in August with slight bottom heat, usually by seeds sown in spring, and treated like those of spirea.

Millefòlium, Maxim. (*Spirèa Millefòlium,* Torr. *Sorbària Millefòlium,* Focke) Shrub, to 3 ft., glandular-pubescent lvs. bipinnate, short-stalked, ovate-oblong to linear-oblong in outline, 2–3 in long, primary segms. linear, deeply pinnatifid, with closely set obtuse lobes about a line long. fls white, ½–⅝in. across, short-pedicelled, in terminal panicles 3–6 in. long· carpels hairy. Calif to Wyo. and Ariz B M. 7810 G C III. 22 237; 40.183 Gn 75, p. 459 G F. 2 509 R H. 1900, p 515 M D. 1905·198 M D.G. 1908 208 ALFRED REHDER.

CHAMÆCÊRASUS: *Lonicera*

CHAMÆCYPARIS (*chamai*, dwarf, and *kuparissos*, cypress; referring to its affinity). *Pinàceæ*. Trees or shrubs grown for their handsome evergreen foliage; also valuable timber trees; RETINOSPORAS, in part

Evergreen, with opposite scale-like lvs in 4 rows, densely clothing the compressed branchlets fls monœcious, small; pistillate inconspicuous, globose; staminate yellow or red, oblong, often conspicuous by their abundance· cones small, globular, with 6–11 bracts, each bearing 2, or rarely 5, winged seeds, ripening the first season Closely allied to Cupressus, which differs in its larger cones maturing the second year, the bracts containing 4 or more seeds, and in its quadrangular branches and minutely denticulate lvs —Six species in N. Amer and E Asia, all very valuable timber trees in their native countries Highly ornamental evergreen trees of pyramidal habit, of which only *C. thyoides* is fully hardy N , while the Japanese species



891. Chamæcyparis pisifera.

are hardy in sheltered positions north to New England, and *C Lawsoniana* only from Mass south; the horticultural varieties are often shrubby.

They grow best in somewhat moist but well-drained, sandy loam and in a partly shaded position, sheltered against dry winds *C Lawsoniana* and *C. obtusa* like more dry, the others more moist situations, and *C. thyoides* grows well even in swamps Propagated by seeds sown in spring; increased also by cuttings from mature wood in fall, inserted in a sandy soil and kept in a coolframe or greenhouse during the winter; if in early spring gentle bottom heat can be given, it will hasten the development of roots considerably. All the so-called retinosporas and the dwarfer forms, and most of the varieties of *C. Lawsoniana*, are readily increased in this way, while the other forms of *C. nootkatensis*, *C obtusa* and *C. thyoides* do not grow well from cuttings; therefore for most varieties veneer-grafting on seedling stock during the winter in greenhouse is preferred, but dwarf forms always should be grown from cuttings, as they often lose their dwarf habit if grafted. The so-called retinosporas of the gardens, with linear, spreading leaves, are juvenile forms, which have retained the foliage of the seedling state. There are similar forms in Thuja For their distinguishing characters, see *Retinospora*. For the numerous gardens forms, see Beissner, Handb. der Nadelholzk., 2d ed., pp. 528–574, quoted below as Beissner.

A. *Lvs. green on both sides or paler beneath.*

thyoïdes, Brit. (*C. sphæroïdea*, Spach *Cupréssus thyoïdes*, Linn.). WHITE CEDAR. Tree, to 70 or 80 ft , with erect-spreading branches. branchlets irregularly arranged, spreading, not pendulous, very thin and slender, flattened: lvs. closely imbricate, glaucous or light green, with a conspicuous gland on the back, fragrant cones small, ¼in diam., bluish purple, with glaucous bloom From Maine to Fla , west to Miss S S 10 529. M D G 1896.301 (habit). Beissner 529 (habit) Var. **ericoïdes,** Sudworth (*C ericoïdes*, Carr. *Retinóspora ericoïdes*, Hort) Compact shrub, of erect, dense habit lvs linear-lanceolate, spreading, with 2 glaucous lines beneath, coloring in winter usually reddish brown. Beissner 532, see also *Retinospora* Var. **andelyénsis,** Silva-Tarouca (*C. sphæroïdea andelyénsis*, Carr. *C. leptóclada*, Hochst *Retinóspora leptóclada*, Hort., not Zucc) Intermediate form between the former and the type· bluish green, and of erect growth, with loosely appressed, lanceolate lvs , often some branchlets with lvs of the type and some with lvs of the var. *ericoïdes* R H 1869, p 32, and 1880, p 36. M D G 1890 329 R B. 2 155 Beissner 532, see also *Retinospora* Var. **glaùca,** Sudworth (*C sphæroïdea glaùca*, Endl Var *kewénsis*, Hort) Of compact habit, very glaucous, with silvery hue Var **variegàta,** Sudworth (*Cupréssus thyoïdes variegàta*, Loud) Branchlets partially colored golden yellow

nootkaténsis, Sudworth (*Cupréssus nootkaténsis*, Lambert *C. nutkaénsis*, Spach *Thuyópsis boreàlis*, Hort). YELLOW CEDAR Tree, to 120 ft , with ascending branches, pendulous at the extremities. branchlets distichously arranged, slightly flattened or nearly quadrangular, pendulous lvs densely imbricate, usually dark green, acute, mostly without glands: cones subglobose, nearly ½in diam , dark red-brown, with glaucous bloom From Sitka to Ore. S S 10 530. R H. 1869, p 18. G 19:345. F E 25 513 Gt 53, p 542. G W. 8, p 484; 10, pp. 41, 227 Beissner 555. Gn. 5.395. G C. III 40.167. Var **glaùca,** Regel (*Thuyópsis boreàlis* var. *glaùca*, Jaeger) With very glaucous foliage Var **péndula,** Beissn Distinctly pendulous Gt. 53, p. 542 G W 1, p 300 G C III. 40:166. Beissner 539. Var. **lùtea,** Beissn. The young growth colored light yellow. J H S 1902.427, fig 113. Gn. 50, p. 68. Gn W. 11:313 —There are other forms with variegated lvs. *C. nootkatensis* is about as hardy as the Japanese species.

AA. *Lvs. with glaucous or whitish marks beneath: branches with horizontally spreading ramifications.*

Lawsoniàna, Parlatore (*Cupréssus Lawsoniàna*, Murr. *C. Boursièri*, Decne.). LAWSON'S CYPRESS Tree, to 200 ft , with horizontally spreading and usually pendulous branches. branchlets frond-like arranged, flattened: lvs. closely appressed, obtuse or somewhat acute, usually bright green, with a gland on the back: staminate catkins bright red (yellow in all other species): cone globose, about ¼in. across, red-brown and often glaucous. From Ore. to Calif S S 10·531. Gng. 2:327. S M 2, p. 49 F E 23 309, 33 559 G W. 10, p. 42. Beissner 541 G 1:121, 7.129 —This is one of the most beautiful conifers and very variable, about 80 garden forms being cult. in European nurseries and collections. The following are some of the best. Var. **álbo-spica,** Beissn. Tips of branchlets creamy white, of

slender habit. Var. **Álumii,** Beissn. Of columnar habit, foliage very glaucous, with a bluish metallic hue The best blue columnar form. Var. **argéntea,** Beissn. (*Cupréssus Lawsoniàna argéntea,* Gord). Of slender habit, with very glaucous, almost silvery foliage Var **erécta víridis,** Beissn. Dense, columnar habit and bright green foliage One of the most beautiful varieties, but somewhat tender G W. 14, p 601. M D G 1909.45 G M. 51: 511. F 1871, p 92 Var. **erécta glaûca,** Beissn. Similar in habit, but with glaucous foliage Var **filifórmis,** Beissn. Branches elongated, somewhat pendulous, with few lateral branchlets, of low, globular habit Var **glaûca,** Beissn Foliage of metallic glaucous tint One of the hardier forms. G M 53.832 Var. **grácilis,** Beissn. (var. *grácilis péndula,* Hort). Elegant light green form, with graceful, pendulous branchlets Var. **intertéxta,** Beissn Glaucous form, of vigorous growth, with remote, pendulous branches and distant, thickish branchlets Beissner 550 Var **lûtea,** Beissn Of compact habit, young growth clear yellow. G C III 20 721 J H S 1902, p 426, fig 110. Var **nàna,** Beissn (*C Boursíri nàna,* Carr) Dwarf, globose habit (Beissner 553), with some variegated and glaucous forms Var **péndula,** Beissn With pendulous branches Mn 1.43 F E 27 187 Gt 1890, p 449 Var **pyramidàlis,** P Smith Of columnar habit. Var **pyramidàlis álba,** Beissn. Of columnar habit with the young growth colored white. R B 4 281. Var. **Weisseàna,** Hansen Low dense form of umbrella-like habit with almost horizontally spreading branches and nodding tips M D G 1890·245 S M 1, p 214. Var **Youngi,** Beissn Upright form of vigorous growth with thickish dark green branchlets G C. III. 1 176, 177



892. Chamæcyparis pisifera var plumosa.

obtûsa, Sieb & Zucc (*Cupréssus obtûsa,* Koch *Retinóspora obtûsa,* Sieb & Zucc) Hinoki Cypress. Tree, to 120 ft , with horizontal branches: branchlets frond-like arranged, flattened, pendulous: lvs bright green and shining above, with whitish lines beneath, thickish, obtuse, and very closely appressed, with a gland on the back: cones globose, nearly ½in diam., brown Japan S Z 121 G C II 5 236. R.H. 1869, p 97 Gn W. 20, suppl. April 25. Var **álbo-spicàta,** Beissn Tips of branchlets whitish Var. **aûrea,** Beissn (*Retinóspora obtûsa aûrea,* Gord) Golden yellow. Gt 25.19. Var. **breviràmea,** Beissn. (*C. breviràmea,* Maxim. *Thùja obtûsa* var. *breviràmea,* Mast). Tree, of narrow pyramidal habit, with short branches: branchlets crowded, glossy green on both sides Var. **compácta,** Beissn Of dwarf and dense subglobose habit Gn M. 7 76 Var **ericoides,** Boehmer (*Retinóspora Sánderi,* Sander *Juníperus Sánderi,* Hort). Of low subglobose habit with bluish gray linear spreading blunt lvs , marked with a green line above. G C. III. 33:266; 36, suppl. April 25. M D G 1900:589; 1903:291, R H. 1903, p. 399 Beissner, 556 Var. **filicoides** Beissn Of slow growth with short and densely frond-like arranged branchlets G C II 5 235 Var **filifórmis,** Beissn. (*C. péndula,* Maxim. *Thùja obtûsa péndula,* Mast , not *C. obtûsa péndula,* Beissn.) Branches elongated, thick and thread-like, pendulous, with few distant branchlets Var **grácilis aûrea,** Beissn. Graceful form, foliage bright yellow when young, changing later to greenish yellow. Var **lycopodioides,** Carr. Low form, of somewhat irregular habit, with spreading, rigid branches and thick, nearly quadrangular, dark green branchlets Var **nàna,** Carr Low form, of slow growth, with short, deep green branchlets. R.H 1882.102. Var **pygmæa,** Carr (*C obtûsa breviràmea,* Hort., not Beissn) Very dwarf form, with horizontal, almost creeping branches, densely frond-like branched Exceedingly interesting form for rockeries R H 1889, p 376 Var **formosàna,** Hayata. Differs in its smaller and finer foliage, and much smaller cones Formosa J C T 25, 19, p 209

pisífera, Sieb. & Zucc (*Cupréssus pisífera,* Koch. *Retinóspora pisífera,* Sieb & Zucc) Sawara Cypress. Fig 891 Tree, to 100 ft , with horizontal branches: branchlets flattened, distichously arranged and somewhat pendulous. lvs ovate-lanceolate, pointed, shining above, with whitish lines beneath cones globular, ¼–¼in diam , brown S Z 122 G C II 5 237. C L A 11 311 —This is, next to *C thyoides* the hardiest species, and some varieties are much cult , while the type is less planted Var **aûrea,** Carr. Yellow foliage G W 1, p 303 Var **filifera,** Beissn (*Retinóspora filifera,* Standish *C obtûsa filifera,* Hort). Branches elongated and slender, thread-like, gracefully pendulous, with distant branchlets and lvs Very decorative form. G C. II. 5.237 G W 1, p 301;



893. Chamæcyparis pisifera var. squarrosa.

5, p. 17. Beissner 571, 572. Var. **plumòsa,** Beissn. (*Retinóspora plumòsa,* Veitch) Fig 892 Of dense, conical habit branches almost erect, with slender branchlets of feathery appearance lvs subulate, pointed and slightly spreading, bright green Intermediate between the type and var *squarrosa* G C. II. 5:236. Gn. M 2 27 Beissner 569 Var **plumòsa**

argéntea, Beissn Tips of branchlets whitish. Var. **plumòsa aûrea,** Beissn. (*Retinóspora plumòsa aùrea,* Standish). Young growth of golden yellow color A very showy form. Var. **squarròsa,** Beissn. & Hochst. (*Retinóspora squarròsa,* Sieb. & Zucc. *R leptocláda,* Zucc.). Fig 893 Densely branched, bushy tree or shrub, with spreading, feathery branchlets· lvs linear, spreading, glaucous above, silvery below. A very distinct and beautiful variety S.Z. 123. R.H. 1869, p. 95, and 1880, p 37. Beissner 567. M D.G. 1909.44. R.B. 2.189

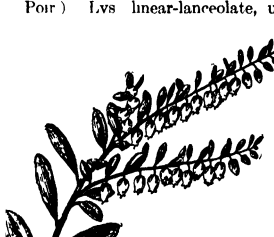
C formosénsis, Matsum (Cupressus formosensis, Henry) Allied to C pisifera Tree, to nearly 200 ft and 20 ft diam branchlets dull green on both surfaces or slightly bloomy below lvs acute, ovate cones ovoid, ½in across, with 10 or 11 scales Formosa G C III 51 132, 133. — Recently intro into England, but probably tender

ALFRED REHDER

CHAMÆDÁPHNE (*chamai,* dwarf, and *daphne,* the laurel in ancient Greek, alluding to its dwarf habit and evergreen leaves) Syn , *Cassándra. Ericàceæ.* LEATHER-LEAF. Small plant, rarely cultivated for its early white flowers and evergreen foliage

Low shrub, with evergreen alternate small lvs fls. nodding in terminal leafy racemes, calyx small, 5-lobed; corolla urceolate-oblong, 5-lobed, with 5 included stamens; anthers 2-pointed· fr. a depressed-globose, 5-lobed caps with numerous seeds —One species in the colder regions of the northern hemisphere Low, hardy, ornamental shrub, valuable for the earliness of its pretty white fls It thrives best in a peaty and sandy, moist soil Prop by seeds sown in sandy peat, only slightly or not covered, and kept moist and shady; also by layers and suckers and by cuttings from mature wood in late summer under glass

calyculàta, Mœnch (*Cassándra calyculàta,* Don *Lyónia calyculàta,* Reichb *Andrómeda calyculàta,* Linn) Fig 894 Bush with spreading or horizontal branches, 1–3 ft · lvs short-petioled, oblong, obtuse, slightly serrulate and revolute at the margins, dull green above and rusty-lepidote beneath fls short-peduncled, nodding, corolla white, oblong, about ¼in long B M. 1286 L B C 6:530, 15 1464, 16 1582. Mn N 1 125 Em 423. Var **angustifòlia,** Rehd (*Andrómeda calyculàta* var *angustifòlia,* Ait *A crispa,* Poir) Lvs linear-lanceolate, undulate and crisped at the margin. Var **nàna,** Rehd. (*Andrómeda calyculàta* var *nàna,* Lodd *A vaccinioìdes,* Hort). One foot or less high, with horizontal branches. L B C 9:862 — Handsome little shrub, well suited for borders of evergreen shrubberies and for rockeries



894. Chamædaphne calyculata. (×⅛)

ALFRED REHDER.

CHAMÆDÒREA (Greek, *dwarf* and *gift*) *Palmàceæ.* Spineless, erect, procumbent or rarely climbing usually pinnatisect or pinnate palms.

Trunks solitary or cespitose, slender or reed-like· lvs. simple, bifid at the apex or variously equally-pinnatisect; lobes broad or narrow, straight or oblique, acuminate, plicate-nerved, usually callous at the base, the basal margins folded back or recurved; petiole usually cylindrical; sheath tubular, oblique at the throat: spadices among or below the lvs , simple or paniculately branched; spathes 3 or many, often appearing much below the lvs., alternate, sheathing, elongated, split at the apex, membranous or coriaceous, usually persistent, pistillate fls. very small, solitary, in small pits in the spadix: fr small, of 1–3 globose or oblong-obtuse carpels, coriaceous or fleshy.—Species about 60. Mex to Panama. G.C. II. 23.410, and Dammer's articles in G C III. 38.42–44 (1905), and 36.202, 245 (1904)

Peat or leaf-mold, loam and sand in equal parts, with a little charcoal added, form the best soil. The species common in cultivation are quick-growing They are well suited for planting out in greenhouse borders The sexes are on different plants, therefore several should be planted in a group if the handsomely colored fruit is desired All of the kinds require warm temperature in winter Increased from seeds Of the many species, only a few appear in the American trade. (G W. Oliver.)



895. Chamædorea glaucifolia.

INDEX.

Arenbergiana, 8.
desmoncoides, 2.
elatior, 7
elegans, 5.
Ernesti-Augusti, 1.
glaucifolia, 3.
Karwinskiana, 7.
latifolia, 8
Pringlei, 9.
Sartorii, 4.
Tepejilote, 6.

A *Lvs simple.*

1. **Érnesti-Augústi,** Wendl St 3–4 ft , reedy, erect, radicant at base blade obovate, cuneate at the base, deeply bifid, coarsely serrate along the margins; petiole shorter than blade, sheath amplexicaul sterile spadix 8–9 in , the simple branches 6–8 in , attenuate, slender; fertile spadix simple, fls red. Mex. B M 4837. F.S. 13·1357.

AA *Lvs pinnate*

B. *Plant becoming of climbing habit.*

2. **desmoncoides,** Wendl Lvs. 2–3 ft long, with drooping, narrow lfts a foot long, and glaucous petiole. plant tending to climb after it becomes a few feet high. Mex.

BB. *Plant not climbing.*

C *St or trunk evident*

D. *Lfts. 40–60, glaucous on both sides.*

3. **glaucifòlia,** Wendl Fig 895 St 20 ft. lvs. long, pinnate, lfts 40–50, narrowed, long and slender, dark green, glaucous. fls on a tall spadix which often exceeds the lvs and comes out from between them. Guatemala G F 8·507 (adapted in Fig 895).—Horticulturally one of the best of all chamædoreas.

DD. *Lfts. less than 40, bright green, at least above.*

E. *Spadix appearing among or with the lvs., not conspicuously cauline*

4. **Sártorii,** Liebm St 8–14 ft , ringed, clothed above with lf -sheaths: lvs. 3–3½ ft. long; petiole terete, sulcate, dilated at the base, sheath, petiole and rachis white on the back, lfts. 12 in long, 1½–2 in. wide, alternate, falcate, acuminate, narrowed at the base, sometimes almost confluent spadix among or just below the lvs Mex.

5. **élegans,** Mart. St. strict, 6 ft. high, scarcely more than 1–1½ in. thick, closely ringed, often sending out

roots from above the base. lvs. 6–8 in a cluster, broadly lanceolate; lfts. about 14, the upper pair sometimes confluent, acuminate, straight: fls. reddish orange: fr. globose. Mex. B.M. 4845.

EE. *Spadix appearing much below the lvs., conspicuously cauline.*

6. **Tepejilòte,** Liebm. St. 10 ft high, closely ringed, about 1½ in. thick· lvs 4 ft; lfts. 20–30, 7-nerved, close alternate, falcate, acute, narrowly lanceolate, 13–15 in long, 1½ in. wide, rachis convex on the back, canaliculate above. fls. yellow Mex. B.M. 6030.

7. **elàtior,** Mart (*C. Karwinskiàna,* Wendl). St 20–30 ft, bamboo-like. lvs 6 ft long, the sheath 18 in. long, lfts. 15 or 16, the lower very narrow, opposite or nearly so, the upper lanceolate, acuminate at each end, petioles 1½–3 ft long spadix simply branched, appearing at least 6 ft below the lvs; fls reddish orange fr globose, ovoid. Mex.—Intro. by Franceschi in 1898.

8 **Arenbergiàna,** Wendl. (*C. latifòlia,* Hort). St. slender, 5–6 ft, green lvs usually only 5 or 6, erect-spreading, lfts. 10–15 pairs, alternate and drooping, very long-pointed, plicate and many-ribbed. fls. yellowish white Guatemala B M 6838.

cc. *St or trunk none.*

9 **Pringlei,** Wats Acaulescent or nearly so: lvs. usually rather stiff, erect, pinnate, 3 ft; lfts. 12–15 on each side, linear-lanceolate, acuminate, 6–8 in long, ¼–½in wide, rachis triangular spadix simple, 8 in long San Louis Potosi, Mex

C. atrovirens, Mart St bamboo-like, stiff and simple, about 9 ft high lvs bright green, spreading about 2½ ft long Mex Not common in the trade but grown in fanciers' collections.—*C. bambusoides,* Hort Sts tufted, thin, reed-like, with feathery light green lvs Honduras.—*C. formòsa,* Hort A showy pinnate-lvd palm of unknown botanical status G C II 5 724.—*C. geonomaformis,* Wendl St 4 ft lvs simple, deeply cut, about 9 in long spadix from among the lvs long-pendulous Guatemala Gn 24, p 244, 30, p 594.—There are said to be a number of unidentified species scattered about Calif

JARED G SMITH.
N TAYLOR †

CHAMÆLÍRIUM (*dwarf* or *ground lily,* a Greek combination) *Liliàceæ* Sometimes spelled *Chamælirion* Rhizomatous whitish flowered hardy plant, sometimes planted in the herbary

Erect, tall unbranched herb 2–4 ft high (or perhaps 2 species), inhabiting low grounds from Mass to Fla and W rootstock tuberous dioecious, the sterile plant less leafy than the other lvs radical and cauline, the lowermost spatulate, the upper lanceolate, narrowed at the base fls small (¼in across), in a slender terminal raceme, segms of perianth 6, white, narrow, 1-nerved, withering and persistent, sterile fls with 6 stamens, and fertile fls with rudiments of stamens, ovary 3-celled and 3-styled: fr. a 3-valved caps

lùteum Gray (*C. carolinìanum,* Willd *Chamælirion carolinia,* Hort) BLAZING-STAR DEVIL'S-BIT Variable as to height (6 in to 3 ft or more), with most of the lvs at the base raceme spike-like, 4–12 in long, fls yellowish white, in effect, fruiting pedicels ½in or less long.—A good perennial, blooming May–July, thriving in moist shady places.—*C. oborùle,* Small, by some considered not to be distinct, has larger fls and fruiting pedicels ½in or more long L H B

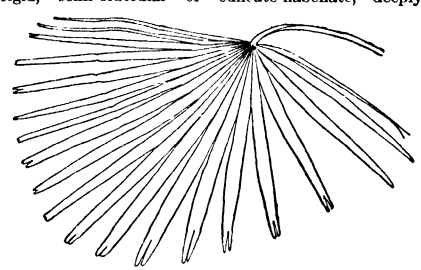
CHAMÆMÈLUM (*small apple,* suggested by the odor of the fls) *Compósitæ* Under this name one plant is offered. The genus is by many included in Anthemis, however, the sub-group being distinguished by very short or absent pappus, sometimes making a 1-sided border, ray-fls fertile, and other minor characters **C. caucásicum,** Boiss. (*Pyrèthrum caucásicum,* Bieb), is listed, with white daisy-like fls about the size of a marguerite, of trailing habit, very free-flowering, recommended for the rockery: perennial, 1–1½ ft, smooth, not strong-scented. st ascending from a rhizome or procumbent or sub-erect: lvs oblong, pinnatisect, the segms, cut into linear-subulate parts: fl-heads large, terminal; involucre-scales oblong-obtuse, margined. High mts. in the Caucasus, variable. L. H. B.

CHAMÆPEÙCE: *Carduus.*

CHAMÆRÁNTHEMUM (*dwarf* and *flower,* from the Greek) *Acanthàceæ* Three or 4 Brazilian small herbs, allied to Eranthemum, but readily distinguished by the 4 (instead of 2) stamens. Lvs large and membranaceous, entire, variously marked. fls. showy, white or yellow, in bracteate clusters.—Grown chiefly for the beautiful foliage, greenhouse subjects. **C. ígneum,** Regel (*Eránthemum igneum,* Lind), is in the American trade It is a low spreading warmhouse plant (cult. of Eranthemum and Justicia), with dark green lvs., with the veins and sometimes the margins richly banded with orange or yellow: fls. small. F S 17:1722.
N. TAYLOR †

CHAMÆROPS (Greek for *dwarf bush*). *Palmàceæ,* tribe *Sàbaleæ* Low fan-leaved palms.

Caudices cespitose, branched from the base and clothed with the bases of the lf-sheaths. lvs terminal, rigid, semi-orbicular or cuneate-flabellate, deeply



896 Chamærops humilis.

laciniate, the lobes narrow, bifid, plicate; no rachis; ligule very short, petiole slender, bi-convex, the margins smooth or rough, sheath split, reticulate, fibrous: spadices short, erect compressed, branches short, densely fld·spathes 2–4, broad, thickly coriaceous, the lower ones split, the upper entire, bracts small, subulate, bractlets none primary spadix branches bracted: fls small, yellow. fr globose or ovoid, 3-sided toward the base, brown or yellow.—Species 1 or perhaps 2 Medit region From Rhapidophyllum, an American relative, it may be distinguished by its bracted spadix The common *C. humilis* is widely cult, and very variable. Many of specific-made names represent forms of this species Of such cases are evidently the garden names *C. arborescens, C. argentea, C. canariensis, C. elata, C. elegans, C. farinosa, C. gracilis, C. littoralis, C. nivea.* G C II 23.410.

The best soil for these palms is fibrous loam two parts, leaf-mold and sand one part, with good drainage. Propagated by suckers and by seeds These are among the hardiest of all palms, and are well suited to greenhouses where a high temperature is not kept up. (G. W Oliver)

hùmilis, Linn Fig 896 This is the only palm native to Eu St 1–1½ ft high lvs. ragged, fibrous; margins of the petioles armed with stout, straight or hooked spines, blade suborbicular, truncate or cuneate at the base, rigid, palmately multifid, segms acuminate, bifid Medit B M 2152 R H 1892:84 (showing habit and a colored plate of the fr)—Reaches 20 ft in a rather arborescent variety Var **dactylocárpa,**

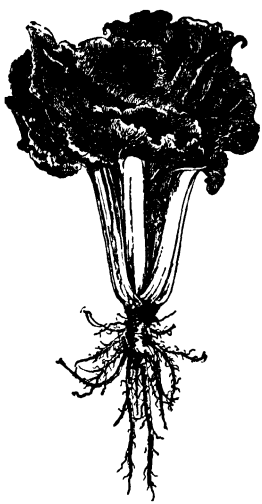
Becc, is interesting for its elongated frs shaped like a date. Offered by Montarioso Nursery in 1912.

C. Biroo, Sieb. = Livistona rotundifolia. — *C. Byrrho*, Hort. = Livistona rotundifolia. — *C. excelsa*, Thunb. = Trachycarpus excelsus. — *C. farinòsa*, Hort. = C. humilis, Linn. — *C. Fortunei*, Hook. = Trachycarpus. — *C. humilis* × *hystrix*, Hort. Said to be a "choice garden hybrid of Florida origin." — *C. hystrix*, Fraser = Rhapidophyllum hystrix. — *C. stauracantha*, Hort. = Acanthorhiza aculeata.

JARED G. SMITH
N. TAYLOR.†

CHAMOMILE: *Anthemis.*

CHAPTÀLIA (J. A. C. Chaptal, 1756–1831, agricultural chemist) *Compósitæ.* Low perennial herbs, with white or purplish fls. on naked scapes, blooming in spring and summer; heads radiate, the ray-fls pistillate, and the disk-fls perfect, but some or all of them sterile, involucre campanulate or turbinate, of appressed and imbricated bracts; pappus of soft capillary bristles: achenes oblong or fusiform, narrowed above, 5-nerved. —Twenty-five American species. The only species in the American trade is **C. tomentòsa,** Vent. (*Thyrsanthema semiflosculòsa,* Kuntze), of N. C. and south. Of this the scape is 1 ft. or less high, and the heads are purple-rayed; lvs. oblong or oblanceolate, more or less remotely denticulate, rather thick, white-tomentose beneath. Intro. as a border plant. B. M. 2257. N. TAYLOR.†



897. Chard, or sea-kale beet.

CHARD (*ch* pronounced as in *charge*) SWISS CHARD. SEA-KALE BEET. A form of the plant (*Beta vulgaris*) which has produced the common beet, known as *Beta Cicla* (p. 496). See *Beet* and *Beta*.

The beet plant has given rise to two general types of varieties: those varieties with thickened roots (the beet of America, the beet-root of European literature), and those with large and pulpy or thickened leaves (but whose roots are small and woody). The latter type is known under the general name of leaf-beets. These leaf-beets may be arranged into two sub-groups: (1) Common or normal leaf-beets, or spinach beets, in which the leaf-blade is large and pulpy, and is used as spinach, chard, in which the petiole and midrib are very broad and thick, is a form of this, although the name is sometimes used as synonymous with the general edible leaf-beet group. (Fig. 897), (2) ornamental beets, of which the foliage is variously colored.

Chard is of the easiest culture. Seed is sown in spring, as for common beets. The broad petioles, or chards, may be gathered from midsummer until frost. These broad white stalks or ribs are used as a pot-herb; and, if desired, the leaf-blades may be cooked with them. The dish is usually more attractive, however, if only the chards are cooked. If cutting of the leaves is carefully performed, a succession may be had till cold weather. Chard is an attractive vegetable when well grown, but is little used in this country.

L. H. B.

CHÁRIEIS (Greek, *elegant,* from the pleasing flowers). *Compósitæ.* Attractive hardy flower-garden annual.

A small, branchy plant, 6–12 in. high, with blue or red aster-like fls., on long sts.; plant pubescent or hispid: lvs. oblong-spatulate or oblong-lanceolate, entire or remotely denticulate: heads many-fld., radiate, the ray-fls. pistillate, the disk-fls. perfect; achene obovate and compressed, those of the disk with plumose pappus; involucre scales in 2 rows. —One species, in the W. Cape region. Known as Kaulfussia in gardens. The genus Kaulfussia was founded by Nees in 1820, in 1817, however, the plant was described by Cassini as *Charieis heterophylla.*



898. Charieis heterophylla. (×1)

heterophýlla, Cass. (*C. Neèsii,* Hort. *Kaulfussia amelloides,* Nees). Figs. 898, 899. Rays blue, disk yellow or blue. An excellent subject of easy cult. in any garden soil. Var. **atrovioláceа,** Hort., has dark violet fls. Var. **kermesìna,** Hort., has violet-red fls. Sow seeds where the plants are to grow, or they may be started indoors and the plants transplanted to the open. L. H. B.

CHARLOCK. *Brassica sinapistrum. Raphanus.*

CHARLWOÒDIA. *Cordyline.*

CHASTE TREE. *Vitex.*

CHAVÍCA, kept distinct in part by recent authors, is accounted for under *Piper.*

CHEAT, or CHESS. *Bromus.*

CHECKERBERRY: *Gaultheria.*

CHEESES. Vernacular for *Malva rotundifolia.*

CHEILÁNTHES (Greek, *lip-flower,* alluding to the indusium). *Polypodiàceæ.* Semi-hardy or hothouse ferns of small size.

Plants often hairy or woolly, with the sori terminal on the veins and covered with a roundish indusium. — Some 60 or 70 species are known, nearly a third of which are natives of the W. and S. W. United States, one species as far east as Conn. They are of easy cult., enjoying a position near the glass, and disliking strong, close heat and syringing or watering overhead. Most of the species grow naturally in dry rocky situations. They are among the few ferns to be found in dry regions. Commercially valuable only from the fern collector's standpoint.



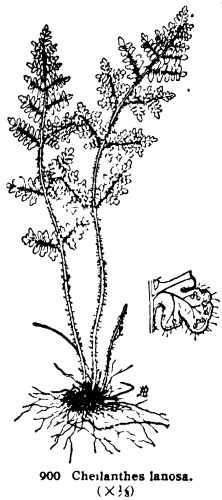
899. Charieis heterophylla.

INDEX

californica, 1.
Clevelandii, 9.
Cooperæ, 7.
elegans, 12
Elliotiana, 5.
Fendleri, 11
gracillima, 8
hirta, 5
lanosa, 6.
meifolia, 2.
microphylla, 3
myriophylla, 12
tomentosa, 10
vestita, 6
viscida, 4

A. *Lvs. pentagonal-deltoid, the indusium confined to a single vernlet*

1. **califórnica,** Mett. (*Hypólepis califórnica,* Hook.). Lvs. densely cespitose from a short creeping rootstock, 2–4 in each way, on stalks 4–8 in long, quadripinnatifid, ultimate segms. lanceolate, incised or serrate. Calif.



900 Cheilanthes lanosa. (×½)

2 **meifòlia,** D C. Eaton (*Hypólepis meifòlia,* Baker) Lvs cespitose, with slender brown stalks 5–7 in long, the lamina 2–3 in each way, 3–4-pinnatifid, with finely cut segms $\frac{1}{10}$in wide Mex.

AA. *Lvs lanceolate or ovate-lanceolate*

B. *Segms. flat. indusia extending over the apices of several vernlets, but not continuous*

C *Surface of lvs smooth.*

3 **microphýlla,** Swartz. Lvs 4–10 in long, on stalks nearly as long, from a short, creeping rootstock, bi-tripinnate sts glossy, rusty-pubescent on the upper side Fla. and New Mex southward.

CC. *Surface of lvs viscid-glandular*

4 **víscida,** Davenport Lvs. 3–5 in long, on stalks of the same length, tripinnatifid, segms toothed, everywhere glandular Calif

CCC *Surface of lvs hairy, not woolly*

5 **hírta,** Swartz Lvs densely cespitose, with short, scaly stalks which are brownish, like the rachides, pinnæ numerous, rather distant bipinnatifid, the segms with much incurved margins The lvs are usually 6–15 in long Cape of Good Hope Var **Ellisiàna,** is more commonly cult

6 **lanòsa,** Wats (*C. reshta,* Swartz). Fig 900. Lvs. cespitose, with stalks 2–4 in long, slightly hairy, as are the segms., tripinnatifid, 4–10 in long, 1–2½ in wide, the pinnæ lanceolate-deltoid indusia formed of the ends of roundish or oblong lobes Conn to Kans and Ala —Hardy

7 **Coöperæ,** D C. Eaton Lvs 3–8 in long, bipinnate, the stalks covered with nearly white hairs, each tipped with a gland, pinnules roundish ovate, crenate and incised Calif to Mex

BB *Segms bead-like, minute: indusia usually continuous.*

C. *Lvs hairy or woolly beneath, but not scaly.*

D. *Upper surface of segms smooth.*

8. **gracíllima,** D C. Eaton. Lace Fern Lvs cespitose, 1–4 in long, borne on the nearly equal dark brown stalks, bipinnate; pinnæ with about 9 pinnules, finally smooth above. Idaho to Calif.—Hardy

9 **Clèvelandii,** D C Eaton Lvs 4–8 in. long, tripinnate. dark brown beneath, with closely imbricate, ciliate scales, which grow on both the segms and the rachides; segms. nearly round, the terminal larger. Calif.

DD. *Upper surface of segms. pubescent.*

10. **tomentòsa,** Link Lvs 8–15 in. long, on stalks 4–6 in. long, everywhere covered with brownish white hairs, tripinnate, terminal segms twice as large as the lateral. Va to Ariz

CC. *Lvs. covered beneath with scales, but not woolly*

11. **Féndleri,** Hook Lvs 3–6 in long, borne on the chaffy stalks, rising from tangled, creeping rootstocks, tripinnate, rachis with broadly-ovate white-edged scales, which overlap the subglobose segms. Texas, and Colo to Calif

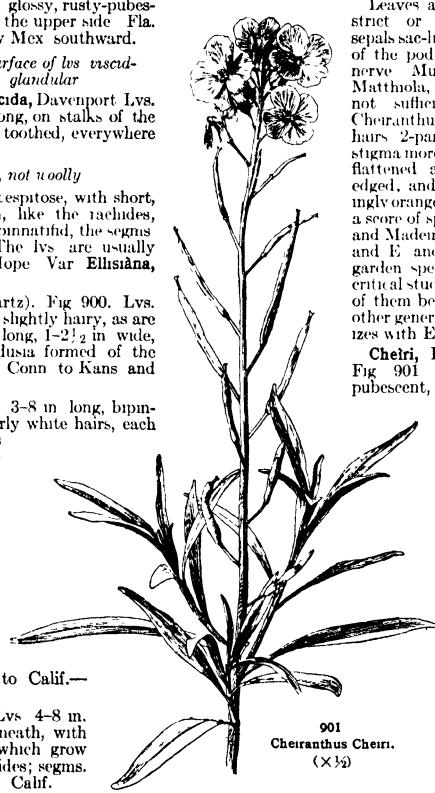
CCC *Lvs covered beneath with both scales and wool.*

12 **myriophýlla,** Desv (*C. élegans,* Desv.). Lvs. densely cespitose from short, erect, scaly rootstocks, 3–9 in long, borne on the chestnut-colored scaly stalks, triquadripinnatifid, ultimate segms minute, innumerable Texas, Ariz and Trop Amer

A native species worthy of cult. is (*leucopoda,* Link, from Texas, with broadly deltoid-ovate lvs —*C. undulata,* Hope & Wright Dark green fronds, softly pubescent China G C III 31.397 (desc.)

L M Underwood.
R C Benedict †

CHEIRÁNTHUS (derivation in dispute, but probably from Greek for *hand* and *flower*) *Cruciferæ* Flower-garden perennials, with large purple, brown, orange or yellow fragrant bloom



901 Cheiranthus Cheiri. (×½)

Leaves alternate, entire, on a strict or upright st lateral sepals sac-like at the base valves of the pod with a strong mid-nerve Much confounded with Matthiola, and the genera are not sufficiently distinct In Cheiranthus, the lvs are acute, hairs 2-parted and appressed, stigma more spreading, pod more flattened and seeds not thin-edged, and the fls are prevailingly orange or yellow—Probably a score of species, in the Canary and Madeira Isls., Medit region and E and in N Amer The garden species are confused, a critical study may find that some of them belong to Erysimum or other genera The genus hybridizes with Erysimum

Cheiri, Linn. Wallflower Fig 901 Perennial, slightly pubescent, 1–2½ ft lvs lanceolate and entire, acute fls large, mostly in shades of yellow, in long, terminal racemes, sweet-scented S Eu —An old garden favorite, blooming in spring Although a woody perennial, it is best to renew the plants from seed, for they begin to fail after having bloomed one or two years. Seedlings should bloom the second year, in England, Christmas bloom is secured from seeds sown in Feb. There are dwarf and double-fld. varieties,

and innumerable forms in various shades of yellow, brownish, and even purple. Not prized so much in Amer. as in Eu. A common plant on walls in England.

alpìnus, Linn. St. strict and simple, 1 ft lvs. lanceolate, somewhat dentate, stellate-pubescent: pods spreading on short pedicels fls. lemon-yellow, spring. Norway, Lapland.

mutábilis, L'Her More or less woody, 2–3 ft : lvs. linear-lanceolate and pointed, obscurely serrate: fls. white, cream-colored or yellowish, becoming darker and striped Madeira B M 195.—It is doubtful whether the plant known in cult. as *C mutabilis* is this species.

Mârshallii, Hort. Perhaps a hybrid, 1–1½ ft.. lvs spatulate and crowded below, more scattered and narrower above: fls. orange.

Alliònii, Hort. Said to be a hybrid· 12 in or less: fls brilliant orange, profusely produced in spring and summer and sometimes so freely that the plant exhausts itself and becomes practically biennial.

kewénsis, Hort, is valuable as a winter-blooming greenhouse plant, prized for its fragrance and its dark-colored fls In 1897 at Kew a cross was made between *C. mutabilis* of the Canary Isls and a yellow wallflower, the cross being known as *C hybridus,* and this in turn was crossed with a red wallflower, producing the plant known as *C kewensis.* It has the bushy character of *C mutabilis,* racemes upright; fls about 1 in. across, brown in bud, or expanding brownish orange inside and reddish brown outside, all turning pale purple with age. Prop. by cuttings G C. III. 35·123. Gn 65, p 89.

C annuus, Hort =Matthiola, but early-blooming forms of C. Cheiri seem to pass under this name.—*C Menziesii* Benth & Hook.=Parrya. L H. B



902 Chelone glabra. (×¼)

CHELIDÒNIUM (Greek for the *swallow,* the fls. appear when the swallow comes) *Papaveràceæ* Celandine Poppy One or two loose-growing herbs, sometimes seen in old gardens Plant with fl.-buds nodding, and small yellow fls. in small umbel-like clusters; sepals 2; petals 4; stamens 16–24; style very short, the stigma 2-lobed. pod slender, 2-valved, opening first at the bottom. **C. màjus,** Linn., is a European plant, now run wild in waste places, and often seen in old gardens. It is biennial or perennial, with brittle hairy sts. and pinnately-parted lvs , the lobes rounded and toothed (or, in var. *laciniàtum* again dissected) The plant has bright orange juice which has been used for removing warts Herb an old-time remedy, used for its cathartic and diuretic properties, for promoting perspiration, and as an expectorant. Lvs. light glaucous underneath. L. H B.

CHELÒNE (Greek for *tortoise* or *turtle·* the corolla fancied to resemble a reptile's head) *Scrophulariàceæ.* Turtle-Head Several North American perennial herbs, with showy flowers in short spikes or in panicles, some of which are now sold by dealers in native plants. Allied to Pentstemon.

Upright smooth branching plants: corolla more or less 2-lipped or gaping, white or red, the upper lip arched and conspicuous and notched; anthers 4, woolly, and a rudiment of a fifth stamen seeds winged. lvs. opposite, serrate.—Four species, in N Amer

Half-shaded places are preferable for these easily cultivated plants Very dry grounds should be avoided, from the fact that they are best in swampy places. In the ordinary border they should have a very liberal mulch of old manure in their growing season 4–5 in. thick is none too much· the surface roots will feed in this compost, and the plants are not so liable to suffer from drought when thus protected. (J B Keller.)

A. *Fls. in terminal and axillary close spikes*

B *Lvs. elliptic to broad-ovate, long-petioled*

Lyònii, Pursh Plant, 2–3 ft high lvs broad to nearly cordate at base, thin, evenly serrate: fl.-bracts minutely ciliate fls rose-purple Mts , Va and S.

BB *Lvs lanceolate or oblong, short-petioled*

obliqua, Linn Two ft or less· lvs 2–8 in long, broad-lanceolate or oblong, very veiny, sharp- or deep-serrate or cut· fl.-bracts ciliate. fls deep rose. Damp grounds, Ill , Va , S

glàbra, Linn (*C obliqua* var *álba,* Hort) Fig 902 One to 2 or more ft high, more strict lvs mostly narrower, acuminate, appressed-serrate, nearly sessile, not very veiny fl.-bracts not ciliate. fls white or rose-tinged Wet grounds: common

AA *Fls in a loose thyrse or panicle*

nemorôsa, Douglas (*Pentstèmon nemorôsus,* Trautv.). Two ft or less high, of unpleasant odor lvs. ovate and acute, sharp-dentate, sessile or nearly so fl.-bracts none, corolla 1 in. long, violet-purple Calif and N B R 1211.

C barbàta of gardens is Pentstemon barbatus. L. H. B.

CHENILLE PLANT. A proposed name for *Acalypha hispida,* better known as *A. Sanderi.*

CHENOPÒDIUM (*goosefoot,* alluding to the shape of the leaves). *Chenopodiàceæ.* Goosefoot Widely dispersed weedy herbs, with very inconspicuous greenish flowers, some of which occur in gardens as oddities or for ornament, and others are pot-herbs of very minor importance Spinach, beet, and orach are allied plants

Plants of various habit, mostly erect· fls perfect, bractless, sessile in small masses and these clusters arranged in spikes or panicles; calyx 4–5-parted, petals wanting; stamens usually 5; styles 2 or 3.: seed lenticular. lvs. alternate The calyx sometimes enlarges and becomes succulent and colored, inclosing the fr , and the glomerules may then look like berries.—Perhaps 60 species in all parts of the globe, annuals and perennials, sometimes woody Many of them are field and garden weeds They are mostly mealy or

glandular herbs, often with strong odor. Some of them are used as pot-herbs or "greens."

A. *Fls. in dense heads or glomerules which become berry-like and bright red in fr.*

capitàtum, Aschers (*Blìtum capitàtum,* Linn.). STRAWBERRY BLITE Annual, erect and becoming diffuse or spreading, branching, glabrous or nearly so lvs soft, hastate-ovate, toothed, stalked· fr-clusters large and becoming fleshy, in an interrupted spike, the upper part leafless Eu —A frequent but not pernicious weed, and sometimes offered as a pot-herb.

AA. *Fls. not in dense separate heads, and the clusters not becoming prominently fleshy or colored.*

B. *Plant shrubby, spinescent.*

nitrariàceum, F Muell Rigid, much-branched, often prostrate shrub or undershrub, mealy-white lvs linear-oblong or linear-spatulate, obtuse, entire, 1 in or less long, often clustered fls clustered in dense or more or less interrupted spikes and panicles, greenish Austral.—Offered in Eu

BB *Plant herbaceous*

C *Species perennial a pot-herb.*

Bònus-Henrìcus, Linn (*Blìtum Bònus-Henrìcus,* Reichb.) GOOD KING HENRY MERCURY (by corruption, Markery) Stout and erect from a thick root-stock, to 2½ ft, glabrous lvs broad, triangular-hastate or ovate, with very long wide-spreading basal points, entire or undulate fls in paniculate spikes Eu. —Escaped now and then, and sometimes cult for "greens"

CC *Species annual.*

purpurăscens, Jacq (*C. Atriplicis,* Linn f) Vigorous, erect, 3 ft, the young parts and lvs covered attractively with a rose-violet or violet-purple crystalline pulverulence lvs spatulate or rhomboid or oval, obtuse, long-petioled, the lower ones sinuate-dentate and the upper lanceolate and entire fls small and numerous, in dense pyramidal leafy reddish clusters China —An old garden plant, seldom seen in this country, grown for its colored character in summer There are different forms, one with variegated foliage

amarantĭcolor, Coste & Reyn Very large, 8 ft, much like the preceding and perhaps derived from it: st glabrous, striped white and red lvs triangular to rhomboid, 4 in or less long, red-pulverulent fls in a long red panicle S France —Differs from *C. purpurascens* in its greater size and its black shining somewhat sharp-edged seeds. The brilliant colors disappear as the plant matures.

Quinòa, Willd QUINOA. Erect, stout, st furrowed, 4-5 ft lvs triangular-ovate, sinuate, long-petioled, angulate-pinnatifid, glaucous fls small and green, in dense axillary and terminal farinose clusters arranged in panicles. seeds very large W slope of the Andes B M 3641 —A very important plant in W S Amer, the seeds being used as food. There are white- and red-fruited forms Sometimes cult in this country as a curiosity. Allied to *C. album,* the common pigweed

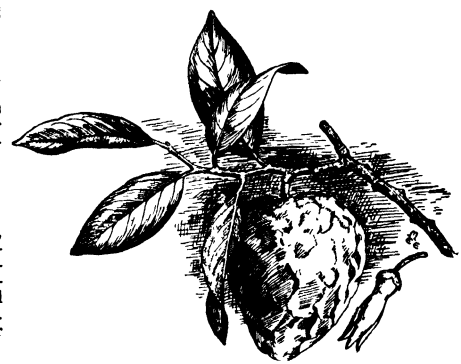
Bŏtrys, Linn. FEATHER GERANIUM. JERUSALEM OAK. Erect, glandular-pubescent and viscid, aromatic, 1–3 ft. high, with pinnatifid long-petioled lvs and long, feather-like, enduring spikes, for which it is used in vases and baskets; pretty Eu, and widely naturalized although not usually becoming abundant

Many weedy chenopods invade cult grounds *C. álbum,* Linn, the common pigweed or lamb's quarters is a favorite for "greens"! This species runs into many forms *C. viride,* of Eu and Asia, has seeds that are said to be edible *C. Vulvària,* Linn, sparingly intro from Eu, has the smell of stale fish *C. ambrosioides,* Linn, Mexican tea and var *anthelmínticum,* Gray, wormseed, are frequent, they contain strong essential oils The weedy species are variable, and puzzling to the systematist

L. H. B.

CHERIMOYA, CHERIMOYER (Quichua language of Peru, *charimuya,* signifying *cold seeds*) (*Annòna Cherimòla,* Mill) Figs 903-905. An important table fruit of warm countries See p 293, Vol I, for botanical description

The cherimoya is considered by many to be the finest of the subtropical fruits, and that not only by the natives of the countries in which it grows, but also by Europeans It is somewhat like the pomme-cannelle, or sweet-sop, but differs from it in having a peculiar acidulous flavor most agreeable and grateful to the taste. For centuries the cherimoya has been cultivated



903. Cherimoya -smooth form (×¼)

and several distinct varieties have resulted One of these has smooth fruit devoid of protuberances, which has been confused with the inferior fruits of both *Annona glabra* and *A. reticulata* The last two species, however, are easily distinguished by their leaves and flowers, *Annona glabra,* commonly known as the alligator apple or mangrove annona, having glossy laurel-like leaves and globose flowers with 6 ovate petals, and *A. reticulata* having long narrow glabrate leaves devoid of the velvety lining which characterizes those of the cherimoya. Both of these species, moreover, are essentially tropical, while the cherimoya is subtropical, growing in tropical countries only at considerable elevations, where the climate is cool and the soil well drained

The origin of the cherimoya has been much discussed. De Candolle, however, is in all probability correct in attributing it to the mountains of Ecuador and Peru. The common name which it bears, even in Mexico, is of Quichua origin, as explained above, and terra-cotta vases modeled from cherimoya fruits have been dug up repeatedly from prehistoric graves in Peru. It was introduced at a very early date into Central America and Mexico and into Jamaica in 1786 by Hinton East It is now of spontaneous growth in limited areas both in Central America and the mountains of Jamaica In Madeira, the cherimoya has taken the place of the grape-vine on many of the estates on the warm southern slopes of the island. Here the cultivation is systematic The two-year-old seedlings are budded or grafted. The trees are frequently trained on walls or on trellises, so that the fruit may hang in the shade while ripening, and manure is regularly supplied (see *Annona*) The result of careful selection is that there are varieties of fine flavor, comparatively few seeds, and great size, weighing from twelve to sixteen pounds According to W Fawcett, ordinary fruits weighing from three to eight pounds, have been sold in the London market at $1 50; large ones at $2 50 and even $3 The cherimoya has been

successfully introduced into southern California where it finds the most favorable conditions in the foot-hills near the coast

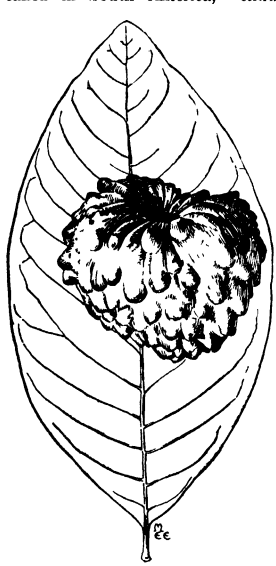
The cherimoya grows in the form of a small tree, usually about 15 or 20 feet high The flowers are remarkably uniform, but vary somewhat in size They are often solitary or in two's or three's, while those of the bullock's heart (*Annona reticulata*) and the sugar-apple (*A. squamosa*) are usually clustered The leaves are always velvety on the lower surface The following varieties, based upon the form of the fruit, are recognized·

(1) Finger-printed cherimoya (forma *impressa*), known in Costa Rica as "anona de dedos pintados" This form was the first to be figured (Feuillée, Pl med. Journ Obs. 3. append 24, pl 17, 1725) The fruit, conoid or subglobose in shape, has a smooth surface covered with concave U-shaped areoles resembling finger-prints in soft wax or putty It is one of the best varieties, with sweet juicy pulp of good flavor, and with relatively few seeds

(2) Smooth cherimoya (forma *lævis*), called in South America "chirimoya lisa" and in the market of Mexico City, "anon" Fig 903. It is this form which is so often mistaken for *Annona glabra* and *A. reticulata* on account of the general appearance of the fruit and the common name "anon," which is also applied to the fruit of the last-named species This is one of the finest of all the cherimoyas

(3) Tuberculate cherimoya (forma *tuberculata*). Fig. 904 One of the commonest forms, in which the fruit is heart-shaped and bears small wart-like tubercles near the rounded apex of each areole To this group belongs the "golden russet" cherimoya grown in the orchard of C. P. Taft at Orange, California It is the form most frequently found in the Peruvian markets and is represented in prehistoric pottery from the graves of that country

(4) Mammillate cherimoya (forma *mamillata*), called in South America, "chirimoya de tetillas." This is the form successfully established on the ranch of Charles F O'Brien, in the mountains of Santa Monica, southern California It is also the common form of the Nilgiri Hills of India, and is one of the best forms grown on the Island of Madeira



904. Cherimoya, tuberculate form. (×⅓)

(5) Umbonate cherimoya (forma *umbonata*), called "chirimoya de puas" and "anona picuda" in Latin America In this form the skin of the fruit is comparatively thick, the pulp more acid than in other forms, and the seeds more numerous It has the flavor of pineapple and is one of the best for producing cooling drinks and sherbets. The fruit is oblong-conical in shape, with the base more or less umbilicate and the surface studded with protuberances, each of which corresponds to a component carpel. To this form should be referred the "Horton" cherimoya, grown in the vicinity of Pasadena, California.



905. Flower of Cherimoya with two outer petals removed to show minute inner petals and essential parts, also an outer petal. (×1½)

Very recently there has been received from Florida an interesting fruit borne by a hybrid, the result of pollinating the stigmas of a cherimoya with the pollen of *Annona squamosa* The leaves of this plant are very broad, resembling those of *A Cherimola* in shape, but glabrous like those of *A squamosa*. The fruit resembles that of *A Cherimola* in form, but with the protuberences very distinct and covered with a glaucous bloom like that of *A. squamosa* The seeds are distinct from both species, larger than those of *A squamosa*, and much darker colored than those of *A Cherimola*, and the pulp is very juicy, with the fine slightly acidulous flavor of the cherimoya

For the propagation and culture of cherimoyas, see *Annona*

W. E SAFFORD.

CHERLÈRIA: *Arenaria.*

CHERRY. Several kinds or types of small stone-fruits ripening in late spring and in summer, widespread and popular in domestic and commercial use. Figs 906–910 Plate XXI.

Sweet and sour cherries have been domesticated from two Old World species: cultivated sweet cherries having come from *Prunus avium* and the sour cherries from *Prunus Cerasus* Varieties of these two species, and hybrids between them, now encircle the globe in the north temperate zone and are being rapidly disseminated throughout the temperate parts of the southern hemisphere For centuries, probably from the beginnings of agriculture, cherries have been valuable fruit-producing trees in Europe and Asia,—inhabitants of nearly every orchard and garden as well as common roadside trees in temperate climates of both continents.

Coming from the Old World to the New, the cherry has played an important part in the orcharding in temperate regions of the western hemisphere. In North America, varieties of one or the other of the two cultivated species are grown from Newfoundland to Vancouver Island on the north, southward to the Gulf of California, Texas and Florida, probably yielding crops in a greater diversity of soils and climates on this continent than any other tree fruit

Sour cherries are suited to many environments, thriving in various soils and withstanding rather better than most orchard fruits heat, cold and atmospheric dryness, and though they respond to good care, yet they thrive under neglect better than most other tree fruits Sour cherries also have fewer insect and fungous troubles than other tree fruits, being practically immune to the dreaded San José scale. Sweet cherries, however, are much less easily grown. Sweet varieties are all somewhat fastidious as to soils, are lacking in hardiness to both heat and cold, are prey to more insects than sour cherries and subject to nearly all of the fungous ills to which stone-fruits are heir, suffering in America in particular from brown-rot and leaf-spot.

Sweet cherries can be grown with commercial success in but few and comparatively limited regions, although the localities adapted to sweet varieties are rather widely distributed

The cherry is probably the most popular of temperate climate fruits for the home yard, being planted more commonly than any other tree-fruit, in the many regions in which it is grown, in the dooryard, garden and along the roadside The characters, other than those already named, that commend it for home plantations, are, early bearing after planting, early ripening in the season, regularity in bearing, great fruitfulness and ease of culture It is more than a home fruit, however, and is largely grown for the markets, for canning and for preserving



906
Tall erect growth of sweet cherry

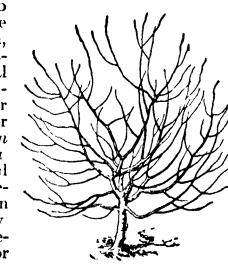
In America, the consumption of cherries is being greatly increased by the fashion of adding them preserved to many ices and drinks The demand for canned cherries has also increased enormously in this country during the last few years In Europe, wine is made from cherries, "kirschwasser," a spirit, is distilled from the fermented fruit pulp, and in the Austrian province of Dalmatia a cordial called maraschino is made by a secret process of fermentation and distillation This liquor is imported to America in considerable quantities to flavor preserved cherries which become the well-known "maraschino cherries" of confection and delicatessen shops.

Other species

Several species of cherries other than the two named have more or less horticultural value *Prunus Padus* and *Prunus Mahaleb* of the Old World furnish fruits sometimes used for culinary purposes but much more cultivated, in their various forms, as ornamentals, the latter furnishes a stock upon which orchard varieties are now most commonly budded *Prunus Besseyi*, *Prunus pumila* and *Prunus pennsylvanica* are species from North America, the first two having varieties cultivated for their fruits and all three being used as ornamentals and for stocks *Prunus Pseudo-Cerasus* and *Prunus tomentosa* from Asia are much grown in China and Japan as ornamentals, for their fruits and as stocks, and should find favor in Europe and America for these purposes In recent years many new species of cherries have been discovered in Asia E Koehne, one of the best authorities on the genus Prunus, places 120 species, nearly all from Asia, in the subgenus Cerasus to which belong the orchard cherries (Mitt Deut Dendrol. Gesell, 1912 168–183) A few of these have already been introduced in America by the United States Department of Agriculture, and from them one is sure to find valuable horticultural species to be used for their fruits, as ornamentals, as stocks, and for hybridization with species already domesticated.

Propagation.

Both orchard and ornamental cherries are commonly propagated in Europe and America by budding on Mazzard or Mahaleb stocks and in Japan, where cherries are much grown, on *Prunus Pseudo-Cerasus* When exceptional hardiness is required, seedlings of the Russian sour cherries may be used or those of *Prunus Besseyi* or *Prunus pennsylvanica* Undoubtedly the Mazzard is the best stock for regions in which cherries can be grown commercially Upon the Mazzard, varieties of either sweet or sour cherries make larger, thriftier, longer-lived and more productive trees The Mahaleb, on the other hand, is the best stock from the nurseryman's point of view It is more easily budded, hardier, freer from insects and fungi as it stands in the nursery before budding, and the buds more quickly develop into salable trees But the advantages of the Mazzard are so much greater for the fruit-grower that he should accept only trees on this stock unless hardiness be a prime requisite Cherries are set in the orchard at two years from the bud



907 Low-headed and spreading growth of sour cherry.

The cultivation and handling

Sweet cherries are most profitably grown on high, comparatively light, sandy, gravelly or even stony loams, while sour cherries do best on somewhat heavier soils The former are set 22 to 24 feet apart, the latter 16 to 20 feet Both respond to care in cultivation which, in brief is early spring plowing, frequent cultivation until the first of August with a cover-crop sown just before the last cultivation Cover-crops are various—a favorite one in New York and Michigan is a half bushel of oats or barley, and twelve pounds of clover or twenty pounds of winter vetch In Delaware and New Jersey the cowpea is much liked as a cover-crop.

Cherry trees are usually headed 2 or 3 feet from the ground with a tendency to head them lower—half the above distances, in the lower-headed orchards there seems to be no inconvenience in tilling with modern implements Nearly all commercial growers form the head with five to seven main branches about a central trunk, but some prefer to remove the central stem, especially in sweet varieties, leaving a vase-formed head After the head is formed, the subsequent pruning is exceedingly simple, consisting of cutting out an occasional injured or crossed branch and now and then heading-in a long whip-like growth

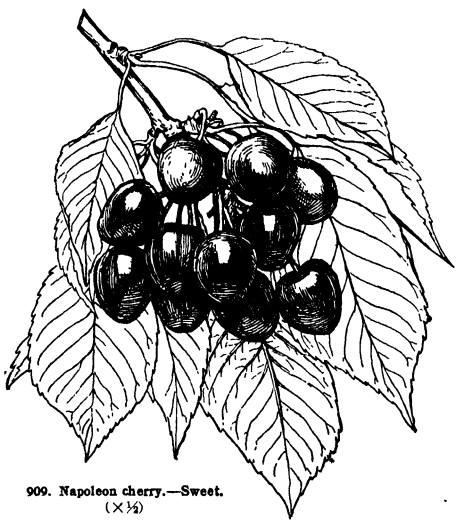


908. Old sweet cherry tree, on the Chesapeake peninsula

In soils well adapted to cherry-growing, commer-

cial fertilizers are little needed. Good cultivation, the yearly cover-crop and an occasional dressing of stable-manure furnish an abundance of food. If, with this treatment, the trees fail to make sufficient growth, and if the drainage be good, the grower should experiment with fertilizers containing potash, phosphoric acid or nitrogen to see which, if any, his trees may need.

Cherries are picked with stems on, the sweet a few days before fully ripe, the sour when practically



909. Napoleon cherry.—Sweet. (×½)

mature. Some growers guard against breaking the fruit-spurs for the next year by using picking scissors. Cherries are variously packed in boxes and baskets but the container is usually a small one and much art may be displayed in placing in layers, facing, and in making the package in all ways attractive. Fruit for canning must be carefully picked but is sent to the cannery in trays holding one or two pecks

The chief commercial plantations in eastern America are found in New York, New Jersey, Delaware, northern Ohio and western Michigan Sweet-cherry growing is precarious because of natural obstacles, and sour cherries are so easily grown that through very abundance their sale is often difficult. Yet with both success has been attained by many, the profits ranging as high as $300 to the acre.

Special difficulties.

The cherry is attacked by a dozen or more fungi. Of these, three are serious pests. The brown-rot, *Sclerotinia fructigena*, attacks the flowers, leaves, twigs and most disastrously the fruits at ripening time. Leaf-blight, *Cylindrosporium Padi*, produces diseased spots on the leaves, which for the most part drop out, giving a shot-hole effect and eventually causing the foliage to drop prematurely. A common and striking disease of the cherry is black-knot, *Plowrightia morbosa*, characterized by wart-like excrescences on shoots and branches which at maturity are black; affected parts sooner or later die

The text-books give no less than forty insect enemies of cherries, of which the plum-curculio, *Conotrachelus nenuphor*, the peach-borer, *Sanninoidea exitiosa*, and the San José scale, *Aspidiotus perniciosus*, on sweet cherries, must be combated. All of the pests named, both fungi and insects, are more destructive to plums and peaches, and the reader is referred to these fruits for treatment which is much the same as for the cherry.

Sweet cherries suffer severely in the South and the Mississippi Valley, and somewhat in the North, from sun-scald, either directly from the sun's rays or from alternate freezing and thawing in winter or spring. The injury is manifested by the bursting of the bark and the exudation of gum on the south and west sides of the tree. Some immunity from such injuries may be obtained by protecting the trunks with boards or other screens. "Gummosis," or a flow of gum from the wood, often follows injuries of various kinds and the work of insects and fungi in both sweet and sour cherries.

Types and varieties.

There are now about 600 varieties of cherries grown in America and Europe, and the names of as many more that have passed from cultivation remain These are variously grouped, but the following simple classification takes in the common orchard sorts

A. *Prunus avium*

(1) *The Hearts.*—Large, heart-shaped, soft-fleshed, sweet cherries, light-colored as represented by Governor Wood and dark as in Black Tartarian

(2) *The Bigarreaus* —Large, sweet, heart-shaped and colored as in the previous group but with firm, crisp and crackling flesh Well represented by Napoleon (Fig 909) and Yellow Spanish as light-colored members of the group, and by Schmidt and Bing as dark sorts

(3) *The Dukes* —Somewhat smaller cherries than the Hearts and Bigarreaus, softer in flesh, light-colored and usually sour or nearly so This group is placed under *Prunus avium*, but there can be no doubt but that the widely varying Dukes are hybrids between *Prunus avium* and *Prunus Cerasus* May Duke and Reine Hortense serve as illustrations of the group

AA. *Prunus Cerasus*

(1) *The Amarelles* —Rather small, light-colored, sour cherries with colorless or nearly colorless juice, produced on upright trees, represented by Early Richmond and Montmorency (Fig 910)

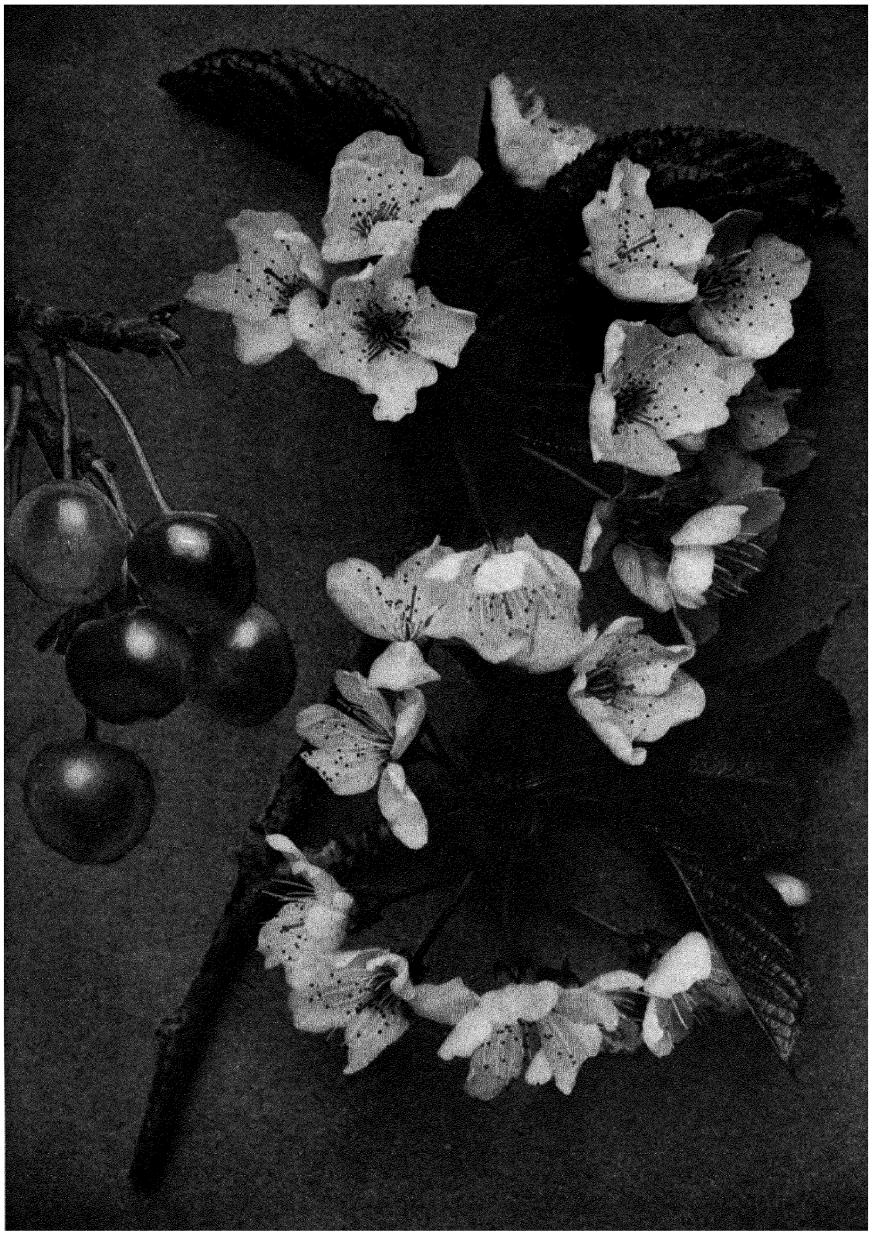
(2) *The Morellos* —Also comparatively small and very sour but dark in color and with dark-colored juice and trees with a drooping habit, represented by English Morello and Louis Philippe

In spite of the great number of varieties, the cherry, of all stone-fruits, seems most fixed in its characters Thus, the difference between tree and fruit in the cherries of the several groups is comparatively slight and many of the varieties come nearly true to seed So, too, cherries, although probably domesticated as long ago as any other of the tree-fruits, are now most of all like their wild progenitors Notwithstanding this stability, there are probably rich rewards to be secured in breeding cherries by those who will put in practice the discoveries of recent years in plant-breeding, and will hybridize especially the various groups of the two species now cultivated and introduce wholly new blood from wild species. So little effort has been directed toward improving cherries, and the material seems so promising, that it would seem that with proper endeavor the coming generation may have a new and greatly improved cultivated cherry flora.

U. P. Hedrick.

The cherry in California.

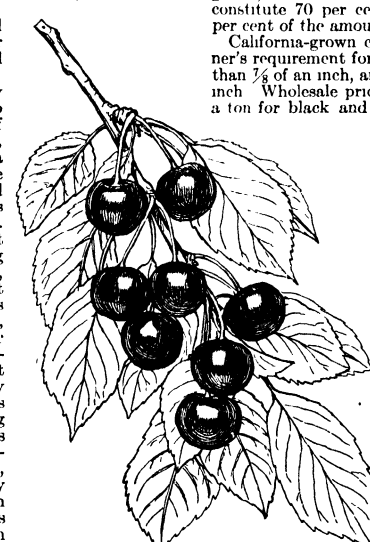
In commercial importance, the cherry is least of the fruits of the temperate zone grown in California on a commercial scale—not considering the quince and



XXVI. Sweet cherry in flower and fruit.

nectarine, of which the product is almost insignificant. This is not because the finest cherries cannot be grown, but because the avenues for the disposition of the product are not so wide as for other leading fruits. Recently there are indications that these avenues will be widened, for, in the year 1912, 244 carloads were profitably shipped in a fresh state to eastern markets, and in 1911 a product equivalent to 243,010 cases (each containing two dozen 2½-pound cans) of canned cherries were disposed of to advantage. In 1910, there was large shipment of barreled cherries in sulfur water to eastern bottlers who put up maraschino cherries in competition with importations, but this business seems to have transgressed the pure food laws and declined. Until it is demonstrated that such distant demands will increase, present plantations will not be largely extended. Cherries are costly in picking and packing, and the chance of low price in a local market, over-supplied whenever the trees do their full duty, the grower does not enjoy Cherry-drying has never seemed warranted on a large scale, because of the large amount of labor required to the pound of product; and the grower has had no recourse when the canner and local consumer would pay only the cost of picking and boxing A good shipping demand seems, therefore, the measure of the extension of California's cherry interest, and the early ripening of the fruit, which permits its sale during the blooming season of eastern cherry trees, is the leading surety of such demand On several occasions early varieties have been shipped from the Vacaville district overland, on March 31, but the usual opening date is about two weeks later, and thence onward later varieties, and from later regions, may be shipped until July, if found profitable

But, although there is plenty of good land upon which to multiply the present total of three-quarters of a million trees, the cherry regions of California are restricted It is one of the most exacting of all trees, and is profitable only when its requirements are respected. About one-half of the present acreage lies in valleys opening upon the bay of San Francisco, where deep and moist, but well-drained alluvial soil fosters strong and sound root-growth, and modified atmospheric aridity favors leaf and fruiting On similar deep and moist soils, however, the sweet cherry enters the hot interior valleys to certain limits, chiefly along the river bottoms It abhors dry plains In dry air it usually refuses to fruit, although, if the soil be moist, it may make stalwart tree-growth In foot-hill valleys it sometimes does admirably, both in growth and fruiting, and in mountain valleys, above an elevation of 2,000 feet, on good soil, and in the greater rainfall, and even with the snow flurries, which are experienced every year at proper elevations, the tree becomes very thrifty and profitable to the limits of local markets The tree seems to have no geographical limitations in California, wherever suitable soil and weather conditions occur, it accepts the situation—the Dukes and Morellos succeeding under conditions too trying for the Hearts and Bigarreaus, but the latter, only, are of commercial account



910. Montmorency cherry —Sour. (×½)

Cherry trees are grown by budding upon Mazzard and Mahaleb seedlings—both being largely imported. It is customary to plant out in orchards at the end of the first year's growth from the bud, though two-year-old cherry trees can be more successfully handled than other two-year-olds The trees are headed at 1 or 2 feet from the ground, cut back to promote low branching for two years, and then allowed to make long branches, and not usually shortened-in, so long as thrifty and healthy The tree, in a good environment, is, however, a very hardy tree, and will endure pruning to almost any degree There are many trees which have made a very broad but not usually high growth, bearing 1,000 pounds of fruit to the tree, and a few others which have even doubled that figure, while others have been dwarfed and trained *en espalier*. The commercial orchards are, however, uniformly of low trees, approximately of vase form in exterior outline, and with branches curving outward without shortening.

The cherry is very readily grafted over by the usual top-grafting methods, and large orchards have been thus transformed into varieties more acceptable for canning or shipping Comparatively few varieties are grown. Early Purple Guigne, Chapman and Knights Early Black are grown in early-ripening localities. Black Tartarian, Lewelling and Bing are the mainstay for black cherries The Napoleon Bigarreau (locally known as Royal Ann) is the ideal for a white cherry, and almost excludes all others, although the Rockport Bigarreau has some standing Of all the varieties grown, the Black Tartarian and Napoleon (Fig 909) constitute 70 per cent of the crop, and probably 90 per cent of the amount marketed

California-grown cherries attain large size, the canner's requirement for fancy fruit is a diameter not less than ⅞ of an inch, and for No 1 not less than ¾ of an inch Wholesale prices usually range from $40 to $60 a ton for black and $80 to $120 for white, but occasionally canners have paid as high as $160 a ton for white cherries The higher rates can be expected only in years of short crops

EDWARD J. WICKSON

CHERVIL. A term applied to two umbelliferous plants that produce edible parts, neither of which is well known in America The name is sometimes applied, also, to the sweet cicely

Salad chervil or leaf chervil is *Anthriscus Cerefolium*, Hoffm., a native of Caucasus, southern Russia and western Asia It is annual, reaching 1½ to 2 feet high The neat and aromatic leaves are used like parsley, which they much resemble. The leaves are decompound, with oval cut leaflets; and there are varieties with much cut and curled foliage. The cultivation of salad chervil presents no difficulties. Leaves are ready to use in six to ten weeks from seed-sowing, and any good garden soil is congenial It thrives best in the cooler and moister part of the year. In hot weather, seeds would better be sown in a shaded place.

Tuberous or turnip-rooted chervil is *Chærophyllum bulbosum*, Linn., of southern Europe. (See *Chærophyllum*) It is biennial or pluri-annual, like the radish and carrot. The roots are like small carrots in shape (4 to 5 inches long), but are gray or blackish, and the

flesh is yellowish white and of different flavor. The roots are eaten as carrots are, either boiled or in stews. The one difficulty in the growing of tuberous chervil is the fact that the seeds germinate very tardily, or even not at all, if kept dry over winter. It is customary, therefore, to sow them in the fall, although they do not germinate until spring. If they are to be reserved for spring-growing, they should be stratified (see *Seedage*) or kept in sand. In four or five months after germination, the roots are fit to use, although they improve in quality by being left in the ground. The roots keep well in winter. L. H. B.

CHESS, or CHEAT: *Bromus.*

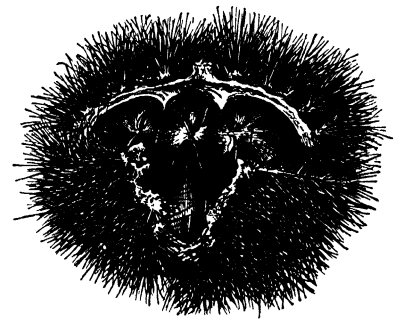
CHESTNUT. Three species of tree or true chestnuts are cultivated in this country for their nuts,—the European *Castanea sativa*, the American *Castanea dentata*, the Japanese *Castanea crenata*. See *Castanea*. The horticultural characters that distinguish these three types are as follows:

European chestnuts.—Tree large, with a spreading but compact head, stocky, smooth-barked twigs and large glossy buds of a yellowish brown color; leaves oblong-lanceolate, abruptly pointed, with coarse sometimes incurved serrations, thick and leathery, generally pubescent beneath when young, but green on both sides when mature. Burs very large, with long branching spines, and a thick velvety lining. Nut larger than American chestnut, sometimes very large, shell dark mahogany-brown, pubescent at tip, thick, tough and leathery; kernel inclosed in a thin tough and astringent skin: quality variable from insipid, astringent to moderately sweet The leaves remain on the trees until late in autumn, but are more susceptible to the attacks of fungi than the American and Japanese species. At least one variegated and one cut-leaved variety are grown as ornamentals. This species is variously known as European, French, Spanish and Italian chestnut (*Castanea sativa*), and sweet chestnut of English writers. It is an inhabitant of mountain forests in the temperate regions of western Asia, Europe and north Africa, and is esteemed for its nuts in Spain, France and Italy, where they have constituted an important article of food since an early day. Introduced to the United States by Irénée Dupont, at Wilmington, Delaware, in 1803, although recorded by Jefferson, under the designation "French chestnut," as grafted by him on native chestnut near Charlottesville (Monticello), Virginia, in 1773.

American chestnut (*Castanea dentata*).—Fig. 911. A tall straight columnar tree, in forests reaching a height of 100 feet and a diameter of 3 to 4 feet; when grown in the open, forming a low round-topped head of slightly pendulous branches. Leaves thinner than in *C. sativa*, oblong-lanceolate, acute, long-pointed at the apex, coarsely serrate except toward the wedge-shaped base, green and glabrous on both surfaces, changing to bright clear yellow later in autumn. The staminate flowers open in June or July after leaves have attained full size, and exhale a sweet, heavy odor, disagreeable to many persons, and sometimes causing symptoms of hay-fever. The two- or three-flowered involucres of pistillate flowers are on short stout peduncles at the bases of androgynous aments which bear toward their tips scattered clusters of staminate flowers. Burs smaller and spines sharper than in *C. sativa*. The nuts, usually two or three, rarely five to seven, are usually broader than long, and much compressed by crowding, although sometimes nearly oblong and approaching cylindrical.



911. Native wild chestnuts. (×¼)



912. Japanese chestnuts. (×½)

They are of a bright brown color, covered at the apex with thick pale tomentum, which sometimes extends nearly to the base of the nut. The nuts are sweet and agreeable in flavor, the best among chestnuts, and are marketed in large quantities from the forests of the Appalachian region Occurs in eastern North America, Maine to Georgia, westward to Michigan, Mississippi and Louisiana Gradually receding from its southern areas from causes not yet understood A few selected forms have been propagated by grafting

Japanese chestnut (*C. crenata*) —Fig 912. A dwarfish close-headed tree of slender growth, said to attain a height of 50 feet in Japan, with small buds leaves smaller than other chestnuts, lanceolate-oblong, usually pointed, with a truncate or cordate base, finely serrated, with shallow sharp-pointed indentations, whitish tomentose beneath, pale green above, less subject to injury by fungi than other species Burs small, with a thin papery lining and short widely branching spines. Nuts large to very large, glossy, usually three, sometimes five or seven in a bur, usually inferior to the other chestnuts in quality, although good when cooked, and in a few varieties excellent in the fresh state. Many cultural varieties are recognized Introduced to the United States in 1876 by S. B. Parsons, Flushing, New York.

Aside from these three types, there are certain dwarf and small-fruited castaneas known as chinquapins. The two native chinquapins may be contrasted as follows (page 682):

Common or tree chinquapin (*C. pumila*) —Fig. 913. A shrub 4 or 5 feet tall, rarely a tree, attaining a height of 50 feet, with slender branchlets marked with numerous minute lenticels, and coated with a pale tomentum, which disappears during the first winter. Leaves oblong, acute and coarsely serrate at apex, bright yellowish green, changing to dull yellow before falling in autumn. Flowers strong-smelling, the catkins of staminate ones appearing with the unfolding leaves in May or June, the spicate androgynous aments later, with pistillate flowers in spiny involucres, producing solitary cylindrical nuts ¾ to 1 inch in length and ½ inch in diameter, with sweet seeds This species occurs in dry lands from southern Pennsylvania to Florida and Texas, and its nuts, which ripen earlier than the American chestnut, are esteemed for

food and marketed in considerable quantities. The species is sparingly introduced to cultivation and in its native region is being somewhat grafted upon in place with the choicer varieties of chestnuts. It has some promise as a dwarfing stock but is subject to the troublesome fault of suckering rather abundantly. Two named varieties, the Fuller and the Rush, have been published and somewhat propagated. (Upper part of Fig. 913 illustrates common chinquapin bur, and nut in natural size.) Apparent intermediates between this species and the American chestnut, probably of hybrid origin, are found in various localities from Pennsylvania southward and westward to southern Arkansas and eastern Texas, in some localities attaining truly arborescent proportions (Lower figure in Fig 913 illustrates bur of hybrid chinquapin.)

Bush chinquapin (*C. alnifolia*).—A shrub, rarely more than 3 feet in height, forming small thickets, by means of stolons, in sandy barrens South Atlantic states, westward to Louisiana and Arkansas. Distinguished from *C. pumila* by larger, oval-lanceolate, mostly obtuse leaves, which are but slightly tomentose beneath, and by its larger nuts, which ripen earlier.

The cultural range of Castanea in America is not well defined, but extends from Florida and Texas to Massachusetts and Wisconsin, and on the Pacific slope. The three species cultivated in America thrive best on dry, rocky or gravelly ridges or silicious uplands, failing on heavy clays and on limestone soils unless deep, dry and rich.

Propagation of chestnuts.

Propagation of species is by seeds. Certain types reproduce their striking characteristics in their seedlings, but varieties are perpetuated by grafting, occasionally by budding. Seeds for planting should be free from insect larvæ, and should not be allowed to dry out before planting. They may be planted in drills in fall on deep and well-drained loam, or, to avoid damage by rodents, may be stratified in damp sand until spring. Nuts held in cold storage at 15° F. from October to April have germinated well at Washington, D. C. Young trees destined for removal to orchard should be transplanted in nursery at one year old, to promote symmetrical development of root system. Grafting may be done on any of the species of Castanea, and on some of the oaks, notably the chestnut oak, *Quercus Prinos*, though the durability of grafts on the oak is questionable. Where the chestnut is indigenous, bearing orchards of improved varieties are quickly secured by cutting down and removing the timber, and grafting the young sprouts which spring up in abundance about the chestnut stumps (Fig. 914). Recently the chinquapin has been similarly used with good success where chestnut does not occur. Grafting may be by splice method on one-year-old seedling roots, by splice or cleft at crown on two- or three-year trees in place; or by veneer, splice or cleft methods on one- to three-year-old sprouts or branches. Top-working of old trees is uncertain and practised only in special cases. Cions should be dormant, and work may be done at any time after freezing ceases, but in trunk- and branch-grafting best results are secured by most grafters if work is done after leaves begin to unfold. Two- or three-bud scions are preferred. The fitting of cion to cleft or splice and the waxing should be carefully done. If strips of waxed muslin are wrapped about the stubs, the danger of loss by summer cracking of wax is lessened. In cleft-grafting young sprouts or seedlings, the stub should be cut 2 or 3 inches above the departure of a branch, to prevent too deep splitting of cleft. Two or three weeks after growth begins the waxing should be inspected and repaired if cracked. If grafts make rank and brittle growth they should be checked by pinching, and if in exposed situations, tied to stakes to prevent breaking out of cions. Budding is sometimes practised, usually by use of dormant buds inserted in shoots of previous year, when the bark "slips" after growth has begun in spring. There is a growing conviction in the minds of close observers that certain of the popular varieties, especially Paragon, under certain conditions do not find the American chestnut a congenial stock. In several orchards, Paragon, when grafted on native sprouts, although apparently making a good union at the start, has within eight to ten years developed weakness at the point of union, followed by loss of vigor and death of the top without other apparent cause than lack of congeniality of cion to stock. For this variety, at least, the grafting upon seedling stocks grown from nuts of the variety appears advisable.

The chestnut is admirably adapted to ornamental planting, either singly or in groups on suitable soils.



913. Chinquapin. (Nut and bur natural size.)

The native species is successfully used as a roadside tree in many sections outside of its natural range. It requires a space of at least 40 feet for development when thus used, the European species 30 feet, and the Japanese 20 feet. If in orchard, the last-mentioned may be planted as close as 20 feet, and thinned when the trees begin to crowd, thus securing several crops of nuts from land otherwise unoccupied.

Care of chestnut orchards.

Planted orchards are yet few in America, most of the extensive commercial efforts having consisted in the grafting of sprouts on rough lands where the American chestnut is indigenous. On such lands no cultivation is attempted, the brambles and undesired sprouts being held in check by occasional cutting in summer, or by pasturing with sheep. Much care is necessary

to protect against damage of the sprouts by fire on such land. Clean cultivation, at least during the first few years, is probably best in planted orchards, although heavy mulching may be found a satisfactory substitute The Japanese and some of the American varieties of the European species require thinning of the burs on young trees to avoid over-bearing, with its consequent injury to the vitality of the tree.

Special difficulties.

Leaf diseases are apparently subject to control by bordeaux mixture, but for the weevils, which damage the nuts previous to maturity, no satisfactory remedy has yet been discovered except the yarding of poultry in sufficient numbers to destroy the adult insects and their larvæ when they reach the ground

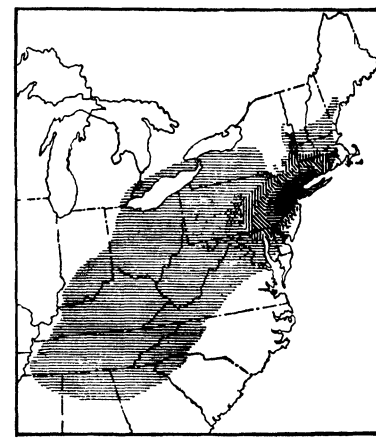
The most serious difficulty confronting the present or prospective chestnut-grower in North America is the chestnut-bark disease which, during the last decade, has worked havoc in the native chestnut forests throughout a region of country extending from central Connecticut through southeastern New York, New Jersey, and eastern Pennsylvania into northern Delaware, northeastern Maryland and northern Virginia As this region contains most of the commercial plantings of improved chestnuts they have also suffered severely, especially since about 1908 The distribution of the native chestnut, together with the known distribution of the disease February 1, 1912, is shown on the accompanying map (Fig 915), which was prepared by Metcalf to accompany a special report on the disease in response to a resolution of the United States Senate.

This disease, caused by a parasitic fungus (*Diaporthe* or *Endothia parasitica*), attacks trees of all ages and kills by girdling at various points It is known to attack all species of chestnut and chinquapin grown in this country, although some, at least, of the Japanese varieties, are practically resistant, so far as observed. A few cases of the disease have also been found on living trees of the chestnut oak in Pennsylvania, though with less evidence of destructive effect than on chestnut.



914. Chestnut sprouts two years grafted The cion was inserted where branching begins

The disease is spread by the spores of the fungus, which are sticky, and are carried by rain, insects, and man, and probably by birds and small mammals It is known to have been carried on nursery stock for long distances and is easily transported on newly cut



915. Distribution of the chestnut blight.

timber and cordwood from which the bark has not been removed Infection frequently occurs through wounds made by bark-borers.

Although first attracting attention in New York City in 1904, it appears certain that it had secured a firm foothold in southeastern New York, including Long Island and adjacent portions of Connecticut and New Jersey, prior to that time, there being some indication that it was introduced from Japan, although satisfactory evidence of this is still lacking The presence of the disease in chestnut forests in China was discovered by Meyer in 1913, where, upon an unidentified species of chestnut, it is reported to be less virulent than in American chestnut forests

For several years after publication of the cause of the disease by Murrill, in 1906, little effort was made in a systematic way to accomplish its control until 1911, when the legislature of Pennsylvania appropriated $275,000 for this purpose and inaugurated a state-wide, two-year campaign of eradication The work is being done in cooperation with the Federal Department of Agriculture which, since 1907, has been investigating the disease with a view to developing effective methods of controlling it Several other chestnut-producing states are also giving more or less attention to the problem Up to the present time, systematic cutting out of infected trees coupled with destruction of their bark by fire has proved the only practicable control method. This is being vigorously applied in Pennsylvania and those portions of Maryland, West Virginia, and Virginia in which the disease has appeared

In forests, the disease is exceedingly difficult to eradicate after it has once gained a foothold, owing to the minute examination of the entire tree which is required to locate infections in their early stages. In any district in which there is a general infection of the forests, the only practicable course is to clear off the timber while it is sufficiently sound to be merchantable.

The relative disease-resistance of the Japanese chestnuts, coupled with their precocity and productiveness, renders them now the most promising sorts for the American chestnut-grower. Planted in sections

outside of the native range of the American chestnut, they may reasonably be expected to remain practically free from the disease, especially if care is exercised to prevent its introduction from infested regions on nursery stock or cions The poor flavor and eating quality of most of these varieties is their worst fault, but in view of their wide range of variation in this respect, the problem of producing resistant varieties of good quality appears relatively simple. The few trees of Korean and Chinese chestnuts thus far grown in the eastern United States are apparently quite resistant to the disease and therefore of much interest to the tree breeder as parents of possible resistant forms Systematic work on the breeding of resistant varieties is being prosecuted in the Bureau of Plant Industry

Varieties of chestnuts.

The varieties of the three species, although possessing many points in common, differ sufficiently in important characteristics to justify separate grouping for cultural discussion As chestnut-culture is new in this country, it seems best to append descriptions of all the varieties which are in the American trade For fuller discussion of cultivated chestnuts, see Nut Culture in the United States (Bull Div of Pomology, U S Dept of Agric), from which Fig 913 is adapted, Nut Culturist, A S Fuller, 1896, European and Japanese Chestnuts in Eastern United States, G Harold Powell (Bull Del Exp Station), 1898, Nut Culture for Profit, Jno R Parry, 1897







916. Successive stages in the ravages of the chestnut blight. 1909, 1910, 1911.

American Group —Although the wild nuts exhibit wide variations in size, form, quality, productiveness, and season of ripening but few varieties have been dignified by names and propagated Solitary trees are frequently sterile, although producing both staminate and pistillate flowers, apparently requiring cross-fertilization to insure fruitfulness This is especially true of planted trees of this species on the Pacific slope, where productive trees are reported to be rare The susceptibility of the species to injury by leaf diseases, as pointed out by Powell, and the injury to nuts by larvæ of weevils, are drawbacks to its extensive culture

The following varieties are propagated to some extent

Dulany —Bowling Green, Ky Large, and of fine quality Original tree productive, though isolated

Griffin —Griffin, Ga A large, very downy nut, of good quality

Hathaway —Little Prairie Ronde, Mich A large, light-colored, sweet nut, annually productive, frequently having five to seven nuts to the bur

Ketcham —Mountainville, N Y Above medium in size, oblong, tomentose, sweet Tree productive and vigorous in heavy sod at fifty years of age

Murrell —Coleman's Falls, Va A large, high-flavored nut, bearing three nuts to the bur

Otto —Otto, Tenn Large, oblong, very downy at tip, very sweet, and rich

Rochester —Rochester, N Y First fruited at Alton, Ill Nuts medium to large, somewhat rounded, usually three in a bur, of dull brown color, downy at tip, quality excellent Tree a very rapid grower and a heavy bearer, ripens late

Watson —Fay, Pa Medium to large, slightly downy, compressed, very good

European Group —It is a significant fact that, during the century that has elapsed since the introduction of this species, the imported named varieties of Europe have not found favor in eastern America Seedling trees have been found productive and profitable at many points in New Jersey, Pennsylvania, Delaware, and Maryland, however, and these form the basis of the culture of the species east of the continental divide West of the Rocky Mountains, several of the choice French "Marrons" are reported to succeed in California and Oregon Among the more important varieties of the European group in America, are the following

Anderson —Flushing, N J Bur medium to small, nuts of medium size, bright reddish brown, pubescent at the tip and over half of the nut. Tree a strong grower, with medium to small leathery leaves Very productive

Bartram —Milltown, Pa Bur medium to small, nut medium, thickly pubescent at tip, dark reddish mahogany color, three in a bur, unusually free from insect attack, quality good Tree vigorous, spreading, with large leaves, productive

Combale (Marron Combale) —France A large and handsome, bright brown striped nut, with but little tomentum at tip, usually two, sometimes but one in a bur Somewhat grown in California, where it was introduced from France about 1870

Chalon (syn , Marron Chalon Early) —France Sparingly grown in California Nut of medium size, early, productive, precocious

Corson. —Plymouth Meeting, Pa Bur large, with thin husk, nuts large, usually three in a bur, dark brown, ridged, heavily pubescent at tip, quality very good Tree vigorous, spreading, very productive

Dager —Camden, Del Bur medium, nut medium to large, dark brown, thickly tomentose, usually three in a bur, quality good. Tree vigorous, spreading, productive, a seedling of Ridgely

Darlington —Wilmington, Del Bur medium to small, nut medium to large, usually three in a bur, dark, distinctly striped, thickly tomentose at tip, sweet, good Tree vigorous One of the earliest to ripen of this group

Lyon (Marron de Lyon) —France A large, round nut of fair quality, grown in a small way in California, but less productive than Combale, which it resembles

Marron —This term is used by the French to designate the larger cultivated chestnuts, most of which have relatively few nuts, often only one in a bur

Moncur —Dover, Del A seedling of Ridgely Bur medium, nuts medium, of light color, heavily tomentose Tree vigorous, spreading, very productive

Nouaillard —France A large, handsome variety from central France, and there considered very productive and valuable Has been tested in New Jersey, Pennsylvania and California without marked success in any locality

Numbo —Morrisville, Pa Bur medium conical, nut large, from two to three in a bur, bright brown striped, thinly tomentose, of good quality Tree compact and drooping, rather uncertain in bearing

Paragon (syn , Great American, Sobers Paragon) —Germantown, Philadelphia, Pa Bur very large, nut large, usually three in a bur, broad, plump, thickly tomentose at the tip, and thinly over two-thirds of surface, color dull brown, quality very good Tree hardy, spreading, vigorous, with narrow, coarsely serrate leaves having a narrow base, subject to leaf-blight, but very productive The most widely planted and most uniformly successful variety of chestnut yet cultivated in the United States Possibly a hybrid with C. dentata

Quercy (syn , Marron Quercy) —France. A beautiful, medium-sized nut, commended in portions of California for precocity, earliness, productiveness and quality

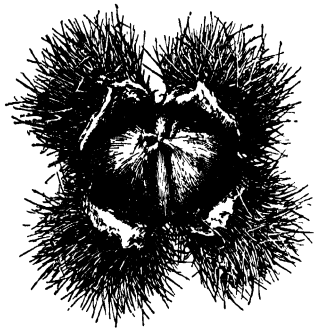
Ridgely (syn , Du Pont) —Dover, Del Bur medium, nut medium to large, moderately tomentose, dark, of very good quality. Tree vigorous, with narrow leaves free from blight, spreading, very productive, hardy

Scott —Burlington, N J Bur medium; nut medium, slightly pointed, usually three in a bur, glossy, dark brown, slightly tomentose at the tip Tree open, spreading, very productive, said to be comparatively free from attacks of weevil

Styer —Concordville, Pa Bur medium, nut medium pointed, dark brown, striped, tomentose at tip, 1 to 3 in a bur Tree very vigorous, upright, with large, dark green leaves, free from disease

Japanese Group —Though most of the imported Japanese chestnuts have been found of poor quality for eating in the fresh state, the product of many imported seedling trees, and of a number of American-grown seedlings of this type, is equal to the European nut in this respect The Japanese varieties in general have the advantage, also, of greater precocity and productiveness, larger size and earlier maturity of nut, greater freedom from injury

by leaf diseases and nut-eating insect larvæ. As productiveness and earliness are the most important points in chestnut-culture at the present time, this type is the most important to commercial nut-growers Because of the ease with which chestnuts hybridize, the disease-resistance of varieties that have originated from seed produced within the habitat of the American chestnut must be regarded as doubtful until thoroughly tested Information as to the place of production of the seed from which the several varieties originated is therefore of importance in selecting varieties for planting. The more important named varieties are as follows



917. Boone chestnut.

Alpha —New Jersey Bur medium, nuts medium to large, generally three in a bur, dark, of fair quality, ripening very early Tree upright, very vigorous and productive Originated in New Jersey from seed of Parry

Beta —New Jersey Bur small, nut medium, light brown, smooth, slightly tomentose at tip, good, ripening just after Alpha Seedling of Parry

Biddle —New Jersey First fruited in Maryland Bur medium; nut large, bright brown, broad, rather thickly tomentose, two to five in a bur, of medium season and fair quality Tree regular, round-headed, vigorous Grown from imported seed.

Black (syn, Dr Black) —New Jersey First fruited in Maryland Bur large, nut medium to large, three to seven in a bur, consequently irregular in shape, dark brown, slightly tomentose, very early and of good quality Tree round, close-headed, vigorous, productive. Grown from imported seed

Boone —Villa Ridge, Ill Fig 917 A hybrid between Giant and a native chestnut Bur of medium size, nuts large, usually three in a bur, of light brown color, rather heavily tomentose, quality very good Tree vigorous, precocious and productive, nuts ripening early Considered difficult to propagate

Coe —California. A large, very sweet variety, but recently disseminated Tree upright, somewhat spreading. Grown from imported seed

Felton —New Jersey First fruited in Delaware Bur small, nut medium, dark brown, slightly tomentose, rather early and of excellent quality Tree round-headed and fairly productive Grown from seed of an imported tree.

Giant —Japan A trade name, under which a number of varieties have been imported from Japan See Parry

Hale (syn, Eighteen Months) —California A newly introduced variety, having a large, dark brown nut of excellent quality. Very precocious Grown from imported seed

Kent (syn, Extra Early) —New Jersey First fruited in Delaware Bur small, nut medium to large, dark, usually three in a bur, very early, of good quality Tree round-headed, precocious, productive Grown from seed of an imported tree

Kerr —New Jersey First fruited in Maryland. Bur small, nut medium to large, dark brown, broad, three in a bur, early, and of excellent quality. Tree vigorous, symmetrical, round-headed, very productive Grown from imported seed

Killen —New Jersey. First fruited in Delaware Bur very large, nut very large, broad, light brown, slightly ridged, of excellent quality, midseason Tree upright, open, spreading, moderately vigorous, productive The largest chestnut yet brought to notice. Grown from seed of an imported tree.

Mammoth —A trade name for the imported Japanese nuts and trees, not restricted to any particular variety

Marlin (syn, Col Martin) —New Jersey First fruited in Maryland Bur large, nut large to very large, broad, bright reddish brown, slightly tomentose, three to five nuts in a bur Midseason; of good quality for cooking Tree vigorous, open, spreading, productive Grown from imported seed

McFarland —California Bur very large; nut large, and of fine quality; early. Tree spreading, very productive. A newly disseminated variety of great promise Grown from imported seed

Parry —Japan Bur very large, nut very large, one to three in a bur, broad, with apex sometimes depressed, dark brown, ridged, of fair quality Tree moderately vigorous, open, spreading, with large leaves One of the largest and most beautiful of this group. Selected for propagation as the best of 1,000 imported grafted Japanese chestnuts

Prolific —Japan Bur small, nut medium, rather long, striped, three in a bur, early. Tree vigorous, compact, with small narrow leaves

Reliance —New Jersey Bur medium, nut medium to large, rather long, light brown, ridged, midseason, and of fair quality. Tree dwarfish, spreading, drooping, very precocious and productive, inclined to overbear, and needs thinning Seedling of Parry.

Success —New Jersey. Bur very large, nut very large, usually three in a bur; midseason, of rather poor quality until cooked. Seedling of Parry Tree upright, productive.

Superb —New Jersey Bur large, nut large, oroad, brown, usually three in a bur, early, and of fair quality Tree vigorous and very productive. Seedling of Parry.

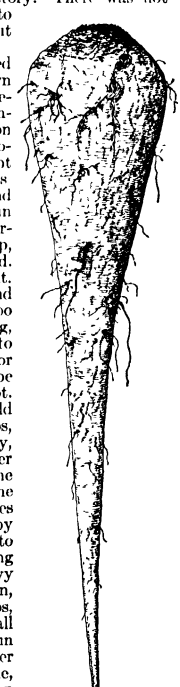
Wm. A TAYLOR.

CHEVALIÈRA, CHEVALIÈRIA, CHEVALLIÈRA, CHEVALLIÈRIA. The species in the American trade are Æchmeas.

CHICK-PEA. *Cicer.*

CHICKWEED: *Cerastium* and *Stellaria.*

CHICORY, or SUCCORY (*Cichòrium Intybus*, Linn) *Compósitæ* Fig 918 A native of Europe, naturalized in America and familiar to many as a weed, is a pot-herb, a salad, and the leading adulterant of coffee It came prominently before the public in the late nineties and the early years of this century as an American farm crop Prior to that year, its cultivation as an adulterant and substitute for coffee was largely prevented by the prejudice of the principal consumers, our foreign-born population, who insisted that American was inferior to European root, and also by the low tariff, which allowed the root to enter duty free, or with a very small impost During 1898 and 1899 advantage was taken of a protective duty, and several factories were erected, for which farmers grew the roots For a few years our home market was supplied from American fields in part But even the substitution of horse-power for manual labor, improved plows and cultivating implements for crude ones, machine-digging of the roots for hand-digging, efficient slicing machines, and improved evaporating kilns did not make the business satisfactory. There was not enough money in it either to growers or to manufacturers, so it has been abandoned



918 Improved chicory root (×¼)

Chicory will probably succeed wherever the sugar beet is grown in this country, the climatic requirements being similar In general, it may be said to thrive upon all stone-free soils that will produce paying staple crops, except clays, lightest sands and mucks The first are too hard, the second too dry, the third too rich in nitrogen and too sour The surface layer of soil should be deep, the subsoil open and well drained. If the water-supply be sufficient, high land is as good as low land of the same texture, though if too dry for profitable grain-growing, the former may yet be made to produce chicory, but if too wet for cereals, the latter will generally be found unsuitable for this root. The fertilizing of the land should be the same as for other root-crops, nitrogen being used sparingly, potash and phosphoric acid rather freely—one and one-fourth to one and one-half times as much of the former and two and one-half times the latter as has been removed by the preceding crop. It is best to apply these fertilizers to preceding crops that do not make heavy demands upon them In rotation, chicory is classed with root-crops, and should be preceded by a small grain, since this is harvested in time for fall plowing Clover should not immediately precede, since it leaves too much nitrogen in the soil. The ground being warm, fairly moist, thoroughly

prepared by deep plowing, harrowing and scarifying with a weeder, the seed, which must be fresh and clean, is sown rather thickly but covered thinly, in drills 18 inches apart

There are but few well-defined varieties of this plant used for field culture, and even the garden sorts are not so stable as could be desired Of the former group, Magdeburg, Brunswick and Schlesische are the principal, of the latter, Witloof (so-called), Red Italian, Broad-leaved, Improved Variegated and Curled-leaved are best known Witloof and Barbe de Capucin can be produced from any variety, the difference being brought about by the method of growing

Chicory has no specific enemies in this country, and is troubled by only a few of the general-feeding insects, such as cut-worms and wire-worms

From six to ten tons is the general acre yield, although with good management fifteen tons may be produced The cost of growing and the returns are about as follows Rent, wear of tools, etc, $5, preparation of land, $4 50, seed, 75 cents, cultivating and tending, $15, harvesting and delivering, $12, total, $37 25. Average price the ton, $7

From a purely horticultural standpoint, chicory is of interest as a root, a pot-herb, and a salad plant The young tender roots are occasionally boiled and served with butter, pepper and salt, like young carrots, but they have never become widely popular in this form As a pot-herb, the young leaves are equal to those of dandelion They are cut when 6 to 8 inches long, boiled in two waters to remove the bitter flavor, and served like spinach As a salad, chicory is famous in three forms Common Blanched, Barbe de Capucin and Witloof Barbe de Capucin is comprised of small blanched leaves Witloof is a more solid head The pink, red and curled varieties make a very pretty appearance, and, if well grown and served fresh, are delicious, there being only a slightly bitter flavor The method of growing for salads is the same as for endive

For Barbe and Witloof, well-grown roots are dug in October, trimmed of unnecessary roots and of all but an inch of top For Barbe, the roots are laid horizontally in tiers in moist earth, the whole forming a sloping heap, the crowns of the roots protruding an inch or so Since darkness is essential, a warm vegetable cellar is the usual place selected to grow this vegetable, which requires three or four weeks to produce its fine white leaves These are cut when about 6 inches long, eaten as a salad, boiled like kale or cut up like slaw If undisturbed, the roots will continue to produce for several weeks The most rapid way to produce Witloof is to plunge the roots (shortened to 5 inches) in spent tanbark, or such material, and cover with 2 feet or more of manure, the space under a greenhouse bench being used. In about two weeks, heads resembling cos lettuce may be dug up, boiled like brussels sprouts, or served as salad If the roots be left in place, protected from the light, but uncovered, a crop of leaves resembling Barbe may be gathered Sowing and other cultural management is the same as for other garden roots, as beets and carrots It is a pity that these vegetables are so little known in this country Witloof is a popular winter vegetable in the larger cities of the East Much of it is imported from Europe

Chicory has run wild along roadsides and in dry fields in many parts of the country, and is considered to be a bad weed However, the handsome sky-blue flowers (Fig. 962), which open only in sunshine, are very attractive M. G. KAINS.

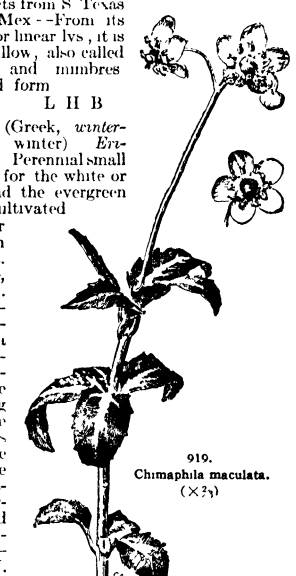
CHILDSIA WERCKLEI: *Hidalgoa.*

CHILIÁNTHUS (*a thousand flowers*) *Loganiàceæ.* Four or 5 S African trees or shrubs, very closely allied to Buddleia, from which it differs in having stamens exserted from the short tube lvs. opposite, entire or dentate, nearly always tomentose or scaly fls very numerous, in dense terminal cymes or panicles, calyx and corolla deeply 4-parted, the latter usually yellowish Unknown to the American trade The plants known as *Buddleia salicifolia*, Jacq, and *B saligna*, Willd, are *Chilianthus arboreus*, Benth (which is probably identical with *C. oleaceus*, Burch.).

CHILÓPSIS (Greek, *lip-like*) *Bignoniàceæ* One deciduous shrub or low tree, often planted in southern California and other parts

Allied to Catalpa differs in having 4 anther-bearing stamens and 1 rudiment, a more trumpet-shaped corolla and with jagged lobes, and lvs linear and often not opposite

linearis, DC (*C. saligna*, Don). Slender-branched, 10-20 ft. fls handsome, bignonia-like, in a short terminal raceme, corolla 1–2 in. long, 5-lobed and crimped, the tube and throat lilac, and 2 yellow stripes inside Dry districts from S Texas to Calif, and in Mex.—From its narrow-lanceolate or linear lvs, it is known as desert willow, also called flowering willow and mimbres There is a white-fld form L H B



919.
Chimaphila maculata.
(×⅔)

CHIMÁPHILA (Greek, *winter-loving*, green in winter) *Ericàceæ* PIPSISSEWA Perennial small plants, interesting for the white or pinkish flowers and the evergreen foliage, but little cultivated

Half shrubby or herbaceous, with creeping st lvs. evergreen, serrate, in irregular whorls. fls nodding, forming a terminal, few-fld umbel, on a long naked peduncle, petals 5, spreading, stamens 10, the anthers opening with 2 pores at the apex, the filaments short, dilated, style short, with a peltate stigma fr a dehiscent, deeply furrowed, 5-celled caps with numerous minute seeds — Four species in N. Amer., Eu., and N. Asia to Japan; formerly united with Pyrola Low evergreen plants, with pretty white or reddish fls in summer They grow best in a light, sandy soil, mixed with peat or leaf-mold, and prefer a half-shady position Prop. by division of the creeping rootstock. Useful in wild borders.

A. *Lvs broadest above the middle.*

umbellàta, Nutt. (*C. corymbòsa*, Pursh) Five to 12 in lvs 3–6 in a whorl, short-petioled, cuneate-lanceolate to oblong-obovate, sharply serrate, dark green and shining above, 1–2 in. long fls. 4–7, white or reddish, ½–¾in. wide. N. Amer, from Canada to Mex, Eu, Japan B M 778. L B C 5 463. Mn 7·161.—Lvs. said to be employed in rheumatic and kidney affections

AA *Lvs broadest below the middle.*

maculàta, Pursh Fig 919 Lower and less branched than the foregoing. lvs. usually in 3's, ovate or oblong-

lanceolate, sparsely and sharply serrate, variegated with white along the nerves, 1–2 in long fls 2–5, white, ¾in. wide. From Canada to Ga. and Miss. B.M. 897. Mn. 9 1. G C III. 32 318.

Ménziesii, Spreng Slender plant, 3–8 in high: lvs. alternate or in 3's, ovate to oblong-lanceolate, acute at both ends, ¾–1¾ in. long, sharply serrate, sometimes variegated fls 1–3, white, ½in across, filaments with a round dilated portion in the middle Brit Col. to Calif ALFRED REHDER.

CHIMONÁNTHUS. *Meratia*

CHINA ASTER. *Aster*

CHINA-TREE: *Melia.*

CHINA WOOD-OIL. *Aleurites Fordii*

CHINESE LANTERN PLANT: *Physalis.*

CHINESE LAUREL. *Antidesma.*

CHINESE SACRED LILY *Narcissus.*

CHINKAPIN, CHINQUAPIN: *Chestnut* and *Castanea*

CHIOCÓCCA. *Rubiàceæ* SNOWBERRY (which the name means in Greek). Shrubs, mostly climbing or trailing, of Trop Amer (a half-dozen or so species), and 3 in extreme S. Fla Fls in axillary panicles, the corolla funnelform and 5-parted, stamens 5, inserted on the base of the corolla, the filaments cohering at base, style filiform, the stigma club-shaped; ovary 2–3-loculed, becoming a small globular 2-seeded drupe **C. racemòsa,** Linn , of the Fla Keys and S , is sometimes cult in hothouses for its panicles of yellowish white fls and the white frs.: lvs. ovate to lanceolate, thick and shining, entire drupes ¼in diam twining, glabrous **C. anguifuga,** Mart (*C brachiàta,* Ruiz & Pav), of S Amer , the root affording a native snake-bite remedy, has appeared in cult (under the name var. *acutifòlia*) · woody, with erect branches lvs ovate, 3 in or less long, sharp-acuminate fls ¼in long with recurved lobes, in axillary panicles shorter than the lvs —In S Fla or on the Keys, 2 other species occur, but they apparently are not in cult *C álba,* Hitchcock. Large, erect or reclining · lvs elliptic to ovate fls white, often becoming yellow. *C. pinetòrum,* Brit Small, trailing. lvs. mostly elliptic to oblong corolla always white L H. B ·

CHIÓGENES (Greek, *snow, offspring,* referring to the snow-white berries) *Ericàceæ* SNOWBERRY. Creeping plant, rarely grown in rockeries for the carpeting effect of the evergreen foliage and for the attractive white berries, with small alternate 2-ranked lvs and inconspicuous axillary fls ; corolla short-campanulate, 4-cleft, stamens 8, included, with short filaments, anthers opening by a slit · berry white, many-seeded — Two species in the colder regions of N. Amer and Japan Slender trailing evergreens, in appearance much like the cranberry, rarely cult Thriving best in moist and peaty soil, in a shaded position, creeping amongst growing moss. Prop by seeds, by division or by cuttings in Aug under glass. The American species, **C. hispídula,** Torr & Gray (*C. serpyllifòlia,* Salisb), has hirsute branches and ovate or oval, ¼–½in -long ciliate lvs , greenish white fls. and white berries, ¼in. across, usually hirsute. ALFRED REHDER.

CHIONÁNTHUS (Greek for *snow* and *flower,* alluding to the abundance of snow-white fls). *Oleàceæ.* FRINGE TREE Woody plants grown for their profusely produced white flowers.

Shrubs or low trees, with deciduous, opposite and entire lvs : fls in loose panicles from lateral buds at the end of last year's branches, white, dioecious or only functionally dioecious, calyx 4-cleft; corolla divided nearly to the base in 4 narrow petals, stamens 2, short; ovary superior, 2-celled; style very short with a 2-lobed stigma. fr a 1-seeded oval drupe —Two species in E. N. Amer. and China Ornamental shrubs, with large, dark green foliage, and very showy white fls in early summer. The American species is almost hardy N , but requires a somewhat sheltered position, the Chinese may be more tender, but has proved hardy at the Arnold Arboretum They thrive best in a somewhat moist and sandy loam, and in a sunny position Prop by seeds sown in fall or stratified, increased also by layers and by grafting under glass or budding in the open air on ash seedlings (in Europe, *Fraxinus Ornus* is preferred), sometimes by cuttings from forced plants in early spring

virgínica, Linn Fig 920 Large shrub or slender tree, to 30 ft lvs oval or oblong, acuminate, pubescent beneath when young, mostly glabrous at length, 4–8 in long panicles 4–6 in long, pendulous, fls functionally dioecious, petals 1 in long fr dark blue, ovoid, ½in long May, June From Pa to Fla and Texas L B C 13 . 1264 Gt 16 564 Mn. 2 154 G F 7 325. A G 22 362 F E 29 733 Gng. 16 306 G M 31 527 V 10 227 G W S, p 293 M D G 1899 412, 413, 1900 413, 1907 73, 337 —Variable in shape and pubescence of the lvs , and several varieties have been distinguished, but none of them sufficiently distinct for horticultural purposes The staminate plants are showier in flower on account of their larger panicles and broader petals, but lack the attractive pendulous blue frs in autumn. Root-bark tonic, febrifuge, laxative, reputed narcotic



920 Chionanthus virginica. (×½)

retùsa, Lindl (*C chinénsis,* Maxim) Shrub, with spreading branches, or small tree, to 20 ft lvs obovate or oval to oval-oblong, acute or obtuse, sometimes emarginate, pubescent on the veins beneath, at least when young, and reticulate, petioles densely pubescent fls dioecious, fragrant, in panicles 2–4 in long, petals about ½in long, narrow oblong drupe ovoid, dark blue, ½in long China P F G 3, p. 85 G C II 23 821; III. 47.328, 329 Gt 35, p 667 A G. 13 374; 20 107; 22·363 Mn 2 157 G F 7 327 G 29:347; 33·521. Gn. W. 8 453 — Young plants have the lvs. serrulate. ALFRED REHDER

CHIONODÓXA (Greek, *snow* and *glory*). *Liliàceæ* GLORY-OF-THE-SNOW. Very early-blooming hardy bulbs, flowers and leaves appearing together

Closely allied to Scilla, but differs, among other characters, in having a short tube to the corolla fls blue (running into white and red forms), with recurved-spreading acute segms , dilated filaments, and small or capitate stigma —Four species, Crete to Asia Minor.

These are among the best of early-flowering plants, blooming in February, March and April, according to the locality, with the early snowdrops and scillas Since their introduction to cultivation by Maw in 1877, they have been widely cultivated under the popular name of "glory-of-the-snow," in allusion to their early-blooming habit *C. Lucilæ* is the most widely cultivated species This varies much in color, the type having flowers whose petals are more or less deeply tipped with blue, shading to white at their bases *C Lucilæ* also occurs with pure white flowers, and in reddish and pink forms *C sardensis* has smaller flowers of a deeper tone of blue and without the white markings of the petals. There are two varieties of this, one with white

and the other with black stamens *C. grandiflora* is the largest-flowered of the group, the type being slaty blue with dark lines down the center of the segments; however, like others of the genus, there are pink and white forms sometimes found in collected bulbs, although somewhat rare. *C. Tmolusii*, one of the kinds sent out by Whittall of Smyrna some years ago, is very like *C. Luciliæ* in form but of a deeper blue and a distinctly later flowering habit. Chionodoxas hybridize with Scilla, and the hybrids are sometimes known as chionoscillas.—Chionodoxas thrive in any fertile soil, well drained and not too heavy, and in any exposure, the main requisite for growth being that they have light and an adequate supply of moisture while growing and until the foliage is ripened. The bulbs should be planted about 3 inches deep, and closely, say an inch or less apart. Lift and replant about the third year. They need no winter covering. They flower well in pots in winter in a coolhouse temperature. Must be forced only gently, and given abundance of air, light and moisture. They are increased by offsets and seeds, which they produce freely. Under favorable conditions they increase rapidly by self-sown seeds. Preferably, seeds should be sown in a frame, and may be expected to germinate the following winter. Under ordinary conditions, self-sown seeds germinate early in the year, or late winter. (J. N. Gerard.)

Luciliæ, Boiss. Fig. 921. Bulb ovoid, brown-coated. lvs. long and narrow, 2 or 3 with each st., scape 3–6 in. high, bearing a dozen or less bright blue, more or less hanging, white-centered fls. Asia Minor and Crete. B.M. 6433. Gn. 28, p. 179.—Runs into many forms, one of which has white fls. **C. gigantèa,** Hort., is a larger form of it, distinct in habit. **C. grandiflòra,** Hort., is a large garden form, with fls. violet-blue and white in the throat. Var. **Fórbesii,** Hort., somewhat taller and bearing more fls. **C. amábilis Leichtlinii,** Hort., is a very handsome form, 2 weeks later than the others; fls. 1¾ in. across, with broad full segms. of soft creamy white shaded rose-purple. **C. Tmolùsii,** Hort., is a late-blooming form, bright blue and white, apparently a variant of *C. Luciliæ*.



921. Chionodoxa Luciliæ. (×½)

sardénsis, Drude. Fls. 2–6, smaller, much darker blue with no white in the eye, the perianth-limb twice longer than the tube; lvs. channeled. Sardis. Gn. 28.178.—Probably a form of *C. Luciliæ*.

crética, Boiss. & Held. Slender: fls. smaller and fewer (1–2 on a scape) than *C. Luciliæ*, white or very pale blue. Crete.—Of little horticultural value.

Állenii, Hort. (*Chionoscilla Allenii*, Hort.). Perianth segms. cut to the base: habit of *C. Luciliæ*, but the white eye is indistinct. Supposed natural hybrid of *Scilla bifolia* and *Chionodoxa Luciliæ*. G.C. III. 21:191. There is said to be another *C. Allenii* that is a direct selection probably from *C. Luciliæ*, very like var. *grandiflora*. *Chionoscilla Penryi* is another Chionodoxa× Scilla hybrid, the exact parentage not being stated.

L. H. B.

CHIONOSCILLA: Hybrids of Chionodoxa and Scilla, consult these genera.

CHIRANTHODÉNDRON (Greek, signifying *handflower-tree*) *Sterculiàceæ*. Odd-flowered ornamental tree of Mexico and to be expected in West Indies and elsewhere in cultivation.

A *monotypic* genus, which together with the Californian *Fremontodendron* forms the remarkable group Fremontieæ. The fls. are devoid of a corolla, but in its place have a large deeply 5-parted cup-shaped calyx, concave at the base, in which there are 5 glands which secrete an abundance of honey, stamens united together for about one-third their length, above which they separate into 5 rays bearing linear anthers which dehisce by a longitudinal groove, style issuing from the center of the stamens and terminating in a pointed stigma fr. a woody caps. with 5 valvate dehiscent lobes. foliage linden-like and densely clothed with stellate hairs.



922. Chiranthodendron platanoides. The hand-flower. (×⅓)

platanoides, Baill. (*Cheirostèmon platanoides*, Humb. & Bonpl.) The celebrated Macpalxochiquahuitl, or Handflower Tree of the Mexicans, also called Mano de Mico, Monkey's Hand, and Devil's Hand. Fig. 922. The remarkable feature of the fl. is the form of the bright red stamens, which resemble the fingers of a human hand and are tipped with appendages like claws, from the base of the fingers issues the style which is more or less like a thumb. A single tree growing near the city of Toluca was known to the ancient Mexicans, who regarded it with superstitious veneration. It was of great age and was supposed to be the only tree of its kind in the world. But an entire grove of the trees was discovered in Guatemala on the slope of the Volcano de Agua, near the town of Antigua, whence in pre-Columbian times the specimen had been brought. This established itself on the slope of the volcano of Toluca, where the conditions of soil and climate were similar to those of its original habitat.

W. E. Safford

CHIRÌTA (Hindostani name). *Gesneràceæ*. Plants much like gloxinias and streptocarpuses. A genus of 100 species, none of which is in the American trade. They are natives of E. Asia and are herbs or low undershrubs with opposite, often unequal lvs.. fls. in shades of purple and blue, tubular, in clusters on the tops of short scapes. For cult., see *Gloxinia*.

C. barbàta, Sprague. Perennial. fls. pedicellate, corolla funnel-shaped, bluish lilac, with yellow band in front. India. B.M. 8200.—*C. rupéstris*, Ridl. Bushy, compact annual. Malay Peninsula. B.M. 8333.—*C. sinénsis*, Lindl., is the best known

species and is well worth cult. It has bright green lvs. and scapose cymes of blue and white fls., the yellow anthers of which add attractiveness. B R. 30 59.—A variegated form is known

N. TAYLOR.†

CHIRÒNIA (classical mythological name) *Gentianàceæ* A dozen or so soft perennial herbs or shrubs of Afr , rarely seen in collections of greenhouse material Fls in shades of red and purple, terminal, with a salver-form corolla and short tube: lvs opposite, sessile, on single or branching sts Most of them are from the Cape region.

CHIVE, or CHIVES (written also Cive) *Allium Schœnóprasum*, Linn., a perennial plant native to Europe and the northern borders of the United States and northward See *Allium* The leaves of chive are used green as seasoning in soups, salads and stews Chive grows 6 to 8 inches high, making dense mats of narrow hollow leaves, and blooming freely in violet-colored heads, which scarcely overtop the foliage, bulbs small, oval. The plant makes an excellent permanent edging, and is worth growing for this purpose alone. It is easily propagated by dividing the clumps; but, like other tufted plants, it profits by having the stools broken up and replanted every few years. It rarely seeds. It thrives in any garden soil. The leaves may be cut freely, for they quickly grow again.

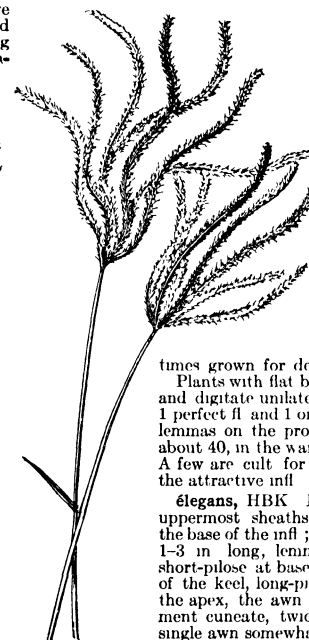
L. H B.

CHLIDÁNTHUS (*delicate flower*, from the Greek) *Amaryllidàceæ*. Tropical American summer-flowering bulbs. Allied to Zephyranthes.

Flowers erect, yellow, fragrant, in a small 2-bracted umbel, terminating a solid scape, long-tubed, with wide-spreading segms ; stamens 6, inserted at the throat, the filaments unequal and dilated at base· fr a 3-valved caps . lvs long and strap-shaped bulb tunicate —Three or four species Mex , and S Amer.



923. Chloris elegans (×⅓)



924 Chloris polydactyla. (×⅓)

Chlidanthuses are increased by offsets or by seeds. The bulbs should be kept dry and cool during winter and in spring started in a moderately warm house. After flowering, care must be taken to have the bulbs make their annual growth. They may either be grown in pots plunged in ashes, or planted out where they can be watered occasionally during dry weather. Like other similar plants, they will benefit by a mulching of spent hops or rotted manure (G W Oliver)

fràgrans, Herb (*C lùteus*, Voss) Bulb large and ovoid: lvs. about 6, appearing in spring or early summer with the fls , narrow, glaucous, obtuse fls 4 or less in each umbel, 3 in or less long, nearly sessile, erect, on a 2-edged scape or peduncle 10 in or less high. Andes. B.R 640 F S. 4:326.—A good summer-blooming plant.

Éhrenbergii, Kunth. Somewhat taller: fls. yellow, nearly horizontal, distinctly stalked, the 3 outer segms. wider than the inner. Mex.—Perhaps a form of the above.

L. H. B.

CHLORÁNTHUS (*green flower*). *Chloranthàceæ*. Tropical herbs, shrubs or trees, one of which is sometimes grown under glass in the North.

Perennial aromatic herbs or evergreen shrubs, with jointed sts opposite simple lvs , and small, inconspicuous fls , in slender terminal spikes. perianth represented by a single scale, in the axil of which is the 1-loculed ovary and mostly 3 united stamens (the side stamens sometimes obsolete) —Some 10 species in the eastern tropics Two other genera (Ascarina and Hedyosmum) comprise the family Chloranthaceæ, of the pepper-like series of plants

brachýstachys, Blume. Shrub used for pot-growing, reaching a height of 1–2 ft , bearing glossy foliage and small yellow berries stamen single in each fl . lvs long-lanceolate, acuminate, serrate —Tropics and subtropics, Ceylon eastward There is a variegated-leaved form.

L H. B.

CHLÒRIS (the goddess of flowers) *Gramineæ* FINGER-GRASS Annual or usually perennial grasses, sometimes grown for decoration

Plants with flat blades, compressed sheaths and digitate unilateral spikes spikelets with 1 perfect fl and 1 or more rudimentary sterile lemmas on the prolonged rachilla —Species about 40, in the warmer regions of the world A few are cult for ornament on account of the attractive infl Of simple treatment

élegans, HBK Fig 923 Annual, 1–3 ft : uppermost sheaths usually inflated around the base of the infl ; spikes 6–12, pale or dark, 1–3 in long, lemma fusiform, 1 line long, short-pilose at base and along the lower half of the keel, long-pilose on the margins near the apex, the awn about 5 lines long, rudiment cuneate, twice as long as broad, the single awn somewhat shorter than the awn of the perfect floret Mex Dept Agric , Div. Agrost , 7:192, 20 102

polydáctyla, Swartz (*C barbàta*, Nash) Fig 924 Perennial, 1–3 ft. spikes several, awns 2–3 lines, rudiment triangular-truncate, the 2 awns about as long as the awn of the perfect floret. Tropics of both hemispheres.

verticillàta, Nutt. WINDMILL-GRASS Perennial, 4–15 in spikes several, slender, in 1–3 whorls, 2–4 in long; awns 2–3 lines, lemma 1 line long, nearly glabrous; rudiment oblong-truncate, 1-awned Dept Agric , Div Agrost 7 191. Kan to Texas.

radiàta, Swartz. Perennial, 2–3 ft · spikes several, about 3 in. long; spikelets slender; lemma slightly ciliate on callus and near apex, the awn 6 lines long; rudiment narrow, acute, the single awn about half as long as the awn of the perfect floret. W Indies

gayàna, Kunth. RHODES-GRASS. Robust perennial, with abundant foliage and terminal umbels of 6–15 spikes —An African species at present under experimentation in U. S. in dry regions. Cult. in Austral. (See Agr. Gaz. New S. Wales 19:19, 118, 389 [1908]).

truncàta, R. Br. (*C. barbàta vèra,* Host., not *C. barbàta,* Swartz or Nash). STAR-GRASS. A stoloniferous perennial, with erect culms 1–3 ft.: spikes 6–10, 3–6 in., becoming horizontal or reflexed; spikelets 1½ lines, dark at maturity, the awns 3–6 lines long. Austral. Turner, Austr. Grasses 1:17.—Cult. for ornament

C. gràcilis, Dur.=Leptochloa virgata, Beauv. This has been recommended as an ornamental.—*C. petræa,* Swartz, and *C. glauca,* Vasey, both handsome species from Fla., have been recommended for cult. as ornamentals.

A. S. HITCHCOCK.

CHLORÓCODON (Greek for *green* and *bell,* alluding to the flowers) *Asclepiadàceæ.* Twiners, one of which is planted far South.

Large plants with opposite cordate entire heavy lvs., notched stipules and purplish or greenish fls. in axillary panicles; calyx 5-parted, corolla deeply 5-lobed, corona of 5 lobes coming from the base of the filaments, the lobes obcordate or broader, sometimes with an erect or incurved projection or horn on the back; pollen granular.—Two species in Trop. and S. Afr. *C. ecornutus,* N. E. Br., is apparently not in cult.

Whitei, Hook. f. Strong woody twiner, with large opposite cordate-ovate thick lvs. and axillary clusters of odd fls. ¾–1 in. diam., corolla rotate-bell-shaped, thick, segms. ovate and acute, purple and with margins and central stripe green, and bearing long-notched lobes, corona-lobes horned, anthers connivent over the capitate stigma. Guinea to Natal. B. M. 5898. G. C. III. 18: 243.—It is now cult. in S. Fla. and S. Calif. The roots are used medicinally in Natal, under the name of mundi. The plant is an interesting greenhouse climber, but not handsome. L. H. B.

CHLORÓGALUM (*green* and *milk,* from the Greek, referring to the juice of the plant) *Liliàceæ.* Hardy West American bulbs, allied to Camassia.

Tall plants with a tunicated bulb; lvs. at base of st., long-linear, wavy-margined, those on the st. very small; fls. white or pink, in a panicle terminating a nearly leafless st., on jointed pedicels, segms. of perianth 6, 3-nerved, at length twisting over the ovary; stamens 6, not exceeding segms.; style long and deciduous. Plants of easy cult., to be treated like camassias or ornithogalums. Three species, in Calif.

A. *Pedicels nearly as long as the fls.: segms. spreading from near the base.*

pomeridiànum, Kunth (*Anthéricum califórnicum,* Hort.) SOAP-PLANT. AMOLE. St. reaching 5 ft., many-branched, from a very large bulb; fls. small (1 in. or less long) and star-like, numerous, white with purple veins, on spreading pedicels, opening in the afternoon (hence the specific name *pomeridianus, post-meridian*).—Bulb used by Indians and Mexicans for soap-making. Has been catalogued as *Anthéricum califórnicum.* Bulb 4 in. long and half as thick, covered with coarse brown fibers.

AA. *Pedicels very short: segms. spreading from above the base.*

parviflòrum, Wats. Bulb small (1 in. diam.): st. 1–3 ft., slender-branched: lvs. narrow and grass-like: fls. pinkish, ¼ in. long, ovary broad and acute.

angustifòlium, Kellogg. Low, about 1½ ft. Resembles the last, but fls. white and green-lined and somewhat larger, the ovary acute above, perianth funnel-form campanulate, the segms. narrow-oblong.

C. Leichtlinii, Baker=Camassia Leichtlinii. L. H. B.

CHLORÓPHORA (Greek, referring to the fact that the fustic-tree bears a green dye). *Moràceæ.* Two milky-juiced alternate-leaved trees, one in Trop. Afr. and one in Trop. Amer. Lvs. entire or toothed: dioecious, male fls. in cylindrical spikes, the females in nearly globular or oblong heads, these clusters solitary in the axils, perianth of male fls. 4-parted, the segms. broad and obtuse, stamens 4; ovary a minute rudiment in the males, perianth of female fls. 4-parted or -divided, the segms. concave-thickened at the apex, style lateral on the oblique-ovoid ovary, achene equaling the perianth or somewhat exserted, covering the receptacle. *C. tinctòria,* Gaud. (*Maclura tinctòria,* Don) is the fustic of the W. Indies. It reaches a height of 50 ft., and a diam. of trunk of 2 ft. usually not thorny. lvs. nearly entire, oblong, acuminate. Variable. The handsome yellow wood yields a yellow dye, which is used also in the making of browns and greens, it is also a strong and resistant timber. L. H. B.

CHLORÓPHYTUM (name means, in Greek, *green plant*) *Liliàceæ.* Rhizomatous herbaceous plants, one of which is familiar in greenhouses.

Very like Anthericum, but differing in the thickened filaments of the stamens and the 3 angled or 3-winged caps: infl. often denser; lvs. broader, often oblanceolate and petiolate; seed disk-like.—Some 60 or more species, in warm parts of Asia, Afr., and Amer. Consult *Anthericum* and *Paradisea.*

elàtum, R. Br. (*Anthéricum variegàtum, A. vittàtum, A. picturàtum, A. Williamsii,* Hort.) Root fleshy and white; lvs. freely produced from the crown, often 1 in. wide, flattish and bright green, or in the garden varieties with white lines along the margins, and often (var. *picturatum*) also with a yellow band down the center; scape terete and glabrous, 2–3 ft. high, branched, fls. white, ½ in. long, with revolute oblanceolate segms., which are obscurely 3-nerved on the back. S. Afr. F. S. 21: 2240–1.—A valuable and common plant for vases and pots, and sometimes used in summer borders.

Three species that recently have been mentioned in horticultural literature are *C. amaniense,* Engler, from German E. Afr., 10 in. lvs. lanceolate-acuminate, 16 in. long and 3½ in. or less broad, somewhat fleshy, bronze, with white margin; fls. greenish white, in cluster 6 in. long.—*C. comòsum,* Wood (Natal Plants, fig. 279), from Lake Albert, Cent. Afr., proliferous; lvs. radical, linear, deep green, 2 ft. long; fls. small, white, soon fading, usually in 4's, in a branched cluster 3 ft. long.—*C. Huyghei,* De Wild, Congo, lvs. in a basal tuft, lanceolate, petioled, about 18–20 in. long, 2–2½ in. broad; fls. greenish white, about ¼ in. long, in a bracted raceme 2–3 ft. long. L. H. B.

CHLORÓPSIS BLANCHARDIÀNA: *Trichlorie.*

CHLORÓXYLON (*green wood*· Greek) *Rutàceæ.* One species of moderate-sized tree of India, slightly intro. in this country, **C. Swietènia,** DC. (*Swietènia Chloróxylon,* Roxbg.) Young parts gray-puberulent: lvs. abruptly pinnate, the lfts. 20–40, oblique and obtuse and entire; fls. small, 5-merous in terminal and axillary pubescent panicles, calyx deeply lobed, petals clawed, spreading, stamens 10, disk a 10-lobed pubescent body, in which the stamens are inserted; fr. a coriaceous 3-celled caps. Heartwood fragrant, with a beautiful satiny luster, whence the name "Indian Satin-wood." An interesting tree for trial on the southern borders of the U. S. L. H. B.

CHOCOLATE: *Theobroma.*

CHOÍSYA (J. D. Choisy, Swiss botanist, 1799–1859). *Rutàceæ.* One Mexican shrub, **C. ternàta,** HBK., grown in S. Calif. and S. Fla., and sometimes under glass. It grows 4–8 ft. high, making a compact free-blooming bush, with opposite ternate lvs., the lfts. lance-obovate or oblong, thick and entire, with pellucid dots; fls. in a terminal, forking cluster, white, fragrant, orange-like (whence the vernacular name "Mexican orange"), 1 in. across, with pellucid dots. R. H. 1869. 330. Gn. 50, p. 203. J. H. III. 34: 253.—A handsome shrub, worthy of greater popularity. It will endure several degrees of frost, and should succeed in the open in many of the southern states. Blossoms in S. Calif. at different seasons; it can be made to bloom, it is said, every two months by withholding water and then watering liberally, as is done with roses in S. France. Hardy against a wall in parts of S. England. L. H. B.

CHOKE-CHERRY. *Prunus demissa* (West) and *P. virginiana* (East).

CHONDROBÓLLEA (compounded from Chondrorhyncha and Bollea) A genus established to contain hybrids between these genera See also *Bolleo-Chondrorhyncha*

CHONDROPÉTALUM: hybrids of Chondrorhyncha and Zygopetalum, see those genera.

CHONDRORHÝNCHA (*cartilage* and *beak*). *Orchidàceæ* Three species of S American epiphytal orchids, practically unknown in the American trade Cult. as for *Odontoglossum crispum*. They are short-stemmed herbs without pseudobulbs, and oblong, plicate, petioled lvs, the simple scape bearing a single large, odd, yellowish fl *C Chèstertonii*, Reichb f (O R. 11·305; 16·57), *C. fimbriàta*, Reichb. f, and *C.ròsea*, Lindl, are the species Keep cool and moist. A garden hybrid is reported between *C Chestertonii* and *Zygopetalum Mackayi* under the name of *Chondropetalum Fletcheri*. O R. 1908, 56, f. 8. GEORGE V. NASH.

CHORÍSIA (Ludwig Choris, born 1795, artist of Kotzebue's expedition) *Bombacàceæ*. Spiny trees of S. Amer (3 species), one of which is somewhat cult. Lvs alternate, digitate, of 5–7 entire or serrate lfts fls large, with 5 linear or oblong petals, the peduncles axillary or racemose; staminal tube double, the outer one short and with sterile anthers; ovary 5-loculed and many-ovuled fr a pear-shaped caps. with many silky seeds **C. speciòsa,** St. Hil, of Brazil, the "floss silk tree," is cult in S Calif, and is adapted to warm glasshouses It is a medium-sized tree, allied to Ceiba and Bombax Lfts. lanceolate, acuminate, dentate· calyx irregular, shining outside, but silky inside, petals obtuse, yellowish and brown-striped at the base, pubescent on the back The soft silk or cotton of the seed-pods is used for pillows and cushions. L. H. B.

CHORÍZEMA (fanciful Greek name) Sometimes spelled *Chorozema Leguminòsæ* Evergreen coolhouse small shrubs grown for the showy pea-like yellow orange and red, usually racemose flowers; spring- and summer-blooming

Woody plants of diffuse or half-climbing habit, with thick and shining simple often spiny-toothed lvs and pea-like red or yellow fls calyx-lobes 5, the 2 upper ones mostly broader; petals clawed, the standard very broad, keel short, stamens not united: pod short, not constricted —About 15 species, in Austral., 3 of which



925. Chorizema ilicifolium (×⅓)

appear to be chiefly concerned in the garden forms. Handsome plants for the cool greenhouse, less popular in this country than abroad. When not grown too soft, they will stand slight frost at times. Grown in the open in S. Calif and S. Fla They are grown in a rather peaty soil, after the manner of azaleas, and usually rested in the open in summer. They are excellent for training on pillars and rafters

Chorizemas are among the most attractive spring-flowering plants, and they are not difficult to grow. Cuttings should be secured in March from medium-ripened wood and may be either potted singly in small pots, or several placed together in larger pots. The former method has the advantage, because when cuttings are well rooted in the small pots, they may be shifted along without so much disturbance to the roots. The cuttings root readily in a mixture of two parts sharp sand and one of peat, sifted through a fine sieve. They should be placed in a tight case or covered with a bell-glass in a temperature of 58° to 60° by night A rise of 10° in the day will be sufficient. The inclosure that protects them from drafts should be opened a few minutes now and then to change the air. For potting chorizemas in the early stages, equal parts of good peat and sharp sand is about right. When a 5- or 6-inch pot is reached, much less sand should be used,—just enough to give the earth a gritty feeling and the peat may be in a rather rough state, just small enough to be conveniently used in potting The potting should be firm, as loose potting is bad for all kinds of hardwood plants Keep the plants shaded from the sun during the hot months, and use the syringe freely. Also pinching must be attended to from their early stages to insure a good bushy plant It is best not to stop the plants after August, as they will begin then to set buds A plant in a 5- or 6-inch pot may be grown the first year if properly attended to The plants should be wintered in a night temperature of 40° with a rise of 10° or 15° during the day The second summer, and from that on as long as the plants are kept, they do better if plunged in a bed of clean coal-ashes out-of-doors, provided there is no danger from frost, by so doing, a much shorter-jointed growth will be the result Plants well established in their pots may be fed with liquid manure until they set buds A 3-inch potful of cow- or horse-urine to two and one half or three gallons of water, will be sufficient, and for a change a handful of soft-coal soot to the same amount of water, but always water twice with clean water between applications Brown scale sometimes gets a foothold on chorizemas and it may be eradicated by fumigation with cyanide of potassium Red-spider may be kept down with the syringe (George F Stewart)

vàrium, Benth (*C élegans*, Hort) The common cult species, in several forms erect, 4–6 ft, pubescent on under side of lvs and on branches lvs cordate-ovate, undulate and prickly-toothed, 2 in or less long: fls in many pubescent racemes, standard light orange, wings and keel handsome purple-red B R 25.49 — Garden forms are *C Chándleri*, with yellow-red standard, and blood-red wings, the fls large and numerous, and such names as *grandiflorum, macrophyllum, latifolium, floribundum, multiflorum C. Lówii*, Hort, is a form of this species, with larger and brighter-colored fls.

cordàtum, Lindl (*C supérbum*, Lem). Tall slender glabrous shrub (7–10 ft.), with weak branches lvs cordate-ovate to ovate lanceolate, 2 in. or less long, small-toothed and more or less prickly fls many, standard scarlet-red, wings and keel purple-red B R 24:10 I H 29. Var *rotundifòlium*, Hort, has roundish lvs Var. *splèndens*, Hort, is offered

ilicifòlium, Labill. Fig 925. Low and diffuse, weak, glabrous, the branches slender and erect or drooping. lvs. ovate to lanceolate, 1 in long, often cordate at base, thick, coarsely veined, strongly undulate and with prickly teeth or lobes fls in few-fld loose racemes, orange-red in spring and summer B M 1032 (as *C. nanum*). B.R. 1513 (as *C. triangulare*). L. H. B.

CHRISTMAS FLOWER: *Euphorbia pulcherrima.*

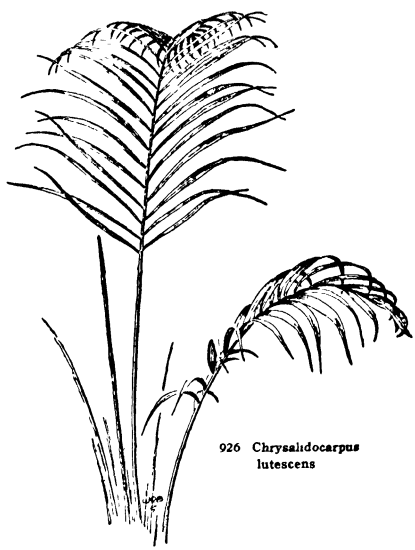
CHROSPÉRMA: *Zygadenus.*

CHROZÓPHORA (Greek, *color-bearing*, on account of their use). *Euphorbiàceæ*. Dye-yielding herbs. Lvs. alternate, stellate hairy· fls. monœcious; staminate calyx 5-parted, valvate; petals free; styles biparted,

ovary 3-celled, 3-ovuled.—Nine, species chiefly of Old World deserts. **C. tinctòria**, Juss (*Cròton tinctòrius*, Linn.), TURNSOLE, a Medit. annual, formerly used for its blue dye, is listed in some European catalogues.

CHRYSALIDOCÁRPUS (Greek for *golden fruit*). *Palmàceæ*, tribe *Arèceæ*. Spineless stoloniferous feather palms, with medium fasciculate ringed stems

Leaves pinnatisect, long-acuminate; segms about 100, bifid at the apex, the lateral nerves remote from the midrib fr usually violet or almost black.—Species 1, which is a popular florist's plant Madagascar. Treated



926 Chrysalidocarpus lutescens

as a part of Hyophorbe by Engler and Prantl, but here kept distinct, as it is commonly known as Chrysalidocarpus by cultivators.

lutéscens, Wendl (*Hyophórbe índica*, Gaertn *H Commersoniàna*, Mart *Arèca lutescens*, Bory) Fig 926 St 30 ft high, 4–6 in diam, cylindrical, smooth, thickened at the base lvs very long, segms almost opposite, lanceolate, 2 ft long, 2½ in wide, acute, with 3 prominent primary nerves, which are convex below and acutely 2-faced above Bourbon A G 13. 141 A F 4.566.—In growing *Chrysalidocarpus* (or *Areca*) *lutescens* in quantity, it will be found a good plan to sow the seeds either on a bench, in boxes or seed-pans, so prepared that the seedlings will remain in the soil in which they germinate until they have made 2 or more lvs The first if made above the soil is small, and if plants are potted off at this stage they must be very carefully watered in order not to sour the soil In the preparation of the receptacles for the seed, a little gravel in the bottom will be found good, as the roots work very freely through it, and when the time comes to separate the plants previous to potting, it is an easy matter to disentangle the roots without bruising them Probably the plan which works best is to wash the soil and gravel entirely from among the roots. Pot in soil not too dry, and for the next few days keep the house extra warm and humid, and the plants shaded from the sun without any moisture applied to the soil.

JARED G SMITH and G. W. OLIVER.

CHRYSÁNTHEMUM (Greek, *golden flower*). Including *Pyrèthrum*. *Compósitæ*. Plate XXX. A diverse group of herbaceous and sub-shrubby plants, mostly hardy, and typically with white or yellow single flowers, but the more important kinds greatly modified in form and color, grown in the open or flowered under glass in fall

Annual or perennial herbs, sometimes partly woody, glabrous or loosely pubescent or rarely viscid, usually heavy-scented lvs alternate, various, from nearly or quite entire to much dissected· heads many-fld, terminating long peduncles or disposed in corymbose clusters, radiate (rays sometimes wanting), disk-fls. perfect and mostly fertile, ray-fls pistillate, mostly fertile, the ray white, yellow, rose-colored, toothed or entire; receptacle naked, flat or convex, involucre-scales imbricated and appressed, mostly in several series, the margins usually scarious achene of disk- and ray-fls. similar, striate or angled or terete or more or less ribbed, those of the ray-fls often 3-angled, pappus 0, or a scale-like cup or raised border.—Probably nearly 150 recognizable species, in temperate and boreal regions in many parts of the globe, but mostly in the Old World.

The genus Chrysanthemum, as now accepted by botanists, includes many diverse species so far as general appearance is concerned, but nevertheless well agreeing within themselves in systematic marks and by these same marks being separated from related groups The marks are in large part set forth in the preceding paragraph Bentham and Hooker make twenty-two sub-groups (of which about six include the garden forms), based chiefly on the way in which the seeds are ribbed, cornered, or winged, and the form of the pappus The garden pyrethrums cannot be kept distinct from chrysanthemums by garden characters The garden conception of Pyrethrum is a group of hardy herbaceous plants with mostly single flowers, as opposed to the florists' or autumn chrysanthemums, which reach perfection only under glass, and the familiar annual kinds which are commonly called summer chrysanthemums When the gardener speaks of pyrethrums, he usually means *P roseum* Many of the species described below have been called pyrethrums at various times, but they all have the same specific name under the genus Chrysanthemum, except the most important of all garden pyrethrums, viz, *P roseum*, which is *C coccineum* The feverfew and golden feather are still sold as pyrethrums, and there are other garden species of less importance The botanical conception of Pyrethrum is variously defined, the presence of a rather marked pappus-border on the achene is one of the distinctions, the pyrethrums are mostly plants with large and broad heads either solitary or in loose corymbose clusters, the rays usually conspicuous and commonly not yellow, and the fruits five- to ten-ribbed Hoffmann, in Engler & Prantl "Naturlichen Pflanzenfamilien," adopts eight sections, one of them being Tanacetum (tansy) which most botanists prefer to keep distinct

Although the genus is large and widespread, the number of plants of interest to the cultivator is relatively few Of course the common garden chrysanthemum, derived apparently from two species, is the most useful The insect powder known as "pyrethrum," is produced from the dried flowers of *C cinerariæfolium* and *C coccineum* The former species grows wild in Dalmatia, a long narrow mountainous tract of the Austrian empire "Dalmatian insect powder" is one of the commonest insecticides, especially for household pests *C. cinerariæfolium* is largely cultivated in France *C. coccineum* is cultivated in California, and the product is known as buhach

There are over one hundred books about the garden chrysanthemum, and its magazine literature is probably exceeded in bulk only by that of the rose It is the flower of the East, as the rose is the flower of the West.

Aside from oriental literature, there were eighty-three books mentioned by C. Harman Payne, in the Catalogue of the National Chrysanthemum Society for 1896 Most of these are cheap cultural guides, circulated by the dealers The botany of the two common species has been monographed by W B. Hemsley in the Gardeners' Chronicle, series III, vol. 6, pp 521, 555, 585, 652, and in the Journal of the Royal Horticultural Society, vol. 12, part I. The great repositories of information regarding the history of the chrysanthemum, from the garden point of view, are the scattered writings of C. Harman Payne, his "Short History of the Chrysanthemum," London, 1885, and the older books of F. W. Burbidge and John Salter. For information about varieties, see the Catalogues of the National Chrysanthemum Society (England) and the Liste Descriptive, and supplements thereto, by O Meulenaere, Ghent, Belgium There are a number of rather expensive art works, among which one of the most delightful is the "Golden Flower: Chrysanthemum," edited by F. Schuyler Mathews, Prang, Boston, 1890. "Chrysanthemum Culture for America," by James Morton, Clarksville, Tenn, published in New York in 1891, was the first authentic American work. Within the past few years have appeared "The Chrysanthemum," by Arthur Herrington, "Smith's Chrysanthemum Manual," by Elmer D Smith, and recently "Chrysanthemums and How to Grow Them," by I. L. Powell



927. Chrysanthemum carinatum, the form sold as C Burridgeanum. (×⅓)

Aside from the florist's chrysanthemum (*C. hortorum*), no particular skill is required in the growing of these plants, although great perfection is attained by some gardeners in the handling of individual plants of the marguerites (*C. frutescens*). The hardy border perennial chrysanthemums may be either small-flowered rugged forms of *C hortorum*, as the "hardy pompons" and also the "artemisias" of old gardens, or they may be other species. Some of these other species are the "pyrethrums" of gardens, and some (as the *C. maximum* and *C. uliginosum* class) are the "moon daisies" and "moonpenny daisies" of the hardy perennial plantation. Some of the very dwarf tufted kinds (as *C. Tchihatchewii*) make excellent edging plants. The moon daisies deserve to be better known for mass planting and bold lines when a great display of heavy white bloom is wanted. Most of them bloom the first season from early-sown seed. The Shasta daisy and its derivatives are of the moon daisy group. They all profit by a covering of coarse mulch in the fall. See *Pyrethrum* and *Marguerite*.

The annual chrysanthemums are easily grown flower-garden subjects, suitable for a bold late display in places where delicate and soft effects are not desired. *C. carinatum*, *C. coronarium* and *C. segetum* are the common sources of these annuals They are hardy and rugged; and they need much room.

INDEX

achilleæfolium, 8.
anethifolium, 13.
annulatum, 1
arcticum, 22
atrosanguineum, 14.
aureum, 10
Balsamita, 16
Burridgeanum, 1.
carinatum, 1
cinerariæfolium, 15.
coccineum, 14
coronarium, 2
corymbosum, 9
Davidsii, 18
Dunnettii, 1.
filiforme, 18
fœniculaceum, 13.
frutescens, 12
glaucum, 10.
gracile, 5
grandiflorum, 3, 12.
hortorum, 6
hybridum, 14.
indicum, 6
laciniatum, 10.
lacustre, 17
latifolium, 17
Leucanthemum, 20.
marginatum, 7
Marschallii, 14
matricaroides, 1.
maximum, 18
morifolium, 5.
multicaule, 4
nipponicum 21.
ornatum, 7.
Parthenium, 10.
pinnatifidum, 20.
præaltum, 10.
pumilum, 3.
Robinsonii, 18.
roseum, 14
segetum, 3
selaginoides, 10.
Shasta daisy, 18.
sinense, 5
tanacetoides, 16.
Tchihatchefii, 11.
Tchihatchewii, 11.
tricolor, 1.
uliginosum, 19.
venustum, 1.

A. *Plant annual (at least so treated in cult): the "summer chrysanthemums"*

B. *Rays typically white.*

1. **carinàtum,** Schousb (*C tricolor*, Andr *C. matricaroìdes*, Hort) Fig. 927 Glabrous annual, 2–3 ft. high st much branched. lvs rather fleshy, pinnatifid fls in solitary heads which are nearly 2 in across, with typically white rays and a yellow ring at the base, involucral bracts carinate (keeled). Summer The two colors, together with the dark purple disk, gave rise to the name "tricolor" The typical form, intro. into England from Morocco in 1798, was pictured in B M 508 (1799) By 1856 signs of doubling appeared (F S 11 1099). In 1858 shades of red in the rays appeared in a strain intro. by F K Burridge, of Colchester, England, and known as *C Burridgeànum*, Hort (see B M. 5095, which shows a ring of red on the rays, adding a fourth color to this remarkably brilliant and varied fl, and F S 13 1313, which also shows *C. venùstum*, Hort, in which the rays are entirely red, except the original yellow circle at the base) G 2 307 Gn W. 24.675 *C. annulàtum*, Hort, is a name for the kinds with circular bands of red, maroon, or purple. R H 1869 450 *C Dùnnetti*, Hort, is another seed-grower's strain There are full double forms in yellow margined red, and white margined red, the fls 3 in. across (see R H 1874 410), under many names See, also, Gn 26, p. 440; 10, p 213; 21 22 R H. 1874, p 412 S H. 2 477. G.W 14, p 99 — The commonest and gaudiest of annual chrysanthemums, distinguished by the keeled or ridged scales of involucre and the dark purple disk.

BB. *Rays typically light yellow*

2 **coronàrium,** Linn. (*Anthemis coronària*, Hort), Annual, 3–4 ft lvs. bipinnately parted, somewhat clasping or eared at the base, glabrous, the segms closer together than in *C. carinatum* involucral scales broad, scarious; rays lemon-colored or nearly white. July–Sept Medit. Gn 26 440 G C II 19.541 — The full double forms, with rays reflexed and imbricated, are more popular than the single forms This and *C. carinatum* are the common "summer chrysanthemums" This is common in old gardens, and is also somewhat used for bedding and for pot culture.

BBB. *Rays typically golden yellow.*

3. **ségetum,** Linn Corn Marigold. Annual, 1–1½ ft.: lvs sparse, clasping, oblong to oblanceolate, variable, the lower petioled and the upper clasping incisions coarse or fine, deep or shallow, but usually only coarsely serrate, with few and distant teeth, the lower ones less cut· bracts of involucre broad, obtuse; rays obovate and emarginate, golden yellow. June–Aug. Eu., N. Afr., W. Asia. Escaped in waste places. Gn. 18, p. 195. R.H. 1895, pp 448, 449. Var. **grandiflòrum,** Hort, is a larger-fld form of this weed, which is com-

mon in the English grain fields. Forms of the plant are cult ; the var. Cloth of Gold, J.H. III. 12:445, is one of the best Var. **pûmilum,** Hort., very compact, 8 in. high. This species is much less popular than *P carinatum* and *P coronarium* It is forced to a slight extent for winter bloom.

4 **multicaûle,** Desf. Glabrous and glaucous annual, 6–12 in high· sts numerous, simple or branched, stout, terete· lvs. fleshy, variable, usually linear-spatulate, 1–3 in long and ½–¾in broad, very coarsely toothed or lobed, sometimes shorter, with few narrow-linear, acute, entire segms about 1 line broad rays much shorter and rounder than in *C. segetum*, golden yellow. Algeria B M 6930 —Rarer in cult than the last. Said to be useless as a cut-fl.

AA *Plant perennial.*

B. *The florist's chrysanthemum, and wild progenators or near relatives, grown as pot or bench subjects because the seasons are not long enough, in the N , for full maturity in the open rays of many forms and colors in cult , heads often double: lvs usually lobed or strongly notched*

5 **morifôlium,** Ram (*C sinénse*, Sabine) Fig 928. Perennial, one of the sources (with *C. indicum*) of the large florist's chrysanthemums wild plant shrubby erect and rigid, 2–3 ft , branching, few-lvd : lvs thick and stiff, 2 in long, densely white-tomentose beneath, variable in shape from ovate to lanceolate, cuneate at base, margin entire or coarsely toothed outer bracts of involucre thick, linear, acute, white-tomentose, fl.-heads small, with yellow disk and white rays somewhat exceeding the disk China G C III 31.302 (adapted in Fig 928) Var **grácile,** Hemsl Lvs thin or only moderately thick, palmately lobed or pinnately lobed, dentate, the teeth often mucronate outer involucral bracts herbaceous, linear and acute, varying in pubescence, rays white, pink or lilac, equaling or exceeding the disk China, Mongolia, Japan

6 **índicum,** Linn Fig 929. Much like the last, but lvs. thin and flaccid, pinnately parted, with acute or



928. Wild form of Chrysanthemum morifolium, as grown in England.



929. Wild form of Chrysanthemum indicum, as grown in England.

mucronate teeth outer involucral bracts broad and scarious except the herbaceous midnerve, rays yellow, shorter than diam of the disk China and Japan. B M 7874 G C III 8 565, 28 342, 31 303 (adapted in Fig 929) —This species is not native to India, and therefore Linnæus' name is inappropriate Abroad, *C indicum* is often used in a wide sense, to include *C morifolium*. In recent years, both *C morifolium* and *C indicum* have been grown in England from wild stock, and from such studies of them the present descriptions and figures are drawn From these plants it is supposed, by endless variation and by hybridization, the highly developed glasshouse or florist's chrysanthemums have come, a group that may be distinguished as **C. hortórum,** Figs 938–50

7 **ornàtum,** Hemsl (*C marginàtum*, Hort) Allied to the above two species, and perhaps a form of *C morifolium* bushy plant, 3–4 ft lvs palmately lobed, ovate in outline, white-tomentose beneath and on the margin, 1½–2 in. long fl.-heads loosely corymbose, 2 in or less across, the disk yellow and rays white and broad, bracts of involucre in about 3 series, all similar, white in center, purple-brown on margin achenes small, oblique, glabrous. B M 7965 G C III 35 51 Gn 71, p 53, 73, p 90 —A recent introduction, grows well in the open in England, but does not bloom unless taken indoors

BB *The garden pyrethrums and others, heads usually not highly doubled and modified*

C *Lvs cut to the midrib or nearly so*

D. *Heads borne in corymbs, i e , flat-topped, dense clusters*

E *Rays yellow*

8 **achilleæfôlium,** DC (*Achillèa aùrea*, Lam) Perennial, 2 ft . st usually unbranched, except along the creeping and rooting base· sts and lvs covered with fine soft grayish white hairs, oblong in outline, about 1 in long, ¼in wide, finely cut: rays 7–8, short, a little longer than the involucre Siberia, Caucasus — Rare in cult Less popular than the achilleas, with larger fl.-clusters.

EE *Rays white.*

9 **corymbôsum,** Linn (*Pyrèthrum corymbòsum*, Willd). Robust perennial, 1–4 ft · st branched at the apex. lvs sometimes 6 in long, 3 in. wide, widest at middle and tapering both ways, cut to the very midrib, the segms alternating along the midrib Eu , N Afr , Caucasus G C. II. 20·201 —Rare in cult. Segms. may be coarsely or finely cut, and lvs glabrous or villous beneath

10. **Parthènium,** Pers. (*Pyrèthrum Parthènium,* Smith. *Parthènium Matricària,* Gueld.). FEVERFEW. Fig. 930. Glabrous strong-scented perennial, 1–3 ft, much branched in the taller forms. lvs ovate or oblong-ovate in outline, pinnatisect or bi-pinnatisect, smooth or lightly pubescent; segms oblong or elliptic-oblong, pinnatifid or cut, the uppermost more or less confluent: fl.-heads small, many, stalked, corymbose, disk yellow; rays white, oblong, equaling or exceeding the disk. Eu. to the Caucasus.—Some authors regard this as one widely variable species, others make at least two species, one of them (*C. præaltum,* Vent.) being the Caucasian form, distinguished by more deeply cut lvs., longer-peduncled heads, and rays longer than the disk rather than equaling it (as in *C. Parthenium* type).—There are double-fld. and also discoid forms. Var. **aûreum,** Hort. (*P. aùreum,* Hort.), is the GOLDEN FEATHER commonly used for carpet-bedding. It has yellow foliage, which becomes green later in the season, especially if fls. are allowed to form. It is used for edgings and cover. Var. **aûreum crîspum,** Hort., is dwarf, compact, with foliage curled like parsley. Var. **selaginoïdes,** and var. **laciniàtum,** Hort., are distinct horticultural forms. Var. **glaûcum,** Hort., has dusty white foliage, and does not bloom until the second year. Intro. by Damman & Co., 1895. All these varieties are prop. by seeds. The feverfew is common about old yards, and is much employed in home gardens as edging. In its undeveloped and prevailing forms, it is one of the "old-fashioned" plants.



930. Chrysanthemum Parthenium. Feverfew. (×½)

DD. *Heads borne singly on the branches or sts. (or at least not definitely clustered).*

E. *Height less than 1 ft.*

11. **Tchihátchewii,** Hort. (*C. Tchihátcheffii,* Hort.). TURFING DAISY. Densely tufted perennial for carpeting dry, waste places; height 2–9 in. sts very numerous, rooting at the base: foliage handsome dark green, finely cut, the segms. linear, persisting into winter: fl.-heads solitary on axillary peduncles, borne profusely for several weeks; rays white, disk yellow. Asia Minor. R. H. 1869, p. 380, desc., and 1897, p. 470. Gn. 26, p. 443.—Prop. by division of roots or simply by cutting the rooted sts., but chiefly by seeds. Highly recommended abroad for spring and early summer bloom in edgings and low formal plantings. Said to thrive in dry places and under trees.

EE. *Height more than 1 ft.*

F. *Group of greenhouse plants (at the N.), shrubby at the base: sts. branched at the top: rays white or lemon.*

G. *Foliage not glaucous.*

12. **frutéscens,** Linn. MARGUERITE. PARIS DAISY. Figs. 931, 932. Usually glabrous, 3 ft. high, perennial. lvs. fleshy, green: heads numerous, always single, rays typically white, with a lemon-colored (never pure yellow or golden) form. Canaries. G. C. II. 13: 561; III. 35: 216. Gn. 12, p. 255; 17, p. 5, 26, p. 445, 70, p. 310.—Intro. into England 1699. This is the popular florists' Marguerite, which can be had in flower the year round, but is especially grown for winter bloom. Var. **grandiflòrum,** Hort., is the large-fld. prevailing form. The lemon-colored form seems to have originated about 1880. Under this name an entirely distinct species has also been passing, yet it has never been advertised separately in the American trade. See No. 13.



931. Chrysanthemum frutescens. The Marguerite or Paris daisy. (×⅛)

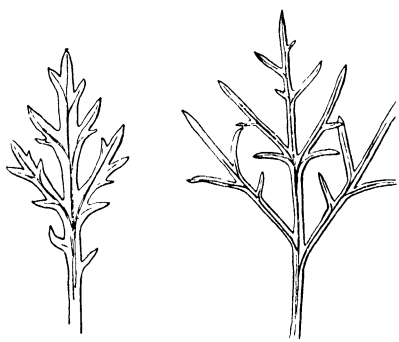
GG. *Foliage glaucous.*

13. **anethifòlium,** Brouss. (*C. fœniculàceum,* Steud. *P. fœniculàceum* var. *bipinnatifidum,* DC.). GLAUCOUS MARGUERITE. Fig. 932. Perennial rarer in cult. than *C. frutescens* (which see), but distinguished by its glaucous hue, and by the way in which the lvs. are cut. The segms. are narrower, more deeply cut, and more distant than in No. 12. The lvs. are shorter petioled. Canaries.—This species is doubtless cult. in American greenhouses as *C. frutescens.* A lemon-fld. form is shown in R. H. 1845:61 but called *C. frutescens.*

FF. *Group of hardy outdoor herbs. sts. usually unbranched: rays white or red, never yellow.*

G. *Foliage not glaucous. fls. sometimes double.*

14 **coccíneum,** Willd. (*Pyrèthrum róseum,* Bieb., not Web. & Mohr. *P. hýbridum,* Hort.). Fig. 933. Glabrous perennial, 1–2 ft. high: st. usually unbranched,



932. Leaves of Chrysanthemum frutescens (left) and C anethifolium (right) (×1)

rarely branched at the top lvs thin, dark green, or in dried specimens dark brown involucral scales with a brown margin; rays white or red in such shades as pink, carmine, rose, lilac, and crimson, and sometimes tipped yellow, but never wholly yellow Caucasus, Persia F S 9 917 Gn 26, pp 440, 443 Gng 2 7, 5 309 R H 1897, p 521 Not B M 1080, which is *C coronopifolium* The first picture of a full double form is R H 1864 71 —This species is the most important and variable of all the hardy herbaceous kinds There have been perhaps 700 named horticultural varieties There is an anemone-fld form with a high disk The species is also cult in Calif and France for insect powder *C atrosanguíneum,* Hort., is said to be a good horticultural variety with dark crimson fls The *C roseum* of Weber & Mohr being a tenable name, Hoffmann proposes Ascherson's name, *C Marschallii,* for the *P roseum* of Bieberstein, but Willdenow's *C coccineum* is here retained.

GG *Foliage glaucous fls never double*

15. **cinerariæfólium,** Vis Glaucous perennial, slender, 12–15 in high sts unbranched, with a few short, scattered hairs below the fl lvs long-petioled, silky beneath, with distant segms involucral scales scarious and whitish at the apex. Dalmatia B M 6781 —Said to be chief source of Dalmatian insect powder Rarely cult. as border plant Common in botanic gardens

CC. *Lvs. not cut to the midrib, pinnatifid or coarsely toothed (except perhaps in No. 22)*

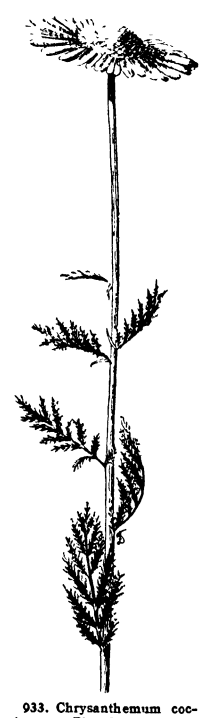
D. *Heads borne in clusters, mostly flat-topped*

16 **Balsámita,** Linn. (*Tanacètum Balsámita,* Linn. *Pyrèthrum Balsámita,* Willd. *Balsámita vulgàris,* Willd.) Costmary Mint Geranium. Sometimes erroneously called "lavender," from its sweet agreeable odor. Tall and stout perennial lvs sweet-scented, oval or oblong, obtuse, margined with blunt or sharp teeth, lower ones petioled, upper ones almost sessile, the largest lvs 5–11 in long, 1½–2 in wide: pappus a short crown W Asia —Typically with short white rays, but when they are absent the plant is var **tanacetoides,** Boiss Fig. 934. Rayless This has escaped in a few places from old gardens it seems to be the prevailing garden form.

DD *Heads borne singly on the branches or sts, or at least not in definite clusters, rays large, white.*

17 **lacústre,** Brot. (*C latifólium,* DC) Fig 935. Perennial, endlessly confused with *C. maximum* in gardens, and the two species are very variable and difficult to distinguish; the fls can hardly be told apart. *C lacustre* is a taller and more vigorous plant, and sometimes it is branched at the top, bearing 3 heads, while *C. maximum* is always 1-headed, and the lvs in that species are much narrower Height 3–6 ft : st sparsely branched lvs partly clasping, ovate-lanceolate, with coarse, hard teeth. rays about 1 in long; pappus of the ray 2–3-eared Portugal, along rivers, swamps and lakes. R H 1857, p 456

18 **máximum,** Ramond Fig 936 This perennial species has narrower lvs than *C lacustre,* and they are narrowed at the base Height 1 ft st more angled than the above, simple or branched at the very base, always 1-headed and leafless for 3–4 in. below the head: lower lvs petioled, wedge-shaped at the base, or long-oblanceolate; the upper lvs becoming few, lanceolate but usually not very prominently pointed, the teeth not very large or striking pappus none involucral scales narrower and longer, whitish-transparent at the margin, while those of *C lacustre* are broader, more rounded at the apex, and with a light brown scarious margin Pyrenees J H III 5 251 Gn 26, p 437, 73, p 567. G 5 445 G M 46 676. Var. **Róbinsonii,** Hort., has finely cut or fringed rays, giving the bloom the appearance of a Japanese chrysanthemum R H 1904 515 Var **Dàvidsii,** Hort., has sts of great length, suitable for cutting Var **filifórme,** Hort., has deeply serrate long and drooping rays There are many other forms, differing in time of bloom as well as in habit and in form of fl The **Shasta daisy** (said to be a



933. Chrysanthemum coccineum. The Pyrethrum roseum of gardens. (×½)



934. Chrysanthemum Balsamita var. tanacetoides. Costmary or mint geranium. (×½)

hybrid) is an early-flowering very floriferous race, with several strains of fls, mostly large and pure white, although in one form the buds are reported as lemon-yellow but opening white; various sub-varieties are now offered. It is a good summer and autumn bloomer, and usually hardy in the northeastern states.



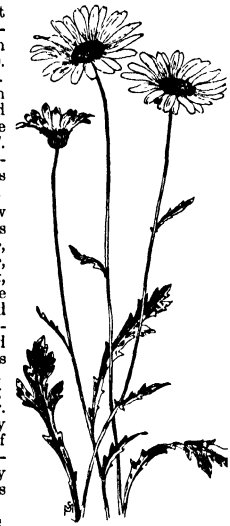
935 Chrysanthemum lacustre A short-rayed form (×⅓)

19 **uliginòsum,** Pers (*Pyrèthrum uliginòsum,* Waldst) GIANT DAISY Stout, erect bushy leafy-stemmed perennial, 4–7 ft. high, with light green foliage: st. nearly glabrous, striate, branching above, roughish: lvs. long-lanceolate, prominently pointed, with large coarse sharp teeth: heads often several together and not long-stalked, 2–3 in across, white, late Hungary. B M 2706 A F. 4:523; 8.813 Gng. 2 375, 5: 183. A G 19:403 R H 1894, p 82 Gt 46, p. 103 G C II 10:493 Gn 26, p 442; 38, p. 523; 62, p 180 G W 15, p 316 G M 51.453 Gn W 23 415 —It blooms the first year from seed or division, and has been forced for Easter somewhat as *Hydrangea paniculata* can be treated Excellent for cut-fls. The blossoms should be cut soon after opening, as the disks darken with age The plant needs a rich moist soil; it deserves a greater popularity

20 **Leucánthemum,** Linn (*Leucánthemum vulgàre,* Lam) WHITEWEED. OX-EYE DAISY. Fig. 937 Glabrous perennial erect weed, 1–2 ft high. root-lvs. long-petioled, with a large, oval blade and coarse, rounded notches; st.-lvs lanceolate, becoming narrower toward the top, serrate, with few distant and sharper teeth. (Var *pinnatifidum,* Lec & Lam, has more divided lvs) heads terminal, showy white June, July Eu, N Asia Gn 70, p 176. —One of the commonest weeds in the eastern states, being characteristic of worn-out meadows The daisies are not cult., but they are often gathered for decoration, and make excellent cut-fls. The plant is very variable, and forms adapted to fl-garden uses will probably be developed Rayless plants are sometimes found.

21. **nipponicum,** Hort. (*Leucánthemum nipponicum,* Franch) Differs from others of this set in being shrubby at base and lvs broadest above the middle: to 2 ft, the sts. strong, simple, few-fld.: lvs. thick, oblong-spatulate to oblanceolate, sessile, irregularly denticulate but entire at base, 3–4 in. long, pale beneath: fl.-heads 2–3½ in. across, with a hemispherical involucre of oval obtuse bracts, rays bright white, linear, minutely 5-toothed; disk pale greenish yellow. Japan. B M 7660. R H. 1905, p 47. F E. 20. 434 —Hardy in the N, in the root, but the sts. killed down by frost, has the general appearance of *C. lacustre* A beautiful large-fld species, producing its large blooms in late autumn

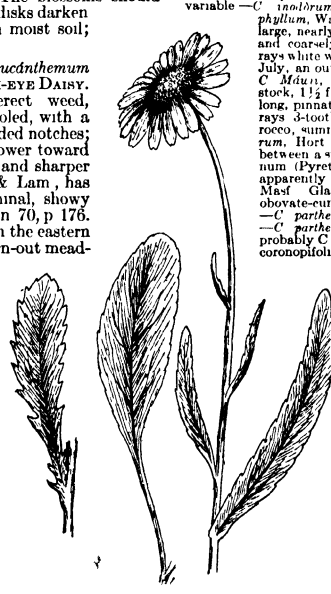
22 **arcticum,** Linn Low perennial, 3–15 in, glabrous or nearly so. lvs cuneate, long-tapering at base, toothed or cut at the apex, sometimes 3–5-lobed, the uppermost ones small and very narrow and nearly entire: involucre-bracts broad and brown-margined, rays clear white, about 1 in long. pappus wanting Arctic Eu, Asia and Amer. —An attractive very hardy species, making a clump of dark green foliage and producing in autumn many large white fls, sometimes tinged lilac or rose



937. Chrysanthemum Leucanthemum Ox-eye daisy, or whiteweed (×½)

C coronopifòlium, Willd. = *C. roseum* — *C gránde,* Hook f. (Plagius grandiflorus, L'Her) Stout erect perennial of Algeria, 2–3 ft lvs oblong to linear-oblong, often lyrate, coarsely toothed fl.-heads large, solitary, rayless, golden yellow, to 2 in across B M 7880 — *C grandiflòrum,* Willd Shrubby, smooth, from the Canaries, with cuneate lobed lvs, the parts lanceolate or linear and toothed or entire fl.-heads solitary, the rays white and disk yellow allied to C frutescens, variable — *C inodòrum,* Linn = Matricaria inodora — *C macrophyllum,* Waldst & Kit Perennial herb, 3 ft lvs very large, nearly sessile, pinnatisect, the lobes lanceolate and coarsely toothed heads very many, corymbed, rays white with yellowish tinge, the disk yellow June, July, an outdoor plant Hungary W 12, p 410 — *C Máun,* Hook f Herbaceous, with woody rootstock, 1½ ft lvs about 1 in long, triangular to oblong, pinnatifid fl.-heads 1½ in diam, long-stalked, rays 3-toothed, white with reddish backs Mts Morocco, summer in the open B M 5997 — *C multifòrum,* Hort Fls greenish white said to be a cross between a single-fld chrysanthemum and C Pallasianum (Pyrethrum Pallasianum, Maxim, of N Asia, apparently not a garden species) — *C ochroleucum,* Masf Glabrous undershrub of the Canaries lvs obovate-cuneate, coarsely toothed rays pale yellow — *C parthenifòlium,* Willd, a form of C Parthenium — *C parthenòides,* Voss One of the feverfew forms, probably C praealtum — *C róseum,* Web & Mohr (*C coronopifolium,* Willd, not Vill), not Bieb Perennial herb, 2½ ft lvs once-pinnate fl.-heads solitary, rays rose-red or flesh-color Caucasus — *C tomentòsum,* Lowel An alpine Corsican species tufted, 2 in high when in bloom lvs pinnatifid, densely tomentose fl.-heads ¾ in across, white-rayed, on sts 1 in long — *C viscòsum,* Desf Annual disk orange-yellow, rays sulfur-yellow Medit — *C vulgàre,* Bernh = Tanacetum vulgare — *C Zawadskii,* Herbich, of Gallicia, is a tufted plant with rose-tinted fls all summer.

WILHELM MILLER.
L. H B.†



936. Chrysanthemum maximum (×⅓)

Types of the common chrysanthemum.

The common chrysanthemums of the florists (*C. hortorum*) are often called "large-flowering," and "autumn chrysanthemums," to distinguish them from the hardy outdoor kinds, although

neither of these popular names is entirely accurate or distinctive They are the blended product of *C. indicum* and *C. morifolium*, two species of plants that grow wild in China and Japan. The outdoor or hardy chrysanthemums are derived from the same species, being less developed forms. The florist's chrysanthemum is not necessarily a glasshouse subject, but it is bloomed under glass for protection and to secure a longer season Ten to fifteen dominant types of chrysanthemums have been recognized by the National Chrysanthemum Society of England. The words "types," "races," and "sections," have always been used by horticulturists to express much the same thing, but types can always be defined clearly, while sections cannot, and the word race should be restricted to cultivated varieties that reproduce their character by seed, which is not the case with the large-flowering chrysanthemums The following explanation and scheme, it is hoped, will clearly set forth the main types, and explain some of the many terms that confuse the beginner The horticultural sections are wholly arbitrary, being chiefly for the convenience of competitors at exhibitions, and therefore changing with the fashions The present classification is based on the form of the flower, as each type can be had in any color found in the whole genus



938. The small and regular anemone type.

A *Single forms: rays in 1 series, or few series: disk low and flat*

1 *The Small Single Type* —Fig 950 Fls about 2 in across, star-like, i. e, with the rays arranged in one series around the yellow disk "Single," however, is a relative term, and in Fig 950 there is more than one series of rays, but this does not destroy the "singleness" of effect All fls are either single, semi-double, or double, but all the intermediate forms between the two extremes of singleness and doubleness tend to disappear, as they are not desired



939. Japanese anemone chrysanthemum when fully expanded.

2 *The Large Single Type* —Like the preceding, but the fls. 4 in or more across, and fewer The large and small single types are practically never grown outdoors and are best suited for pot culture, each specimen bearing 20–80 fls They are also grown by florists in considerable quantity for cutting

AA *Anemone-fld. forms rays as in A: disk high and rounded.*

B. *Fls (florets) small, numerous, regular.*

3. *The Small Anemone Type* —Commonly called "Pompon Anemone." Fig. 938. Fls 2–3 in across, and usually more numerous than in the large anemone type. All the anemone forms are essentially single, but the raised disk, with its elongated tubular fls, usually yellow but often of other colors, gives them a distinct artistic effect, and they are, therefore, treated as intermediates in character between the single and double forms Like the single forms, they are less popular than the double kinds, and the varieties are, therefore, less numerous and more subject to the caprices of fashion

BB. *Fls. large, fewer, regular*

4. *The Large Anemone Type* —Fls 4 in or more across and fewer Heads must have large size, high neatly formed centers, and regularly arranged florets, the disk being composed of long tubes or quills and the rays flat and horizontally arranged.

BBB *Fls large, few, irregular.*

5 *The Japanese Anemone Type* —Fig 939. Fls. 4 in or more across, and irregular in outline, fantastic and extreme anemone forms

AAA. *Double-fld forms rays in many series disk absent or nearly so*

B *Fls small, rays short*

6 *The Pompon Type* —Figs 940, 949 Fls. 1–2 in. across The outdoor kinds are likely to be small, flat and buttonlike, while those cult indoors are usually larger and nearly globular Fig 940 shows the former condition. It is from one of the old hardy kinds long cult in the gardens as "Chinese" or "small-flowered" chrysanthemums, and commonly supposed to be the product of *C indicum*, as opposed to the "Japanese" or "large-flowered" kinds intro in 1862, which marked a new era by being less formal and more fanciful than any of the preceding kinds Pompons are little cult under glass in Amer, being regarded mostly as outdoor subjects.

BB *Fls. large*

C. *Blossoms hairy.*

7 *The Hairy Type.* —Fig 941 Also called "Ostrich Plume" and "Japanese Hairy" The famous prototype is the variety Mrs. Alpheus Hardy, pictured in Gn 35, p 307, which was sold for $1,500 in 1888, and started the American chrysanthemum craze White fls with long hairs are very delicate and pretty, but the hairs are often minute, and on many of the colored fls they are



940 Type of pompon chrysanthemum. Grown outdoors, with no special care

considered more curious and interesting than beautiful So far, nearly all hairy chrysanthemums are of the Japanese Incurved type. Since the hairs are on the backs of the florets, they show best in incurved types.



941. Hairy type.

cc. *Blossoms not hairy.*

D. *Rays reflexed.*

8. *The Reflexed Type* — Also called "Recurved." Fig. 942. The reflexed forms can be easily broken up into 3 types (*a*) the small and regular, (*b*) the large and regular, and (*c*) the large and irregular types The latest standard requires that reflexed flowers have hemispheroidal heads, with no trace of thinness in the center, and broad overlapping florets.

DD *Rays incurved.*

E *Form absolutely regular.*

9. *The Incurved Type* — Fig 943 shows the general idea, but such a fl. would hardly win a prize at an English show, where anything short of absolute regularity is relegated to the "Japanese Incurved" section (No 10) This form is by far the most clear-cut ideal of any of these types, and for many years this ideal of the florists so completely dominated the English chrysanthemum shows that the incurved section came to be known there as the "exhibition" or "show type." In America the Japanese types, which are less formal and fanciful, early prevailed, but in England this has been the most important section of all

EE *Form more or less irregular.*

10 *The Japanese Incurved Type* —This section and the next have been the most important in America. There are many variations of this type. It often happens that the outer 4 or 5 series of rays gradually become reflexed, but if most of the rays are incurved, the variety may be exhibited in this section Fig 943.

DDD. *Rays of various shapes forms diverse*

11 *The Japanese Types* —The word "Japanese" was originally used to designate the large-fld fantastic kinds, intro by Robert Fortune from Japan in 1862. It has never been restricted to varieties imported directly from Japan, but has always included seedlings raised in the western world. Before 1862, all florists' flS. in England were relatively formal and small. The informal, loose, grotesque, Japanese chrysanthemums, intro by Fortune broke up the conventional era, and the demand for large specimen blooms that resulted in fl -shows all over the world reached Amer. in 1889 The "Japanese section" now means little more than "Miscellaneous." The 10 types previously mentioned can be rather accurately defined, but the Japanese section is purposely left undefined to include everything else. All the tubular and quilled sorts are now included in it, although formerly kept distinct.



942. Reflexed type.

Relative importance and uses of the foregoing types.—

In general, the large-flowered forms are more popular than the small-flowered forms, especially at exhibitions, where great size is often the greatest factor in prize-winning. Types 9, 10 and 11 are the most important in America, especially the Japanese section The flowers of types 9 and 10 are likely to be more compact and globular, and hence better for long shipments than the looser and more fanciful types Types 9, 10 and 11 are those to which most care is given, especially in disbudding and training They are the ones most commonly grown by the florists for cut-flowers, and whenever one large flower on a long stem is desired The anemone-flowered forms are all usually considered as curiosities, especially the Japanese anemones, which are often exhibited as freaks and oddities The single and anemone-flowered forms are used chiefly for specimens in pots with many small flowers, but all the other types are used for the same purpose. For outdoor culture, the hardy pompons, with their numerous small flowers, are usually better than the large-flowering or Japanese kinds

As an indication of the constant change in standards of appreciation, may be cited the present popularity



943. Type of Japanese incurved chrysanthemum

of short-stemmed chrysanthemums (Fig 944) as distinguished from the greatly elongated stem that was exclusively desired some years ago; and also the demand for bushy many-flowered plants, producing small bloom as compared with the former excessively large detached flowers.

The current English classification.

The Floral Committee of the National Chrysanthemum Society (of England) in 1912 published the following "new classification of Chrysanthemums" (published also in American Florist, Sept 21, 1912, by Elmer D. Smith):

SECTION I. INCURVED (Fig 945)

The distinguishing characteristics of this section are the globular form and regular outline of the blooms The flower should be as nearly a globe as possible, as depth is an important point in estimating its value The florets ought to be smooth, rounded, or somewhat pointed at the tip, of sufficient length to form a graceful curve, and be regularly arranged A hollow center or prominent eye are serious defects, as also are a roughness in the blooms, unevenness of outline and a want of freshness in the outer florets.

The section is now subdivided into.

Sub-section (*a*) —Large-flowered varieties.

Sub-section (*b*) —Medium- and small-flowered varieties.



944 New type with short stem, which is becoming very popular with commercial growers

SECTION II JAPANESE (Fig. 946).

Japanese varieties include a wide range of form, size and color Their florets may be either flat, fluted, quilled or tubulated, of varying length, from short, straight, spreading florets, to long, drooping, twisted or irregularly incurved In breadth the florets may vary greatly, ranging from those an inch in width to others scarcely broader than a stout thread. Some also either have the tips of the florets cupped, hollowed, curved or reflexed

Sub-section I Japanese
- (*a*) Large-flowered varieties
- (*b*) Medium-flowered varieties
- (*c*) Small-flowered varieties

Sub-section II. Incurved Japanese
- (*a*) Large-flowered varieties
- (*b*) Medium- and small-flowered

Sub-section III Hairy Japanese

Reflexed section to be deleted as these varieties are now referred to other sections

SECTION III ANEMONES (Figs 947 and 948, also Figs 938, 939)

The distinctive characteristics of anemone varieties are their high, neatly formed centers and regularly arranged ray-florets There are two distinct sets of florets, one quilled and forming the center or disk, and the other flat and more or less horizontally arranged, forming the border or ray The flowers may have the ray or guard florets broad or twisted, or narrow, and forming a fringe, but should be so regularly arranged as to form a circle round the center, the latter should be a hemispheroidal disk, with no trace of hollowness and every floret in its place

- (*a*) Large-flowered, i e, with a diameter of 3 inches and upwards
- (*b*) Small-flowered, i e, with a diameter of less than 3 inches

SECTION IV POMPONS (Fig 949, also Fig 940)

Pompon varieties have blooms that may be somewhat flat or nearly globular, very neat and compact, formed of short, flat, fluted or quilled florets, regularly spreading or erect, the florets of each bloom being of one character

- (*a*) Large-flowered, i e, with a diameter of 2 inches and upwards
- (*b*) Small-flowered, i e, with a diameter of less than 2 inches.

SECTION V SINGLES (Fig. 950).

Single varieties may be of any size and form, but the florets, whether short and rigid or long and drooping, should be arranged sufficiently close together to form a regular fringe

Sub-section I Varieties with one or two rows of ray florets
- (*a*) Large-flowered, i e, with a diameter of 3 inches and upwards
- (*b*) Medium and small-flowered, i e, with a diameter of less than 3 inches.

Sub-section II Varieties with three to five rows of ray florets
- (*a*) Large-flowered, i e, with a diameter of 3 inches and upwards
- (*b*) Medium and small-flowered, i e, with a diameter of less than 3 inches

Sub-section III. Anemone-centered varieties.



946. Japanese type.

SECTION VI SPIDERY, PLUMED AND FEATHERY.

Varieties in this section have small or medium-sized flowers of eccentric shape, but most frequently of a light and graceful character, some have threadlike florets, and some have broader florets, but they may be either erect, horizontal or drooping and of various shapes and colors

Market, Decorative and Early-flowering varieties will be deleted as such, but lists will be drawn up under each heading for general guidance.

WILHELM MILLER.



947. Japanese anemone type.

Culture of the florist's chrysanthemum (C. hortorum)

The first step towards success in chrysanthemum-culture is good healthy cuttings, and as they become established plants they should receive generous culture throughout their entire growing season. This requires close attention to watering, airing, repotting, and a liberal supply of nutriment

Chrysanthemums are propagated in four ways,—by cuttings, division, seeds, and grafting. By far the most important is the first, because it is the most rapid It is the method of the florists In localities in which the plants can remain outdoors over winter without injury, they may be increased by division. This system is practiced more by amateurs than florists, being the easiest method for the home garden but not rapid enough for the florist Propagation by seeds is employed only to produce new varieties, and is discussed at length elsewhere (page 764) Grafting is seldom practised Skilful gardeners sometimes graft a dozen or more varieties on a large plant, and the sight of many different colored fls. on the same plant is always interesting at exhibitions



945. Incurved type.

Section I.—Culture of chrysanthemums for cut-flowers.

This account is intended to describe the method chiefly employed by florists, the plants being grown in benches under glass

1 *Propagation by cuttings* —Plants of the preceding year afford stock from which to propagate the following season. They produce quantities of stools or suckers, which form excellent material for the cuttings. These are usually taken from 1½ to 3 inches in length, the lower leaves removed, also the tips of the broad leaves, then placed in propagating-beds close together, where they are kept continually wet until rooted To insure a large percentage, the condition of the cuttings should be moderately soft. If the stock plants are allowed to become excessively dry, the cuttings are likely to harden, and thus be very slow in producing roots Single-eye cuttings may be used of new and scarce varieties when necessary. These are fastened to a tooth-pick with fine stemming wire, allowing half of the tooth-pick to extend below the end of the



948 Pompon anemone type.

cutting, and when inserted in the cutting-bed the end of the cutting should rest upon the sand It requires more time to produce good plants by this system than when fair-sized cuttings can be taken, but it is often of service when stock is limited The propagating-house should be well aired, and it is advisable to change the sand after the second or third batch of cuttings has been removed, to avoid what is termed cutting-bench fungus. The cuttings should never be allowed to wilt, and this is avoided by giving abundance of air, and when the temperature reaches over 70° from sun heat, by shading with some material, either cloth or paper. Fig. 951 shows a good form of chrysanthemum cutting



949 A pompon chrysanthemum. (×⅓)

2 *Planting* —Cuttings should not be allowed to remain in the cutting-bench after the roots are ½ inch in length, or they will become hardened, which will check the growth As soon as rooted, they should be potted into 2- or 2½-inch pots, using good mellow soil, with a slight admixture of decomposed manure Most of the large flowers are produced under glass, and the bench system is generally employed, which consists of 4 or 5 inches of soil placed upon benches In these benches the small plants are planted 8 to 12 inches apart each way, from the latter part of May to the middle of July Those planted at the first date usually give the best results. The soil should be pounded rather firm either before planting or after the plants have become established.

3 *Soil* —There are many ideas as to what soil is best suited for the chrysanthemum, but good blooms may be grown on clay or light sandy loam, provided the cultivator is a close observer and considers the condition of the soil in which they are growing Clay soil, being more retentive of moisture, will require less water and feeding than soil of a more porous nature The chrysanthemum is a gross feeder, and, therefore, the fertility of the soil is very important in the production of fine blooms. Each expert has a way of his own in preparing the soil, but as equally good results have been secured under varied conditions, it is safe to conclude that the method of preparing the soil has little to do with the results, provided there is sufficient food within their reach All concede that fresh-cut sod, piled late the preceding fall or in early spring, with one-fourth to one-fifth its bulk of half-decomposed manure, forms an excellent compost. Many use 1 or 2 inches of manure as a mulch after the plants have become established Others place an inch of half-decomposed manure in the bottom of the bench This the roots find as soon as they require it. Good blooms have been grown by planting on decomposed sod and relying on liquid applications of chemicals.

4. *Feeding.*—No definite rule can be given for this work, as so much depends on the amount of food incorporated in the soil If the soil be very rich, the liquid applications should be only occasional and very dilute. There is more danger of overfeeding by the use of liquids than by using excessively rich soil Each grower must depend on his own judgment as to the requirements, being guided by the appearance of the plants When the leaves become dark-colored and very brittle, it is safe to consider that the limit in feeding has been reached Some varieties refuse to bud when overfed, making a mass of leaves instead Others show very contorted petals, giving a rough unfinished bloom. Still others, particularly the red varieties, are likely to be ruined by decomposition of the petals, called "burning," especially if the atmosphere is allowed to become hot and stuffy. The same result will follow in dark weather, or when the nights become cool, if the moisture of the house is allowed to fall upon the blooms Under such conditions, the ventilation should remain on during the night, or heat be turned in according to the outside temperature



950. Single type

5 *Watering and shading* — Let the foliage be the index to watering If it appears yellow and sickly, use less water, and see that the drainage is perfect There is little danger of over-watering as long as the foliage is bright green A little shading at planting time is not objectionable, but it should be removed as soon as the plants are established It is often necessary to shade the pink and red flowers, if the weather continues bright for some time, to prevent their fading

6. *Training* —When the plants are 8 inches high, they should be tied either to stakes or to jute twine In the former system, use one horizontal wire over each row, tying the stake to this after the bottom has been inserted into the ground Two wires will be necessary when twine is used, one above the plants and the other a few inches above the soil to which the twine is fastened From the first of August until the flowers are in color, all lateral growths should be removed as soon as they appear, allowing only the shoots intended for flowers to remain The above remarks refer to the training of benched chrysanthemums as grown by florists for cut-flowers. Other kinds of training are described under Section II, pages 763-4



951 One kind of chrysanthemum cutting.

7 *Disbudding* —No special date can be given for this work, as much depends on the season and the earliness or lateness of the variety to be treated. Buds usually begin to form on the early sorts about August 15, or soon after, and some of the late varieties are not in condition before October 10 Golden Glow and Smith Advance among the large-flowering, and several of the early-flowering of the hardy varieties, are exceptions to the foregoing, as they will set buds in June and July that will develop very good blooms during the month of August and later. The advent of these kinds has advanced the flowering season four to six weeks The object of removing the weak and small buds and retaining the best is to con-

centrate the whole energy of the plant and thereby increase the size of the flower.

There are two forms of buds, crowns and terminals. A crown bud (Fig 952) is formed first, never coming with other flower-buds, and is provided with lateral growths which, if allowed to remain, will continue their growth and produce terminal buds later Terminal buds come later, always in clusters (Fig. 954), are never associated with lateral growths, and terminate the plant's growth for that season If the crown bud is to be saved, remove the lateral growths as shown by Figs 952, 953, and the operation is complete If the terminal bud is desired, remove the crown and allow one, two or three (according to the vigor of the plant) of the growths to remain In a few weeks these will show a cluster of buds, and, when well advanced, it will be noticed that the largest is at the apex of the growth (the one saved, if perfect, as it usually is), and one at each of the leaf axils (see Fig 955) The rejected buds are easiest and safest removed with the thumb and forefinger Fig 956 Should the bud appear to be one-sided or otherwise unperfect, remove it and retain the next best In removing the buds, begin at the top and work down By so doing there are buds in reserve, in case the best one should accidentally be broken, while if the reverse course were taken, and the best bud broken at the completion of the work, all the labor would be lost A few hours' disbudding will teach the operator how far the buds should be advanced to disbud easily Early and late in the day, when the growths are brittle, are the best times for the work Some growers speak of first, second and third buds The first is a crown, and usually appears on early-propagated plants from July 15 to August 15 If removed, the lateral growths push forward, forming another bud In many cases in which the crowns are removed early, the next bud is not a terminal, but a second crown, which is termed the second bud Remove this, and the third bud will be the terminal. Plants propagated in May and June usually give the second and third bud, not forming the typical crown Those struck in July and planted late give the terminal only Most of the best blooms are from second crown and terminal Pink, bronze and red flowers from first crowns are much lighter in color than those from later buds They are large, but very often abnormal to such an extent as to be decidedly inferior This is doubtless due to the large amount of food utilized in their construction, owing to the long time consumed in development The hot weather of September and October must have a detrimental effect upon the color

Enemies —Green aphis (*Aphis rufomaculata*) and the black aphis (*Macrosiphum sanborni*) are sometimes very troublesome They may be controlled by spraying with "Black Leaf 40" tobacco extract, one part to 800 parts water with soap added Fumigation with hydrocyanic acid gas is also widely practised by commercial growers In moderately tight greenhouses, use one ounce potassium cyanide for each 3,500 cubic feet of space for all-night fumigation For details, see *Fumigation* Red Spider (*Tetranychus bimaculatus*) becomes injurious if neglected It may be easily controlled by spraying with water, using much force and little water to avoid drenching the beds. The use of sulfur has also a beneficial effect.

Thrips (See Carnation).

Leaf-tyer (*Phlyctænia ferrugalis*) is frequently very abundant in some parts of the country. It is essentially a greenhouse pest although it can live out-of-doors. The greenish whitish striped caterpillars, ¾inch in length when full grown, feed on the under side of the leaves which they roll or tie together The moth is pale brownish with an expanse of about ¾inch. The leaf-tyer is most destructive during the summer months when the temperature is highest. It can be controlled by spraying with arsenate of lead. It is advisable to begin the work early in the season when the insects are less numerous and the plants are small Care should be taken to hit the under surface of the leaves

The tarnished plant-bug (*Lygus pratensis*) often injures the blossom buds by its feeding punctures. This causes wilting and blind growths The bugs may be excluded from greenhouses with screens Out-of-doors no satisfactory means of control has been devised But it has been noticed that plants growing in partial shade are less subject to injury.



952 The crown bud

Grasshoppers are sometimes injurious They may be controlled by the use of arsenate of lead or by hand-picking.

Diseases —Damping-off in the cutting-benches is not uncommon See *Damping-off*, page 961 Rust (*Puccinia chrysanthemi*) is the only serious fungous disease of the chrysanthemum It is characterized by the reddish brown pulverulent masses on the foliage consisting of the spores of the fungus The disease is usually not destructive but may make the foliage unsightly Any leaves appearing diseased should be removed promptly In watering care should be taken not to wet the foliage, as moisture on the leaves allows new infections Leaf-blight (Cylindrosporium) and leaf-spot (Septoria) occur on mature or languishing foliage and usually do little damage

Section II —Culture of chrysanthemums in pots.

The same principles are employed in pot culture as when planted upon the bench, with the exception that the plants are generally allowed to produce more blooms The most popular type of pot-plant for home growing, or for sale by florists and intended for home use, is a compact, bushy plant, 1½ to 2 feet high, branched at the base, and bearing four to twenty flowers averaging 3 to 4 inches across They are here called "market plants" "Single-stem plants" are also popular Great quantities of large flowers (say twenty to one hundred) are rarely grown on a potted plant, except for exhibitions Such plants are commonly called "specimens," and the three leading forms are the bush, the standard and the pyramid, the first mentioned being the most popular.



953. Crown bud after it has been selected or taken.

1 *Market plants* —Dwarf plants of symmetrical form, with foliage down to the pots, are the most salable, and when thus grown require constant attention as to watering and stopping, allowing each plant plenty of room to keep the lower leaves in a healthy condition. Cuttings taken June 1 and grown in pots, or

planted on old carnation benches or in spent hotbeds (light soil preferable), and lifted by August 15, will make very good plants 1 to 1½ feet high. The reason for lifting early is to have them well established in their flowering pots before the buds are formed.

2. *Single-stem plants* —Same culture as market plants, except that they are restricted to one stem and flower. Those from 1 to 2 feet in height are more effective and useful than tall ones. For this reason, many prefer plunging the pots out-of-doors where they have the full benefit of the sun and air, making them more dwarf than when grown under glass.



954. The terminal bud.

3 *Pot-plants for cut-flowers.* —Culture same as for specimen plants, except that the nipping should be discontinued July 1 to give sufficient length to the stems If large flowers are desired, restrict the plants to eight or ten growths Such plants can be accommodated in less space than specimens, when the chief object is symmetry

4. *Bush plants* —For large bush plants, the cuttings should be struck early in February, and grown along in a cool airy house, giving attention to repotting as often as necessary. The final potting into 10- or 12-inch pots generally takes place in June They are potted moderately firm, and watered sparingly until well rooted As soon as the plants are 5 or 6 inches high the tips should be pinched out, to induce several growths to start As the season advances and the plants make rapid growth, pinching must be attended to every day up to the latter part of July, to give as many breaks as possible and keep them in symmetrical form By the middle of August (if not previously attended to), staking and getting the plants in shape will be a very important detail If stakes are used, they must be continually tied-out, as the stems soon begin to harden, and this work can be best accomplished by looking them over daily Light stakes of any material may be used. Many other methods are in use, such as wire hoops and wire framework, to which the growths are securely tied.

5 *Standards* differ from bush plants in having one stout self-supporting stem, instead of many stems. They require the same culture as bush plants, with the exception that they are not stopped, but allowed to make one continuous growth until 3, 4 or 5 feet high, and are then treated the same as bush plants They require the same attention as to stopping and tying to secure symmetrical heads.

6 *Pyramids* are only another form of bush plants, and it is optional with the grower which form he prefers.

Section III —Culture of chrysanthemums for the production of new varieties.

The object of seed-saving is the improvement of existing varieties. It is not conclusive, however, that all seedlings will be improvements; in fact, it is far from this, as the greater proportion are inferior to their antecedents Only those who give the most careful consideration to cross-fertilization are certain of marked success. Hand-hybridized seeds possess value over those haphazardly pollinated by wind and insects only according to the degree of intelligence employed in the selection of parents What the result will be when a white flower is fertilized with a yellow one, the operator cannot determine at the outset It may be either white, yellow, intermediate, or partake of some antecedent, and thus be distinct from either Improvements in color can be secured only by the union of colors, bearing in mind the laws of nature in uniting two to make the third. Red upon yellow, or vice-versa, may intensify the red or yellow—give orange or bronze, as nature may see fit The operator is more certain of improving along other lines, such as sturdiness or dwarfness of growth, earliness or lateness of bloom, or doubleness of flowers. The selection of those most perfect in these particulars is very sure to give similar or improved results. Always keep a record of this work showing the parents of a seedling The satisfaction of knowing how a meritorious variety was produced more than pays for the trouble, and may lead to further improvements along certain lines —The operation begins when the flower is half open, cutting the petals off close to their base with a pair of scissors, until the style is exposed Should the flower show signs of having disk or staminate florets, remove these with the points of the scissors and thus avoid self-fertilization When the styles are fully grown and developed, the upper surface or stigma is in condition to receive the pollen By pushing aside (with the thumb) the ray-florets of the flower desired for pollen, the disk-florets which produce the pollen will become visible The pollen may be collected on a camel's-hair pencil or toothpick and applied to the stigma of the flower previously prepared If a toothpick be used, never use it for more than one kind of pollen By allowing the camel's-hair pencil to stand in an open-mouthed vial of alcohol a few moments after using, it may be again used, when dry, upon another variety without fear of the pollen of the former operation affecting the present —Cuttings struck in June and July and grown to single bloom in 4-inch pots are the most convenient for seeding Such flowers, if not given too much food are more natural and furnish an abundance of pollen, as well as being easier to trim than the massive blooms produced for the exhibition-table The pollinating should be done on bright, sunny days, and as early in the day as possible As soon as the seed plants are trimmed, they should be placed by themselves to avoid fertilization by insects, and should there remain until the seeds are ripe Keep the plants rather on the dry side, and give abundance of air. Seeds, which ripen in five to six weeks, should be saved without delay, and carefully labelled. In sowing seeds,



955. Terminal buds of chrysanthemum at an early stage. None too early for disbudding.

they should be covered very lightly and kept in a temperature of 60° When the seedlings are large enough to handle easily, remove to small pots, or transplant farther apart in shallow boxes Chrysanthemums flower the first season from seed

Section IV.—Varieties.

Of the long list of new varieties sent out each year, but few are retained after the second year's trial This is probably due to the fact that most American growers are more interested in the commercial value of the flower than the curious forms or striking colors they present Exhibitions have not reached the people here

as in England and France. There are a few varieties that have stood the test for several years, such as Ivory, 1889, Geo W Childs, 1892; Golden Wedding, 1893, Major Bonnaffon, 1894; Yanoma, 1896, W H. Chadwick, 1898, John K Shaw and Nagoya, 1899; Monrovia, Col D Appleton and White Bonnaffon, 1900. There are many other varieties that have stood the test for four or five years

It is not the purpose of this article to recommend varieties of chrysanthemums, but the following list includes the best varieties known in North America at the present time The list will be valuable as showing a serviceable classification, and also for reference when other varieties have come into existence:

Selection of varieties based on main types—(1) *Incurved* Æsthetic, Emberta, Major Bonnaffon, Pink Gem, Mary Donellan, Naomah, Smith's Sensation, William Turner (2) *Japanese* Pacific Supreme, Crocus, Ramapo, December Gem, F S Vallis, Glen Cove, Golden Robin, Reginald Vallis (3) *Japanese Incurved* Chrysolora, Col D Appleton, W H Chadwick, Mlle Jeanne Nonin, Artistic Queen, Christy Mathewson, Elberon, Nakota (4) *Hairy* Arvedo Barnie, Beauty of Truro, Frison d'Or, Leocadie Genelis, Louis Boehmer, L'Enfant des Deux Mondes, R M Grey, White Swan (5) *Reflexed* Smith's Advance, Dick Witterstaetter, Harvard, Yanoma, Mrs J Wells, Rose Pockett, Thanksgiving Queen, Madison (6) *Large Anemone* Satisfaction, Surprise, Ernest Cooper, Geo Hawkins, Gladys Spaulding, John Bunyan (7) *Japanese Anemone* Eleanor, Mrs F Gordon Dexter, Zoraida (8) *Pompons* Alma, Baby, Clorinda, Fairy Queen, Helen Newberry, Minta, Jube Lagravere, Quinola (9) *Pompon Anemone* Diantha, Ada Sweet, Gertrude Watson, Lala Thomas, Vayenne, Bessie Flight (10) *Large-flowering Single* Arlee, Catherine Livingstone, Felicity, Itaska, Lady Lu, Red Light (11) *Small-flowering Singles* Ladysmith, Anna, Blazing Star, Little Barbee

Selection of varieties based on color—*White* Smith's Advance, Chadwick Improved, Christy Mathewson, Mrs Gilbert Drabble, Naomah, William Turner *Yellow* Chrysolora, Comoleta, Golden Glow, Golden Eagle, Ramapo, Lenox *Pink* Pacific Supreme, Unaka, Patty, Glen Cove, Morristown, Smith's Sensation *Crimson* Dick Witterstaetter, Harvard, Intensity, J W Molyneux, Pockett's Crimson, Mrs Harry Turner *Bronze and buff* Glenview, Mrs J A Miller, Mrs H Stevens, Ongawa, Rose Pockett, William Kleinheinz *Crimson, golden reverse* Harry L Converse, Howard Gould, Mrs O H Kahn, W Woodmason *Amaranth or purplish crimson* George J Bruzard, Mrs G C Kelly, Reginald Vallis, T Carrington, Leslie Morrison

Selection based on special uses—*Bush plants* Golden Age, Brutus, Dick Witterstaetter, Dr Enguehard, Garza *Single stemmed pot-plant* Naomah, Chrysolora, Æsthetic, President Roosevelt, Ben Wells, Glen Cove, Mrs George Hunt, Mrs O H Kahn, Pockett's Crimson *Exhibition blooms* Artistic Queen, Christy Mathewson, Chrysanthemiste Montigny, F S Vallis, George J Bruzard, Glen Cove, Glenview, Harry F Converse, Lady Hopetoun, Lenox, Elberon, Morristown, M Loiseau-Rousseau, Mrs Gilbert Drabble, Mrs H Stevens, Mrs Harry Turner, Naomah, Pockett's Crimson, Rose Pockett, William Turner, W Woodmason, Ben Wells, Merza, Reginald Vallis *Commercial blooms*—*Extra early-flowering, July to October* Golden Glow, Smith's Advance *Second-early-flowering, last of September into October* Early Snow, Glory of Pacific, Monrovia, October Frost, Roserie *Early-midseason-flowering, middle of October* Chrysolora, Comoleta, Gloria, Ivory, Pacific Supreme, Unaka, Virginia Pochlmann *Midseason-flowering, last of October to November 10* Col D Appleton, Crocus, Dick Witterstaetter, Pink Gem, Ramapo, Mrs W E Kelley *Late-midseason-flowering, November 10 to Thanksgiving* Dr Enguehard, Timbuctu, Golden Eagle, Golden Wedding, Major Bonnaffon, Patty, President Roosevelt, Timothy Eaton, W H Chadwick, Mrs Jerome Jones, White Bonnaffon *Late-flowering, Thanksgiving and later* December Gem, Harvard, Helen Frick, Intensity, John Burton, Mlle Jeanne Nonin, Thanksgiving Queen, Yanoma.

Section V.—Culture of chrysanthemums for exhibition.

This branch in which the highest standard must be attained if the slightest hope of success at the exhibitions is entertained, requires a thorough knowledge of the most suitable kinds for the purpose and the ability to bring them to the highest state of perfection. The methods are not very different from those employed in the production of high-grade commercial blooms. The most successful growers usually propagate earlier, and if grown on benches they are also planted earlier to secure all the vigor possible. The finest blooms are those produced on the private estates, where one man has charge of a few hundred plants, giving them his undivided attention, so that every need is provided at the proper time. During the past few years, the majority of such expert growers have adopted a system of growing in pots, each plant restricted to one bloom, which is practically the same method as the one used throughout England for many years. Here they are kept under glass the entire season, while in England the climate permits them to be grown out-of-doors during the summer months By this method, the roots are more closely confined, which has a tendency to produce short-jointed plants with stronger stems, and gives the grower perfect control, so that each variety may be treated according to its needs, especially when liquid fertilizers are necessary to promote the maximum in size and finish. The other factors necessary to the successful exhibitor are full consideration of the requirements of the schedules, so as to select the best varieties for the various classes, and a complete knowledge of packing and staging the blooms During the past decade, those originating new varieties have scrutinized more closely in making a decision, and, as the commercial and exhibition varieties are considered from an entirely different standpoint, these two sections are drifting farther and farther apart Size is the foremost quality from the exhibition point of view.



956. Terminal bud after the disbudding operation.

At the present time (1912) the varieties generally shown in prize-winning exhibits are *White*—Beatrice May, Lady Carmichael, Merza, Mrs David Syme, Naomah, Wm Turner *Yellow*—F S Vallis, Lenox, Mrs Geo Hunt, Mrs J C Neill, Yellow Miller *Pink*—Lady Hopetoun, M Loiseau-Rousseau, Mrs C H. Totty, O H Broomhead, Wm Duckham, Wells' Late Pink *Bronze*—Glenview, Harry F Converse, Mrs O H Kahn, Mrs H. Stevens *Red*—J W Molyneux, Pockett's Crimson, W Woodmason

A few of the commercial section are suitable for this purpose, especially when the schedule calls for twelve or more blooms of a kind for one vase and at exhibitions at which artificial supports are prohibited The best are as follows *White*—Lynnwood Hall, Timothy Eaton, Chadwick Improved, Mrs Jerome Jones *Yellow*—Col D Appleton, Golden Eagle, Golden Wedding, Yellow Eaton, Golden Chadwick, Major Bonnaffon *Pink*—Dr Enguehard, Mayor Weaver, Maud Dean *Red*—Dick Witterstaetter, Geo W. Childs

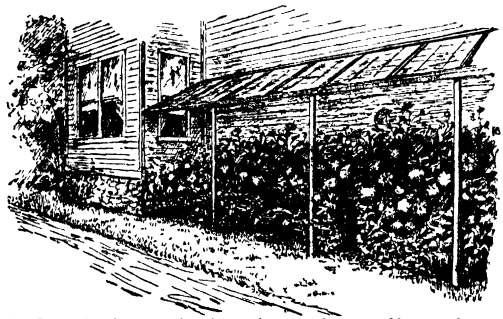
Section VI.—Culture of chrysanthemums out-of-doors

The kinds most suitable for out-of-door culture are those making abundance of rhizomes or underground stems, which withstand the winter and furnish the new growths for the successive years The Pompons are more hardy than the large-flowering sorts, and, as hardiness is of vital importance to those interested in this subject, especially north of the Ohio River, it should be fully considered in selecting for this purpose. It is more practicable to choose varieties which perfect their flowers early, during August, September and October when grown in the northern states, as the buds are less likely to be injured while in a soft growing state by frost In the South many of the later varieties will live over and be satisfactory, owing to the continuance of mild weather In the past few years, some improvements in this section have been attained, many of which are the results of crosses between the Pompons and the large-flowering Japanese, in which the progeny have combined the hardiness and dwarf habit of the former with the larger and more irregular-formed flowers of the latter, producing aster-like flowers rather than the symmetrical form of the pompons All of the types may be successfully grown out-of-doors if provision is made to protect the bud, blooms and roots from severe frost A temporary covering of cloth or sash in early autumn will protect the blooms, but the roots will require artificial heat or should be removed to the greenhouse or frame where the temperature can be maintained a few degrees above freezing In growing exhibition blooms out-of-doors, all the important details, such as watering, airing, disbudding, feeding

staking and tying, must be complied with, if the grower expects to be rewarded for his efforts.

The oldest of the outdoor types are the Pompons, which produce from forty to one hundred buttons an inch or two across, with short and regular rays. Such plants can be left outdoors all winter

Since the large-flowering or Japanese types have come in, numberless attempts have been made to grow them outdoors, but with poor results. The greenhouse varieties are not so hardy In the North they are likely to be killed by the winter Their flowers usually lack in size, depth and symmetry, largely because there are more of them on a plant than a florist allows for his best blooms, but chiefly because they do not have so much care in general as is given to plants under glass, where space is precious For the very best results, chrysanthemums must be flowered under glass, and they need the greatest care and forethought practically all the year round Half-way measures are unsatisfactory Thus it happens that the Japanese varieties are usually unsatisfactory out-of-doors, and the Pompons are chosen by those who can give very little care to plants and would rather have many small flowers than a few large ones This also partly explains why no two dealers recommend anything like the same list of Japanese varieties for outdoor culture Nevertheless, it is possible to grow excellent flowers 4 and 5 or even 6 inches across outdoors, but it requires staking, disbudding, and some kind of temporary protection, as of a tent or glass, during frosty weather Fig 957 shows a cheap and simple structure of coldframe sashes resting on a temporary framework In severe weather a canvas curtain can be dropped in front, and the window of a warm cellar in the rear opened to temper the air. For general outdoor culture, however, when no special care is given to the plants, the Japanese kinds are usually less satisfactory than the Pompons These Pompons are a much-neglected class since the rise of the large-flowered Japanese kinds, but they are unlike anything else in our garden flora Their vivid and sometimes too artificial colors harmonize with nothing else at Thanksgiving time, and they are so strong and commanding that they should have a place by themselves It is not uncommon for the flowers to be in good condition even after several light falls of snow, and they may be considered the most resistant to frost of any garden herbs In fact, their peculiar merit is blooming after the landscape is completely desolated by successive frosts. The flowers are not ruined until their petals are wet and then frozen stiff. They are essentially for mass effects of color, and great size is not to be expected Masses of brown and masses of yellow, side by side, make rich combinations. The whole tribe of crimsons, amaranths, pinks, and the like, should be kept by themselves, because their colors are variable and because they make a violent contrast with yellow, which few persons can find agreeable



957. Suggestion for protecting chrysanthemums that are to bloom outdoors.

WILHELM MILLER.
ELMER SMITH †

CHRYSOBÁCTRON (*golden wand*, from the Greek). *Liliàcæ*. Two New Zealand rhizomatous herbs, usually classed with "bulbs" by gardeners, bearing many small yellow fls in a long raceme on the top of an elongated scape plant often dœcious or polygamous. perianth 6-parted, the segms nearly equal; stamens 6 caps 3-celled and 3-valved The genus is now commonly united with the S. African Bulbinella, the combined species becoming 13 or 14 **C. Hoòkeri,** Colenso (*Bulbinélla Hoòkeri*, Benth & Hook., now the accepted name. *Anthéricum Hoòkeri*, Colenso)is in cult in this country It is a hardy plant 2-3 ft high, with sword-like foliage. fls ½in diam., bright yellow, perfect, on slender pedicels, the segms linear-oblong, and obtuse and spreading B M 4602.—Cult. in the ordinary border, and treated like the asphodel, they do well But they are improved in rich, deep and rather moist soil, strong clumps, 4-6 years old, are then at their best and are very excellent plants After that they should be divided Prop by division or seed Blooms in June and July

J B KELLER and L H. B

CHRYSOBÁLANUS (*golden acorn*, from the Greek, referring to the fruit) *Rosàcæ*. Bushes or trees, planted far south for ornament, fruit often edible

Leaves thick and coriaceous, entire, glabrous fls white, rather small, in axillary or terminal short cymes, calyx 5-parted, petals 5, clawed, stamens 15 to many, some of them perhaps sterile fr a dryish-pulpy drupe, with stone pointed at base and ridged Two species in tropics of Amer and Afr., reaching Fla., and another one in S U S

Icàco, Linn Cocoa-Plum Icaco On coasts and along streams in S Fla., to S Amer., and also in Afr., and is sometimes planted in the extreme S (and in the tropics) as an ornamental shrub and for its sweetish but insipid and dry plum-shaped frs which are sometimes used for preserves It is a mere bush on the northern limits of its distribution, and on elevations, but in extreme S Fla it reaches a height of 25-30 ft Lvs glossy, thick, obovate (sometimes obcordate) fls small and white, in axillary erect racemes or cymes, calyx 5-cleft, pubescent, petals 5, stamens about 20 fr 1-seeded, 1-1¾ in. long, varying from nearly white to almost black, globular or nearly so. Wood close-grained and heavy, hard, brown or reddish It is best prop by seeds, but may also be had from cuttings of half-ripened wood *C. pellocárpus*, Meyer, the small-fruited cocoa-plum, is a smaller plant, with smaller lvs., petals spatulate, drupe obovoid or oblong, about half the size of that of *C. Icaco*, it grows in extreme S Fla and farther south; probably not planted *C. oblongifólius*, Michx., occurs from Ga to Fla and Miss It is a low shrub, spreading widely by means of underground sts. lf-blades longer than broad, sharp-tipped fr. ovoid or obovoid, about 1-1⅓ in. long not in cult

L. H. B.

CHRYSÓCOMA. *Linosyris.*

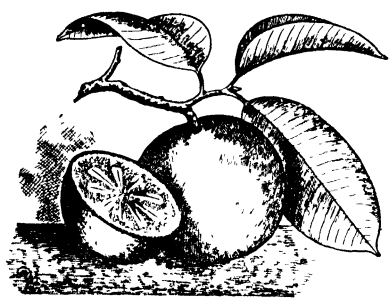
CHRYSÒDIUM: *Elaphoglossum.*

CHRYSÓGONUM (Greek-made name, *golden knee* or *joint*). *Compósitæ* A few composites, of which **C. virginànum,** Linn., is a perennial yellow-fld plant of S. Pa. and south; sometimes cult as a border plant. It blooms in spring or early summer on sts which become 1 ft high, the heads being solitary and pedun-

cled in the axils or some of them terminal lvs. opposite and basal, ovate and mostly obtuse, crenate. Prop by creeping rootstocks and runners. Of little merit horticulturally

CHRYSOPHÝLLUM (Greek, *golden leaf*, in reference to the color of the under surface of the leaves) *Sapotàceæ* Handsome trees, grown far south for fruit and for ornament.

Juice milky. lvs. alternate, thick and stiff, usually shining and copper-colored or golden beneath with



958 Chrysophyllum Cainito (×⅓)

silky pubescence, with many parallel cross-veins fls small, sessile or stalked, clustered at the nodes or in the axils, calyx mostly 5-parted, corolla tubular-campanulate or somewhat rotate, mostly 5-lobed, without appendages, stamens as many as the corolla-lobes, and staminodia 0, ovary 5-10-celled fr fleshy and usually edible, 1- to several-seeded —About 60 species in tropics, the larger part American

The various species of Chrysophyllum have beautiful broad green leaves, with under surfaces of a silky texture, varying in color from a silvery white through golden to a russet-brown, and are well worth a place in the conservatory as ornamental trees By giving them sufficient room, they will bear fruit in the course of a few years, under glass, which in the case of *C Cainito*, the star-apple of tropical America, is edible, and well liked even by people of a temperate clime All species are strictly tropical and cannot be grown where frosts occur unless properly protected Propagation is ordinarily effected by seed, which readily germinate if planted when fresh, and it is stated that all species may be grown from cuttings of well-ripened shoots placed in strong, moist heat The soil most suited for their growth is of a sandy character, and if not of a good quality should be well manured, using a considerable proportion of potash in the fertilizer for fruiting specimens They seem to do well on a great variety of soils, however, that are sufficiently well drained, wet land not agreeing with them (E N Reasoner)

Cainito, Linn STAR-APPLE CAIMITO Fig. 958. Thick-headed evergreen, to 50 ft lvs oval or oblong, silky-golden beneath corolla-tube twice as long as the calyx, stigma 8-10-crenate or -lobed; fls purplish white W Indies, Panama, Cent Amer I H 32 567 A G 11 405 —The fr is the size of an apple, symmetrically globular and smooth, hard, a cross-section shows the star-shaped core, whence the common name, it varies from white to purple in color of skin and also of flesh The pulp is delicious (used uncooked) if the fr. is allowed to remain on the tree until ripe It has large, pumpkin-like dark seeds It is very impatient of frost.

olivifórme, Lam (*C monopyrènum*, Swartz). SATIN-LEAF To 35 ft lvs like those of *C Cainito* fls white; stigma 5-crenate fr ovoid-oblong or oval, 1-seeded by abortion of ovules, blackish, 1½ in long, said to be insipid S Fla and S. B M. 3303 —Sparingly transferred to grounds as an ornamental tree.

imperiàle, Benth (*Theophrásta imperiàlis*, Lind). Plant strict and simple, to 20 ft or more, unarmed: lvs obovate-oblong to oblong-oblanceolate, 3 ft long, on large plants very sharply serrate. fls yellowish green, small, in clusters along the trunk, the cluster sessile but the fls pedicellate, corolla rotate, 5-lobed, thick fr 5-angled, nearly globular, size of a small apple, with a hard thick flesh, seeds 1 in long and ¾ in wide, compressed Brazil B M 6823 I H 21 184 Gt 1864.453 —This species was grown 30 years before its genus was determined, but upon flowering in European gardens it was found to be a Chrysophyllum (by some referred to Martiusella, which see) L. H B.

CHRYSOPÒGON: *Sorghastrum.*

CHRYSÓPSIS (*golden appearance*, from the heads). *Compósitæ* Mostly low and hairy perennials, sometimes planted in borders heads of medium size and many-fld, usually with numerous yellow rays, involucre bell-shaped or hemispherical, of imbricated narrow bracts. achenes compressed, bearing a pappus of numerous hair-like bristles About 20 species of Chrysopsis are known Mex and N **C. villòsa,** Nutt (*C. Bolánderi*, Gray), is one of the species in the trade It is widely distributed from Ill, west, north, and south: 1-2 ft, grayish pubescent lvs oblong to lanceolate, entire or few-toothed heads usually at the ends of leafy branches, aster-like in shape Extremely variable, and has several named forms Mn 7 101 Var. **Rútteri,** Rothr, is larger and later Of value as a border plant Cult the same as aster Perennials, but bloom the first year from seed, if sown early

C mariana, Nutt Differs from C villosa in having corymbose-paniculate fl-clusters F N Amer Aug.-Sept Offered by dealers in native plants It has showy yellow fls and prefers dry sandy places N TAYLOR †

CHRYSOSPLÈNIUM (name from *golden* and *spleen*, referring to some old medicinal tradition). *Saxifragaceæ* GOLDEN SAXIFRAGE. Low semi-aquatics, sometimes used in bog-planting

C. americànum, Schw, is a native plant creeping in mud Sts forking, bearing roundish or cordate small mostly opposite lvs, with very small, nearly sessile, greenish, inconspicuous fls Scarcely known in cult and, except for wet places where a cover or carpet is wanted, of no value horticulturally



959 Chufa—Cyperus esculentus. (×½)

CHRYSÙRUS CYNOSUROÏDES: *Lamarckia*

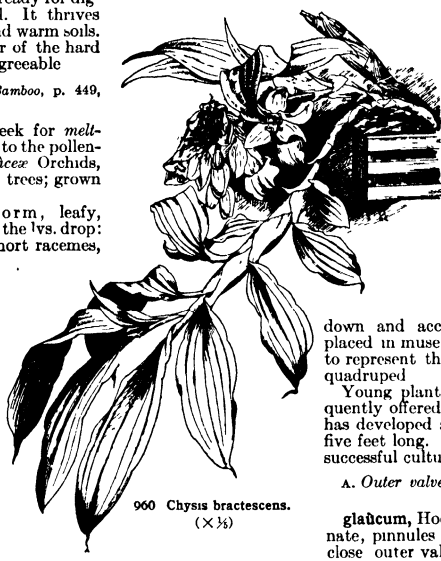
CHUFA. The edible subterranean tubers of *Cyperus esculentus*, Linn., (which see) much prized in the South. Fig

959. Chufas are eaten raw or baked, or used for the making of coffee. The plant is sometimes cultivated in the North, but it will not withstand the winter. The tubers are oblong, ½ to ¾ inches long, cylindrical, hard The plant is grass-like, and in the North does not flower Tubers are planted in the spring, and the new crop is ready for digging in the fall. It thrives easily in loose and warm soils. The nutty flavor of the hard tubers is very agreeable

CHUSQUÈA: *Bamboo*, p. 449, Vol I.

CHŸSIS (Greek for *melting*, in allusion to the pollen-masses). *Orchidàceæ* Orchids, pendulous from trees; grown in hothouses.

Stems fusiform, leafy, thickening after the lvs. drop: fls. fleshy, in short racemes, which are produced freely in the axils of the young growths; dorsal sepal and petals similar in shape, the lateral sepals with the foot of the column forming a long foot; lip jointed to the column foot, lamellate longitudinally, the lateral lobes upright, loosely surrounding the column; pollinia 8.—About 6 species in Trop. Amer. Cult as for Vanda, in baskets, pans or pots. They require tropical temperature when growing, then cooler.



960 Chysis bractescens. (×⅛)

A *Ground-color of fls. yellow.*

aùrea, Lindl. Fls. 5–8, about 2 in across; sepals and petals yellow, oblong-oval; lateral lobes of lip yellow, the middle lobe white, downy, spotted with red and yellow S Amer B R 1937. B M. 3617.

lævis, Lindl. Fls 8–12, about 2½ in across; sepals and petals yellow, tinted above with lines of purple-carmine, sepals oblong, the dorsal one inflexed, the lateral falcate; lip yellow, marked with red. Mex.

Chélsonii, Hort Fls 5–7, about 2½ in across; sepals and petals yellow, with a large blotch of reddish fawn at the apex; lip yellow spotted with red. Hybrid: *C. bractescens* × *C lævis* F.M. 1878. 297.

AA. *Ground-color of fls white.*

bractéscens, Lindl Fig. 960 Fls 3–5, about 3 in. across; sepals and petals ivory-white; lip with the lateral lobes white outside, the inner surface yellow, streaked red, the middle lobe yellow, streaked and stained with red Mex. B M 5186. R.H. 1859, pp. 294, 295. I H. 27.398. O R. 9 371; 13:236, 19:201. J.H. III. 28 263 C O 1. A F 28 747.

Límminghei, Lindl. & Reichb. Fls. 4–7, 1½–2 in. across; sepals and petals white, with an apical blotch of purple; lip with lateral lobes yellow, marked with reddish purple on the inside, the middle lobe white, streaked with bright purple. Mex. B.M. 5265. I.H. 7:240. C.O. 3.

Sèdenii, Hort. Fls. 3–6; sepals white; petals white with an apical rose-purple blotch; lip with the side lobes sulfur-yellow, purple-streaked within, the middle lobe white, streaked with amethyst Hybrid: *C. Lamminghei* × *C. bractescens.* GEORGE V. NASH †

CIBÒTIUM (Greek, *a little seed-vessel*) *Cyatheàceæ.* A small group of tree-ferns from Mexico and Polynesia, with bivalved coriaceous indusia, differing from Dicksonia in having the outer valve entirely distinct from the leaf For culture, see *Dicksonia*

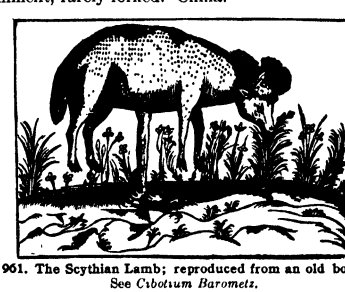
C Barometz is the plant that gave rise to the wonder stories of the Barometz or Scythian lamb (Fig. 961), which, according to Bauhin, 1650, had wool, flesh and blood, and a root attached to the navel The plant was said to resemble a lamb in every respect, but grew on a stalk about a yard high, and turning about and bending to the herbage consumed the foliage within reach, and then pined away with the failure of the food until it died In 1725 Breyne, of Dantzig, declared that the Barometz was only the root of a large fern, covered with its natural yellow down and accompanied by stems, which had been placed in museums in an inverted position, the better to represent the appearance of the legs and horns of a quadruped

Young plants of *C Schiedei* and *C regale* are frequently offered by florists at a stage before the trunk has developed and when the leaves are about four or five feet long. They require greenhouse conditions for successful culture

A. *Outer valve of the indusium larger, or the valves subequal*

glaùcum, Hook & Arn Lvs ovate-lanceolate, tripinnate, pinnules about 6 in long, taper-pointed, segms. close outer valve of indusium larger, broader than the inner. veins once- or twice-forked. Hawaiian Isls

Bárometz, J Smith. SCYTHIAN LAMB Trunkless; lvs scented, tripinnate the lower pinnæ ovate-lanceolate; pinnules short-stalked, 4–6 in long, with falcate segms valves of the indusium nearly equal: veins prominent, rarely forked. China.



961. The Scythian Lamb; reproduced from an old book. See *Cibotium Barometz.*

AA. *Outer valve of the indusium smaller than the inner.*

Schiédei, Hook Trunk 10–15 ft high lvs oblong-deltoid, tripinnate, with pinnæ 1–2 ft long; segms. falcate, sharp-pointed: sori sparse veins forked, on the lowest pinnate Mex

regàle, Lind. Trunk 10–12 ft. high lvs oblong-deltoid, tripinnate, with pinnæ 18–24 in long; pinnules sessile, with close, falcate, deeply incised segms.; veins pinnate in the lobes. Mex

L M. UNDERWOOD.
R. C. BENEDICT.†

CÍCCA: *Phyllanthus.*

CÌCER, (old Latin name for the vetch). *Leguminòsæ* Pea-like annual or perennial herbs, with 5-parted calyx, the lobes being nearly equal or the 2 upper ones somewhat shorter and connivent, oblong turgid 2-valved pod, mostly 1-fld. peduncles, odd-pinnate lvs and toothed lfts.: standard ovate or nearly orbicular, wings obovate and free, keel rather broad and incurved: fls white, blue or violet terminal lft often represented by a tendril or spine —A dozen or more species, with a Mediterranean-Asian range. **C. arietînum,** Linn, the CHICK-PEA or GARBANZO, is sometimes cult. in vegetable-gardens for the edible ripe seeds It is an annual and is cult. the same as bush beans It withstands dry weather well It grows 2 ft high, making a bushy, hairy plant, seeds are planted as soon as warm weather comes, usually in drills, the plants standing 8-12 in apart Lvs with small, roundish lfts . fls white or reddish, small, axillary Seed roundish, but flattened on the sides, with a projection on one side, shaped like a miniature ram's head (hence the name *arietinum,* in vars of red, black and white Much cult in S Eu and Asia, and widely known in Calif and in Mex , and other Spanish-American regions The peas are eaten boiled, or roasted like peanuts, often used for soup or as a substitute for coffee, and some kinds are used for horse-feed It is a promising crop for some purposes; yield sometimes 500 to 1,000 lbs to the acre.

L H B

CICHÒRIUM (from an old Arabic name) *Compósitæ* Seven or eight herbs, one of which is chicory and one endive Perennial, biennial or annual, branching and diffuse when in bloom, mostly with deep hard roots, milky juice and alternate lvs , and sessile axillary and terminal fl -heads fls several to many in the head, all ligulate and perfect, blue, purple or white, involucre double, pappus of bristle-like scales —Mostly in the Mediterranean region and to Abyssinia.

íntybus, Linn CHICORY SUCCORY. Fig 962 Stout deep-rooted tall perennial (3-6 ft) lvs broadly oblong, oblanceolate or lanceolate, hairy, rapidly becoming very small toward top of plant so that the branches appear nearly naked and wand-like, more or less clasping and the lower ones runcinate. fls. bright azure-blue, 1½ in or more across, closing about noon; pappus about 8 times shorter than fr. July-Oct.— Now a widespread weed of hard roadsides and fields but producing one of the clearest of light blues and worthy a place in the fl -garden Recent experiments promise attractive color forms. For cult. for the root and for the salad lvs. see *Chicory*

Endívia, Linn. ENDIVE Annual or biennial lvs many at the base, oblong, lobed and cut, smooth st 2-4 ft, branching, grooved. fls pale blue; pappus about 4 times shorter than fr India; but by some thought to be a derivative of *C Intybus,* or of *C. dwaricatum* of the Medit. region For cult. as a salad plant. see *Endive.*

L H. B.

CIENKÒWSKIA: *Kaempferia.*



962. Flowers of chicory.—Cichorium Intybus (×½) A familiar weed along roadsides in the eastern part of the country.

CIMICÍFUGA, Linn (*cimex,* a bug; *fugere,* to drive away) *Ranunculàceæ* BUGBANE Tall hardy herbaceous perennials, ornamental, but bad-smelling, suited for the back of plantings or for partially shaded places in the wild garden. The leaves and tall plants are admired in the hardy border

Leaves large, decompound: fls. white, in racemes, sepals 2-5, petaloid, deciduous, petals 1-8, small, clawed, 2-lobed or none· follicles 1-8, many-seeded, sessile or stalked; stigma broad or minute Allied to Actæa —About 10 species, natives of the north temperate zone, practically all of which have been used in gardens.

Cimicifugas thrive in half shady or open places in any good garden soil, but are much taller and more showy if the soil is very black and rich Propagated by seeds and division of roots in fall or early spring Seeds should be sown in cool moist soil soon after ripening

americàna, Michx (*Actæa podocárpa,* DC) Slender, 2-4 ft high lvs pale beneath fls in elongated raceme; petals 2-horned; pedicels nearly as long as the fl. follicles 3 or 5, stalked, seeds in 1 row, chaffy, stamens and pistils usually in same fl Aug -Sept Moist woods N. Y. and S.

fœtida, Linn. Lvs bipinnate, terminal lft 3-lobed. petals of the white fls. often tipped with anthers, no staminodia follicles 3-5, seeds very chaffy. Summer Siberia —Following forms are more commonly cult

racemòsa, Nutt (*C serpentària,* Pursh) Fig 963 St 3-8 ft high· lvs. 2-3 times 3-4-parted, lfts mostly ovate, firm texture racemes few, rigidly erect, often becoming 2 ft long follicles rather shorter than the pedicel, nearly ¼in. long, short style abruptly recurved July, Aug Ga to Canada and westward Intro 1891 Gt 13:443 Gn 46, p. 269 G C II 10 557; III 48·218 — Very pretty in fr , with its 2 rows of oval follicles always extending upward from the lateral branches The commonest in gardens Rhizome and roots valued in medicine

Var **dissécta,** Gray (*C spicàta,* Hort) Lvs more compound than the type small white fls closely packed on lateral and terminal branches Lasting until Sept Conn to S Pa J H III. 33.381

Var **símplex,** Regel (*C. simplex,* Wormsk). Tall and handsome. fls short-pedicelled, forming a fine, dense raceme, and at first pubescent follicle short-stalked. Kamtschatka. Gn 67, p. 8. Gn.W. 21 115, 23.899

C cordifólia, Pursh Lvs very broadly ovate or orbicular U S B M 2069 —*C dahúrica,* Hutt Higher and more branched than former Cent Asia —*C clàta,* Nutt (C fœtida, Pursh Actæa Cimicifuga, Linn) Used in medicine Ore , Wash —*C japónica,* Spreng 3 ft high lvs very large F S 22 2363 (as Pithyrosperma acerinum) —*C palmàta,* Michx =Trautvetteria carolinensis, Vail

K. C. DAVIS.

CINCHÒNA (from the Countess Chinchon, wife of a Spanish Viceroy of Peru, who was cured of fever in 1638 by the use of Peruvian bark) *Rubiàceæ* Plants widely known as yielding a remedy, in the bark, for malaria

Some of the species are lofty trees, others are mere shrubs. They grow isolated in various districts of the Andes, at elevations ranging from 2,300–9,000 ft, and between 22° south and 10° north latitude. Lvs opposite, with deciduous stipules. fls. much frequented by humming-birds, fragrant, white and pink in color, growing in terminal panicles; calyx small, 5-toothed,



963 Cinicifuga racemosa (Lfts ×⅔)

and persistent; corolla has a long tube with 5 short spreading valvate lobes, hairy at the margins, stamens 5, included in the corolla; ovary 2-celled, with very numerous ovules inserted on linear axile placentæ: caps opening septicidally from the base upwards; seeds small, numerous, flat and surrounded with a wing — There are 30–40 confused species Specimens are sometimes seen in collections of economic plants, but they are not horticultural subjects.

From the pharmacopœial point of view there are two distinct kinds of cinchona bark: (1) Cinchona, also called yellow cinchona and calisaya bark, which is probably the bark obtained from *Cinchona Ledgeriana*, Moens, and hybrids of this with other species of Cinchona The bark secured from these sources is said to contain 6 to 7 per cent of alkaloids, of which one-half to two-thirds is quinine. (2) *Cinchona rubra*, or red cinchona, which is obtained from *Cinchona succirubra*, Pavon, or its hybrids In this bark the alkaloid cinchonidine exists in greater proportion.

The cinchona trees are considered to yield the maximum of alkaloids at six to nine years of age. The bark of the trunk and roots is removed; the latter is used mostly in the manufacture of quinine Effort has been made to adopt the spelling Chinchona, although Linnæus, in founding the genus, used only one h. see Clements R Markham "A Memoir of the Lady Ana de Osorio, Countess of Chinchon and Vice-Queen of Peru (A D 1629–39), with a Plea for the Correct Spelling of the Chinchona Genus," London, 1874

The febrifuge reached Spain as early as 1639. Knowledge of it was spread by the Countess of Chinchon, hence it was called Countess' powder and Peruvian bark, and also Jesuits' bark, from the knowledge of it spread by Jesuits The word quinine is derived from the name by which it was known in Peru, *quinaquina*, or "bark of barks" In 1849, trees were sent by the Jesuits to Algeria, but the experiment was not successful. In 1852–4, Hasskarl successfully introduced living plants into Java. In 1859, Clements R. Markham was entrusted by the government of India with the task of collecting plants and seeds on the Andes, and establishing them in India In his fascinating book "Peruvian Bark a popular account of the introduction of Chinchona cultivation into British India" (1880), Markham recounts the difficulties in South America and his final success Cinchona is now grown commercially in India and also in Jamaica, but most of the commercial product is secured from trees grown in Java, it is also cultivated in New Zealand and Australia *C Ledgeriana*, Moens (*C Calisaya*, Wedd, var *Ledgeriana*, How), is a small tree with small thick elliptical lvs, reddish beneath, and with yellowish not fragrant fls, and a short caps *C succirubra*, Pav, has large and thin broad-elliptic lvs, purple-red calyx and rose-colored petals, and an elongated caps *C officinalis*, Hook f, has oval-lanceolate acute shining lvs, and rose-colored silky fls It is sometimes seen (in some of its forms) in collections. Var *Condaminea* (*C Condaminea*, Humb & Bonpl) is one of these forms and has been intro in S Calif. and said to be easily grown there. L H. B.

Cultivation of cinchona (By Wm Fawcett)

The seedlings may be raised either in boxes or in beds. The boxes should not be more than 3 or 4 inches deep. Three-quarter-inch drainage-holes should be made in the bottom, about 6 inches apart Whitewash the boxes or dust them inside with lime Put pieces of broken flower-pots over the drainage holes, and cover the bottom with gravel to a depth of 1 inch The soil should be made up of one-third leaf-mold, one-third good soil and one-third fine river gravel These should be thoroughly mixed and passed through a ¼-inch sieve Fill the boxes to within ¼ inch of the top, and slightly water Sow the seed evenly, and sprinkle over it some of the sifted soil, only just covering it The boxes should be under shade, sheltered from rain, and watered every day with a very fine spray from a watering-can The seedlings will appear in three or four weeks If the seeds are sown in beds, they require the protection of a roof sloping south, and supported by posts 4 feet 6 inches high on the north, and 3 feet 3 inches on the south side The sides may also have to be covered in The breadth of the beds is 3 feet The roof projects beyond the south posts sufficiently to keep off direct sunlight, and in the summertime, at any rate, a narrow north roof must be added at right angles. If the sheds are built under the shade of tall trees, the roof is needed only for shelter from rain

When the seedlings are 1½ to 2 inches high, they should be transplanted into nursery beds, made up in the same way as for seeds. In transplanting, use a wooden peg 4 or 5 inches long, ¾inch thick at one end and tapering to a dull point A seedling is picked up with the left hand from a bundle brought from the seed-beds, a hole is made with the peg in the right hand, big enough to receive the roots without bending or crushing them The soil is then pressed closely over the rootlets with the peg Two inches between each plant is enough room At first the plants should be shaded, but

when they are twice or thrice as high as when transplanted the shading may be gradually removed to harden them for putting out in their permanent positions

The soil and subsoil should be free and open to insure good drainage; newly cleared forest land on a hillside is the best for Cinchona trees. In Jamaica, *Cinchona officinalis* flourishes best at an elevation of about 5,500 feet, with a mean annual temperature of about 60° F., ranging from a minimum of 46° to a maximum of 75° and with a total annual rainfall of 120 to 150 inches

The distance when planted out in their permanent positions is 3 by 3 feet, and as soon as they begin to interfere with each other's growth they should be thinned out just sufficiently at first to prevent this The bark of those cut down may be worth stripping if the price of bark is high

Several methods have been used in taking the bark from the trees In South America, the tree is uprooted, and the whole of the bark may be taken from both root and stem A second plan is used if shoots spring from the root; the trunk is cut through above the ground, the bark stripped, and the stump left to coppice, one or two of the shoots being allowed to grow The third method is to make the same tree yield bark in successive seasons, for this purpose longitudinal layers of the bark are removed from the trunk, and the exposed surface is sometimes covered with moss, the bark renews itself, and the "renewed bark" is as rich (or richer) in alkaloids as the original In this way, by taking successive strips of bark in different years, the tree yields a continuous supply of bark L. H. B.†

CINERÀRIA (*ash-colored*, from the Latin, referring to the gray foliage) *Compósitæ* Herbs or undershrubs, closely allied to Senecio, from which they are separated chiefly by technical characters of the achene. The genus is variously understood by different authors As limited by Bentham & Hooker, and also by Engler & Prantl, it comprises about 25 South African species, and the common garden Cineraria becomes a Senecio (*S. cruentus*, DC.) The genus Cineraria differs from Senecio in having a cone-like rather than branched style, and a usually flattened or many-angled rather than terete achene, the species are herbs or subshrubs with yellow fl-heads

The cineraria of the florists (Fig 964) is now much modified by cultivation There are two views of its origin, one holding that it is a direct development of *C. cruenta*, Mass (*Pericallis cruenta*, Webb & Berth.), B M 406; the other that it is a hybrid, into which *C. cruenta*, *C. Heritieri*, *C. populifolia*, and perhaps others, have probably blended These are all natives of the Canary Islands. For important literature respecting the origin of the garden cineraria, see Nature, 51.461, 605, 52.3, 29, 54, 78, 103, 128, 55 341 G C III. 3.654, 657; 17·588, 655, 742, 18·89, 186, 29 297



964. Small plant of the florists' cineraria — Botanically Senecio cruentus.

The florists' cinerarias run in white, and in shades of blue, pink and purple-red There is promise of yellow-flowered strains by hybridizing with yellow senecios or related plants.

See *Senecio* for *Cinerària acanthifòlia*, *C. candidíssima*, and *C. maritima* To the garden or florists' cineraria (*C. cruenta*) belong the horticultural names *C. grandiflòra*, *C. kewénsis*, *C. nàna*, *C. stellàta*, and others. There are full-double forms (see R H 1874, p 47, 1886, p. 41. F S 22 2347-8 I H. 32 556.)—*C. flaríscens*, Hort., is a garden hybrid between Cineraria "Feltham Beauty" and *Senecio auriculatissimus* G C III 45, 322 Gn 73 252 It is a compact grower, originating with James Veitch & Sons, giving promise of a new strain of winter-blooming plants fls creamy yellow, the younger blooms almost canary yellow, if peculiarly constricted at the middle and much enlarged at the top.—*C. hýbrida*, Hort., is a hybrid between *Senecio cruentus* and *S. tussilaginis*, with white fls. having pale blue tips on the rays and purplish centers G M 55·337.—*C. stellàta*, Hort., now a popular race of florists' cineraria, has open spready panicles of star-like single fls. Fig 965. Most excellent.

The true yellow-fld South African cinerarias seem not to be in cultivation, although *C. pentactina*, Hook f., has been recorded in horticultural literature within recent years slender and climbing, with lax paniculate inflorescence, pale red flower-stems and five golden yellows rays in each head. B M 7799. Elegant greenhouse climber. L. H. B.

Culture of the florists' cineraria.

The single hybrid cinerarias are among the most useful and beautiful of all greenhouse flowering plants. The ease with which they can be raised, the little heat required, together with their free-blooming qualities, brilliant and various-colored flowers, which last for a considerable time in blossom, make them popular with most people possessing even only a small greenhouse Though they are herbaceous in character and may be propagated by cuttings or division of the roots, the single varieties are best treated as annuals, raising them from seed each year and throwing away the plants after flowering Although one may save one's own seed, the cinerarias, like most hybrids, will deteriorate both in size and quality of the flower after one or two generations unless they are crossed; therefore, unless one cares to cross one's own plants, it is best to purchase fresh seed from some reliable firm that secures its stock from hybridists. For florists' use, or when a succession of

these flowers is required, two sowings of seed should be made—the first about the middle of August, and the second a month later. The seed should be sown in pans or shallow boxes 1 foot square, these should be well drained, and the soil should consist of one part fine loam, one part leaf-mold, and one part clean sharp silver sand. The surface should be made very fine and pressed down evenly The seed should then be sown evenly and rather thinly, and covered with sand about the eighth part of an inch. This will in a great measure prevent the seedlings from what gardeners term "damping off," which they are very apt to do if the atmospheric conditions become at all stagnant. The seed-pans or boxes should be carefully watered with a fine rose and then placed in some cool shaded place, such as a frame placed on sifted coal-ashes on the north side of a wall or building, where they will germinate in about a week or ten days. As soon as large enough to handle conveniently, the seedlings should be potted into thumb-pots and grown on as rapidly as possible, shifting on into larger size pots as often as required, never allowing them to become the least pot-bound, or suffer in any way during the season of growth. The soil should consist of half leaf-mold and half fine fibrous loam, with a good sprinkling of silver sand, until the final shift into their flowering pots, when the soil should be three parts fibrous loam and one part well-decayed cow-manure or pulverized sheep-manure. About the first of October the plants should all be removed to the greenhouse, where the atmosphere should be kept cool and moist, but not stagnant If a rainy spell should set in, a little artificial heat should be given to cause a circulation of the atmosphere, and as autumn advances the temperature should be kept about 45° at night, with a rise of 10° by day. Liquid stimulants should not be given until the flower-buds begin to appear, when they are greatly benefited by an occasional watering of clear liquid cow- or sheep-manure. The plants should be well in bloom after the holidays.

If bloom is wanted in late fall or early winter, seed may be sown in May, keep the plants growing all summer, but do not let them bloom till they are established in 5- or 6-inch pots

The Star cineraria (Fig 965), now popular, is an open grower, 2 feet, not having the large solid masses of flower-heads of the older larger-flowered kinds. The blooms are single and mostly smaller, and the rays are separated as in a wild aster. These plants go under the name of *C. stellata* They are very free flowering, and as pot plants are more decorative than the large-flowered types, they meet the present demand for simplicity. In color they have the same range as the ordinary florists' cinerarias, and there are cactus-flowered strains, with narrow rolled petals The star cinerarias require the same handling and treatment as the others.

Double-flowered varieties of cineraria are not commonly grown, neither are they so beautiful as the single varieties. They may be propagated by seed or by cuttings, the latter being the best method, as a large percentage of seedlings are sure to turn out single, which will be inferior in size of flower as compared with the best single varieties Double-flowering varieties must be propagated each year to secure the best results As soon as the plants have finished blossoming, the flower stalks should be cut away to induce the plants to make fresh growth, which, as soon as large enough for cuttings, should be taken off and inserted in an ordinary propagating bed, where they will soon root, after which they should be potted and shifted on as often as required, growing them during the hottest months in as cool and shaded a position as can be provided

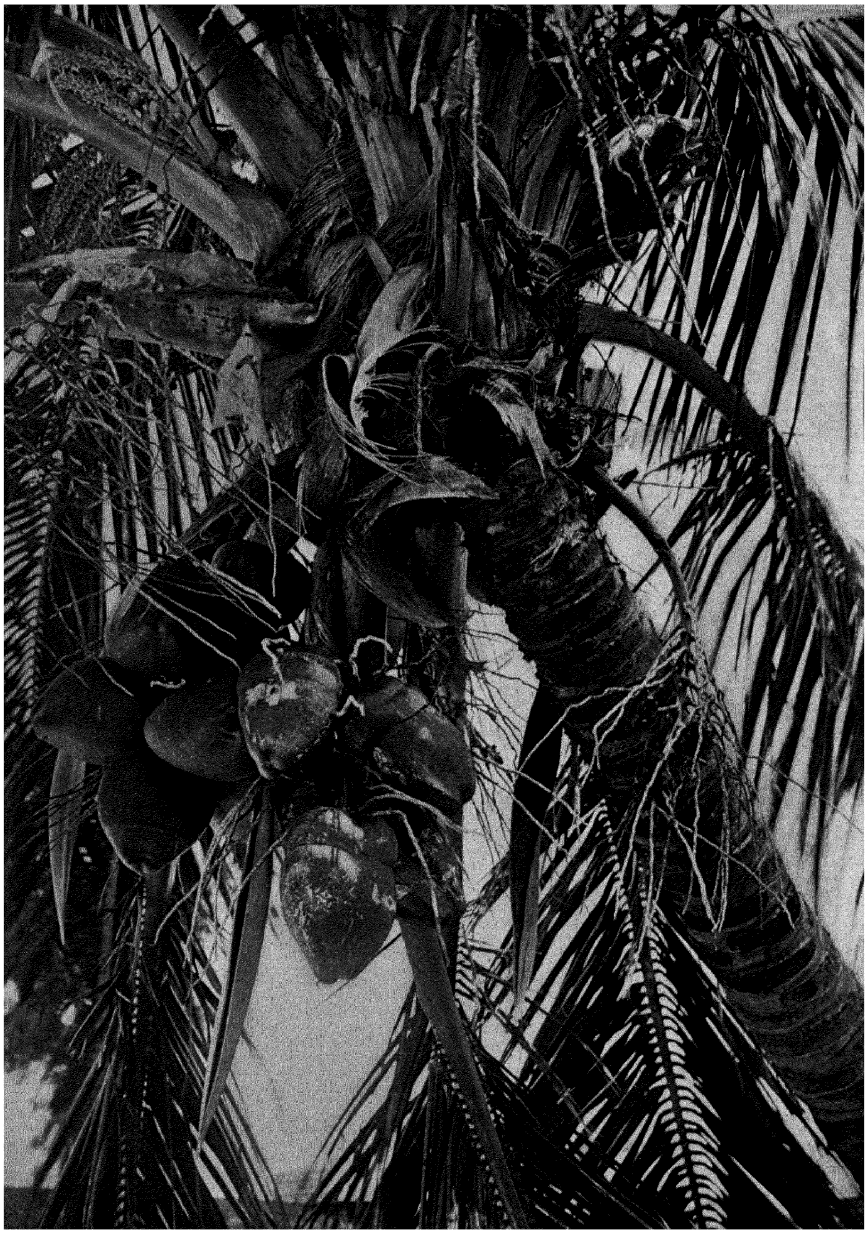


965. Stellata, a popular form of cineraria. (×½)

Cinerarias are very subject to the attacks of greenfly To keep these in check, the house in which they are grown should be fumigated with tobacco about once in ten days, or tobacco stems placed among the plants if fumigating is objectionable, or the cyanide treatment used See *Diseases* and *Insects*

Of the different species of Cineraria from southern Europe (properly Senecios), *C maritima* is perhaps the best It is of dwarf habit, with tomentose, silvery, pinnatifid leaves, and is a most useful subject for edging flower-beds It is not hardy in the North, consequently must be treated as an annual, sowing the seeds early in March in the greenhouse, afterward treating it as an ordinary summer bedding plant. The other species from south and eastern Europe do not prove hardy North, and if grown should be treated as tender annuals, planting them in the herbaceous borders for the summer. The species from the Cape of Good Hope require greenhouse treatment, the culture being the same as for the common cineraria, although, from an ornamental point of view, most of them would hardly pay for the room they would occupy. EDWARD J. CANNING.

CINNA (old Greek name for a kind of grass). *Gramineæ*. Tall perennials with flat leaf-blades. Spikelets 1-fld., numerous, in nodding panicles, the



XXVII. Coconut in flower and fruit. Southern Florida.

rachilla prolonged; lemma short-awned below the apex. There are two species, **C. arundinàcea,** Linn., with contracted panicle, the spikelets 2½ lines long, (Dept. Agric ,Div Agrost 7.140,20.79) and **C. latifòlia,** Griseb (*C. péndula,* Trin), with open panicle, the spikelets 2 lines long. Both species are native in cooler parts of N. Amer.

A. S. Hitchcock.

CINNAMÒMUM (the ancient Greek name) *Lauràceæ* Evergreen trees and shrubs of Asia and Australia, with aromatic leaves and wood, of which a few are cultivated in the extreme southern United States

Leaves usually thick, mostly opposite, strongly 3-nerved or pinnate-nerved buds not scaly (exception in *C Camphora*) fls usually perfect, with 9 (or less) perfect stamens in 3 unlike rows and a row of imperfect ones, perianth short-tubed, segms 6 and nearly equal fr a small 1-seeded berry, in the cup-like perianth.—Upward of 50 species, among which are plants yielding cinnamon (*C zeylanicum*), camphor (*C Camphora*), cassia-bark (*C Cassia*), and other aromatic and medicinal products Various species may be expected in collections of economic plants, but most of them are not strictly horticultural subjects. It is not known whether some of the species in cult in this country are passing under the proper names; possibly *C Tamala,* Fr Nees, widely distributed in the Far East, may be confused in our cultures.

The genus Cinnamomum embraces tropical and semi-tropical shrubs and trees, which are mostly of economic value, and in one or more cases are valuable shade trees for lawn and street planting The leaves are evergreen, usually of a rich shining green, and in *C. Camphora* have a silvery blue color on the under surfaces (*C Camphora,* the camphor tree, is hardy in the lower Gulf states, and is now being extensively planted, both for shade and extraction of gum *C Cassia* is not quite so hardy, but withstands a temperature of 20° F without injury, and has been planted in Florida for manufacture of its various products,—oil, gum, buds and cinnamon bark *C zeylanicum,* is likely to be extensively grown in Mexico and the West Indies — The various species are usually propagated by seeds, which are sown as soon as ripe in a shaded bed, the seedlings being transplanted when very small into pots and kept thus growing until permanent planting out The species, without exception, are very difficult to transplant from the open ground, and hence pot-grown plants are almost a necessity. Cuttings of half-ripened wood of some species may be rooted in the spring in moderate heat, following the usual method of preparation, and planting in coarse sand The soil best suited to cinnamomums in general, and *C. Camphora* in particular, is sandy loam, although a heavy loam, when well prepared, answers fairly well The sandy soil of Florida, when moderately manured, suits all species so far tried admirably. (E N Reasoner)

Camphòra, Nees & Eberm (*Camphòra officinàrum,* Nees *Laùrus Camphòra,* Linn) Camphor Tree Stout tree with enlarged base, to 40 ft · lvs. alternate, ovate-elliptic, acuminate, not large or very thick, pinkish on the young growths, with a pair or more of strong side veins buds scaly fls small, yellow, in axillary panicles, perianth membranaceous fr a drupe the size of a large pea China, Japan B M 2658.—A handsome dense-topped tree when young, becoming bare below with age; withstands some frost The young growth is very attractive It is hardy in central peninsular Fla , where it thrives well if attention is given to fertilizing and cultivating; it does not thrive in wet soils. Camphor is a common roadside planting in S. Calif. Commerical camphor is extracted from the wood.

zeylánicum, Nees. Cinnamon Tree. Small tree (20–30 ft). lvs very stiff, 4–7 in long, ovate to lance-ovate, glossy, 3–5-nerved, obtuse or somewhat acute, reticulate on under side: fls. small (¼in. long), yellow-white, in loose somewhat silky clusters, which often exceed the lvs.: fr. ¾in long, dry, pointed India, Malaya, and widely dispersed in tropical countries as a cult. plant. B.M 2028 L.B.C. 1:91.—Variable; and many forms have been described.

Cássia, Blume. Cassia-Bark Tree. Handsome tree· lvs stiff, 3–6 in long, oblong to nearly lanceolate, long-acuminate, glossy, 3-ribbed; petiole slender· fls. very small, in terminal or axillary silky-tomentose panicles 3–6 in long fr size of a pea. China —Young branches somewhat 4-angled Hardy and successful in central peninsular Fla (Nehrling), thriving best in moist and rich land, and making specially fine specimens near residences where now and then it receives applications of fertilizer and water

pedunculàtum, Presl Glabrous tree: lvs. thick, oblong-lanceolate, acuminate, 3-nerved, glossy above; petiole to ¾in long, blade 2–5 in· long and somewhat glaucous or areolate beneath· fls very small (⅛in or less long), in axillary corymbs that about equal the lvs , perianth glabrous outside and whitish-puberulent inside, the lobes oval-obtuse: berry globose-ovoid, ¼in. long Japan —This species is said to have been intro at Los Angeles some 35 years ago, where a handsome tree still exists, seedlings of which are to be found in other parts of S Calif In central peninular Fla , this species and *C Lourieri* are hardy and attractive, thriving particularly well in rich and rather moist land.

Lourèirii, Nees Cassia-Flower Tree. Middle-sized tree, glabrous lvs opposite or alternate, rigid, elliptic or oblong, attenuate-acuminate; petiole to 1 in long, the blades 3–5 in long fls very small (there is a variegated-lvd form) China, Japan —Perhaps a form of the last, with nerves on upper side of lf. less prominent or sunken, and other minor differences.

L. H. B.

CINNAMON FERN: *Osmunda.*

CINNAMON VINE: *Dioscorea.*

CINQUEFOIL: *Potentilla.*

CIPÙRA (origin of name unexplained). *Iridàceæ.* Four Trop American bulbous plants, rarely grown under glass Allied to Nemastylis· fls with 6 parts or petals, the inner 3 being much smaller, white or light blue, borne in terminal heads, short-tubed. The only species likely to be in cult is *C. paludòsa,* Aubl , with white fls and radical linear-lanceolate lvs ; bulb conical-globose B M 646 (as *Marica*). Prop by seeds and offsets; to be kept on the dry side through winter.

CIRCÆA (Circe, the enchantress). *Onagràceæ.* Enchanter's Nightshade Six or seven herbs of low or moist woods in North America and other temperate and cold regions of the northern hemisphere, two of which have been offered for growing in shady places and about garden bogs

Perennials, small and soft· lvs. opposite and stalked: fls perfect, small, and white, in terminal and lateral racemes, calyx-tube hairy, prolonged beyond the ovary, 2-lobed, petals 2, notched: fr a small, bristly bur. They are interesting little plants, but not showy. Of easy cult. in shady, damp spots.

Lutetiàna, Linn. Erect and branching, 1–3 ft , the st swollen at the nodes: lvs. ovate-acuminate, more or less rounded at the base, somewhat toothed: pedicels slender, reflexed in fr.: fr. 2-celled, bristly. Woods, E.

pacífica, Aschers & Mag. From 6–12 in , from a little tuber; smaller than the above, lvs. less acuminate, fls. smaller, fr. 1-celled and less bristly. Wyo , west

L. H B.

CIRRHÆA (from *Cirrhus,* a tendril) *Orchidàceæ.* About a half-dozen Brazilian orchids, of no special importance, one of which, *C. viridipurpùrea,* Lindl., is sparingly offered abroad, and two or three others of

which are mentioned in horticultural literature Allied to Gongora; cultured as for Cymbidium; warmhouse. Fls mostly greenish and red (or purple), on long pendulous racemes that arise from base of the pseudobulbs.

CIRRHOPÉTALUM (*tendril petal*, alluding to the narrow lateral sepals). *Orchidàceæ* Epiphytes, grown in baskets or on blocks in a warmhouse.

Pseudobulbs from a creeping st: dorsal sepal free; lateral sepals much longer than the dorsal, cohering excepting at the base; petals much shorter, often ciliate; lip entire, usually recurved; column short, 2-winged at the apex; pollinia 4.—About 90 species in Trop. Asia, Mascarene Isls, and Australia.

Being of rambling habit, with creeping rhizomes, cirrhopetalums should be grown in baskets sufficiently large to afford plenty of growing surface, and suspended from the roof where they will get abundant light and free access of air to the roots, which is equally essential. Liberal allowance must be made for drainage, which should consist of either broken potsherds or charcoal, the latter being preferable, as it is light, durable and contains nothing detrimental. Two-thirds osmundine, or other clean fiber, and one-third chopped live sphagnum moss, well mixed together, afford a good compost, and after this has been carefully tucked in about the roots and interstices, the plant should be held firm with brass or copper wire until reestablished The compost should be used rather sparingly to prevent over-watering. Many of the smaller-growing species do very well on orchid blocks, firmly attached, with a small quantity of compost beneath them During the winter months, little or no shade is required The temperature may range from 58° to 65° F by night, with about 10° rise through the day, or even a little more, with sun-heat, will do no injury. No artificial heat is necessary in summer, except in extreme cold or wet weather, but a shaded moist location should be chosen, such as is afforded in the cattleya or palm department. When the plants are dormant, light syringing overhead will keep the compost moist and the plants in healthy condition, but as the growing season advances, a liberal quantity of water and copious syringing in bright weather will be necessary. The stock is increased by division, the most judicious method being to cut nearly through the rhizome with a sharp knife, about three pseudobulbs behind the lead, just before growth action, allowing the part to remain until the dormant eyes start to grow, when it may be removed and treated as an established plant. A little extra heat and moisture at this period will prove beneficial with the weak plants. All are of moderately easy culture. (Robert M. Grey)

Medúsæ, Lindl Pseudobulbs ovoid, ribbed: lvs. 5–8 in long, oblong-elliptic scapes with large sheathing bracts; umbel many-fld; fls creamy, yellow-spotted; dorsal sepal lanceolate; lateral sepals with long pendent tails, 4–5 in. long; petals and lip minute Singapore. B.R. 28:12. B.M. 4977. I.H 39.154. G C III 21 25.

picturàtum, Lindl Pseudobulbs ovoid, about 2 in. long, angled· lvs 3–5 in. long, linear-oblong scape with sheaths pale yellowish-green, red-speckled; umbel 10–15-fld, sepals and petals green, the dorsal sepal erect, obtuse, red-spotted, with a thread-like purple-knobbed summit, the lateral sepals linear; petals small, rounded, curved; lip blood-red, obtuse. India. B.M. 6802.

C Ándersonii, Kurz. Dwarf habit· fls in umbels, lateral sepals whitish, with fine rose dots, dorsal sepal marked with purple lines Sikkim.—*C. appendiculàtum*, Rolfe. Dorsal sepals and petals pale yellow, lip rosy purple E. Indies.—*C. biflórum*, J J. Smith Sepals purple-spotted, the dorsal elliptic, about 1¼ in. long, including the seta, the lateral sepals linear-lanceolate, 2–3½ in long Java B M 8321.—*C. breviscàpum*, Rolfe Dorsal sepal oblong-lanceolate, about ¾in long, dull purple, the lateral sepals yellow, spotted red-brown, about 1 in long, the lip rose-purple, broadly cordate, ovate-cuneate, hairy at base. Perak B.M 8033.—*C. caudàtum*, King & Pantl. Dwarf species dorsal sepals short; lateral sepals tail-like, about as long as scape Himalayas.—*C. chinénse*, Lindl Fls pale fawn-color, the dorsal sepal hooded, crimson-spotted, the lateral sepals linear-lanceolate, the lip crimson-spotted China B R 29 49.—*C. chrýseum*, Kränzl Scape filiform, 1-fld, fls yellow Philippines.—*C. Cumingii*, Lindl Umbel 9-12-fld, fls purple, the dorsal sepal glandular-ciliate, the lateral sepals 1 in long, linear-oblong, lip with 2 erect processes Philippines B M 4996.—*C. Hookeri*, Duthie Fls 1 in. long, yellow, the dorsal sepal about ¼in long, obtuse, purple-streaked, the lateral linear-lanceolate, acuminate Himalayas B M 7869.—*C. lepidum* (Bulbophyllum lepidum, J J Smith) Dorsal sepal, erect, ciliate, ⅓in long, brownish yellow, lateral sepals united, spreading, bright brownish yellow, somewhat red-flushed, at base, the upper portion pale yellow, marbled with brown-red, about 1 in long, petals ⅓in long, ciliate Java.—*C. longissimum*, Riddell. Fls whitish, rosy-streaked, the dorsal sepal lanceolate, ⅓–¾in long, the lateral sepals linear, 8–12 in long, with slender tails, petals falcate, ciliate Siam B M 8366.—*C. Mscholtzii*, Rolfe Umbels 8–12-fld lateral sepals deep yellow, dorsal sepal and petals blotched with dark purple on a pale ground Annam.—*C. minùtum*, Rolfe Fls vermilion-colored with hairs of dorsal sepal and petals yellow, lateral sepals caudate, almost thread-like Annam.—*C. papillòsum*, Rolfe Umbels usually 6-fld, dorsal sepals and petals lined with dark purple on a pale ground, lateral sepals speckled with red-brown Siam.—*C. pulchrum*, N E Br I H 33 608 O R 17 328 A F 6 609.—*C. retusiusculum*, Reichb f Fls ¾in length, upper sepals dark purple, lower coherent, yellow, marked with dark red China.—*C. Rõxburghii*, Lindl Small, with ovate reddish green lvs and almost globose umbels of cream-white fls tinged with rose or purple India A pretty dwarf species.—*C. Thouársii*, Lindl Umbel of 10-12 fls, sepals and petals tawny yellow, the dorsal ovate, cuspidate, with purple warts, the lateral lanceolate, acute, stained claret, petals small, ovate-lanceolate, pale yellow, purple-spotted, with a thread-like tail at apex, lip oblong Madagascar, Java, Philippines, Society Isls B R 24 11. B.M. 4237.—*C. sinénse*=*C* chinense

GEORGE V. NASH

CÍRSIUM (old Greek name, referring to the use of the plant in an ailment) *Compósitæ* THISTLE Prickly-leaved plants (largely biennial) of bold habit and showy purple, pinkish, white or even yellowish heads, sometimes planted in wild gardens

The thistles are botanically confused By some authors, Cirsium is combined with Carduus, but others keep it distinct because of the plumose or feathery pappus (which is most constant on the inner florets), and this disposition is here accepted The cirsiums are herbs or subshrubs, more or less spiny lvs alternate, sessile, often pinnatifid fl-heads large, mostly terminal, involucre ovoid or spherical, with many rows of imbricated often spiny-tipped scales, many-fld, florets all tubular and alike (seldom more or less dioecious) —More than 120 species of annuals, biennials or perennials, widely spread in the northern hemisphere



966. Head of pasture or bull thistle. (×½)

Other generic names partaking in the confused usage are Carbenia, now a synonym of Cnicus, Chamæpeuce, now a section of Cirsium; and Cnicus (which see), a genus of one species, distinguished by sterile marginal florets, pappus of ten long bristles and equal numbers of shorter ones and of horny teeth, and achene attached obliquely near the base rather than squarely on the base

A number of the thistles are field and pasture weeds. The most pernicious of these weeds is the Canada thistle, *C arvense*, Scop. (*Carduus arvensis*, Robs), Fig 795 The common bull thistle or pasture thistle (Fig. 966) is a stately biennial, and very decora-

tive. It is *C. lanceolatum*, Hill (*Carduus lanceolatus*, Linn.). Both these species are introduced from Eu., as well as two or three others of lesser distribution in this country. There are a number of showy native species, one of which, *C muticum*, Michx., (*Carduus muticus*, Pers.) is shown in Fig. 967 This purple-fld. species occurs in low grounds from Newfoundland to W Va



967 Cirsium muticum (×½)

A few species of Cirsium (as the genus is here defined) may be expected to occur in cult. *C oleraceum*, Scop, (*Carduus oleraceus*, Vill), of Eu, has very decorative foliage, and thrives in the moister parts of a garden; the fls are not very handsome, whitish or yellowish, 3 ft The Chamæpeuces are sometimes grown for the large prickly spreading rosettes of lvs that are produced the first year, the bloom appearing the second year They combine well with plantings made for subtropical effect· *C Casabonæ*, DC (*Chamæpeuce Casabonæ*, DC *Carduus Casabonæ*, Linn), has lvs deep green veined white, spiny, the fl-heads pale purple; *C Diacantha*, DC (*Chamæpeuce Diacantha*, DC *Carduus Diacantha*, Labill), has thick lvs shining green with silvery lines, white beneath, linear-lanceolate, the principal nerve or rib terminated by a single spine and the lateral nerves usually 2-spined, and dense clusters of purple heads, *C afrum*, DC (*Chamæpeuce afra*, DC *Carduus afer*, Jacq), has dark green blotched white linear-lanceolate lvs tomentose beneath, and large bright purple heads, *C Sprengeri*, Hort, a garden hybrid, perennial, with dark green white-veined spiny lvs, and white fragrant heads, *C tauricum*, Hort, is probably *C Diacantha*

L H B

CISSÁMPELOS (Greek for *ivy* and *vine*. *Menispermàceæ* Mostly twining plants, shrubs and herbs, one of which is cultivated far south

Leaves various, mostly cordate or reniform, often peltate, alternate. fls in axillary racemes or clusters, the plant dicœcious, sterile fls with 4 sepals and 4 petals united, the anthers 2–5 on a staminal column or disk, fertile fls with 2 united fleshy sepals, subtended by a sepal-like bract, and solitary ovary, with 3 styles fr a subglobose drupe, with a flattened and tuberculate stone Many species or distinct forms in tropical regions, but many of them are evidently forms of the widely distributed **C. Pareira,** Linn This plant, as *C. heterophylla*, DC, and under other names, is cult in S Fla and the tropics. It is known as Velvet-Leaf and False Pareira It is an exceedingly variable vine, with downy round-cordate or peltate entire or lobed lvs, the very small sterile fls in stalked corymbs and the fertile in large-bracted clusters, and a hairy or glabrate nearly globular red drupe It occurs in all tropical countries. "Pareira brava" of the pharmacopœas is derived from the root of the related perennial climber, *Chondrodendron tomentosum*, of Peru and Brazil. Whether the genus Cissampelos contains 20 or 70 species depends mostly on the rank given to the many forms of the cosmopolitan *C. Pareira*

L H B

CÍSSUS (Greek name of *ivy*). *Vitàceæ*. Mostly tendril-climbing shrubs, a few of which are grown in the open, and others under glass for the handsome often colored foliage

Very like Vitis (with which some authors unite it): at best a mixed group botanically, and capable of good definition only when certain groups or subdivisions are removed from it For the characters of related genera, see *Ampelopsis*, *Parthenocissus*, *Vitis* As constituted by Gilg in Engler & Prantl's "Pflanzenfamilien," the genus includes Cayratia but which might well be kept distinct. This subgenus, of which two or three interesting species from China and Japan are in cult., differs from Cissus proper in the always compound lvs., which are usually pedate, the axillary infl, the thin or even membranous disk, the 2–4-seeded fr, and the plants mostly herbaceous Excluding Cayratia, Cissus is known by usually simple lvs, 1-seeded fr, and the disk being deeply 4-lobed or separated into 4 gland-like bodies. From Ampelopsis, as that genus is characterized in this work, Cissus differs in the 4-merous fls., often herbaceous, and fleshy st, the 1-seeded rather than 2–4-seeded fr and in the disk not being cup-like and not irregularly lobed From Vitis, it differs in its 4-merous fls, its expanding petals (the corolla not falling off as a cap), the 4-parted disk, its 1-seeded mostly dry and inedible fr, and other characters Cissus comprises probably 200 species, widely dispersed in tropical regions and a few of them reaching extra-tropical areas (as in the southern U S) mostly climbers by means of tendrils without enlarged or disk-like ends, rarely erect shrubs or even perennial herbs, sometimes with greatly thickened sts either under ground or above· lvs alternate, simple or compound, with tendril (if present) opposite or at same node fls usually perfect, in mostly umbel-like cymes that are terminal or axillary, parts of the fl in 4's, the petals at length spreading and falling separately, disk around the ovary 4-parted or -separated, style long and mostly slender rather than conical· fr typically a dryish 1-seeded berry (2–4-seeded in Cayratia)

In cultivation there are very few species of Cissus, and these are mostly the tendril-climbing Vitis-like species grown under glass for the handsome foliage The best known is *C discolor*, although other species are likely to become widespread and popular in greenhouses The fleshy-stemmed erect species are sometimes grown in botanical collections for the cactus-like forms and for illustrations in adaptive morphology. The species are readily propagated by cuttings

INDEX.

acida, 4
adenopodus, 3
antarctica, 9
argentea, 10
Baudiniana, 9
discolor, 8
gongylodes, 6
incisa, 5
japonica, 1.
mollis, 8
oligocarpa, 2.
ovata, 10
Rocheana, 5
sicyoides, 10
striata, 7
velutinus, 8.

A *St herbaceous.*

1 **japónica,** Willd (*Cayràtia japónica*, Gagnep). Herbaceous, glabrous or minutely puberulent, the branches striate, climbing by tendrils lvs pedately 5-foliolate, long-stalked, the lfts lanceolate or obovate-oblong, serrate fls in a long-peduncled 2–3-forking cyme, greenish; petals ovate-triangular, blunt. berry size of a small pea, 2–4-seeded, the seeds 3-angled-ovate, keeled. Japan, Java, Austral —Appears to be root-hardy N., when covered.

2. **oligocárpa** (*Vitis oligocárpa*, Lev. & Van *Cayràtia oligocárpa*, Gagnep.) Differs from the above in the acuminate and more sharply and closely serrate lfts., which are puberulous when young: anthers orbicular. China —Very recently intro.

3. **adenópodus,** Sprague Herbaceous, climbing by tendrils, slender, terete root tuberous lvs red and decorative, 3-foliolate, petioled, 3–6 in long, hairy,

lfts. stalked, ovate, abruptly acuminate, coarsely serrate, green with sunken nerves above and red with prominent nerves beneath· fls light yellow, in a loose panicle or cluster about 4 in long, the pedicels recurved after flowering, petals oblong, much reflexed (about ⅛in. long) berry globose, ⅔in diam , dark purplish black. Trop. Afr. (Uganda). B M. 8278 —A quick-growing plant requiring warmhouse conditions Readily prop by cuttings or seeds, and of very easy cult. Thrives well in sunlight. A recent intro.

AA. *St not herbaceous at maturity, although perhaps fleshy.*

B *Lvs. fleshy, 3-lobed or 3-foliolate.*

4. **ácida,** Linn Low glabrous climber, with slender and striate somewhat fleshy branches and long stout tendrils: lvs rigid, petiolate; lfts or lf -divisions rather small, broad-cuneate and sharply toothed near the apex fls small, in corymb-like or umbel like clusters· fr. an ovoid and abruptly pointed dark purple berry, with 1 or 2 large seeds, the pedicel being recurved at maturity S Fla , and Trop Amer.; also, in Ariz and S.—Sometimes planted.

5 **incisa,** Desm (*C Rocheàna,* Planch) Climbing 20–30 ft , the sts warty and very fleshy and the tendrils root-like lvs pale green, very fleshy; lfts. or divisions wedge-ovate, notched on both sides and top, the middle one sometimes again lobed and the lateral ones 2-lobed fls in umbel-like mostly 3-forking cymes opposite the lvs · fr. an obovoid blackish berry, with 1 or 2 seeds, the pedicel being strongly re-curved Fla , to Ark and Texas R H. 1884, pp 272–3 —Often planted in the extreme S. Sometimes called "marine ivy."

BB *Lvs. not fleshy*

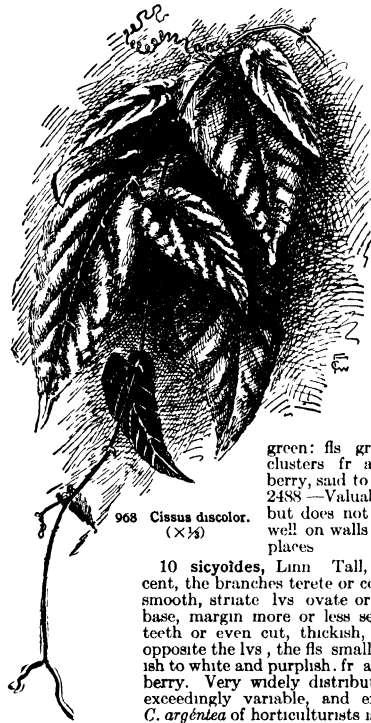
C. *The lvs 3–5-foliate.*

6 **gongylòdes,** Planch (*Vitis gongylòdes* and *V. pteróphora,* Baker) Vigorous tendril-climber with 4-angled branches, desirable for large greenhouses where tropical effects are desired, sending down long bright red aerial roots lvs large, stalked, 3-foliolate; lfts. rhomboid or the middle one often 3-lobed, the lateral ones sometimes lobed on the outside at the base, hairy on margin and nerves· fls red-brown, in pedunculate cymes opposite the lvs.: a tuber (reaching 5–6 in. long) is borne at the end of each branch when the season's growth has ceased, and this drops and produces new plants Brazil. B M. 6803. Gt 37 1273 R H. 1908.203.

7. **striàta,** Ruiz & Pav (*Ampelópsis sempérvirens,* Hort.) Low, shrubby evergreen vine, tendril-climbing, the branches striate and usually lightly hairy: lvs. small, 3–5-foliolate, with cuneate-obovate or lanceolate coriaceous lfts , serrate above the middle. fls. yellowish, in many-fld pedunculate cymes opposite the lvs · fr depressed-globose, size of small pea, often 2-celled and 2–4-seeded Chile, S. Brazil.—Graceful small climber for the cool greenhouse; robust in S. Calif.

CC *The lvs. not compound although perhaps lobed.*

8. **díscolor,** Blume. Fig 968 Tendril-climber, smooth, but not glaucous, the branches slender and with 4 or 5 ribs or angles, red: lvs. oblong-ovate or cordate-ovate, acuminate, bristly serrate, reddish beneath, velvety green and mottled with silvery white above· fls small and yellowish, in dense and very short axillary peduncled clusters· fr. globular, 1-seeded Java. B.M. 4763. Lowe 13. F S. 8.804–5.—One of the best of warmhouse foliage plants Easily grown Prop. by cuttings It must have a season of rest, usually in spring or early summer If wanted for winter growth, temp must be about 75° It thrives in rich somewhat moist soil and responds to small applications of fertilizer now and then. The plant is very susceptible to root-knot. Variable. Known to some as "trailing begonia"



968 Cissus discolor. (×⅓)

Var **móllis,** Planch (*C velùtinus,* Lind) Pubescent or velvety. lvs green and boldly veined with white above, blood-red beneath fls intense bright red, in large laxer and longer-peduncled cymes Habitat unknown. B M. 5207

9 **antárctica,** Vent (*C. Baudiniàna,* Blouss) Kangaroo Vine Upright shrub, but the branches climbing by tendrils, hairy lvs rather thick, glossy, ovate to oblong, sometimes more or less cordate, very short-acuminate, mostly toothed or notched, green: fls green, in few-fld , axillary clusters fr a globular- or few-seeded berry, said to be edible Austral B M 2488 —Valuable for cool greenhouses, but does not withstand frost Grows well on walls in darkish and neglected places

10 **sicyoìdes,** Linn Tall, tendril-climbing, pubescent, the branches terete or compressed, tuberculate or smooth, striate lvs ovate or oblong, often cordate at base, margin more or less serrate with bristle-tipped teeth or even cut, thickish, green: infl. corymb-like, opposite the lvs , the fls small, and varying from greenish to white and purplish. fr an obovoid, 1-seeded black berry. Very widely distributed in Trop Amer , and exceedingly variable, and extending into Fla The *C. argéntea* of horticulturists is var **ovàta,** Baker, which has glabrous ovate or ovate-oblong remotely serrate and somewhat glaucous lvs Called "season vine" in tropics

It is probable that some of the plants listed as Cissus belong to other genera, and some of the trade names are unidentifiable botanically —*C dìbo-nìtens,* Hort Lvs oblong-acuminate, more or less cordate at base, silvery white and shining over the upper surface Brazil Warmhouse climber —*C amazónica,* Lind Lvs glabrous and glaucous, oval-acuminate and narrower, reddish beneath and silvery veined above Brazil Warmhouse climber. —*C Davidiàna,* Carr , is a Vitis (which see) —*C Lindeni,* André (I H 17 2), has large ovate-cordate silver-blotched lvs a glabrous climbing shrub, with terete branches Colombia —*C porphyrophylla,* Lindl , is a Piper —*C. Veitchii,* Hort , is Parthenocissus.

L. H. B.

CÍSTUS (ancient Greek name). *Cistàceæ.* Rock Rose. Low shrubs grown for their red or white hairy flowers.

Plants usually with villous and glandular tomentum, aromatic· lvs. opposite, mostly persistent, entire, the opposite petioles connate at the base fls. large, in terminal and axillary cymes at the end of the branches, rarely solitary, white to purple; sepals 3 or 5; petals 5. stamens numerous; style elongated or short with a

large 5–10-lobed stigma caps many-seeded, splitting into 5 valves.—About 20 species in the Medit. region and many natural and garden hybrids. Monograph by Grosser in Engler, Pflanzenreich, hft 14, pp. 10–32 (1903) and an illustrated monograph by R. Sweet, Cistineæ (1825–30) quoted below as S C

The cistuses are ornamental free-flowering shrubs, usually only a few feet high, with very showy purple or white flowers similar to a small single rose, appearing in early summer. They are hardy only in warmer temperate regions, but many of them will stand 10° of frost without injury, and *C. laurifolius* and *C. villosus* var *lauricus* even more. They thrive best in a well-drained light soil, mostly preferring limestone soil, and in a sunny position; the dwarfer species are well adapted for rockeries with southern aspect They do not bear transplanting well, and should be grown in pots until planted out. Some species yield ladanum, a resin used in perfumery. Propagated by seeds sown in spring in pans or boxes and the young seedlings shaded; increased also by layers and cuttings in spring or late summer, inserted in sandy peat under glass In the Old World, the cistuses are important garden plants, but they are little known in America

INDEX.

albidus, 5
cordifolius, 11
creticus, 1
crispus, 4
Cupanianus, 11
cyprius, 8
heterophyllus, 2
incanus, 1
ladaniferus, 7
laurifolius, 9
maculatus, 7
parviflorus, 6
populifolius, 11
purpureus, 3
rotundifolius, 1.
salvifolius, 10.
tauricus, 1.
undulatus, 1.
villosus, 1.

A *Color of fls purple or red.*

B. *Fls 1½–2 in. wide, petals imbricate.*

C. *Lvs penninerved, 3-nerved only at the base.*

D. *Petals without a dark blotch at the base.*

1 **villōsus,** Linn (*C incànus*, Linn) Erect shrub, 3–4 ft , villous or tomentose lvs penninerved, roundish-ovate or oblong, narrowed into a very short petiole, rugose above and grayish green, tomentose or villous beneath, 1–2 in long fls 1–3, long-peduncled, reddish purple, 2 in wide, petals light pink or yellowish at the base May, June Medit region B M 43 S C 35 Gn 27, p 571 —A very variable species Var **crēticus,** Boiss Lvs smaller, more spatulate at the base, very rugose, undulate at the margin fls purple S E Eu , Asia Minor Sibthorp, Fl Græca 5 495 S C 112 Gn 27, p 571, 33, p 490

Var **rotundifōlius,** Loud Dwarfer, with more roundish lvs S C 75 Garden form Var **taūricus,** Grosser (*C taùricus*, Presl) Lvs obovate-spatulate, the upper ones lanceolate, scarcely undulate. pedicels twice as long as sepals Asia Minor Var. **undulātus,** Dunal Lvs linear-oblong, acute, undulate: fls. solitary S C 63 Garden form

2 **heterophȳllus,** Desf Erect, to 2 ft.: lvs. short-petioled, elliptic- or oval-lanceolate, green on both sides and slightly hairy, ½–1 in long: fls 1–3, 2 in wide; petals red, yellow at the base. N. Afr S C 6.—More tender.

DD. *Petals with a dark blotch at the base.*

3 **purpūreus,** Lam (*C ladaniferus* × *C villōsus*) Shrub to 4 ft , somewhat glutinous lvs. nearly sessile, lanceolate or oblong-lanceolate, acute, rugose above, slightly undulate and revolute at the margin, 1–2 in. long: fls. usually 3, lilac-purple, 3 in. across, the petals yellow at the base and with a maroon blotch. Of garden origin. Gn. 31·326; 45, p 33; 53, p. 134. B R. 5:408 S C. 17. G C III. 48.118–19 —One of the most beautiful rock roses.

CC *Lvs. 3-nerved to the apex.*

4. **crīspus,** Linn Compact shrub, to 2 ft., villous: lvs. sessile, linear-lanceolate or oblong-elliptic, undulate, rugose above, villous beneath fls 3–4, nearly sessile, 1½–2 in. wide, deep rose-colored. June–Aug. S W. Eu. S.C. 22. Gn. 34.252.

5. **álbidus,** Linn. Shrub to 4 ft , the young parts white-tomentose: lvs. sessile, elliptic or ovate-oblong, revolute at the margin, reticulate beneath, whitish tomentose, ½–2 in long fls. 3–6, lilac or rosy, 2½ in across, style longer than stamens. S W. Eu. N. Afr. S C. 31. G.C III. 45.117. G.M. 51:783.

BB. *Fls 1 in. wide; petals not imbricate.*

6. **parviflōrus,** Lam Much-branched shrub, 1–2 ft ; tomentose: lvs. 3-nerved, elliptic-ovate, undulate, rugose above, reticulate beneath, twisted, 1 in. long: fls 3–5; petals pale rose, yellow at the base. June. Greece, Crete. S.C. 14.

AA. *Color of fls. white: lvs. 3-nerved.*

B. *Sepals 3.*

C. *Lvs. nearly sessile: plant very glutinous: fls. usually solitary.*

7 **ladanīferus,** Linn Shrub, to 4 ft , glutinous: lvs lanceolate, glabrous and viscid above, whitish tomentose beneath, 1½–4 in long fls. usually solitary, long-peduncled, 3–3½ in wide, petals yellow at the base June S W Eu S C 84 F S R 2, p 44 G. 22·213 Gn 58, p 171; 66, p 257 F. 1874, p. 160 Var **maculātus,** Sweet Petals with a dark brownish crimson spot above the base Gn 30:30; 33, p. 490. S C 1 G 26·598. Grosser 23.—Probably the most beautiful of all cistuses

CC *Lvs. distinctly petioled: fls. several.*

8. **cȳprius,** Lam (*C. ladaníferus* × *C laurifōlius*). Erect shrub, to 6 ft., somewhat glutinous lvs. oblong-lanceolate, glabrous above, villous-tomentose beneath· fls. 5–7, nearly 3 in wide, petals blotched purple at the base June. Garden origin S C 39 Gn 76, p. 438. B M 112 (as *C. ladaníferus*)



969. Cistus laurifolius. (×⅓)

9 **laurifōlius,** Linn Fig 969. Shrub to 6 ft.: lvs. petioled, ovate or ovate-lanceolate, glabrous above, whitish or brownish tomentose beneath, 1–2½ in long. fls. 3–8, 2–3 in wide; petals with yellow blotch. June–Aug S. W. Eu. Gn. 53, p. 131; 64, p 234 G M. 34: 95. S C. 52 —The hardiest species.

BB. *Sepals 5.*

10 **salvifōlius,** Linn Shrub, to 2 ft , sometimes procumbent: lvs. petioled, oval to ovate-oblong, rigid, very rugose above, tomentose on both sides, ½–1¾ in long; bracts deciduous fls. solitary or several, white, 1½ in. across. S Eu , N. Afr , Orient. S C 54. Gn 76, p. 352 G. 30:593.—A very variable species.

11. populifòlius, Linn. (*C. cordifòlius,* Mill. *C. Cupaniànus,* Presl). Shrub to 6 ft.: lvs long-petioled, cordate-ovate, acuminate, penninerved, rugose, glabrous, 2–3½ in. long. fls. 2–5, white, 2 in. across. S. W. Eu S C. 23, 70.

C. algarvénsis, Sims=Helianthemum ocymoides —*C. canditissimus,* Dun , S C 3=C symphytifolius, var —*C. canéscens,* Sweet (C. villosus var canescens, Nichols. C. albidus × C villosus) Lvs. short-petioled, narrow-oblong or lanceolate, 3-nerved, obtuse, undulate fls dark purple. Of garden origin S C 45.—*C. Clúsii,* Dun =C rosmarinifolius —*C corbariénsis,* Pourr (C populifolius × C salvifolius) To 5 ft lvs slightly cordate, glutinous. fls. 1–5, white, 1½ in. S C 8 —*C florentinus,* Lam (C monspeliensis × C. salvifolius) Dwarf lvs lanceolate fls white, 2 in S C 59. G 11 183, 14 241. G M 32 277, 31 587 Gn 27 570, 38, p 177; 53, p. 130, 134, 75, p 422 F S R 2, p 43 —*C formósus,* Curt = Helianthemum formosum —*C glaucus,* Pourr (C Ledon, Lam. C. laurifolius × C monspeliensis) 1–2 ft lvs lanceolate, glossy above fls 5–10, white, 1½ in S France —*C hirsutus,* Lam 1–3 ft , clothed with spreading and glandular hairs lvs sessile, lanceolate fls 1–5, white S W. Eu S C 19 —*C latifòlius,* Sweet, S C 15=C populifolius var —*C ládzus,* Ait =C nigricans —*C. Ledon,* Lam =C glaucus —*C longifólius,* Lam =C nigricans —*C Lorétii,* Rouy & Foue (C ladaniferus × C monspeliensis) Habit like C monspeliensis lvs linear-lanceolate, revolute, grayish beneath, glutinous fls 1–5, white, 2 in across Of garden origin, also found spontaneous Var *maculátus,* Rouy & Foue Fls with 5 dark red blotches Gn 75, p 653, 76, p 139 —*C monspeliénsis,* Linn To 5 ft lvs sessile, lanceolate fls white, cymose, 1 in S Eu S C 27 —*C nígricans,* Pourr (C longifolius, Lam C laxus, Ait C monspeliensis × C populifolius) 2–4 ft , glandular lvs oblong-lanceolate, glossy above fls white, 1½ in S W. Eu S C 12 Variable —*C oblongifólius,* Sweet, S C 67=C nigricans var —*C obtusifólius,* Sweet, S C 42=C nigricans var —*C rosmarinifólius,* Pourr (C Clusii, Dun) Allied to C ladaniferus. Lvs linear, strongly revolute at the margin, viscid above while young, tomentose beneath fls 4–6, white, 1–1½ in across W Medit. region. S C 32 G M 31 587, 32 277 —*C symphytifólius,* Lam (C vaginatus, Dry Rhodocistus Berthelotianus, Spach) To 2 ft lvs petioled, ovate, acuminate fls cymose, deep rose-colored, yellow in center Canary Isls S C 9 B R 3 225. F S 15 1501 —*C. vaginatus,* Dry =C symphytifolius

ALFRED REHDER

CITHARÉXYLUM (*Zither-wood* used for the making of certain musical instruments) *Verbenàceæ* Shrubs or trees, sparingly planted in southern California, and perhaps elsewhere South for ornament

Spiny or unarmed, tomentose or glabrous, with opposite entire serrate often spinose-dentate lvs : fls white or sometimes yellow, odorous, small, in spiciform terminal or axillary racemes, calyx 5-toothed or -lobed, corolla-tube cylindrical, the limb broad and 5-lobed, the lobes spreading and obovate, stamens 5, included, one of them abortive, the 4 polliniferous ones didynamous, ovary more or less 4-celled, each cell 1-seeded; style often 2-lobed fr. a fleshy drupe, partly inclosed in the calyx —About 20 species, Mex. to S. Amer

cinèreum, Linn. Tree, to 20 ft , the branches 4-angled and becoming cylindrical. lvs elliptic-oblong or lance-oblong, usually obtuse, glabrous or nearly so beneath fls. white, in long lax and nodding spike-like racemes; calyx unequally lobed, corolla-tube twice as long as calyx fr nearly globular, red becoming black. W. Indies. L.D. 7·493.

quadrangulàre, Jacq. Larger tree, the branches permanently 4-angled: lvs elliptic-oblong: fls. white; calyx nearly truncate W. Indies —These two species are here defined as understood by Grisebach, as it is probable that the plants in cult. were determined on that basis. Schulz, however (Symbolæ Antillanæ), refers *C. cinereum,* Linn., to *C. fruticosum,* Linn ; and *C. quadrangulare,* Jacq., to *C. spinosum,* Linn. *C quadrangulare* of Grisebach, at least in part, he refers to *C. fruticosum;* and *C. cinereum,* Jacq , to *C. spinosum.* What are the plants catalogued cannot be determined without a bringing together of material.

ilicifòlium, HBK. Low shrub, very branchy, not spiny, the branches 4-angled: lvs. elliptic-oblong, narrowed into a short petiole, entire or spinose-dentate, thick, the margin revolute, shining above and punctate beneath: fls. white, in a short terminal raceme; calyx 5-toothed; corolla scarcely exceeding the calyx, the lobes pilose: drupe size of a pea. Ecuador.

barbinérve, Cham. Spiny shrub, the branches 4-angled: lvs. obovate or elliptic-lanceolate, acute or obtuse or retuse, narrowed into a petiole, nearly entire, glabrous and shining above and paler and somewhat pilose beneath, bearded at the axils of the nerves. fls. white, in a terminal laxly-fld. raceme. Brazil, Uruguay.

L. H. B.

CITRANGE (from *Citrus trifoliata* and *orange* by syncopation: *Ci*[*trus*] *tr*[*ifoliata*] [*or*]*ange*) *Rutàceæ.* A hybrid between the common orange and the hardy trifoliate orange, *Poncirus trifoliata* (*Citrus trifoliata*)

Citranges have trifoliate lvs , but the lateral lfts are much smaller than the terminal one lvs semi-deciduous, falling completely only during a very severe winter: fls borne on new wood in spring, very large, white, sometimes over 2½ in diam , but with long and narrow petals, which vary much in size in different citranges: frs variable, from 1–4 in diam , globose, or depressed-globose, red-orange or lemon-yellow, smooth or hairy, the pulp abundant and very juicy, acid or subacid, with an agreeable aromatic flavor; peel often full of a disagreeably flavored essential oil.

The citranges are very cold-resistant if in a dormant condition, being able to stand temperatures as low as 15° or even 10° F without injury. They are not adapted to commercial culture but are of much interest for home use in the cotton-belt of the southern states where the winters are too severe to permit of the culture of oranges or other citrous fruit The flowers are showy and fragrant and the handsome fruits are used for making ade and for culinary purposes. The first successful hybrids between these plants were made by the writer at Eustis, Florida, in March, 1897, where eleven were secured. These remarkable hybrids were named citranges by H. J Webber and the writer in 1905 (Yearbook, Department of Agriculture for 1904).

The principal varieties now grown in the southern states are.

Rusk (Fig 970).—This is the most precocious of the citranges and has the smallest fls and smallest (1½–2 in diam) and reddest frs. Young grafted trees often bear in 3 years The foliage is dense and dark green The frs are thin-skinned, aromatic, juicy, and almost seedless The peel contains a disagreeable oil and care must be taken to keep this out of the juice of the fr Many thousand trees of this variety are now growing in the southern states and are prolific bearers

Colman —This is very unlike all the other citranges. The frs are large, 3–3½ × 2¾–3½ in , flattened, light yellow, and with a thick fuzzy peel, usually nearly seedless; the pulp is greenish, juice abundant, strongly acid, agreeably aromatic. It can be used for ade.

Morton.—The largest of the citranges, fr. often weighing more than 1 lb. Fr round, resembling a large orange, rind medium, pulp sprightly acid, with a peculiar taste, usually seedless. Tree a vigorous grower, cold-resistant.

Saunders.—A small-fruited variety. Frs. 2–2½ in. diam. with 5–10 seeds, orange-yellow, peel thick with prominent oil-glands The thick skin of this hybrid makes it keep well.



970. Rusk citrange. (×½)

The juice is sharply acid This is probably the most cold-resistant of the citranges tested as yet.

Etonia.—This hybrid is remarkable for its profuse bloom. The large white fragrant fls make this a good ornamental in the cotton-belt; frs small, very few.

Cunningham.—This resembles the Colman in having fuzzy frs which are, however, small and nearly spherical. The juice is sharply acid, aromatic, and makes very good ade.

Savage.—Fr. similar to an orange in appearance, 2–3 x 2½–3½ in., light yellow, rind medium thick, bitter, pulp tender, translucent, juice with a sprightly acid flavor, aroma pleasant. Tree very vigorous and prolific Foliage dense. WALTER T. SWINGLE.

CITRON (*Citrus Mèdica*, Linn.) *Rutàceæ*. Fig 971. A large lemon-like fruit with a very thick peel and a small amount of very acid pulp, the peel is candied and used in confectionery and for culinary purposes

The citron is grown in the Mediterranean regions, especially in Corsica, and large quantities are preserved in brine and shipped to the United States to be candied The Corsican citron of commerce was introduced into this country in 1894 by David Fairchild for the Division of Pomology of the United States Department of Agriculture, and it has been grown to some extent in California



971. Citron—Citrus Medica, Corsican variety (×⅔)

The plant usually is propagated by cuttings but it can be grafted on rough lemon or other stock In the region of Valencia, in eastern Spain, the citron is used in propagating oranges, since citron cuttings strike root more easily than oranges A piece of citron twig is grafted into branches of orange which are afterwards set as cuttings whereupon the citron strikes root and later on the orange. Then the roots are exposed and the citron roots cut away, leaving the orange growing on its own roots.

The citron can be planted and cultivated much as the lemon in cool equable climates, such as in the coastal region of southern California In Corsica, the trees are kept low and trained in vase form, but otherwise treated like lemons

There are but few citron orchards in the United States, one at West Riverside, California, about 10 acres in extent, is perhaps the largest.

The Etrog or sacred Jewish citron, used by the Jews at the Feast of Tabernacles, has small greenish yellow fruits which, if they are of exactly the prescribed size, form and color, may bring as much as $5 or $10 each. This variety is grown principally in the island of Corfu. See *Citrus* and *Etrog*.

The word citron is also applied to the preserving watermelon. see *Citrullus* and *Melon, Water*.

WALTER T. SWINGLE.

CITRÓPSIS (*Limonia* § *Citropsis*, Engler). *Rutàceæ* AFRICAN CHERRY ORANGE Very interesting and as yet little-known citrous trees, of interest for use in hybridizing and for stocks, also promising as ornamentals

Small spiny trees lvs compound, 3–12 in length; lfts 3, 5 or even 7, coriaceous; petioles and rachis usually very broadly winged, fruiting twigs sometimes with unifoliate lvs spines usually paired, sometimes single fls large, white, in the axils of the lvs, tetramerous (rarely 5-merous), with 8 free stamens: frs small, ¾–1½ in diam., borne in tufts in the axils of the lvs, bright orange-colored, with an agreeable odor and a pleasant flavor, 3–4-celled, with a single seed in each cell; cells in some species filled with pulp-vesicles full of pleasantly flavored juice

There are several species of this interesting genus in the tropical forests throughout central Africa These plants, because of their sweet high-flavored fruits borne in tufts like cherries and their unusually large compound leaves, should prove very interesting for use in hybridizing Tests made in the greenhouses of the Department of Agriculture, at Washington, have shown that at least two species of Citropsis can be budded readily and grow very well on the common citrous stocks This genus is undoubtedly closely related to Citrus See descr in Journ Ag Research, 1 419–430, w figs

Preùssii, Swingle & M Kellerman (*Limònia Preussii*, Engler *L. Demeùseri*, De Wild.?) Lvs 3–5-foliate, with very broadly winged petioles and rachis, lfts. large, broadly oval fls large, axillary; style long, slender, broad at the base: frs small, apiculate Kamerun. W Congo Ill Engler & Prantl, Nat. Pflanzf III 4 189, fig 109, E H De Wildeman, Etudes Fl. Congo, pl 41.

Schweinfurthu, Swingle & M Kellerman (*Limònia Schweinfurthii*, Engler *Limònia ugandénsis*, Baker). Fig 972 A species named from sterile leafy twigs collected by Schweinfurth at Uando at the headwaters of the Ghazal branch of the Nile. Lvs. 3–5-foliate, lfts. narrowly lanceolate, acute at both ends' fls large, usually 4-merous; style rather short and thick frs lime-like, 1½ in. diam., sweet. Sudan, Uganda, Congo

gabonénsis, Swingle & M. Kellerman (*Limònia gabonénsis*, Engler). Lvs of medium size, sometimes unifoliate like orange lvs, sometimes 5–7-foliate; rachis narrowly winged; lfts caudate fls small, borne on long pedicels, 4-merous; style not broad at base frs globose, small, about 1 in diam, almost dry, having only rudimentary pulp-vesicles, seeds large French Congo, Kamerun.

WALTER T. SWINGLE.
MAUDE KELLERMAN.

CITRÚLLUS (diminutive of *Citrus*, said to be in allusion to the shape of fruits and color of flesh resembling those characters in fruits of the orange or citron). *Cucurbitàceæ*. Annual or perennial tendril-bearing herbs of three or four species, one yielding the watermelon and one the colocynth

Climbing or long-trailing, hispid or rough, with 2-3-parted tendrils, often with a strong odor. lvs. alternate, petiolate, mostly round-cordate in general outline, deeply 3-5-lobed, and the divisions often again lobed, and the segms commonly obtuse fls monœcious, solitary and peduncled in the lf.-axils, the corollas 5-lobed, stamens 3, included and united or cohering by the anthers, and rudiments of stamens in the pistillate fls., pistil 1, the ovary ovoid or globose, bearing a short style and 3-lobed stigma fr a globular pepo, morphologically 3-celled, usually smooth and with a hard rind.—Trop. Afr. and Asia, 2 of the species now widely distributed in warm and tropical countries.



972. Citropsis Schweinfurthii. (×¼)

vulgàris, Schrad. WATERMELON (see *Melon*, for culture). Annual, glabrous or pubescent. lvs. not rough, either deeply or moderately divided, the sinuses open and obtuse. fr. in the wild state from the size of an apple to that of a man's head, sweet or slightly bitter. Trop. and S. Afr.—When the fr. is sweet and edible (*C. Cáffer*, Schrad.), it is the watermelon, or "kaffir watermelon" of S. Afr.; when bitter (*C. amàrus*, Schrad.), it is the "bitter-apple" of S. Afr. The fr. now varies widely in cult., in size, season, shape and quality. The soft pink flesh is much prized in its natural state for eating. A form with hard and inedible white flesh is known as "citron," and the rind is used for the making of preserves (as is the rind of the true citron).

Colocýnthis, Schrad. (*Colocýnthis officinàlis*, Schrad. *Cucumis Colocýnthis*, Linn.) COLOCYNTH. BITTER-APPLE. Perennial (in the wild), the st. angular and rough: lvs. rough, 2-4 in. long, 3- or 7-lobed, the middle lobe sometimes ovate, the sinuses open and the lf. in general form like that of *C. vulgaris:* ovary villous: fr. globose, green-and-yellow variegated, about 3-4 in. diam., intensely bitter; seeds small (¼in. or less long), smooth. Trop. Asia and Afr., now widely distributed in Afr. and the Medit. region.—The dried frs. are used in medicine (as purgative), being imported from Turkey and Spain. Sometimes cult. in this country as a curiosity or in collections of economic plants; culture for official purposes has been attempted in New Mex., but the frs., although larger than the official product, are reported to be less active. L. H. B

CÍTRUS (ancient name of a fragrant African wood, afterward transferred to the Citron). *Rutàceæ*. CITRON. LEMON. ORANGE. Small evergreen, more or less spiny trees or shrubs, grown for their edible fruits, and also attractive in foliage and flower.

Leaves glandular-dotted, persistent, apparently simple (in reality unifoliate compound lvs.), borne on more or less winged or margined petioles, which are usually articulated with the blade and at their attachment to the twig. spines usually present, borne singly at the side of the bud in the axils of the lvs. fls. clustered or rarely solitary in the axils of the lvs., or in small lateral or terminal cymes or panicles, white or pinkish purple in the bud, petals 5 (rarely 4 or 6) thick, strap-shaped, not clawed at the base, imbricated, stamens numerous (16–60, usually 20–40) at least four times as many as the petals, polyadelphous, cohering toward the bases in a few bundles, ovary 8–15-celled, with a prominent usually deciduous style containing as many tubes as there are cells in the ovary. fr. a hesperidium, globose, oval or oblate-spheroid, the segms. filled with juicy pulp composed of stalked pulp-vesicles, seeds 1–8 in a cell, oval or oblong, ¼–¾in. long, with a pergameneous testa and thick fleshy cotyledons, usually with adventive embryos arising as buds from the nucellar tissue of the mother plant. Natives of Trop. and Subtrop. Asia and the Malayan Archipelago.—Half a dozen species are commonly cult. and have given rise to very many varieties as well as numerous hybrids, making the delimitation of the species exceedingly difficult. See *Citrange, Citron, Etrog, Grapefruit, Lemon, Lime, Limequat, Orange, Pomelo, Tangelo*

The nomenclature here followed is based on the writer's treatment of the species of Citrus in "Plantæ Wilsonianæ." The fewest possible number of changes have been made consistent with presenting a clear account of the genus. A careful study of Citrus and the genera most nearly related to it has shown that the trifoliate orange differs in so many and such important characters that it seems necessary to recognize it as a separate genus (*Poncirus*). The same is true of the kumquats and the Australian limes.

INDEX

aurantiifolia, 3
Aurantium, 4, 5, 6
Bigaradia, 5
decumana, 4
deliciosa, 7
digitata, 1
grandis, 4.
ichangensis, 9
limetta, 3
Limonia, 2
Limonium, 2
Medica, 1
mitis, 8
myrtifolia, 5
nobilis, 7
sarcodactylis 1
sinensis, 6
unshiu, 7
vulgaris, 5

KEY TO THE SPECIES

A *Winged petiole nearly as large as the blade of the lf. seeds very large, thick. fr. rough, oval, lemon-yellow when ripe. fls. solitary* 9 **ichangensis**

AA *Winged petiole much smaller than the blade of the lvs. seeds small or medium sized. fls. usually in clusters*

B *Lvs. apparently not jointed between blade and petiole, oblong-serrate, petiole wingless. fl.-buds tinted reddish. fr. with a very thick peel, fragrant, pulp acid* 1 **Medica**

BB *Lvs. with an obvious joint between the blade and petiole, crenate. peel thin or only moderately thick*

C *Fl.-buds tinted reddish on outside: petioles merely margined: lvs. crenate. frs. oval, more or less aviculate* 2 **Limonia**

cc. *Fl-buds white petioles more or less winged*
D. *Frs oval, often slightly papillate, small, 1–1½ in diam, greenish-yellow when ripe, thin-skinned, smooth fls small petioles plainly winged lvs small, pallid above, crenate, more or less punctate, obtuse spines short, very sharp* 3 **aurantifolia**
DD *Frs globose, depressed globose, rarely oval or pyriform, never papillate, orange-colored, or if yellow, frs large and thick-skinned*
E *Size of fr very large, pale yellow when ripe twigs pubescent when young petioles broadly winged* 4 **grandis**
EE *Size of fr medium or small, orange or orange-yellow*
F *The frs with a solid core and a light skin, pulp sweet petioles slightly winged* 6 **sinensis**
FF *The frs with a hollow core when fully ripe, skin loose or, if tight, pulp acid and petioles broadly winged.*
G *Skin tight petioles broadly winged pulp acid* 5 **Aurantium**
GG *Skin loose petioles only narrowly winged or margined.*
H *The fr borne singly at tips of branches, small, segms 7–10, pulp very acid lvs pale beneath* 8 **mitis**
HH *The fr borne in axils of the lvs, segms 8–15, pulp sweet lvs dark green below* 7 **nobilis**

1. **Mèdica,** Linn (from Media whence the species first came to the notice of the ancient Greeks and Romans) CITRON Fig 971 A shrub or small tree, with long irregular branches thorns short, stout and stiff lvs rather pale green, large, oblong, 4–6 or 7 in long and 1½-2 in wide, bluntly rounded at the tip with serrate margins, not articulated with the petioles, which are wingless fls large, reddish tinted when in the bud, usually in terminal panicles, or clustered, in the axils of the lvs, petals large, white above, reddish purple below, stamens numerous, 30–40 or more, ovary tapering gradually into the often persistent style fr large, oval or oblong, 6-10 x 4–6 in, bluntly apiculate, often rough or bumpy, lemon-yellow when ripe, skin very thick, fragrant, pulp scanty, acid; seeds oval, smooth, white inside —The citron is very sensitive to cold because of its ability to grow at low temperatures, which causes it to start into a fresh and very tender growth after a few days of warm weather in winter It is cult in the Medit. region, especially in Corsica, whence large quantities of the peel are exported in brine to Amer to be candied The candied peel is much used in confectionery and in cakes Sparingly cult in Calif and Fla A number of ill-defined varieties are grown, the most important being the Corsican, intro from Corsica in 1894 by David Fairchild The Etrog or sacred Jewish citron is grown in Corfu See *Citron*



973 Fingered citron — Citrus Medica var sarcodactylis. (×⅓)

Var **sarcodáctylis,** Swingle (*Citrus sarcodáctylis* v. Nooten. *C. Mèdica* var *digitàta,* Auct., not Lour.). FO SHU KAN (Chinese) BUSHUKAN (Japanese) Fig 973. Differs from the common citron in having the segms of the fr separated into finger-like processes. The frs are very fragrant and are used by the Chinese and Japanese for perfuming rooms and clothing It is sometimes grown as a dwarf potted plant for ornament It should be intro into this country

2 **Limònia,** Osbeck (from Arabic *limūn,* a lemon) (*C. Mèdica* var *Limon,* Linn *C. Limònium,* Risso). LEMON Fig 974 A small tree with long irregular branches thorns short, stout and stiff: lvs rather pale green, elongate-ovate, pointed at the tip, with serrate or sub-serrate margins; petioles wingless but sometimes narrowly margined, articulated both with the blade and the twig fls rather large, solitary or in small clusters in the axils of the lvs, reddish-tinted in the bud; petals white above, reddish purple below, stamens 20–40; ovary tapering into the deciduous style fr oval or oblong, with an apical papilla, 3–5 x 2–3 in with 8–10 segms, lemon-yellow when ripe, with a prominently glandular-dotted peel, often more or less rough and moderately thick, pulp very abundant, very acid; seeds small, ovate, smooth, often few or none, white inside. —The lemon is very sensitive to cold as, like the citron and the lime, it is readily forced into new growth by a few days of warm weather in winter It is found in all tropical and warm subtropical regions and is cult on a large scale in the Medit region, especially in Sicily, whence large quantities of the frs are exported to the U S In this country the lemon is widely cult in Calif and to a much smaller extent in Fla The frs are gathered just before they ripen while still green in color and often before they attain their full size and are then ripened in curing-houses, in which temperature and humidity are artificially controlled The juice is used for making lemonade, for cooking, and the arts, the peel is used in cooking and the oil extracted from it is used in cooking and in perfumery The principal cult varieties have rather small smooth frs The more important varieties are listed here *Eureka* Frs oval-oblong, medium size, usually seedless, ripening early tree small, nearly thornless *Genoa* Frs oval, pointed at base and tip, ripening early, seedless tree dwarf *Lisbon* Frs oblong, with a large papilla at the tip, few-seeded tree of medium size, thorny, a vigorous grower *Villa Franca* Frs oval-oblong, medium to large, apex abruptly papillate, seeds numerous tree of good size, nearly thornless *Kennedy* Frs oval, with a very small papilla, thin-skinned, nearly seedless *Ponderosa.* Frs very large, sometimes weighing 2½ lbs, with a neck at the base; seeds numerous *Everbearing* Frs large, abruptly papillate at the tip, with a narrowed neck at the base, rough all over, seeds rather numerous: everbearing, borne on a straggling bushy tree that sprouts from the roots Grown for home use in Fla. *Rough* (Florida Rough) A tree of doubtful origin, occurring wild in the Everglades of S Fla · frs round-ovate, very rough, apical papilla surrounded by a depressed ring; seeds numerous. tree large and vigorous The frs. of this variety are useless for commercial purposes, but the seeds are in considerable demand by

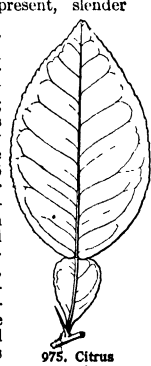


974 Citrus Limonia (×⅓, fr ¼)

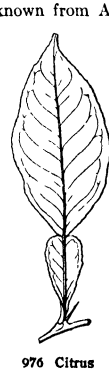
nurserymen as the tree makes an excellent stock for very poor sandy or calcareous soils. See *Lemon*.

3. **aurantifòlia,** Swingle (*Limònia aurantifòlia,* Christmann. *C. limétta* Auct not Risso) LIME A small tree, with rather irregular branches spines very sharp, short, stiff lvs. small, 2–3 in. long, elliptic-oval, crenate, rather pale green; petioles distinctly but narrowly winged· fls small, white in the bud, occurring in few-fld. axillary clusters; petals white on both surfaces; stamens 20–25; ovary rather sharply set off from the deciduous style: fr. small, oval or round-oval, 1¼–2½ in diam., often with a small apical papilla, with 10 segms., greenish yellow when ripe; peel prominently glandular-dotted, very thin; pulp abundant, greenish, very acid, seeds small, oval, smooth, white inside — The lime is perhaps the most sensitive to cold of any known species of Citrus Even a few days of moderately warm weather in winter suffice to force it into a tender and succulent growth that is killed by the slightest frost. It is found in all tropical countries, often in a semi-wild condition It is cult. in the warmest parts of Fla., especially on the Keys Large quantities of the fr, picked when still green and often not full-sized, are packed in barrels and shipped to the cities of the N U S., where they are extensively used for making limeade. Large quantities of bottled lime juice are exported from Montserrat and Dominica Isls in the W Indies, and used on shipboard for preventing scurvy. Limes are too thin-skinned to keep well and are not processed as are lemons It is usually prop from seed—rarely from cuttings The principal varieties grown in the U S are *Mexican* (West Indian). Frs small, smooth, often with a slight apical papilla; seeds few· tree small, very spiny, usually branching from the base This variety, almost always grown from seed, is the only one planted on any considerable commercial scale *Tahiti* (Persian?) Frs large, smooth, with a broad apical papilla; seedless, about the size and shape of an ordinary lemon· poor keepers See *Lime* Hybrids· *Sweet* (*C. limetta,* Risso ?) Frs about the size of a lemon, with a sweet and insipid pulp Commonly grown in the W Indies and Cent Amer Limequats are new hardy hybrids between the common Mexican lime and a kumquat, these hybrids vary much in size, shape and flavor, but some are about the size of a lime and have abundant very acid pulp. See description under *Limequat*.

4 **grándis,** Osbeck (*C. Aurántium* var. *grándis,* Linn. *C Aurántium* var *décumána,* Linn *C decumána,* Linn) GRAPEFRUIT (or POMELO) SHADDOCK. PUMMELO Fig. 975 A large round-topped tree, with regular branches· spines, if present, slender and flexible, rather blunt: lvs large, dark glossy green above, oval or elliptic-oval, with a broadly rounded base; petiole broadly winged, more or less cordate· fls axillary, borne singly or in clusters, large, white in the bud; petals white on both sides; stamens 20–25, with large linear anthers, ovary globose, sharply delimited from the deciduous style: fr very large, 4–6 in. diam., globose, oblate spheroid or broadly pear-shaped, smooth, with 11–14 segms., pale lemon-yellow when ripe, peel ¼–½in thick, white and pithy inside; seeds usually very numerous, large, flattened and wrinkled, white inside.—The grapefruit (or pomelo) is now one of the most appreciated citrous frs grown in the U.S The culture of this delicious fr. was limited to the Fla pioneers until some 25 years ago, when the first commercial plantations were made. Since then, there has been a steady increase in the area devoted to this fr in Fla., and plantings have been made in Calif, Ariz, and the West Indies The pummelo of India, called shaddock in Fla., is not grown on a commercial scale, but occurs in many tropical countries The grapefruit is usually served as a breakfast fr. cut in half and seeded It is a vigorous grower, even on light sandy loam soils and is coming increasingly into use as a stock upon which to graft other citrous frs The young trees are tender, but the mature ones are well protected by a dense canopy of lvs. and may stand more cold than an orange tree The grapefruit is much like the orange in its ability to resist cold and is much less easily forced into a new growth by a few warm days in winter than the lime or lemon The varieties of grapefruit grown in the U S have almost all originated in Fla, where the early settlers prop. this tree from seed, thereby originating many slightly different varieties, the more important of which are listed here. *Duncan* Fr. large, keeps well on the tree, seeds few. tree rather hardy *Hall* (Silver Cluster) Frs. medium size, produced in large clusters, seeds numerous *Triumph* Fr small or medium size, early tree rather tender Does not succeed well when budded on sour orange stock *McCarty.* Fr large, late borne singly, seeds numerous A variety recently found in the Indian River region of Fla Besides these standard varieties of grapefruit of the Fla seedling type a large number of other similar varieties are cult locally in the state, such as the Bowen, Excelsior, Josselyn, Leonardy, Manville, May, McKinley, Standard (or Indian River), Walters, and many others The following varieties differ more or less widely from the old Fla seedling type *Marsh* Frs large, depressed globose, often seedless, pulp subacid, less bitter than in the other varieties This variety, though it originated as a seedling in Fla, is best adapted to cult in Calif, where many of the ordinary Fla varieties do not succeed well *Pernambuco* Frs large, skin very smooth, light-colored, late, seeds abundant Intro from Pernambuco, Brazil, to the U S by the U S Dept of Agric —The shaddocks or pummelos are seldom cult in the U S The Tresca variety from the Bahama Isls has large pyriform frs, with pink flesh of good flavor and abundant seeds the tree is tender A pummelo from near Canton, China, is imported into San Francisco on a small scale by the Chinese resident there The frs are pyriform, very thick-skinned, not pink within, seeds numerous Some seedlings of this variety are to be found at various points in Calif They are very leafy and of vigorous growth, and make excellent stocks upon which to graft other citrous frs Many other sorts of pummelos are known from Asia and the Malayan Archipelago and some have been intro for trial by the Office of Foreign Seed and Plant Introduction of the U S Dept of Agric The true grapefruit seems to be scarcely known outside of U S and the W Indies See *Grapefruit* and *Pomelo.*



975. Citrus grandis. (×⅛)



976 Citrus Aurantium. (×⅛)

5 **Aurántium,** Linn. (*C vulgáris,* Risso. *C Bigarádia,* Risso *C Aurántium* var *Bigarádia,* Hook f) SOUR or SEVILLE ORANGE. Fig 976 A medium-sized tree, with a rounded top and regular branches spines long but flexible and blunt lvs light green when young, medium-sized, 3–4 in. long, tapering to the somewhat wedge-shaped base, and more or less acuminate at the tip; petiole broadly winged· fls medium-sized, axillary, single or clustered, white in the bud; petals white on both sides, very fragrant; stamens 20–24; ovary globular, sharply delimited from the deciduous style. fr. 2¾–3¼ in. diam., globose, slightly flattened at the

tip, with a hollow core when fully ripe; pulp acid, membranes with a bitter taste, segms. 10–12; seeds cuneate-oval, flattened, with raised lines, white inside.—The sour or Seville orange is grown all over the world It is able to withstand more cold than most of the other citrous frs. and is rarely forced into new growth by warm weather occurring in winter The sour orange is found in a thoroughly naturalized condition in many parts of Fla where it doubtless was brought by the Spaniards Most of these wild sour orange trees were dug up and transplanted for use as stocks when orange-culture was being rapidly extended some 25–30 years ago. The Seville orange, as its name would indicate, is grown on a commercial scale in the vicinity of Seville, Spain, whence the frs are shipped in large quantities to England and Scotland for use in making orange marmalade, for which this species is best adapted The petals yield a valuable perfume, oil of Neroli, which is produced in the south of France and the Italian Riviera. The peel of the fr is sometimes candied and, when fresh, yields an essential oil The sour orange is grown in a small way in Fla for home use, the frs being used for making "orangeade" In the U S the sour orange is used almost exclusively as a stock on which to bud other citrous fr trees The seeds are in demand by nurserymen at a good price for this purpose The sour orange is well adapted to grow on a great variety of soils but is especially well fitted for low wet soils, where it is valuable because it is immune to the *mal di gomma* or foot-rot so destructive to the common orange and lemon on such soils There are no named varieties of the sour orange in cult in the U S — Mutations The so-called *Citrus myrtifolia*, a narrow-lvd form with spineless twigs and short internodes, bearing small flattened sour oranges is a mutation arising from the root of the sour orange *Chinotto* (the Chinoise of the French confectioners) This is a broader-lvd form of the above described mutation It is cult along the northern shore of the Medit from Genoa to Toulon, yields the small green frs used for candying This variety, which should be called the Chinotto, is being tested in the U S and may prove adapted for commercial culture on a small scale in this country Hybrids *Bittersweet* A good-sized tree occurring wild in Fla., is undoubtedly a hybrid between this species and the following Frs oblong, flattened at the ends, pulp sweet, but the membranes separating the segms have a bitter taste The fr ripens very late on some trees and keeps well on the tree

6 **sinensis,** Osbeck (*C. Aurantium* var *sinensis*, Linn *C. Aurantium*, Lour et Auct., not Linn.) Common or Sweet Orange Fig 977 A medium-sized tree, with a rounded top and regular branches spines, when present, slender, flexible, rather blunt. lvs medium-sized, rounded at the base, pointed at the apex, petiole narrowly winged, articulated both with the blade and the twig· fls medium-sized, smaller than those of the sour orange, white in the bud, petals white on both surfaces; stamens 20–25; ovary subglobose, clearly delimited from the deciduous style. fr subglobose or oval, pith solid, pulp sweet, membranes not bitter in taste, segms 10–12 or 13 in number, seeds cuneate-ovoid with rugose margined plane surfaces, white inside —The common or sweet orange is widely cult in all the tropical and subtropical regions of the world It is rather tender, not so hardy as the sour or Seville orange, but much more cold-resistant than the lemon or lime A very few orange trees occur in a semi-wild state in S Fla Sweet oranges were doubtless intro into Fla by the Spaniards nearly four centuries ago and, as they were prop by seeds until within the last half-century, many local varieties have arisen there Orange-culture has reached its highest development in S Calif., where it constitutes one of the most important agricultural industries Fla is second only to Calif in the extent and value of the orange groves, while some oranges are grown in favored spots in La., Texas, and Ariz.—Oranges are the best known and probably the most highly esteemed dessert fr A few are used in cooking and the peel is sometimes candied. An essential oil is also pressed from the peel The sweet orange is commonly used as a stock on which to graft other species of citrous frs It grows well on light well-drained loam or sandy loam soil On heavy soil it is subject to the *mal di gomma* or foot-rot Very many varieties are in cult. Some of the principal sorts grown in the U S. are listed here (1) Florida seedlings—varieties originated in Fla as a result of prop oranges from seed, mostly strong-growing trees: *Parson Brown*. Frs. medium-sized, very early. *Pineapple* Frs. medium or large, very juicy; seeds rather numerous midseason tree a strong grower. *Homosassa* Frs medium-sized, very juicy a good bearer and keeper tree nearly thornless *Madam Vinous* Frs medium or large, pulp coarse-grained, juicy, midseason. *Nonpareil* Frs rather large, flattened, pulp fine-grained, juicy tree vigorous Also Arcadia, Summit, Foster, Hick, Magnum Bonum, May, Old Vini, Osceola, Stark, Whittaker, and very many others of the same general type (2) Florida mutations or hybrids—new sorts originated in Fla., usually differing in some striking way from the old Fla seedling oranges, perhaps through hybridization with foreign varieties *Boone* (Boone's Early) Frs medium size, strongly oval or oblong, very juicy, very late, keeping well on the tree: lvs. with petioles varying in width. *Lue Gim Gong* Frs oval, juicy, ripening very late and holding very well on the tree, even until late summer A variety newly intro into cult *Drake Star* A rare variety with variegated foliage, usually a poor bearer but sometimes bearing a good crop of excellent fr (3) Mediterranean varieties, largely intro into Fla by Sanford and Lyman Phelps, about 30–40 years ago *Ruby*. Frs small or medium-sized, peel red-orange, pulp streaked with red when fully ripe, juicy, seeds rather few. rather late tree vigorous, nearly thornless, prolific *St Michael*. Frs medium-sized, oblong, red-blotched when ripe; flesh wine-red, seeds few, rather early. *Jaffa* Frs large, oblong, juicy; seeds few Possibly not the same as the celebrated orange of Jaffa, Palestine. *Mediterranean Sweet* Frs large, oval, juicy, late tree nearly thornless *Majorca* Frs round or slightly flattened, juicy. rather late *Hart* (Hart's Tardiff). Frs. round or slightly oval, medium to large size, juicy; seeds few; ripens very late similar to the next and thought by some to be identical *Valencia* (Valencia Late). Frs. medium to large, oval or rounded, juicy, nearly seedless, very late A prolific variety, largely grown in Calif. and held in cold storage until early autumn. There are many other Medit varieties of nearly or quite as much value as some of the above, such as, Centennial, Du Roi, Joppa, Paper Rind, Prata, Saul Blood, St Michael (Blood), etc —The navel oranges all show a second smaller more or less included fr formed at the tip of the main fr Many varieties are of foreign origin. *Washington* (Bahia, Washington Navel) Fr large, rounded slightly, pointed at apex; flesh firm, juicy; skin



977. Citrus sinensis (×$\frac{2}{5}$)

very tough, seedless. early midseason. The most famous variety of oranges intro from Bahia, Brazil, by Wm. Saunders of the U. S. Dept of Agric in 1870. Its cult. has steadily extended in Calif. until it is the principal variety grown there. It does not succeed well in Fla *Thompson* (Thompson's Improved Navel). A smooth-skinned hard-fleshed variety found by A. D. Shamel to arise as a mutation from the preceding, to which it is inferior in quality though better in appearance *Australian.* Frs large, coarse. tree vigorous, but a shy bearer Also found by Shamel as a variation of the Washington Navel (Bahia) *Surprise.* Fr medium-sized, rounded or even slightly flattened, juicy, early, seedless. A variety originated by E S. Hubbard, of Fla. *Double Imperial* Fr. small or medium-sized, navel hidden, pulp firm; seeds few or none A Brazilian variety, said to fruit well in Fla. when budded on trifoliate orange stock. There are many other varieties of navel oranges occasionally grown on a commercial scale. In Calif., among others, Golden Nugget and Navelencia, in Fla., Egyptian, Melitensis, and Sustain are known There are doubtless many more navel oranges which should be tested. See *Orange* Hybrids Citranges are hardy hybrids between the common sweet orange and the trifoliate orange, *Poncirus trifoliata* The principal varieties are the Rusk, Morton, Colman, Savage, Cunningham and Saunders See description under *Citrange.*



978
Citrus ichangensis
(×⅛)

7. **nóbilis,** Lour KING ORANGE. Small trees, with slender twigs and pointed lvs, with very narrowly winged or merely margined petioles. fls small, white, stamens 18–24· fr. with a loose peel and a hollow pith; seeds usually green inside —This species comprises several well-marked groups; the original *C. nobilis* of Loureiro was undoubtedly something very like the King orange, a medium-sized tree with long upright branches, with dark bark, having large depressed globose fr. with a rough thick not very loose skin; segms usually 12–13; seeds rather numerous, large like those of a sweet orange, white inside See W. A Taylor, Yearb. Dept. Agric. 1907, pl. 34 This variety was found by Loureiro growing in Cochin China in the latter half of the 18th century and was intro into Amer by Mrs S R. Magee, of Riverside, Calif, in 1880, from Saigon, Cochin China, which introduction became known as the King orange. It has frs. of large size, very juicy, and of delicious vinous flavor Its rough skin seems to be no obstacle to its ready sale at good prices.

Var. **deliciòsa,** Swingle (*C. deliciòsa,* Tenore). MANDARIN ORANGE. A small tree, with slender branches, willow-like lvs, with merely margined petioles. fls. small. frs depressed globose, bright orange-yellow or reddish orange, with a very loose peel; seeds small, beaked, bright green within.—This variety comprises the many varieties of Mandarin oranges, including the so-called tangerine varieties These are delicious dessert frs, attractive in appearance and easy to handle because of the loose skin and the easily separable segms. Aside from the greater ease of preparing them for the table, Mandarin oranges are used exactly as are common oranges. The principal varieties grown in the U. S. are the following. *Mandarin* (China, China Mandarin, Willow-leaved). Fr. medium-sized, 2–3 in diam, depressed-globose, early, orange-yellow; very juicy; sweet; seeds abundant. *Oneco* Fr. medium to large, orange-yellow, midseason. Intro. from India in 1888 *Tangerine* (Dancy's Tangerine) Fr red-orange, medium size, depressed-globose, juicy, seeds rather abundant: midseason· tree of good size: lvs much broader than those of the Mandarin variety. Other Mandarin oranges are occasionally grown, especially in Fla, such as the Beauty, Cleopatra, Kino Kumi, and Mikado. Hybrids. Tangelos, are a striking new group of citrous frs *Sampson,* the first tangelo to be grown commercially, was obtained by the writer in 1897 by crossing the tangerine with Bowen grapefruit, it is unlike either parent in quality, being more like a choice sprightly flavored sweet orange. Many other tangelos are now being tested. See *Tangelo.*

Var **únshiu,** Swingle (*C nóbilis* subsp *genuìna* var. *únshiu,* Makino). SATSUMA or UNSHIU ORANGE. A small spineless tree, with a spreading dwarf habit lvs. broad, abruptly narrowed toward the apex, with strongly marked veins on both faces. fls. small, very abundant· fr. depressed-globose, 2–3½ in diam, deep orange; pulp orange, very juicy, of a peculiar but agreeable flavor, pith hollow, segms 9–13, seeds often lacking, when present only few in number, broadly top-shaped, not beaked as in the Mandarin oranges, greenish within —This very marked orange seems to constitute a botanical variety distinct from the King or the Mandarin oranges It is commonly grown in Japan, whence it was intro into Fla by Geo R Hall in 1876, according to H H Hume, "Citrus Fruits and Their Culture," p 112. 1909 The Satsuma orange is one of the hardiest of all edible citrous frs Budded on the trifoliate orange, it can be grown in many parts of the Gulf Coast region, where all other citrous frs except citranges are killed by cold. The Satsuma can be grown best on the trifoliate orange stock It grows on sweet stock but does not produce as much nor as good fruit and is not so hardy. It makes only a stunted growth on sour orange stock and soon dies It cannot be grown satisfactorily on light sandy land or on black waxy lands with a marly subsoil where the trifoliate orange does not grow well It could be grafted on Rusk citrange for the black waxy lime soils of Texas

8 **mitis,** Blanco CALAMONDIN ORANGE A small tree, with upright branches lvs broadly oval, pale green below like those of kumquat, petiole narrowly winged fls small, angular in the bud, borne singly at the tips of the twigs. fr small, depressed globose, deep orange-yellow when ripe, loose-skinned, segms 7–10, easily separable; pulp very acid, seeds few, small — This tree, a native of the Philippine Isls, is commonly cult in Hawaii, where it is wrongly called "China orange" It was intro into Fla by the U S Dept of Agric from Panama, and was for a time distributed by nurserymen under the erroneous name of To-Kumquat. It is very hardy, probably as hardy as the Satsuma, or even more so It can be budded on sour orange or on trifoliate orange stock A promising fr for home use, for culinary purposes and for making ade

9 **ichangénsis,** Swingle Fig 978. A small tree, with long slender spines. lvs narrow, with oblong broadly winged petioles nearly or quite as large as the blade fls white; stamens 20, cohering in bundles fr lemon-shaped, 3–4 in long, with a very broad low apical papilla surrounded by a shallow circular furrow; segms. 8–11; pulp acid, of good flavor, seeds very large, thick, cuneate-ovate, ½–¾in long and ¼–¾in thick, white within —This interesting new species, not closely allied to any other of the known members of the genus Citrus, is native in highlands of S W. China It is the northermost evergreen tree of the citrous group and grows at high altitude, 3,000–5,000 ft. It is able to withstand considerable cold in winter, so it is very likely to prove of value in breeding new types of hardy substitutes for the lemon. E. H. Wilson, who collected excellent material of this plant for the Arnold Arboretum, is endeavoring to secure it for trial in U. S.

C bergâmia, Risso BERGAMOT A small tree lvs oblong-oval, with long, winged petioles fls small, white, very fragrant. frs

pyriform, 3-4 in diam, thin-skinned, pale yellow when ripe, pulp acid, seeds oblong, many Extensively cult in Calabria for the essential oil which is expressed from the peel and used in making Eau de Cologne and other perfumes —*C. hystrix*, see Papeda —*C. japónica*, see Kumquat —*C. taiténsis*, Risso OTAHITE ORANGE A dwarf plant, having lemon-like fls and lemon-shaped fr orange in color with a mawkish taste Commonly grown by florists as an ornamental pot-plant Rarely used as a stock for dwarfing common citrous frs This plant is not a native of Tahiti as the name would indicate, but is probably of hybrid origin —*C. trifoliata*=Poncirus trifoliata.

WALTER T. SWINGLE.

CIVE: *Chive.*

CLADÁNTHUS (Greek, *klados*, branch, and *anthos*, flower; alluding to the branching, which distinguishes this genus from Anthemis). *Compósitæ*. An annual yellow-rayed herb, sometimes planted in the open garden. Plant branched from the base in a forking manner; a fl. terminates each branch, whereupon 2 new branches start from directly beneath the fl., each of these is temporarily stopped by a fl., and so on. involucre hemispherical, receptacle conical or oblong, with scales about fls, ray-fls pistillate, disk-fls perfect —One species, allied to Achillea and Anthemis.

arábicus, Cass (*C. prolíferus*, DC *Ánthemis arábica*, Linn.) Glabrous, 2–3½ ft high lvs alternate, pinnately parted, lobes linear, trifid fl.-heads solitary, bracted S Spain and Morocco —A free-flowering heavy-scented plant of easy culture. L. H. B†

CLADOTHÁMNUS (*klados*, branch, and *thamnos*, bush, from the Greek) *Ericàcæ* Shrubs, rarely cult for their handsome pink fls Erect, with many virgate branches lvs deciduous, alternate, entire fls pink, terminal, 1–3, nodding, corolla divided to the base or nearly so into 5 oblong petals, stamens 10 caps 5-6-celled —One or 2 species in Pacific N Amer., from Alaska to Wash. Hardy, with handsome rather large pink fls in summer, rarely cult They will probably grow best in peaty and sandy soil, in a half-shady position, prop by seeds or by cuttings of soft wood under glass, and by layers

C. pyroliflòrus, Bong Shrub, 4–10 ft lvs nearly sessile, obovate-lanceolate, mucronulate, glabrous, pale green, 1½–2½ in long fls solitary, with 5 separate petals, 1 in across Alaska to Ore G F 10 215 B M 8353 —*C. campanulatus*, Greene According to Greene, this species differs from the preceding chiefly in the petals being united at the base and the anthers opening with a pore at the apex, and occurs in Wash., while *C. pyroliflorus* is restricted to Alaska, but the specimens from Ore. and Wash. do not differ from *C. pyroliflorus*, possibly *C. campanulatus* was based only on an abnormal form ALFRED REHDER

CLADRÁSTIS (Greek, *brittle branch*) *Virgília* of gardens *Leguminòsæ*. YELLOW-WOOD Trees grown chiefly for their large panicles of white flowers and for their handsome foliage

Deciduous winter-buds naked, several superposed and concealed during the summer in the enlarged base of the petiole lvs alternate, odd-pinnate, with few rather large entire short-stalked lfts fls in long, usually panicled racemes, white, papilionaceous; calyx campanulate, 5-toothed, stamens 10, nearly free pod narrow-oblong, compressed, 3–6-seeded, with thin membranous valves —Four species in N Amer and E Asia Hardy ornamental trees of medium size, with showy fls and handsome foliage, turning bright yellow in fall They thrive in almost any soil Prop by seeds, sown in spring, or by root cuttings, dug up in fall and kept in sand or moss, moderately moist and cool, until spring.

lútea, Koch (*C. tinctòria*, Raf. *Virgília lùtea*, Michx.) Tree, with yellow wood and smooth bark, sometimes 50 ft · lfts 7–9, oval or ovate, glabrous, bright green, 3–4 in long: panicles loose, drooping, 10–20 in long; fls. white, fragrant, over 1 in. long. June. Ky, Tenn, and N. C S S 3·119–20. B M 7767. Mich. Hist. Arb. III. 266 Gng. 2·401; 5 98 F E. 8.427. G.F. 1:92. Gn. 24, pp 96–7, 34, p 329. G C III. 42·186–7. M.D.G. 1899 144–5. G.W. 12, p 397 V. 4.307 A G 15 270 —One of the most beautiful flowering native trees, with wide, graceful head and a short trunk, well adapted as single tree on the lawn Hardy north to New England and Ont The wood yields a clear yellow dye There is a var *aùreo-variegàta* with lvs variegated with yellow.

sinénsis, Hemsl Tree, to 80 ft. lfts. 9–13, oblong to oblong-lanceolate, usually rounded at the base, yellowish green, pubescent beneath along the midrib, 2–4 in long, rachis and petiole pubescent: fls. in loose, upright, much-branched panicles, 5–12 in. long and 4–8 in across, white or pinkish, about ½in. long June, July W. and China



979. Clarkia elegans (×⅔)

C. amurénsis, Koch = Maackia amurensis —*C. platycarpa*, Makino (Sophora platycarpa, Maxim.) Tree lfts 9–15, ovate to elliptic-lanceolate, 2–3½ in panicles broadly pyramidal, upright, 6–8 in long, white, standard with yellow spot at the base pod narrowly winged Japan S I F 2 32 Very rare in cult —*C. Tashiròi*, Yatabe = Maackia Tashiroi = *C. Wilsonii*, Takeda Tree, to 50 ft lfts 7–9 elliptic-ovate to ovate-oblong, usually broadly cuneate at the base panicles upright, 5–8 in long, fls ¾in long, ovary pubescent Cent China

ALFRED REHDER

CLÁRKIA (Capt Wm Clark, companion of Lewis, explorer of the Rocky Mt region and beyond, 1806) *Onagràceæ* Flower-garden annuals

Herbs, with alternate mostly entire lvs, and showy fls in the upper axils or in terminal racemes fls regular, the calyx tubular, the petals 4, narrow at the base and entire or lobed, wide-spreading; stamens 8, the alternate ones short or rudimentary; stigmas 4, large and spreading: pod oblong or linear, 4-sided —Half dozen or more species in W N Amer See also *Eucharidium*

Clarkias are hardy annuals of easy cultivation. They thrive in a warm, light soil, either fully exposed to the sun or in partial shade They are useful for low masses or for edgings; also for vases and baskets. They have been much improved by domestication.

A *Stamens (8) all perfect lvs broad.*

élegans, Douglas (*C. unguiculàta*, Lindl *C. nerufòlia*, Hort.) Fig 979 From 1–6 ft high, glabrous or nearly so, the sts reddish and glaucous, simple or sparingly branched lvs broad-ovate to linear, remote-dentate fls purple or rose-colored, running into white vars, double forms in cult; claw of the petal about as long as its rhomboidal entire limb caps sessile B M 3592 B R 1575 R H. 1845 385 Mn 1·22.—One of the commonest annual fls

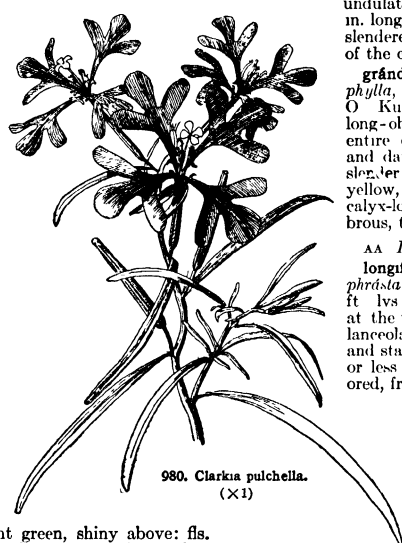
rhomboídea, Douglas Not so tall and more slender· lvs thin, lance-oblong or ovate-oblong, entire: claw

often toothed, shorter than the rhomboidal limb: caps. stalked. B.R. 1981. R.H. 1864:151(?).—Not much cult.

AA. *Stamens 4 perfect and 4 rudimentary· lvs. very narrow.*

pulchélla, Pursh. Fig. 980. One ft. to 18 in high, branchy, often tufted and dwarf, the sts. mostly puberulent lvs narrowly lance-oblong to linear, narrowed into a petiole, entire fls lilac, running into white vars.; petals ¾in or less long in wild plants, with 3 wide-spreading lobes and a pair of recurved teeth on the claw. caps stalked B M. 2918. B R 1100. R H 1845 385, 1886, p 557 —Common in cult There are semi-double and dwarf forms Var **holopétala,** Voss (*C integripétala,* Hort) is a garden form or race with entire petals There are also dwarf forms of it. The garden names *kermesina* and *limbata* belong with *C pulchella*

L H B



980. Clarkia pulchella. (×1)

CLARY. The dried leaves of *Salvia Sclarea,* which are used for seasoning Other species of Salvia have been used for the same purpose. See *Salvia.*

CLAUCÈNA (a personal name) *Rutàceæ* Small inermous trees lvs pinnate: fls in terminal panicles or loose racemes, ovary raised on a short disk, 4–5-celled, with 1–2 ovules in each cell; style short, deciduous; stamens 8–10· fr 4–5-celled, with usually 1 seed in each cell, cotyledons aerial in germination, first foliage-lvs opposite or alternate.

Lánsium, Skeels (*Clausèna Wámpi,* Oliver. *Quinària Lánsium,* Lour. *Coòkia Wámpi,* Blanco) WAMPI. Low spineless tree, with spreading branches: lvs. spirally arranged, pinnate; lfts 5–9, ovate-elliptical, 3–5 in long, petiolate, light green, shiny above: fls. 4–5-parted, small, white, in large terminal panicles; ovary villous, 5-celled, with 1 ovule in each cell, style short; stamens 10: fr ovate-globose, about 1 in long; skin glandular, pubescent, seeds green —The wampi is a native of S China, where it is commonly grown for its frs It is cult to some extent in Hawaii and could probably be grown in the warmer parts of Fla. and Calif. It can be grafted on grape-fruit and other species of Citrus, which makes it desirable to test it as a stock for common citrous frs.

WALTER T. SWINGLE.

CLAVÌJA, (Don José de Viera y Clavijo, of Madrid). Syn , *Horta Myrsinàceæ;* by Mez separated in the family *Theophrastàceæ.* Thirty and more tropical American evergreen unbranched trees or shrubs, a few of which are sometimes grown in the warmhouse. The sts are simple, often spiny, bearing at the top a cluster of large rigid, simple, entire or spiny-toothed lvs : fls. polygamous-dioecious in axillary racemes; calyx 4–5-parted, the segms round; corolla white, yellow or orange, the tube short and fleshy, the limb mostly spreading and 4–5-lobed, stamens 4 or 5, the filaments often united in the sterile fls ; staminodia 4 or 5, being scales in the throat; ovary fusiform, narrowed into a short style, the stigma obtuse or capitate: fr. several-seeded, berry-like. The clavijas thrive in a peaty potting soil, and prop. by cuttings of half-ripened growths. They are odd plants The features are here given as apparently understood by horticulturists.

A *Lvs entire, or only repand.*

nóbilis, Mez, (*C. clavàta,* Decne). Plant 4–5 ft : lvs. long-petioled thick, 1½ ft or less, elliptic or oblong or oblanceolate, entire, acute or semi-acute. fls. yellow, with a very large disk, ¾in long, the corolla fleshy, in drooping racemes 2–4 in long. Venezuela. B.M. 6928 (as *C. Ernstii,* Hook., f).

integrifòlia, Mart (*Theophrásta integrifòlia,* Pohl). Allied to *C longifolia,* differing chiefly in the less rigid, broader and entire leaves, longer petioles and larger fls Lvs distinctly petioled (petioles ½–1 in long), obovate-oblong to lanceolate-oblong, acute and mucronate, cuneate at the base, quite entire or slightly undulate, 8–18 in long racemes erect, 5–7 in. long; fls larger than in *C ornata,* on slenderer pedicels, 5-merous; appendages of the corolla rounded, short. Brazil.

grándis, Decne (*Theophrásta macrophýlla,* Lind , not Link *T. grándis,* O Kuntze) Lvs large (to 3 ft), long-oblong, narrowly pale-margined, entire or sinuate-repand, petiole thick and dark violet, the secondary nerves slender and simple or forked fls orange-yellow, in short and erect racemes; calyx-lobes orbicular and nearly glabrous, the corona 5-lobed Colombia.

AA *Lvs serrate, often spiny-toothed*

longifòlia, Mez (*C ornàta,* Don, *Theophrásta longifòlia,* Jacq) Plant 10–20 ft lvs many, in a crowded head or tuft at the top of the st oblong-spatulate to lanceolate, leathery, narrowed at base and stalked, acute, spiny-toothed, 1½ ft or less long fls orange- or saffron-colored, fragrant, in drooping racemes 4–10 in long Venezuela, Colombia. B M 4922. B R 1764 Blooms in June and July

spinòsa, Mez (*C Riedeliàna,* Regel) Plant 5–6 ft , glabrous, stout and erect lvs obovate-lanceolate, sessile, 20 in or less long, spinose-serrate fls orange-yellow, in slender racemes 5–8 in long Brazil

fúlgens, Hook f Plant 3 ft or more, very stout: lvs spatulate-obcuneate, narrow, remotely toothed near the apex, narrowed into a very short petiole, very coriaceous, 1 ft or so long. fls deep red, with yellow disk, handsome, in erect racemes 4 or 5 in. long. S. Amer. B M 5626.

C latifòlia, Radlk (Theophrastus latifolia, Willd) Lvs gracefully elliptic, petioled, narrowed at both ends, mucronate-serrate. racemes erect Colombia

L H B.

CLAYTÒNIA (after John Clayton, of Virginia, one of the earliest American botanists upon whose collections Gronovius based the Flora Virginica) *Portulacàceæ.* SPRING BEAUTY Little smooth succulent herbs sometimes transferred to gardens for their bright flowers.

Perennials with slender, 2-lvd sts from a deep, globular corm, and loose racemes of white or rose-colored fls with deeper veins, appearing among the first wild fls and lasting only a few days. The genus is characterized by its oval, persistent sepals and 5 stamens Plants can be secured from dealers in native plants They can be naturalized in moist places, and do well in half-shady spots at the bottom of a rockery. For *C. parvifolia, C. parviflora* and *C. perfoliata,* see *Montia.*

virgínica, Linn. Plant 4–8 in. long, often forcing an irregular way through the leaf-mold of damp, rich woods: lvs linear-lanceolate or linear, 2–6 in. long, including the gradually tapering base: fls larger and more numerous than in *C. caroliniana*, whitish, tinged with pinkish Colo. to Atlantic and south to Gulf. B.M. 941. L.B.C. 7.643.

caroliniàna, Michx. Lower and fewer-fld.: lvs. 1–2 in long, oblong, oblong-lanceolate, somewhat spatulate, or even ovate-lanceolate, with a blade 1–2 in. long, abruptly contracted into a marginal petiole: fls smaller than in the preceding and more deeply colored. Minn to Atlantic and south to mts. of N C —Should be grown only in cool places above 1,000 ft.

lanceolàta, Pursh About 4 in high: lvs oblong or lanceolate, ½–1½ in long, the base broad or narrow; petiole as long as the blade. raceme short-peduncled; petals emarginate or almost obcordate N W. N. Amer —Considered by some to be a mere form of the preceding

WILHELM MILLER
N TAYLOR †

CLEISÓSTOMA (Greek, *closed mouth*, referring to the structure of the spur) *Orchidàceæ*. Epiphytic orchids, adapted to the warmhouse.

Stems leafy lvs coriaceous, flat or nearly terete: sepals and petals adnate to the column, spreading; labellum with a large saccate spur, column short, thick, pollinia 2 From E Asia and Austral —A genus comprising in the neighborhood of 40 species, which suggest Saccolabium The plants are little known in Amer They require the treatment usually given Aerides The leading species are *C. crassifólium*, Lindl, from India, with small green rosy-lipped fls in nodding panicles, and thick recurved lvs. 10 in. long. J F 4 397; and *C. ringens*, Reichb f, Philippines, with yellowish white purple-lipped fls. with orange spot on side lobes, spur large, in few-fld racemes: lvs 3–4 in long *C. Dawsoniànum*, Reichb f, is a Trichoglottis; *C. multiflòrum*, Hort, is probably *Aerides multiflorum* *C. secúndum*, Rolfe, a recent introduction from Burma, has light rose-pink fls. that are turned sidewise, the front lobe of the lip rose-purple, borne on a scape 3–4 in long lvs. lance-oblong, about 4–5 in. long and ½in. broad.

CLEISTÁNTHUS COLLÍNUS: *Lebidieropsis.*

CLEISTOCÁCTUS (*closed Cactus*, referring doubtless to the peculiar flowers) *Cactàceæ*. Slender columnar cacti, with few branches and many-ribbed. fls. short and narrowly curved, orange-red, ovary covered with small appressed bracts bearing hairs in their axils, filaments somewhat exserted and grouped together near the upper lip fr spineless, pulp white; seeds slightly punctate —About 14 species have been described in this genus.

Baùmannii, Lem. (*Cèreus Baùmannii*, Lem. *C. colubrìnus*, Otto) Sts dark green, slender, flexuose, columnar, reaching a height of 6 ft and a diam. of 1–1½ in, the few branches ascending, slender, parallel with the main st: ribs 12–16, rounded. areoles close together, brown: spines fine, slender, very sharp, 15–20, fascicled, white to yellow or dark brown, about ¼in. long; sometimes a single one from the center reaches a length of ¾in: fls numerous, tubular, zygomorphous, 2½–3 in long by about ½in diam throughout, red or sometimes with orange-red petals and red tube. Uruguay, Paraguay and Argentina. J. N ROSE.

CLÉMATIS (Greek name of a climbing plant). *Ranunculàceæ* Familiar garden plants, prized for their handsome and often very showy flowers followed in many species by attractive feathery-tailed fruits.

Climbing vines, or erect or ascending perennial herbs, more or less woody. lvs. opposite, mostly slender-petioled, usually pinnately compound, lobed, or in some species entire and rarely sessile: sepals usually 4 or 5, sometimes more, valvate in the bud, rarely imbricate, petaloid; petals none (or small in Atragene section, usually considered as petaloid staminodes); stamens many; pistils many achenes in a head, 1-seeded; style persistent, long, plumose, silky or naked Fig. 983 —About 150 species of very wide geographical distribution, most abundant in temperate regions. About 20 species found native in N Amer and about 80 in E Asia. Les Clematites, Alphonse Lavallée, Paris, 1884; referred to below by "Lav"—The Clematis as a Garden Flower, Thomas Moore and George Jackman, London, 1872, referred to below by "M & J"—Clematises, Dr Jules le Bele, in Bull de la Societe d'Hort de la Sarthe, republished in The Garden (vol. 53), June–Oct, 1898 —O Kuntze, Monogr der Gattung Clematis in Verh Bot. Ver Brandenb. 26 (1885) —A Gray, Fl N Amer 1 4–9, 1895 —Finet & Gagnepain, Contrib. Fl As Orient 1:1–42 (1905).

The culture of clematises. (K C DAVIS)

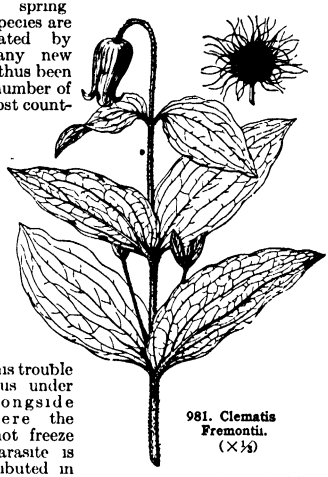
A rich soil of a light, loamy character is the best for clematises, and a little mixture of lime will make it better The soil must be well drained, and must be kept rich by at least annual applications of horse- or cow-manure. On dry, hot soils cow-manure is best, while on heavy soils a thorough dressing of rich leaf-mold would best serve the purpose Mulching with half-rotted manure on the approach of winter tends to increase the strength of the plants and the size of the flowers. In dry seasons, spraying is always helpful during the growing period

Clematises belonging to the Montana, Patens, Florida, and Lanuginosa types should be pruned in February or March, by cutting away all weak, straggling and overcrowded branches The first three mentioned flower from the ripened wood, it is essential, therefore, that in order to secure blossoms, enough of the strong one-year-old wood should be retained. Viticella, Jackmanii and Lanuginosa should be vigorously cut back, say in November, they blossom from the new shoots Those of the Patens type should be pruned very little, soon after the flowers have disappeared, by simply trimming off useless branches and seed-bearing peduncles

Clematises of the vigorous climbing varieties are used in many places to cover walls, root-fences, mounds, arbors, balconies, trellises, small buildings, and, in fact, many other places the ingenious gardener will think of. For pot culture in the greenhouse, and for conservatory walls, the less vigorous species are best suited All the many varieties and hybrids of the Patens and Lanuginosa types, including Henryi and the forms of Jackmanii, are well adapted to this use, as well as for outdoor purposes. The dwarfer and more bushy species are used in greenhouses to some extent, but are found principally in borders or on large rockeries Of the latter J B Keller says. "Their flowers are not so large as we see them in most of the climbers, yet they are indispensable in the flower-garden, being prolific bloomers and free growers in ordinarily rich, deep garden soil. There is room for improvement in this class, however, and specialists, who hitherto have done so much for the climbers, ought to direct their efforts now to the long-neglected bush clematises A noble beginning has been made, resulting in the large-flowering *C. Durandii*, but we expect more of them in the future." See special notes on culture and hybrid-forming qualities after the descriptions of some of the species and varieties

The most common method of propagation is by grafting Roots of *C. Flammula* or *C. Viticella* are used; the cions are taken from plants that have been grown under glass, and are used before the wood is entirely ripe. Cions taken from plants grown in the

garden in summer are rarely successful. The grafts, in pots or trays, are grown in a moist coolhouse, over gentle bottom heat. Another method of propagation, involving less labor but usually successful, is to take cuttings of nearly ripe wood, grown under glass, and treat them as the cions first above mentioned, without the roots. The latter method is practised preferably in summer in gentle hotbeds; shading, spraying, and later on airing, must be strictly attended to Layering is practised when large old stools are at hand The knife is not used in the operation, but a twist of the stem will split the inner bark lengthwise. Every other joint is thus treated, pegged down, and covered with soil It is best to leave the layers undisturbed until the following spring



981. Clematis Fremontii. (×½)

Many of the species are often propagated by seed, and many new varieties have thus been secured The number of hybrids is almost countless; in this account are carefully recorded those in the American trade which are traceable to their origin.

The clematis is subject to a very serious disease, due to the depredations of a nematode worm in the roots This trouble is most serious under glass and alongside buildings where the ground does not freeze deep The parasite is probably distributed in the soil adhering to pot-grown plants It is probable that hard freezing kills the parasite There is no remedy, so far as known, for affected plants Using only soil which has been frozen is to be recommended to the propagator.

The kinds of clematis (Jackson & Perkins Co)

The hybrid varieties of Clematis, commonly known as the large-flowering sorts, are, when successfully grown, among the most beautiful of hardy climbing plants The commercial propagation and growing of most of the large-flowering varieties, however, is attended with so many difficulties and disappointments that it has never been very generally attempted by nurserymen or florists in this country At the present time there are scarcely half a dozen houses on this continent who attempt the propagation of clematis to any considerable extent, and it is only within the past thirty years that clematises have been commercially grown even by this limited number. Prior to that, practically all of the large-flowering clematises planted in this country were imported from Europe, the major part being supplied by Holland, whose moist atmosphere and black soil produces large, vigorous plants, but whose climatic conditions are so entirely different from those usually found in this country that the plants often failed to adapt themselves to their new surroundings, and did not thrive to the extent that their good size and vigorous condition seemed to give promise.

The propagation of clematis throughout Europe is usually effected by grafting pieces of well-ripened, year-old wood upon roots of almost any of the more vigorous-growing species, *Clematis Flammula* being most commonly used In this country, on the contrary, the method commonly pursued is by means of cuttings from young wood, stuck in sand, with gentle bottom heat, usually during May or June So far as concerns the comparative vigor and desirability of plants produced by these two methods, there is small choice between them Propagation by cuttings is, in this country, the more rapid and economical way, and further, it removes the possibility, sometimes realized in grafted plants, of sprouts being thrown up from the roots, and, if in the hands of an uninformed amateur, entirely "running out" the variety grafted in; thus considerable annoyance is avoided.

Clematises hybridize so readily that the number of varieties resultant from various crosses forms a long list But while so many have been dignified with names and places in the catalogues of nurserymen, yet the varieties of large-flowering clematis that have proved so valuable as to secure permanent places for themselves in popular demand can almost be counted upon one's fingers There are many varieties possessing most beautiful shades and variations of coloring that fail to attain popularity, chiefly on account of deficiency in two essential characteristics—vigorous habit of growth and abundance of bloom *Clematis Jackmanii*, purple, originated in 1862, by Mr George Jackman, was one of the first hybrid clematises introduced, and still stands as the most popular, and, of its color, the most valuable variety yet known The variety, Madame Edouard André, a deep rich crimson, is distinct and novel, being at this time about the best large-flowering sort of a truly crimson shade It is not quite so vigorous habit as the Jackmanii, but its flowers are similarly massed, though not produced in quite such profusion. Clematis Madame Baron Veillard is a distinct variety It is of exceedingly vigorous habit, and the flowers are quite freely produced, though, being more dispersed over the plant, they do not make so much of a show as do varieties whose flowers are closely massed The flowers are of very large size and of a light rose-color, shaded with lilac. Of white varieties, Henryi, Mrs George Jackman and Lanuginosa Candida, all of them introduced long ago, still remain about the most desirable ones known Ramona, deep sky-blue, is a variety which originated some twenty-five years ago. It is of extra-large size, often 9 to 10 inches across, of very vigorous habit and free-flowering

Of double-flowered varieties, Duchess of Edinburgh, white, is the best known in this country, and about the most desirable. John Gould Veitch is a double sort with flowers of lavender-blue, but has seemed a shy bloomer and of weak habit Mme Grange (purplish violet), Star of India (purple), Velutina Purpurea (purple), and Viticella Venosa (reddish purple), are all desirable varieties.

Although they are in reality slightly less hardy than the Florida and Patens types, varieties of the Lanuginosa, Viticella and Jackmanii types,which produce their flowers from young growing wood, are recommended for northern localities. Plants of these types, even if frozen back to the ground, will still produce a good show of flowers, since, as stated, they bloom from the recent vigorous wood, even if the old tops are killed. Indeed, they need to be pruned back considerably anyway to induce a free growth of young vigorous blooming wood. With plants of the Patens and Florida types, however, which blossom from year-old wood, a severe freezing back of the plants would destroy the crop of flowers for the year.

Of the small-flowering varieties, *Clematis paniculata* (white), introduced from Japan, has proved to be a wonderfully valuable acquisition in this country, and has become exceedingly popular. It is of remarkably vigorous habit, often making a growth of 20 to 25

feet in a season. It seems thus far to be entirely free from disease, is delightfully fragrant, and so floriferous that the blossoms form a dense sheet of bloom, remaining in full beauty for several weeks. The foliage is very thick and heavy, thus making it very desirable for covering porches and arbors.

Crispa (blue) and texensis (red) are species with very pretty, bell-shaped flowers. They are easily grown and do well in almost all situations

The perennial, non-climbing varieties of clematis are most pleasing border plants, succeeding well in all ordinary soils and making a rich show of bloom at their flowering season. Davidiana (blue) and recta (white) are about the best known and most desirable varieties of this class

To grow clematis most successfully, they should be given a good depth of loamy soil, with a fair supply of well-rotted manure spaded in and thoroughly distributed through the soil In hot, dry weather, the plants should be regularly watered in order to obtain the greatest number of flowers possible, for the plants are very susceptible to injury by drought A point of great importance, especially in caring for newly set plants, is to provide a firm support for them to climb upon. A solid wooden or metal trellis is preferable, for the reason that it prevents the plants from being whipped about by the winds, which often results in breaking the stalks just above the ground or else in cracking the outer bark of the stalks and rendering them more liable to the attacks of insects and fungous diseases. Training the vines upon strings, or a pliable support of any kind, is not to be advised for this reason Propagation of the hybrid varieties is effected both by cuttings and by grafts All of the type varieties grow readily from seed.

INDEX.

æthusifolia, 16
akebioides, 48
alba, 18, 20, 23
alba magna, 23
albiflora, 20
alpina, 18
anemoniflora, 28
angustifolia, 18
apiifolia, 48
Armandii, 30
aromatica, 5
atroviolacea, 20.
azurea, 24
balearica, 26
Bergeronii, 20
bicolor, 22
brevicaudata, 39.
brevicordata, 49
caerulea, 5, 24
californica, 13
calycina, 26
campaniflora, 21.
candida, 23
Catesbyana, 12
Chandleri, 20
cirrhosa, 25
coccinea, 10
columbiana, 17
contorta, 20
crassifolia, 32
crispa, 6
cylindrica, 1
Davidiana, 12
devoniensis, 23.
distorta, 20
dwaricata, 1
Douglasii, 4
Drummondii, 44.
Durandii, 23
erecta, 34
eriopoda, 49
eriostemon, 20
Fargesii, 37
Farquhariana, 30
Flammula, 20, 36
floribunda, 20
florida, 20, 22
Fortunei, 22
fragrans, 36
francofurtensis, 24.
Fremontii, 2
fulgens, 23
fusca, 11
Gabrielii, 23
glauca, 48
globulosa, 4
gracilifolia, 27
grandidentata, 40
grandiflora, 24, 28
grata, 40
gravcolens, 47.
Guwcoi, 24
hakonensis, 23
Hendersonii, 20.
Henryi, 23
heracleæfolia, 12, 13
ichangensis, 12.
indivisa, 16
integrifolia, 1
intermedia, 20.
intricata, 48
Jackmanii, 23.
jouiniana, 11
japonica, 22
Jouiniana, 12
Kermesina, 20.
koreana, 50
lanuginosa, 23.
lasiandra, 15
lasiantha, 45
latisecta, 16
Lavallei, 13
Lawsoniana, 23
ligusticifolia, 43.
lilacina, 28
lilacina-floribunda, 20
lobata, 46
lobulata, 40
magnifica, 23
mandshurica, 34.
marmorata, 20
Meyeniana, 31
modesta, 23
monstrosa, 24
montana, 28, 29.
nivea, 23
nutans, 14
obtusidentata, 38
occidentalis, 18
ochroleuca, 3
odorata, 28
orientalis, 47, 48, 49
Pallasii, 36, 48, 49
pallida, 23
paniculata, 35.
parviflora, 20
patens, 24
Pavolniana, 33
Pelleri, 23
perfecta, 28
Pitcheri, 7
plena, 34
pseudo-coccinea, 10
purpurea-hybrida, 23
recta, 34
repens, 28
reticulata, 8
reticulata, 20
rotundifolia, 36
rubella, 23, 36
rubens, 28
rubra, 20
rubro-marginata, 20.
rubro-violacea, 23.
Sargentii, 7
Scottii, 4
serratifolia, 50.
sibirica, 18
Sieboldii, 22
Simsii, 7
Soulici, 37
splendida, 23
Spooneri, 29
Standishii, 24
tenuisepals, 39
ternifiora, 34.
texensis, 10
thyrsoidea, 14
tubulosa, 12
tunbridgensis, 23.
undulata, 28
Vetchii, 22
velutina-purpurea, 23.
venosa, 20
verticillaris, 17
violacea, 11, 20, 23, 24
Viorna, 9, 10
virginiana, 42
Vitalba, 41.
Viticella, 20
Wilsonii, 28.

KEY TO THE SPECIES.

A. *Sepals upright, forming a tubular or urceolate fl, stamens upright, appressed, pubescent, or sepals more spreading and fls with petaloid staminodes*
  B. *Fls without petaloid staminodes.*
    C. *Lvs simple herbaceous, not climbing*
      D. *Color of fls purple or blue*
        E *The lvs thin, acute, sessile* 1. **integrifolia**
        EE *The lvs subcoriaceous, reticulate, obtusish, short-petioled* .... 2. **Fremontii**
      DD *Color of fls yellow* ..... 3. **ochroleuca**
    CC. *Lvs compound*
      D *Lfts entire fls solitary*
        E *Plants upright, herbaceous*
          F *Shape of lfts lanceolate: lvs bipinnate or ternately compound* . . 4. **Douglasii**
          FF *Shape of lfts ovate lvs. pinnate* 5 **aromatica**
        EE. *Plants climbing, shrubby*
          F *Styles not plumose in fr*
            G *The lvs not reticulate, usually with terminal lft* 6 **crispa**
            GG. *The lvs reticulate, usually without terminal lft* 7 **Simsii**
          FF. *Styles plumose in fr*
            G. *Fls axillary, with the pedicels much longer than the flv*
              H. *Sepals outside pubescent, dull*
                I. *Lfts subcoriaceous, reticulate* 8. **reticulata**
                II. *Lfts membranous, indistinctly veined* 9 **Viorna**
              HH. *Sepals outside glabrous, bright scarlet* 10 **texensis**
            GG. *Fls terminal and axillary, the latter with the pedicels shorter than the fls* 11. **fusca**
      DD *Lfts serrate fls usually clustered or panicled*
        E *Plants herbaceous, upright· fls clustered, often nearly sessile*
          F *Fls blue or violet, in axillary clusters* 12 **heracleæfolia**
          FF *Fls whitish, usually in an elongated terminal panicle* 13 **stans**
        EE. *Plants climbing, shrubby*
          F *Lvs pinnate*
            G *Fls yellowish white, in panicles* 14 **nutans**
            GG *Fls reddish purple, 1–3, axillary* 15 **lasiandra**
          FF *Lvs bipinnate, lfts small, deeply lobed, usually less than 1 in long fls whitish* 16. **æthusifolia**
  BB *Fls with petaloid staminodes, sepals more or less spreading, stamens upright, appressed pubescent*
    C *Lvs always 3-foliolate, lfts ovate, subcordate* 17 **verticillaris**
    CC *Lvs partly biternate, lfts. ovate to ovate-lanceolate* 18 **alpina**
AA. *Sepals spreading, stamens more or less divergent*
  B. *Stamens glabrous or only with a few hairs below the anthers (or hairy at the base only in No 19)*
    C. *Fls solitary or in 3's or in axillary fascicles, blue, violet, red or white, usually large*
      D. *Lfts entire fls on the new growth after the lvs, solitary or in 3's.*

CLEMATIS

EE. *Plant herbaceous, upright: sepals imbricate in bud; stamens pubescent at the base* 19. **Stanleyi**

EE. *Plants woody, climbing sepals valvate, stamens glabrous*

F. *Achenes with short style, pedicels longer than the sepals*

G. *Number of sepals 4: fls. open campanulate, usually 1–2 in across.*

H. *Style glabrous fls 1–2 in across, often in 3's* 20 **Viticella**

HH. *Style pubescent except at the apex, fls 1 in or less across* 21 **campaniflora**

GG. *Number of sepals usually 5–6 fls flat, 2–4 in across* 22. **florida**

FF. *Achenes with long plumose style*

G. *Pedicels shorter than sepals lvs simple or ternate* 23. **lanuginosa**

GG. *Pedicels longer than sepals fls from last year's wood in spring or early summer lvs ternate or pinnate* 24 **patens**

DD. *Lfts or lvs serrate fls in axillary clusters, or solitary on last year's branches with the lvs in spring, white or pink*

E. *The sepals with a small involucre below their base, fls nodding, open campanulate*

F. *Lvs simple fls whitish* 25 **cirrhosa**

FF. *Lvs ternate fls greenish yellow, spotted red inside* 26 **balearica**

EE. *The sepals without involucre*

F. *Lvs pinnate, lfts small, about ½ in long* 27 **gracilifolia**

FF. *Lvs. ternate, lfts 1–3 in long*

G. *Lfts glabrous or sparingly pubescent* 28. **montana**

GG. *Lfts densely silky pubescent beneath, less so above* . 29. **Spooneri**

CC. *Fls. in terminal or axillary panules or cymes, rarely 3 (if solitary, with bracts about the middle of the pedicel) white, rarely pinkish, sepals 4 (sometimes 4–6 in No 37), usually small (except in No 37)*

D. *Lvs 3-foliolate, lfts always entire, often sub-coriaceous or coriaceous*

E *The fls from the old wood from scaly buds* 30 **Armandii**

EE. *The fls from the new growth*

F *Lfts ovate or ovate-oblong*

G *Filaments as long or shorter than anthers lfts rounded or subcordate at the base* 31. **Meyeniana**

GG. *Filaments longer than the anthers lfts cuneate at the base* 32 **crassifolia**

FF. *Lfts narrow-lanceolate or oblong-lanceolate* 33 **Pavoliniana**

DD. *Lvs pinnate or bipinnate (if 3-foliolate, lfts lobed or dentate or fls dioecious)*

E. *The fls perfect*

F. *Lfts entire or nearly entire, or 3-lobed anthers linear, much longer than broad*

G. *Plant herbaceous, upright* . 34. **recta**

GG. *Plant climbing, half-woody*

H. *The lvs pinnate* ..35 **paniculata**

HH. *The lvs bipinnate* 36. **Flammula**

FF. *Lfts serrate, occasionally nearly entire anthers oval or oval-oblong, not more than twice as long as broad (longer in Nos. 37 and 38)*

G. *The fls 1–3, long-stalked, 2–3 in across lvs. pinnate* 37. **Fargesii**

GG. *The fls in panules or cymes, not exceeding 1 in diam*

H. *Lvs ternate or biternate fls ½ in. across, in many-fld cymes* 38. **apiifolia**

HH. *Lvs usually bipinnate, lfts ovate-lanceolate tails of fr about ¾ in long* 39. **brevicaudata**

HHH. *Lvs pinnate tails longer*

I. *Sepals glabrous inside lfts pubescent beneath* 40. **grata**

II. *Sepals pubescent inside and outside lfts glabrous or nearly so* 41. **Vitalba**

EE *The fls dioecious*

F *Foliage deciduous sepals 4.*

G *Fls appearing on the young wood in summer, less than 1 in across*

H. *Lvs ternate, lfts 2–3 in long* 42. **virginiana**

HH. *Lvs pinnate, lfts 1–2 in long*

I. *Plant glabrous lfts rounded or subcordate at the base* 43 **ligusticifolia**

II *Plant pubescent lfts truncate or cuneate at the base* 44 **Drummondii**

GG. *Fls on last year's branches from scaly buds in early spring, 1½ in across* 45 **lasiantha**

FF *Foliage evergreen, lvs ternate sepals 5–7* 46 **indivisa**

BB. *Stamens pubescent, fls yellow or yellowish, nodding achenes with plumose tails*

C. *Lvs pinnate or bipinnate*

D. *Fls usually several, 1–2 in. across, pale yellow lvs. bluish or grayish green, lfts usually entire, often lobed*

E. *Lfts often oblong or lanceolate sepals pubescent inside* 47. **orientalis**

EE. *Lfts usually ovate or oval, pale bluish green sepals glabrous inside* 48 **glauca**

DD. *Fls solitary, 2–3 in across, on stalks to 10 in long, sepals glabrous inside lfts usually lanceolate, serrate, green* 49 **tangutica**

CC. *Lvs biternate, lfts serrate, green fls solitary* . 50. **serratifolia**

Section VIORNA.

Group CRISPÆ.

1. integrifólia, Linn Herbaceous, erect, becoming 2 ft. high: lvs. rather broad, entire, ovate-lanceolate: fls solitary, nodding; sepals 4, rather narrow, blue, coriaceous, 1–2 in. long. June–Aug. Eu and Asia. B.M 65

The following are supposed to be hybrids of this species *C cylindrica*, Sims (×C crispa C integrifolia var diversifolia, Hort. C. integrifolia var pinnata, Hort) Lvs more or less irregularly lobed or pinnate fls solitary, cylindric-campanulate with the sepals more or less recurved from the middle, blue or bluish-violet B.M.

1160. Lav. 13 G W 14, pp 562-3 R H 1856 341 Here also belongs probably *C divaricàta*, Jacq , with short-petioled pinnate lvs. and blue, less spreading sepals

2 **Frèmontii,** Wats. Fig. 981. Closely allied to *C. ochroleuca*, but with lvs 3–4 in long, nearly sessile, either entire or with a few coarse teeth fls. often drooping; sepals thick, purple, nearly glabrous, except the tomentose edges; styles when young downy rather than feathery July, Aug Mo. to Colo. G F. 3.381 (adapted in Fig 981). G.W. 14, p. 563.

3. **ochroleùca,** Ait Herbaceous, 1–2 ft. high, silky-pubescent, becoming glabrate: lvs ovate, entire fls. erect, solitary, terminal, sepals yellow outside, cream-colored within; styles becoming somewhat plumose. July, Aug Dry grounds, N Y to Ga L B C 7:661. —Intro 1883

4 **Doùglasii,** Hook Has habit of *C integrifolia*, about 2 ft high: st and petioles angled and ribbed: lvs twice pinnately or ternately compound, lfts narrow-linear or lanceolate fls tubular or bell-shaped, 1 in long, sepals recurved, deep purple within, paler without June In mts , Mont to New Mex —Intro. 1881 Var **Scóttii,** Coulter, has the lfts ovate- or oblong-lanceolate A hybrid of *C Douglasii* var *Scottii* × *C texensis* is *C. globulòsa*, Hort , with deep purple pitcher-shaped fls Gn 75, p. 472.

5 **aromática,** Lenné & C Koch (*C. cærùlea* var. *odoràta*, Hort) Slender, herbaceous or somewhat climbing, reaching 6 ft high if supported lvs of 3–7 ovate, nearly entire lfts fls. solitary, terminal, very fragrant, 1½–2 in across, sepals 4, spreading, reflexed, reddish violet, stamens white July–Sept Nativity, perhaps S France It is thought by some to be an old garden hybrid, probably *C Flammula* × *C integrifolia*. R H 1877, p. 15. Lav. 9.

6 **crìspa,** Linn A slender climber, reaching 3–4 ft : lvs very thin, lfts 3–5 or more, variable in outline and sometimes undivided, often 3-5-lobed fls purple, varying to whitish, cylindrical or bell-shaped, 1–2 in long, points of sepals recurved, styles of fr hairy but not plumose June–Sept Va to Texas B R 32 60. B M 1892 I H 2 78 (as *C campaniflora*) G 30 503; 34 147. V 6 379 Lav 14 —This and the allied species are fragrant A hybrid of this species is *C. cylindrica*, Sims (× *C integrifolia*) See No 1 A number of hybrid forms, the offspring of a cross between this species and *C. texensis* are figured and described in M D G 1898 500 and one as "blue bells" in Gn. 49, p 189

7 **Símsii,** Sweet (*C Pitcheri*, Torr & Gray) High climbing branchlets pubescent· lvs of 3–4 pairs of lfts and a terminal lft reduced almost to a midrib; lfts coarsely reticulated, lobed or 3-parted, usually mucronate fls 1 in long and ¾in diam , with swollen base, sepals dull purple, recurved at the tips achenes pubescent, styles not plumose June–Aug S Ind to Mo , southward to Mex Lav 15 B M 1816 (as *C cordata*). Var **Sárgentii,** Rehd (*C Sárgentii*, Lav). Fls. smaller, paler. lfts rarely lobed Lav 18 —A hybrid of this species with *C. texensis* is figured in R H. 1893:376

8. **reticulàta,** Walt A slender climber, allied to *C. crispa:* lfts much reticulated and very coriaceous fls. solitary in the axils of the lvs , nodding, bell-shaped; sepals recurved, crispy at the margin: mature fr with plumose tails. June, July. S. C to Ala. and Fla. B M. 6574. Lav. 16.

9. **Viórna,** Linn. Fig. 982. Climbing, 8–10 ft , sparingly pubescent or glabrous: lvs. not glaucous nor coriaceous; lfts. subcordate-ovate to ovate-lanceolate, slightly reticulated: fls solitary, on long peduncles, pitcher-shaped; sepals 4, 1 in. long, variable in color, often dull purple, thick and leathery, finely pubescent outside, tips often recurved; styles plumose when mature, 1 in. long June–Aug. Pa. to Ala. and westward Lav. 17. Gn 45, p 240

10. **texénsis,** Buckl (*C. coccínea*, Engelm. *C Viórna* var *coccínea*, Gray) Climbing, to 6 ft ; glabrous. lvs glaucescent, subcoriaceous, lfts broadly ovate, often obtuse, subcordate, 1½–3 in long. fls solitary, pitcher-shaped, nodding, carmine or scarlet, glabrous outside achenes with plumose style, 1–2 in long, glabrous at the tip Texas. Lav. 19. B M. 6594 Gn. 19 284. G W 10, p 498 G C II. 15·405. W G Z 2.111 F. 1880, p 115 Gt 32·86. R H. 1878·10; 1888 348 —Much superior to the preceding because of its beautiful fls Some of the garden hybrids of this species, which have been classed under *C. pseudo-coccínea*, Schneid (× *C Jackmanii*), are found under the names. *Countess of Onslow*, deep scarlet. Gn 57, p 376 M D G 1898:481. G M 37 381 G C III. 16.9 *Countess of York*, white, tinted with pink. *Duchess of Albany*, clear pink. Gn 52 304. See also No 6 for hybrid forms of *C crispa* with this species and No 7 for a hybrid with *C Simsii*



982 Clematis Viorna (×⅓)

11 **fúsca,** Turcz. Climbing, to 15 ft ; sparingly pubescent lvs pinnate; lfts usually ovate, to ovate-oblong, acute, glabrous or pubescent beneath and ciliate, 1½–2½ in. long, the terminal one usually wanting· fls on rather short villous pedicels, nodding, urceolate, about 1 in long, sepals with recurved tips, densely brownish pubescent outside, violet inside pubescence of achenes and plumose tails fulvous June–Aug E Siberia, Japan Lav 20 Var **violàcea,** Maxim (*C jánthina*, Koehne). Less pubescent fls violet Gt 13 455

Group Tubulosæ.

12 **heracleæfòlia,** DC (*C tubulòsa*, Hook). Stout, erect, woody only at the base lvs ternate, large, bright green, lfts broadly ovate, rounded at the base, slightly pubescent, mucronately toothed, 4–6 in long· fls numerous, in corymbs, either axillary or terminal, polygamous, tubular in form, with 4 light blue sepals, becoming reflexed, peduncles and pedicels downy; recurved stigmas club-shaped. Aug , Sept China. M & J 17 B M 4269, 6801 (as var *Hookeri*). P.M. 14 31. F S 3 195 R H 1858, p. 42 —Prop by root division. Var **Davidiàna,** Hemsl (*C Davidiàna*, Decne) About 4 ft high, hardly strong enough to stand without support lvs usually cuneate at the base, nearly glabrous fls brighter blue, fragrant, in clustered heads, 6–15 together, and also singly or clustered in the lf-axils R H 1867, p 90 Gn 31, p. 145; 45, p. 241, 49, p. 99, 68, p 273 G M 37.48. G W 6, p. 124 Mn 9:76 A F. 25.1055 Var **ichangénsis,** Rehd. & Wilson. Lfts. broad at the base, sparingly pubescent above, densely beneath. achenes densely villous Cent China

A hybrid of this species is *C Jouniàna*, Schneid (var Davidiana × *C* Vitalba) Half-climbing, to 6 ft fls in large panicles, bluish white, first tubular with the sepals finally spreading G C. III 51 34 Another hybrid is *C Davidiàna hybrida*, Lem (var. Davidiana × *C* stans) of which Lemoine advertises several named forms varying from light to deep blue, very floriferous

13 **stàns,** Sieb & Zucc (*C heracleæfòlia* var *stàns*, Hook). Herbaceous, upright, to 6 ft : branches grayish pubescent. lfts. broadly ovate, lobed and coarsely

toothed, more or less pubescent: fls. in terminal panicles sometimes 2 ft long and in axillary clusters, whitish or bluish white, tubular, with revolute sepals, less than ½in. long, dioecious Sept., Oct Japan B.M. 6810.—Used chiefly because of the striking foliage and its late-blooming qualities. Var **Lavállei,** Schneid (*C Lavállei,* Decne.). Fls. ½–¾in. long, monoecious.

Group CONNATÆ.

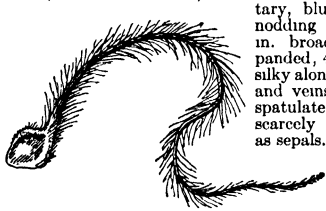
14 **nùtans,** Royle Slender woody climber lvs pinnate, lfts ovate-oblong or lanceolate, deeply 3–5-lobed, rarely entire, 1–3 in long fls nodding in many-fld. panicles, yellowish white, tubular, ½–¾in long, pubescent outside, filaments silky pubescent below the middle: achenes silky with plumose tails. July–Oct. Himalaya Var **thyrsoídea,** Rehd & Wilson Climbing to 20 ft. lfts broadly ovate, usually cordate at the base, silky pubescent beneath: panicles larger and more compact, on upright stout peduncles 3–6 in long W. China G C III 48.310 Gn 75, p 557 (as *C nutans*). R.H. 1905, p 438 (as *C. Buchaniana vitifolia*). See page 3567

15 **lasiándra,** Maxim Climbing, to 12 ft young growth viscid lvs pinnate with 3-foliolate or 3-fid segms.; lfts ovate to ovate-lanceolate, long-acuminate, serrate, glabrous or sparingly pubescent on both sides, 1½–2½ in long: fls axillary, solitary or in 3's on stalks 1–3 in long, campanulate, reddish purple, about ¾in long; sepals with recurved tips, as long as the stamens. Aug.–Oct Cent and W China

16. **æthusifòlia,** Turcz Slender, climbing: lvs. bipinnate, pubescent; lfts. finely cut, usually unequally 3-lobed and deeply incisely serrate with obtusish mucronulate narrow lobes, ⅓–¾in long fls. 1–3, axillary, on slender stalks, whitish, tubular, ¾in. long, sepals with recurved tips: achenes pubescent with long plumose whitish tails. Aug., Sept Mongolia, Manchuria Var **latisécta,** Maxim Lfts larger, to 1½ in long with oval or oblong rounded lobes. Gt 10:342 B M 6542. Gn 6, p 423; 31, p 186; 45, p 241 R H 1869, p. 10.—This is the form usually cult; the type with much more finely divided foliage is very rare in cult

Group ATRAGENEÆ.

17 **verticillàris,** DC (*Atrágene americàna,* Sims) Fig 983 Trailing or sometimes climbing, 8–10 ft usually 4 trifoliate lvs from each node, lfts thin, ovate, acute, toothed or entire, somewhat cordate: fls. solitary, blue or purple, nodding at first, 2–4 in. broad when expanded, 4 thin sepals, silky along the margins and veins; staminodes spatulate, narrow, scarcely half as long as sepals. May, June. Woodlands, Va. to Hudson Bay, west to Minn B M. 887.—Intro. 1881. Var **columbiàna,** Gray Sepals narrower and more pointed than in the type. Rocky Mts.

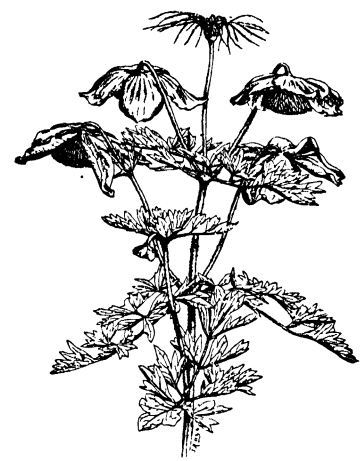


983. Achene of Clematis verticillaris. (×1)

18. **alpìna,** Mill. (*Atrágene alpìna,* Linn.) Sts. 3–5 ft., slender, with prominent joints becoming swollen with age. lvs. once or twice ternate, with ovate or ovate-lanceolate lfts, serrate or incised; many petal-like stamens, which are devoid of anthers, sepals 4, bright blue. Spring N W N. Amer., Siberia to S. and Cent Eu. B.M. 530 (as var *austriaca*) Gn. 46:318; 57, p. 481. R.H 1855 321. L B C. 3.250. G W. 10, p. 82 H.W. 3, p. 16.—A very hardy climber, preferring a northern exposure. Var. **sibírica,** Kuntze (var. *dìba,* Hort. *Atrágene sibírica,* Linn.). Fls white or nearly so. B.M. 1951 L.B C 14 1358 R.H. 1855.321. Var. **occidentàlis,** Gray. Petal-like stamens very few, and often bearing rudimentary anthers. Rocky Mts.

Section PSEUDANEMONE.

19 **Stánleyi,** Hook (*C Stanleyàna,* Hort.) Fig. 984 Erect robust herbs, 3 ft high lvs biternate, lfts sessile or petioled, variable in size, cuneate, silky:



984. Clematis Stanleyi. (×⅓)

fls 1–3 in across, white to pink-purple, sepals becoming widely expanded, stamens yellow; styles becoming very plumose, white July–Oct Transvaal Intro 1893 B M 7166 Gn 39 76. G F 3 513 (adapted in Fig 984). G C III 8 327 G M 34·320.—Suitable for greenhouse cult, in the northern states it is apt to winterkill if left unprotected

Section VITICELLA.

20 **Viticélla,** Linn Climbing 8–12 ft: lvs sometimes entire, but usually divided into 3 nearly entire lfts.. fls 1½–2 in diam., growing singly on peduncles or sometimes in 3's; sepals 4, blue, purple or rosy purple, obovate, pointed, reflexed; stamens yellow fr. with rather short glabrous tails. June–Aug. S Eu to Persia. R H 1860, p. 183; 1876.110, 1879.350 (vars.). B.M 565. G 22 310, 8·399 H.W 3, p 15. Lav. 7.—This is the type of one of the leading groups of garden clematises, and is one of the parents of the Jackmanii type of hybrids.

The following are garden varieties:

Var *albiflòra,* Kuntze Fls white

Var *rubra,* Hort Fls purple.—Var *rùbra grandiflòra,* Jackman, has larger bright crimson fls and 6 sepals F S 20 2053 (1783). F 1872 265

Var *kermésina,* Lem (C kermesina, Hort.) Fls of bright wine-red color, purple being absent Gn 39 30

Var *lilácina-floribunda,* Hort (C lilacina-floribunda, Hort C floribunda, Hort.) Fls pale gray-lilac, conspicuously veined Gn 18, p 389 (note).—An abundant bloomer Produced in an English garden in 1880

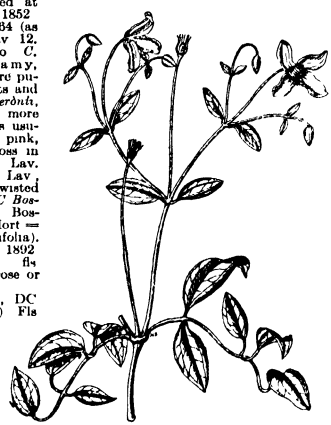
Lady Bovill, Jackman (C. Lady Bovill, Hort.) Fls cup-formed, sepals being concave and little or not at all recurved at the ends, fls 4 in across, sepals 4–6, grayish blue, stamens light brown M & J 15 R H 1876·190.

Var *marmoràta,* Jackman (C marmorata, Hort.) Fls rather small, with 4 broad sepals, light grayish blue with darker veins, 3

longitudinal bars M & J. 1, f 2, same plate in F S 20 2050–55 (2008) F 1872 265

Hybrids of *C. Viticella* which are closely allied to that type.

C. eriostémon, Decne. (×C integrifolia, C. Hendersonii, Henderson. C Chandleri, Hort.) Fig 985 St and habit of C Viticella lfts and fls much like C integrifolia climbing 8–10 ft.: 4 blue sepals, spreading, reflexed at the tips R H 1852 341. F S 13 1364 (as var venosa). Lav 12. Here belong also *C. intermédia*, Bonamy, smaller, with more pubescent branchlets and paler fls *C Bergerónii*, Lav., resembling more C integrifolia lvs usually entire fls pink, about 2 in across in terminal panicles Lav. 10 *C dudórta*, Lav. with rosy-lilac twisted sepals Lav 11 *C Boskoop*, Hort (C Boskoop Seedling, Hort = C V ×C integrifolia). A new race in 1892 growing 3–5 ft fls blue, lavender, rose or reddish rose



985 Clematis eriostemon (×⅓)

C. stolácea, DC (×C Flammula) Fls in several- to many-fld terminal panicles, pale violet, about 1 in across, petals sometimes 6 Here belongs also *C Othéllo*, Cripps (=C V var rubra × C Flammula) Fls of medium size, of a deep velvety purple, continues blooming until Oct —*C rubro-marginata*, Jouin (C Flammula var rubro-marginata, Cripp.) Similar to C Flammula, sepals white bordered reddish violet

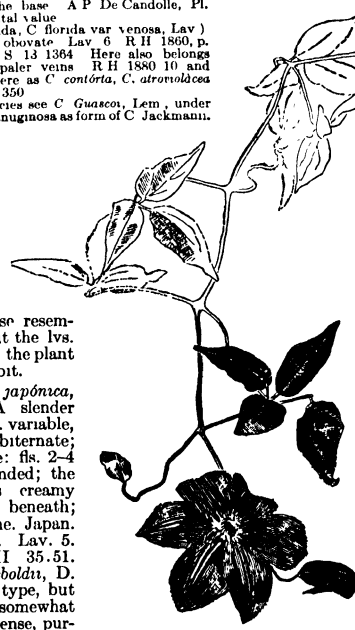
C parviflóra, DC (×C campaniflora, C revoluta, Desf.) Fls white, small, scarcely 1 in across, sometimes larger achenes with the tail usually pubescent at the base A P De Candolle, Pl. Rar Geneve 12 —Of no ornamental value

C venósa, Krampen (×C florida, C florida var venosa, Lav.) Similar to C florida, but petals obovate Lav 6 R H 1860, p. 183 G 2 251 G Z 6 160 F S 13 1364 Here also belongs *Louise Carriere*, fls lilac with paler veins R H 1880 10 and several forms described by Carriere as *C contórta*, *C. atrorioldcea* and *C Viticélla álba* R H 1879 350

For other hybrids of this species see *C Guascoi*, Lem., under C patens, *C splendida* under C lanuginosa as form of C Jackmanni.

21 **campaniflóra,** Brot. Climbing, 10–15 ft. fls. reflexed and bell-shaped as in the above type or more so, usually 1 in or less diam., purple or whitish fr. with short pubescent tail. June, July Native of Portugal. L B C 10 987. Gn 31, p 187. Lav. 8.—This has been called *C. Viticella* because of its close resemblance in fl., fr. and lf.; but the lvs. are often twice ternate, and the plant is much more slender in habit.

22. **flórida,** Thunb. (*C. japónica*, Makino, not Thunb.). A slender plant, climbing 9–12 ft.: lvs. variable, more or less ternate or biternate; lfts. small, ovate-lanceolate: fls. 2–4 in across, flat when expanded; the 5–6 broad, ovate sepals creamy white, barred with purple beneath; stamens purplish. May, June. Japan. B.M. 834. R H. 1856:41. Lav. 5. J.H. III 44:321. G C. III 35.51. Var. **bícolor,** Steud. (*C. Siéboldii*, D. Don). Fig 986. Like the type, but with the purple stamens somewhat petal-like, and forming a dense, purple head in the center. F.S. 5:487. Lav. 5. M. & J. 16. B R. 24 25. P M. 4 147. Gn. 22: 142. R H. 1856:401. S B F G II. 4. 396 F. 1872, p. 200 Var. **Fórtunei,** Moore (*C Fórtunei*, Hort.). Fls. large, very much doubled, sepals creamy white, becoming pink. F S 15·1553 G C 1863.676. I.H 10, p. 86. M. & J. 13. F. 1863 169. F.M. 3.153



986. Clematis florida var. bicolor. (×⅓)

Belle of Woking A hybrid form fls very full and double, sepals purple

John Gould Veitch (C Veitchi, Hort.) Fls velvet, double, resembling var Fortunei, except in the color of the sepals From Japanese gardens F S 18 1875–6

Hybrids of this species are *C venosa*, Krampen, see C. Viticella, *C Lawsoniana*, see C lanuginosa

23 **lanugínosa,** Lindl (including var *pállida*, Hort.). Climbing only 5 or 6 ft. lvs simple or of 3 lfts., cordate-acuminate, woolly beneath fls erect on stout stalks shorter than the sepals, woolly in the bud, the largest of the wild species, being 6 in across; sepals 5 or 6, broadly ovate, leathery, rather flat, overlapping, lavender or bluish gray, center of stamens pale reddish brown; styles plumose. Summer Native near Ningpo, China. F S 8.811 I H 1 14 Lav 1 M & J 4 J. F 4 363. H F 1855 1 1854 225. G C III 29 23 G. I, p 257. Gng. 5·38.—It is to this species, more than to any other, that the beauty and popularity of the garden varieties and hybrids are due. The finest hybrids, including *C Jackmanni* and its section, and *C. Lawsoniana*, contain more or less of the blood of *C. lanuginosa*.

Forms of *C lanuginosa* are

Var *cándida*, Lemoine (C candida, Hort.) Like the type, except that the simple lvs and lfts of the compound lvs are much larger, and the fls are larger, being 7–8 in across, and white with a purplish shading around the margins F M 5 310 V 6 225 — Perhaps a hybrid of C patens

Var *nívea*, Lemoine (C nivea, Hort.) Sepals 6–8, narrowish, pure white, anthers pale brown —Thought to be of same origin as the above var

álba mágna, Jackman Fls very large, pure white, with about 6 broad sepals and purplish brown anthers G C II 3 685

Lady Caroline Nevill, Cripps Fls often 7 in across, sepals 6, nearly white, with mauve-colored stripe down center of each Gn 46, p 33 — One of the finest light-colored varieties

Princess of Wales, Jackman Fls 6 in across, sepals 8, satiny bluish mauve, very broad G C III 27 53. Gn 59, p 366

Marie Lefebvre, Cripps Resembles the last, but has 8 sepals, more pointed, and darker in shade

Perfection, Froebel Fls very large, sepals 8, very broad, lilac-mauve R B 6 193

Sensation, Cripps Fls like the type, but with 6–7 grayish blue sepals, 6 in across

Madame Emile Sorbet, Paillet Fls bright blue R H 1878 291

Madame Van Houtte, Cripps Late-blooming, sepals pale blue, becoming white

Madame Thibaut Fls very abundant — Thought to be a hybrid with C Viticella

The President, Noble A rich violet-blue fl

Excelsior, Cripps Fls double, sepals grayish purple, with a reddish bar down the center of each F S 20 2055

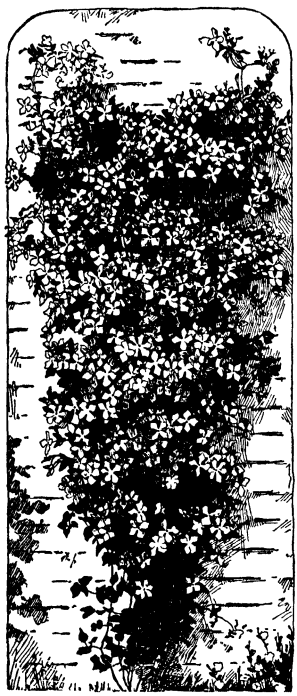
violácea, Noble Fls violet-blue, 7 in. across F M 1876 217

Robert Hanbury, Jackman Sepals bluish lilac, flushed at the edges with red, and the bar slightly tinted with red Gn 16 128.

This species has given rise to numerous beautiful hybrids which in many cases are the product of so much intercrossing that it is impossible to recognize the exact parentage By far the most important group of these hybrids may be classed under *C. Jackmanni*, which, however, by some is considered not a hybrid, but a species intro from Japan

C Jáckmanni, Moore (C lanuginosa × C. Hendersonii and C lanuginosa × C Viticella. C hakonensis, Franch & Sav.) Fig 987. Habit and lvs of C lanuginosa fls flat, 5–6 in broad, usually in 3's and forming

panicles at the ends of the branches; sepals 4–6, very broad, velvety purple, with a ribbed bar down the center, broad, central tuft of pale green stamens. M & J. 5, 6, 9, 10, 11, 12, 14. I H. 11 414 F S 16 1629 Gn 22 142; 53, p. 262, 71, p. 107. A G. 12 125, 19 269 A F. 10 1329, 14 995–7, 16 283. R H 1868 390 Gng 4 261, 9 17, 7 230–2 C L A. 5 379 Gn M 4 226. G M. 47 102 G Z. 9 96 F 1864 193 V 6 129, 9 340. 18 70. Lav. 4 Var. *álba*, Hort. Fls. nearly pure white G 23.185. F. 1884 33. Gn. 25 126. Var. *rubélla*, Jackman. Fls deep velvety reddish violet F. M. 5 310 F S 20. 2050–51 (1874). Var. *supérba*, Hort. Fls violet-purple, resembling C Madame Grangé.



987. Clematis Jackmanii

Also the following hybrids are to be classed under *C Jackmanii modésta*, Modeste-Guérin (=C V ×C lanuginosa) Fls well expanded, large, bright blue, bars deeper colored. *fulgens*, Simon-Louis (=C V. var. grandiflora×C lanuginosa) Sepals 5–6, rather narrow, dark purple to blackish crimson, velvety, edges somewhat serrate *purpurea-hybrida*, Modeste-Guérin (=C V. ×C Jackmanii) Fls 4–6 in across, deep purple-violet, with red veins, but not barred. *rubro-violàcea*, Jackman (C lanuginosa × C Viticella var atrorubens) Lvs pinnate, with ovate-acuminate or sometimes ovate-lanceolate lfts. sepals 4–6, maroon-purple with a reddish bar, stamens greenish F S 16 1630 G. Z 10 112 F. 1864 265 Var *Prince of Wales*, Hort, has fls of lighter tint *La France*, Gégu (C. lanuginosa×C Jackmanii) Lvs smooth: buds woolly, sepals deep cobalt-blue, pointed, with wavy edges *Reine des Bleues*, Boisselot (same cross as the last) Fls large, blue, with broad, recurved sepals *devoniénsis*, Lem (same cross) Fls 8–9 in across, sepals 8, delicate lavender-blue Gn 9, p 563 (note). *splèndida*, Simon-Louis (×C Viticella) Fls. very dark purple, changing to reddish violet R H 1865 71

Gipsy Queen, Cripps Deep violet *Alexándra*, Jackman. Reddish violet *Star of India*, Cripps Five in across, purple, barred with red *tunbridgénsis*, Cripps Reddish purple, barred with light blue Lav 4 bis I H 18 50 *magnífica*, Jackman Rich purple, shaded with crimson, 3 bars of red in each sepal F M 8 453. R H 1876 110 *Madame Grangé*, Hort. Sepals very concave, purple crimson R H 1877 150 *Mrs James Bateman*, Noble Pale lavender, a probable cross of C J with C lanuginosa. M & J 12, f 1 F S 20 2053 (1779) *Mrs Moore*, Jackman Eight to 9 in. across, sepals rather narrow, white *Thomas Moore*, Jackman. As large as the last, rich violet, with white stamens *Madame Baron Veillard*, Baron Veil Rose-lilac *Madame André*, carmine-violet. R H 1893 180 *velùtina-purpùrea*, Jackman Fls 4–6 in across, usually 4, sometimes 5 or 6 sepals, blackish purple *François Morel*, Morel Fls 4 in across, sepals usually 4, bright violet-red R H 1884 444. *Ville de Lyon*, Morel Fls 5 in across; sepals usually 6, broad, deep amaranth-red R H 1899 184.

Other hybrids of *C lanuginosa* are the following

C. Durándii, Kuntze (C integrifolia or possibly C Jackmanii × C. integrifolia) Upright, to 6 ft lvs simple, petioled fls and infl. similar to C. Jackmanii, fls. blue, 4–5 in broad, flat, with usually 4, rarely 5 or 6 recurved sepals June–Sept. Gn. 49 98 Gng. 5.276 G. 31 257 —Here belongs probably *C. Pelléri*, Carr., though the author gives C. lanuginosa ×recta as the parents. R.H. 1880, p. 228

C. Lawsoniána, Anderson-Henry (×C florida var. Fortunei). Fig 989 (adapted from Floral Magazine, 1872) Fls very large; sepals 6–8, broad, rose-purple, marked with darker veins. Aug – Nov G 33 411. Var *Symesiana* (C Symesiana, Anderson-Henry ×C florida var Fortunei) Fls 7 in across, sepals 6–8, pale mauve, a profuse bloomer. Var. *Henryi* (C Henryi, Anderson-Henry) Fig 988 Robust plant, free bloomer fls creamy white, becoming fully expanded when grown in the open sun or under glass Aug –Nov. Gn M 13 348 G M 43 318 —It resembles more the lanuginosa parent It is not to be confused with C. Henryi, Oliv., a Chinese species allied to C. orientalis and not in cult

C. Gablénzi (×C patens; C. patens var Gablenzi, Hort). Lvs. simple or 3-parted, ovate, subcordate fls large deep violet-blue; sepals 6–8 G Z 14 80 —Here belong also

Otto Froebel, Lemoine Lvs leathery, simple or 3-parted· fls of fleshy texture, grayish white, sometimes becoming bluish, sepals 8, blunt, broad, anthers brownish *Imperatrice Eugenie*, Carré (C 1 var pallida×C patens) Lvs simple or 3-parted, lfts broad and woolly fls 8–9 in across, with 8 broad, white sepals *Jeanne d'Arc*, Dauvesse Same cross as last and much like it, but the sepals are grayish white, with 3 blue bars down the center of each *Gloire de St Julien*, Carré (×C patens var plena) Plant much like C. lanuginosa, but with larger fls · sepals 6–8, white or pale gray at first, stamens yellow *Gem*, Baker (×C Standishii) Lvs 3-parted or simple fls like C lanuginosa in form, grayish blue

24. **pátens**, Morr. & Decne (*C. cærùlea*, Lindl. *C. azùrea*, Hort, ex Turcz.). Taller and more slender, and lfts. smaller and narrower than *C. lanuginosa* fls. appearing on last year's branches on slender stalks longer than the sepals, spreading; sepals about 8, rather narrow, delicate lilac, stamens purple Spring. Isle of Nippon, Japan. M. & J. 3. Lav. 2 and 3. B R 23 1955 P M. 4·193. B 3.126 H B 4 78. R H 1856:261 —Should be grown on a northern exposure to preserve the color of the fls It is almost as prolific as *C lanuginosa* in producing garden varieties and hybrids, and it is the most likely of all to produce double-fld forms. Var **grandiflòra**, Davis (*C cærùlea* var *grandiflòra*, Hook) Fls larger than the type. B M 3983 Var. **Stándishii**, Moore (*C Stándishii*, Hort). Fls. about 5 in. across, sepals light lilac-blue, elliptic, of metallic luster· lfts. 3, ovate, acuminate, small —A fine variety from Japanese gardens flowering profusely in spring.

The following other garden varieties or crosses belong here

Mrs James Baker Sepals nearly white, ribbed with dark carmine *Miss Bateman*, Noble Fls more compact than the type, 6 in across, sepals ovate, shortly acuminate, pure white, with cream-colored bars, anthers brown Probably of hybrid origin, allied to var Standishii *Stella*, Jackman Fls not so large as the last, sepals deep mauve, with a red bar down the center of each F S 22 2341 *Amalia*, Sieb Sepals 6 or more, oblong-lanceolate, light lilac From Japanese gardens F S 10 1051 *Lord Lanesborough*, Noble Sepals bluish lilac, each with a metallic purple bar —A good variety to gradually force to blossom in the greenhouse by March *Lady Lanesborough*, Noble Sepals silver-gray, the bar being lighter colored —It will blossom in March in the greenhouse *Marie*, Simon-Louis Fls lighter than the type *Mrs G Jackman*, Jackman Sepals blush-white with indistinct wine-red bars Gn 16 128 *The Queen*, Jackman Fls rather compact, the sepals being broader than the type *John Murray*, Jackman. Habit and foliage bolder than the type fls somewhat later Gn 46 32 *Fair Rosamond*, Jackman Sepals apiculate, broader than the type, and of the same color F S 22 2342 Gn 16 128 *Countess of Loveluce*, Jackman Fls double, blue-violet, sepals much imbricated In the second crop of blooms the fls are single, as is often the case in other double varieties *Albert Victor*, Noble Fls much like the type, but large and more compact —Suitable for forcing under glass *Duchess of Edinburgh*, Jackman. Fls double, white, strongly imbricated *Marcel Moser*, Moser Fls 7 in across, sepals 8, mauve with a reddish violet bar J 1897 104, 1900, p 85 *Nelly Moser*, Moser Fls. 5 in across sepals 8, mauve-pink, with a darker red bar R.H 1898 236 *Louis van Houtte*, Hort Semi-double, rosy white *Vesta*, Endl Sepals gray, anthers red. Gt 39 1345 Gn 9 408 R B 6 193 *Helena*, Sieb Fls pure white, with yellow stamens F S 11 1117. I H 1 21 R H 1855 341 *Louisa*, Sieb Fls pure white, with purple stamens F S 10 1052 *monstròsa*, Planch Fls. semi-double, pure white F S 9 960 R H 1856 9 *Sophia*, Sieb Sepals deep lilac-purple on the edges, with light green bars F S 8 852 I H 1 21 B H 4 97 R H 1855 161. *violácea*, Lem. Fls violet-blue; stamens yellow I H 7 254

Some double-flowered varieties which possibly belong here are. *Snowdrift*, with white, very double fls. Gn 49, p 189. M D G. 1898 496 *Ostrich Plume*, also white and very double with narrower wavy sepals M D G 1898 496 *Waverly*, blue, semi-double M D G 1898 497

Hybrids of this species are the following· *C Gudéoci*, Lem. (×C Viticella) Branches pubescent lfts 5, nearly glabrous fls. solitary, violet-purple, 3 in across, with 4–6 sepals, strongly 3-nerved, tomentose outside J H 4 117 I H 7 226 —*C francofurténsis*, Lav , supposed to be a hybrid of C Jackmanii (C. hakonensis) and C patens, is hardly different Lav 7 bis —*C lanuginosa×C patens*, see the preceding species —*C florida×C patens*. Some believe that C patens var Standishii represents this cross

Section VITALBA.

Group CIRRHOSÆ.

25 **cirrhòsa,** Linn Climbing, to 10 ft.; glabrous: lvs persistent, slender-petioled, simple, ovate to ovate-oblong, crenately serrate, 1–1½ in long. fls 1–2 on the old wood, axillary, whitish, open campanulate, nodding, 1½ in across, with a short involucre below the sepals. achenes with long plumose tail Spring. S Eu, Asia Minor. B M 1070 L.B C. 19:1806.—Tender, only for warmer temperate regions.

26 **balearica,** Rich (*C. calycina*, Ait.). Closely allied to the preceding lvs ternate; lfts incisely serrate, often deeply 3-lobed, ½–1 in long: fls. greenish yellow, spotted red inside Spring S Eu Asia Minor. R H 1859, p 190; 1874, p. 289. G C II. 9.500. Gn. 6, p 425, 31, p 187, 45, p 240. L B C. 8:720. B.M. 959.—Tender.

Group MONTANÆ.

27 **gracilifòlia,** Rehd & Wilson. Climbing, to 10 ft: lvs deciduous, pinnate, lfts 5–7, ovate to oblong-ovate, cuneate at the base, coarsely serrate, pubescent, about ½in long fls 1–4, axillary, fascicled, white, 1–1½ in. across, on slender stalks 1–2 in long; sepals 4, spreading, obovate to oblong-obovate achenes glabrous, with long plumose tail June W China.—Very graceful and floriferous species, has proved hardy at the Arnold Arboretum.

28 **montàna,** Buch.-Ham (*C. odorata*, Hort., not Wall.) A vigorous climber, often reaching a height of 15–20 ft lvs. ternate, with oblong-acuminate cut-toothed lfts fls several in each axil, following each other in succession of time, resembling white anemone blossoms, sweet-scented, sepals 4, elliptic-oblong, 1 in. long, spreading, becoming pink, stamens conspicuous, yellow achenes glabrous with plumose tails May. Himalaya region B R 26 53 M & J 8 Gn. 30, p. 309, 49, p 39, 51, p 319, 60, p 79, 68, p 379, 75, p. 371 A G 19 391 R H 1856 161; 1899, p 529 G C. III 18 303, 20 589 M D G 1902 423 Lav 22 J H. III 49 533 G 27 237 G M 38 661, 46 121, 51.319. Var **grandiflòra,** Hook (var. *anemoniflora*, Kuntze). Fls larger, 3–4 in across B M 4061 M D G 1902: 422 G 34 477 Var **rùbens,** Wilson Foliage reddish, particularly when unfolding fls pink or light pink June R H 1909 35. R B 33 232 F S R 3 252. Gn 77, p 84 G M 50 395; 54 168 J H III 59.325.—Offsprings of a cross between this variety and the preceding are Var. *lilacina*, Lemoine, with bluish lilac fls G 34 345. Var *perfecta*, Lemoine, and var. *undulata*, Lemoine, with bluish white very large fls. Var **Wilsonii,** Sprague (*C. repens*, Veitch, not Finet & Gagnep.) Lfts ovate, usually rounded or subcordate at the base, puberulous on the veins beneath; sepals obovate-oblong, ¾–1 in long fls in July and Aug, nearly 2 months later than the type B M 8365. M D G 1912 26 R B 35·108. See page 3567

29 **Spoòneri,** Rehd & Wilson (*C. montana* var. *sericea*, Franch.) Climbing, to 20 ft. lvs ternate; lfts ovate or oval, usually rounded at the base, with 1 or few teeth on each side, silky pubescent above and beneath, 1–3 in long fls. 1 or 2, white, 3–4 in. across on pedicels 3–6 in. long; sepals broadly obovate, densely pubescent outside: achenes pubescent, with long plumose tail Spring W China.—Beautiful species; has proved fairly hardy at the Arnold Arboretum.

Group RECTÆ.

30. **Armandii,** Franch. Climbing, to 15 ft · lvs. ternate, evergreen, glabrous; lfts ovate to ovate-oblong, acuminate, rounded or subcordate at the base, entire, 4–5 in. long, coriaceous· fls. white, 1–2½ in. across, with oblong-obovate sepals, in loose axillary cymes in the axils of last year's branches, with persistent bud-scales at the base. achenes hairy, with long plumose tails. April, May. Cent and W. China. G.C III. 38: 30 R B. 35, p 281. R H 1913, p 65. Var **Farquhariàna,** Rehd. & Wilson. Fls. light pink, large, about 2 in across. lfts oblong-ovate.—This handsome species is like the following 3 species, adapted only for warmer temperate regions.

31 **Meyeniàna,** Walp Climbing rapidly; glabrous or slightly pubescent lvs ternate, lfts coriaceous, ovate to ovate-lanceolate, cordate or rounded at the base, entire, 2–3 in long panicle loose and many-fld.; fls white, less than ½in across sepals 4, obtusish. anthers as long or longer than filaments· achenes with long feathery tails Japan, E China and Indo-China. Summer. B M 7897.—Hardy only in warmer temperate regions.

32 **crassifòlia,** Benth Closely allied to the preceding species climbing, quite glabrous lfts thicker, cuneate at the base, usually obtusish, sepals acuminate, anthers shorter than the filaments Late summer China.—Suitable for greenhouse, more tender than the preceding.

33 **Pavoliniàna,** Pampanini Climbing, glabrous: lvs. subcoriaceous ternate, lfts long-petioled, lanceolate or oblong-lanceolate, acuminate, 2–3 in long fls slender-pedicelled, white, 1–1½ in across in axillary racemes; sepals linear-oblong achenes fulvous-pubescent, with a long plumose tail May Cent China.

34 **récta,** Linn. (*C. erécta*, Linn.). Herbaceous, somewhat tufted, 2–3 ft long: lvs pinnate, lfts. stalked, ovate, acuminate, entire fls numerous, on a large, branching terminal panicle, white, sweet-scented,



988 Clematis Lawsoniana var. Henryi, a derivative from C lanuginosa (×⅓)

1 in. across. June–Aug. S. Eu. Gn. 52, p. 510; 53, p. 547; 66, p. 152. R.H 1899, p. 528. G.M. 45.866. G.W. 14, p. 561. Var. **plèna,** Lemoine. Fully doubled, button-like blossoms H F. 1860:13. R.H 1860, pp. 512–13 Var **mandshùrica,** Maxim (*C. ternifòra,* DC. *C. mandchùra,* Rupr.). Taller and slenderer. lfts. 3–5, ovate, subcordate at the base, rarely cuneate, obtuse, reticulate beneath: fls. pure white in axillary and terminal panicles. R H. 1909, p. 423.

35 **paniculàta,** Thunb Figs. 990, 991. A vigorous climber. lfts 3–5, often lobed, acuminate, 1–4 in long, glabrous· fls. fragrant, 1–1½ in across, in axillary and terminal panicles; sepals 4, dull white. Sept Japan. G.F. 3:621 (adapted in Fig. 990); 5·91; 9:75 and 185. F.R 2.581; 6:471. Mn. 7:113. Gng 1:101 and 165; 4·161, 229; 6 291; 7 246. A F. 13:1314 M.D G 1898: 487–9 G.W. 11:127. V. 16:18 A.G 20:847. F E. 16:375. Gn. 57, p. 155; 61, p. 91. R H 1874, p. 465 and 1899, p. 527 (as *C. Flammula robusta*). 1902, p 86. Prop. by seed. By far the most common of the fall-blooming species in American gardens Thrives best in sunny situations. Will stand severe pruning in winter.



989. Clematis Lawsoniana, one of C. lanuginosa derivatives. (×½)

36. **Flámmula,** Linn (*C. Pállasii,* J. F. Gmel.). A slender but vigorous climber, reaching 10–15 ft : lvs. usually bipinnate, dark green, remaining fresh till mid-winter; lfts. small, ovate, oblong or linear: fls. small, numerous, in axillary and terminal panicles, sepals 4, linear-oblong, white; stamens white. fr. bearing white plumes. Aug.–Oct. Medit. region. Gn. 52, p. 499; 55, p 114; 58, p 319; 76, p. 23. Gn. M. 13 347 H W. 3, p 14 V. 5·321.—Must have a sunny exposure; very beautiful. Var **rubélla,** Bele (*C. rubélla,* Pers , not Hort). Differs from the type in having the fls. red outside. Var. **rotundifòlia,** DC. (*C. fràgrans,* Tenore). Lfts. broader, obtuse: fls. fragrant. S. Eu. R.F.G. 4:62 (4666).

There are hybrids of this species with *C integrifolia* for which see No. 5, *C. aromatica* and with *C. Viticella,* see *C. violacea* under No. 20.

Group EUVITALBÆ.

37. **Fárgesii,** Franch. Climbing, to 20 ft : lvs pinnate; lfts. 5–7, ovate, incised-serrate, sometimes 3-lobed or 3-parted, nearly glabrous or sometimes sparingly silky-pubescent, particularly beneath, 1–2 in long fls 2 in across, white, in 3-fld axillary cymes, long-stalked, sepals 4–6, obovate, finely pubescent outside achenes glabrous with feathery tails July W. China Var. **Soùliei,** Finet & Gagnep. Fls larger, 3 in across, solitary.—A handsome species, resembling *C montana.*

38. **apiifòlia,** DC Climbing, to 10 ft branchlets pubescent lvs ternate, long-petioled, lfts usually ovate, coarsely serrate and sometimes 3-lobed or occasionally the terminal ternate, glabrous above, pubescent on the veins beneath fls in axillary, many-fld short cymes, white, about ½in across, sepals pubescent on both sides. achenes pubescent with plumose tails Sept , Oct Japan Var. **obtusidentàta,** Rehd & Wilson Lfts broader, usually truncate or subcordate at base, less deeply serrate with shallow rounded teeth, more pubescent Cent China — Resembles *C grata* in the shape of the lfts.

39. **brevicaudàta,** DC. (*C brevicordàta,* Hort) Climbing vigorously· lvs pinnate to bipinnate; segms ovate-lanceolate, acuminate, coarsely toothed, sometimes nearly entire, nearly glabrous or pubescent· fls in axillary panicles, white, ½–¾in. across· achenes hairy, rarely glabrous, with rather short plumose tails Aug.–Oct. China. G.F 5.139 —A very variable species, but little used. Var **tenuisépala,** Maxim. Segms with only 1–3 teeth on each side or sometimes entire· fls about 1 in. across with glabrous sepals

40. **gràta,** Wall High climbing: young branchlets pubescent: lvs pinnate; lfts usually 5, broadly ovate, usually cordate at the base, incisely serrate, sometimes 3-lobed, 1–2 in. long, pubescent on both sides or glabrous above· fls ¾–1 in. across, creamy white, in large panicles; sepals tomentose outside: achenes densely pubescent, with long feathery tails. Sept., Oct. Himalayas. G M. 47·642 Gn 66, p 365; 71, p 506. Var. **lobulàta,** Rehd. & Wilson. Lfts. with coarser and fewer

rounded teeth, often 3-lobed or 3-parted, densely pubescent on both sides Cent. China. Var. **grandidentàta,** Rehd. & Wilson. Lfts. occasionally only 3, incisely dentate, usually rounded at base, glabrescent above, silky pubescent beneath, chiefly on the veins, 2–3½ in. long. Cent. China.



990 Clematis paniculata. (×½)

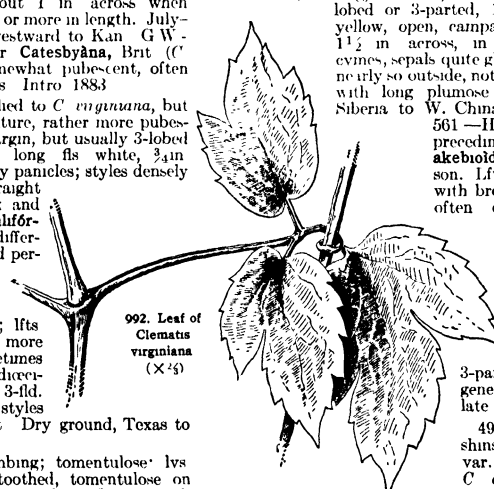
41 **Vitálba,** Linn In England called TRAVELER'S JOY The most vigorous climber of the genus, ascending 20–30 ft lvs. pinnate, lfts ovate to ovate-lanceolate, acuminate, cordate at the base, partly cut, 2–3½ in long fls numerous, in axillary panicles, dull white, ¾in. across, with a faint odor of almonds styles of fr long and feathery, from which it is given the name "old man's beard" July–Sept Eu., N Afr. Caucasus region Gn 31, p 187, 45, p 389, 53, p 546 M D G 1898.319 J H III 54 441 H W 3, p 13 — There is a hybrid of this species with *C heracleæfolia,* for which see No 12

42 **virginiàna,** Linn Fig 992 Climbing 12–15 ft lvs ternate, lfts glabrous, cut-toothed, bases often cordate, 2–3 in long fls white, in leafy panicles, often monœcious or dioecious, about 1 in across when expanded, plumose styles 1 in or more in length. July–Sept Nova Scotia to Ga., westward to Kan G W-F A 12 V 3 19, 9 36 Var **Catesbyàna,** Brit (*C Catesbyàna,* Pursh) Lvs somewhat pubescent, often biternate Southeastern states Intro 1883

43 **ligusticifòlia,** Nutt Allied to *C virginiana,* but having 5–7 lfts., of firmer texture, rather more pubescent, variable in form and margin, but usually 3-lobed or coarsely toothed, 1–2 in long fls white, ¾in across, in terminal and axillary panicles; styles densely silky-pubescent, with long straight hairs Aug Mo. to New Mex and Brit Col Intro. 1881 Var **californica,** Wats., has no marked difference. lvs usually smaller and perhaps more tomentose

44 **Drúmmondii,** Torr & Gray Climbing· st and lvs ashy pubescent lvs pinnate; lfts coarsely cleft, with the segms more or less flaring and sometimes toothed, ½–1 in long· fls dioecious, white, ¾in. across, in 3-fld. cymes or sometimes solitary; styles becoming 2–4 in. long. Sept Dry ground, Texas to Ariz.

45. **lasiántha,** Nutt. Climbing; tomentulose· lvs ternate; lfts roundish, few-toothed, tomentulose on both sides or glabrous above, 1–2 in long: fls. 1–3, axillary from scaly buds on last year's branches, white, fragrant, 1½ in. across, sepals tomentose outside. achenes pubescent, with long feathery tails. Spring. Calif.



992. Leaf of Clematis virginiana (×⅖)

Group HEXAPETALÆ.

46. **indivisa,** Willd Large woody climber: lvs. ternate, coriaceous; lfts ovate-oblong to narrow-oblong, subcordate, 1–4 in long, usually entire. fls in axillary panicles, white, 2–4 in across with 6–8 oblong sepals achenes pubescent with a long plumose tail New Zeal —Only the following var seems to be in cult: Var **lobàta,** Hook. Lfts more or less lobed or even 3-parted B M 4398 R H 1853·241 F S 4·402 Gn 12 400; 41, p 336, 53, p 547, 74, p. 527; 77, p 67. H F. 1853.144 G C. III 29·215; 38 135. G.M 50: 267 G 8:289; 32 281–3 J.H. III 62·387 A F.13 879, 16·56; 30 221. Gng. 16.199, 8.356. G F. 6 167.—Only for warm or temperate regions, often cult. as a greenhouse plant and flowering profusely in winter and early spring.



991 Flower of Clematis paniculata. (×¾)

Group ORIENTALES.

47 **orientàlis,** Linn (*C gravèolens,* Lindl.) A rapid climber, reaching 12–15 ft lvs thin, glaucous and shiny, pinnate, lfts 3-parted or -lobed, with small, ovate or oblong-ovate, entire or cut-toothed divisions ½–1½ in long fls in few-fld cymes, sometimes solitary, becoming erect or nearly so, 1½ in across; sepals 4, yellow, tinted with green, pubescent on both sides, spreading, somewhat reflexed, styles plumose. Aug., Sept Himalaya region to Persia Lav 21 B M 4495 Gn 31, p 186, 45 240, 52, p. 501 F S 4 374b (pl 336), 6 548 R H 1855 321, 1899, p. 530 J F 2 128 P.F G 2, p. 67 Gng. 5 227. V 3 362

48 **glaùca,** Willd (*C orientàlis* var *glaùca,* Maxim.) Slender climber, glabrous lvs pinnate, very glaucous, lfts usually oblong, obtusish, entire or sometimes 3-lobed or 3-parted, 1–2 in long fls yellow, open, campanulate, nodding, 1½ in across, in few-fld axillary cymes, sepals quite glabrous inside and nearly so outside, not reflexed achenes with long plumose tails Aug.–Oct. Siberia to W. China R H 1890, p 561 —Hardier than the preceding species Var. **akebioides,** Rehd & Wilson. Lfts usually 3-lobed with broad rounded lobes often coarsely crenate, about 1 in. long: fls usually in 3's, rarely solitary W China. Var **angustifòlia,** Ledeb. (*C. intricàta,* Bunge) Lfts. usually 3-parted with narrow generally linear-lanceolate segms. Mongolia

49 **tangùtica,** Korshinsky (*C orientàlis* var. *tangùtica,* Maxim. *C eriópoda,* Koehne, not Maxim.) Climb-

ing, to 10 ft. young branchlets slightly villous or nearly glabrous lvs. green, pinnate; lfts. oblong-lanceolate or lanceolate, acuminate, irregularly serrate with spreading teeth, sometimes 3-lobed or 3-parted, 1–3 in. long: fls solitary, bright yellow, nodding, 3 in. across, sepals glabrous, except at the margin, acuminate or obtusish: achenes with very long plumose tails. June, sometimes again in Aug. Mongolia to W. China. B M 7710. R.H. 1902 528. G W. 14, p 651.—Very handsome with its showy bright yellow fls. and later in summer with its large heads of feathery frs.; hardy.

50. serratifòlia, Rehd. (*C. koreàna*, Hort., not Komarov). Shrubby climber: lvs biternate, bright green, glabrous; lfts ovate-lanceolate to lanceolate, acuminate, inequally serrate, 1–2½ in. long: fls. 1–3, axillary, long-stalked, yellow, nodding, 2 in. across; sepals glabrous, except at the margin: achenes with long plumose tails. Aug., Sept. Korea.—Handsome and quite hardy. The true *C. koreana* belongs to the Atragene group and has petaloid staminodes.

C. acutángula, Hook f. & Thoms. Allied to C. lasiandra. Sts. deeply grooved. lvs. bipinnate, with ovate or ovate-lanceolate crenate lfts. fls. axillary, brownish yellow, with the sepals winged on the back. Sept., Oct. Himalayas. Not hardy N.—*C. Addisonii*, Britt. Allied to C. Viorna. Upright herb, glabrous. lower lvs. simple, upper pinnate. fls. purplish. May, June. Va. and N. C. G F 9 325.—*C. angustifolia*, Jacq. Allied to C. recta. Lvs. pinnate with simple or 3-parted linear lfts. fls. solitary or in 3's with 4–8 sepals. S. Eu. R F G 4 62 (4665). —*C. aristata*, R. Br. Allied to C. indivisa. Evergreen. lvs. ternate, with ovate to ovate-lanceolate, cordate lfts. fls. dioecious, white, in few-fld. axillary corymbs, 2 in. across, fragrant. Austral. B R 4 238 and L B C 7 620 (pistillate plant). G C III 32 55 (staminate plant). Var. *Drummondii*, Gulf (C. Sanderi, Watts). Fls. with salmon-red filaments. B M 8367. Tender.—*C. barbellata*, Edgew. Allied to C. montana. Lfts. ovate-lanceolate, toothed. fls. solitary, large, dull purple. achenes glabrous. Himalaya. R H. 1858, p. 407. B M 4794. F S 9 956. —*C. Benthamiana*, Hemsl. (C. ternifiora, Benth. not DC.). Allied to C. Meyeniana and C. chinensis. Lfts. 5, broadly ovate, subcordate, sparingly pubescent, 1½–2 in. long. fls. in axillary and terminal panicles, white, ½in. across. China.—Of no particular ornamental value.—*C. brachiata*, Thunb. Climbing, pubescent. lvs. bipinnate or the upper pinnate. lfts. ovate coarsely toothed. fls. greenish white, in axillary panicles, fragrant, 1–1½ in. across, sepals spreading, obtuse, filaments hairy at the base. S. Afr. B R 2 97. G C III 30 367. Tender.—*C. brachyùra*, Maxim. Similar to C. recta. Herbaceous, upright. lvs. pinnate with 3–5 ovate, 3-nerved lfts. fls. axillary, solitary, white. sepals glabrous except at the margin. achenes few with short pubescent style. Korea.—*C. Buchananiana*, DC. Allied to C. nutans. Large climber, hairy. lvs. pinnate, lfts. broadly ovate, serrate or lobed. fls. in panicles, tubular, sepals ribbed. Himalaya. See also C. nutans var. thyrsoidea.—*C. chinénsis*, Retz. Allied to C. Meyeniana. Lfts. 5, ovate to ovate-lanceolate, nearly glabrous, ¾–1½ in. long. fls. in axillary and terminal panicles. China.—*C. chrysocòma*, Franch. Allied to C. montana. Upright shrub. lfts. obovate with few coarse teeth, ¾–1¾ in. long, yellowish silky-pubescent beneath. fls. axillary, 1–3, 2 in. across, sepals white with pink margin. China. B M 8395.—*C. connata*, DC. Allied to C. nutans. Large climber, glabrous. lfts. 3–7, broadly ovate, slightly pubescent or nearly glabrous, cordate at base, coarsely serrate, often 3-lobed, 2–4 in. long. fls. ¾–1 in. long, in many-fld. panicles. Himalayas. G F 4 235.—*C. Delavàyi*, Franch. Allied to C. recta. Upright shrub. lvs. pinnate, lfts. 9–11, ovate, entire, silvery white beneath, ½–½in. long. fls. white, slender-stalked, 3–5, terminal, about 1 in. across. W. China. Very distinct, but apparently not hardy N.—*C. Gebleriana*, Bong.=*C. songarica* var. Gebleriana.—*C. Gouriana*, Roxbg. Allied to C. grata. Tall climber; usually glabrous. lvs. pinnate or bipinnate, lfts. ovate-oblong, glabrous above, pubescent or sometimes glabrous beneath. fls. ½–½in. across, white, in large panicles. Himalayas. S. Asia, Philippine Isls. Wight, Icon. 933.—*C. grewiaflòra*, DC. Allied to C. nutans. Tall woody climber, densely tomentose. lfts. 3–5, broadly ovate, cordate, serrate, usually deeply 5-lobed, 3–4 in. long. fls. 1½ in. long, tubular-campanulate, tawny yellow. Himalayas. B M. 6369.—Very distinct, but only for warmer regions.—*C. hexapétala*, Forst. (C. hexasepala, DC.). Allied to C. indivisa. Lvs. ternate, lfts. coarsely dentate or lobed. fls. dioecious, in axillary cymes, greenish white, fragrant, 1 in. across. New Zeal. B R 32 44.—*C. koreàna*, Komarov. Allied to C. alpina. Lvs. ternate or biternate, lfts. ovate, cordate, coarsely toothed: fls. yellow or violet, sepals about 1 in. long, staminode, spatulate, narrow. Korea. Act. Hort. Petrop. 22 6.—*C. macropétala*, Ledeb. Allied to C. alpina. Lvs. ternate or biternate, lfts. coarsely serrate or nearly entire. fls. large, violet, petaloid staminodes lanceolate, little shorter than sepals. N. China. Gt. 19 651.—*C. mandschùrica*, Phil. Allied to C. ligusticifolia. Lower lfts. 3-parted or 3-lobed, segms. lanceolate. fls. monoecious, white, in panicles, sepals sparingly hairy inside. tails of achenes very long. Sept., Oct. Chile. Tender.—*C. Pierótii*, Miq. Allied to C. brevicaudata. Slender climber. lvs. biternate, lfts. ovate-oblong, coarsely serrate, 1½–2½ in. long. fls. white, ¾in. across, solitary, or in 3-fld., rarely many-fld. cymes. achenes glabrous, with rather short plumose tails. Aug. Japan.—*C. quinquefoliolàta*, Hutchinson (C. Meyeniana var. heterophylla, Gagnep.). Allied to C. Meyeniana. Lfts. 5, lanceolate or oblong-lanceolate, about 3 in. long. cymes few-fld., shorter than the lvs. tails of fr. fulvous. Cent. China. Y F. 3.—*C. Sánderi*, Watts =C. aristata var. Denniss.—*C. smilacifòlia*, Wall. Tall woody climber. lvs. simple, ovate, usually cordate, entire, 3–10 in. long, rarely ternate. fls. 1–1½ in. across, brownish tomentose outside, purple inside, in axillary panicles. achenes with long feathery tail. B M 4259. F S 2, pt. 12 3. G C III 30 466. —*C. songàrica*, Bunge. Allied to C. recta. Shrubby, upright. lvs. simple, thickish, grayish green, usually lanceolate, entire or sparingly serrate. fls. yellowish white, in terminal and axillary cymes, sepals glabrous inside. Turkestan, Mongolia. Var. *Gebleriana*, Kuntze (C. Gebleriana, Bong.). Lvs. thinner, more serrate, or panicles.—*C. Suksdòrfii*, Robins. Allied to C. ligusticifolia. Lfts. 5, ovate, to ovate-oblong, 1–1½ in. long. fls. in axillary racemes or panicles, white, 1 in. across, sepals reflexed. achenes few. Brit. Col. G F 9 255.—*C. Thunbergii*, Steud. Climbing, pubescent or glabrous. lvs. pinnate with ovate to lanceolate, often 3-lobed or 3-parted lfts. fls. in axillary panicles, sepals spreading, lanceolate, filaments hairy at the base. S. Afr. G C III. 50 253.

K. C. Davis
Alfred Rehder †

CLEMATIS, MOCK: *Aydestis clematidea.*

CLEMATOCLÉTHRA (*Clematis* and *clethra*, referring to the similarity of the flower to that of Clethra and to the climbing habit) *Dilleniàceæ*. Shrubs grown for the profusely produced fragrant flowers and the attractive black or red berries.

Deciduous climbing plants. branches with solid pith. winter-buds conspicuous, free, with several imbricate scales. lvs. petioled, usually serrate. fls. in axillary cymes or panicles, sometimes solitary, white; sepals 5, imbricate, persistent; petals 5, imbricate. stamens 10, short, ovary 5-celled, each cell with 10 ovules, style simple, cylindric. fr. berry-like, with thin flesh, subglobose, usually 5-seeded.—About 12 species in Cent. and W. China. Closely allied to Actinidia which is easily distinguished by its numerous stamens, many styles, many-seeded fr. and in the winter state by its winter-buds being hidden by a swelling of the tissue around their base. Several species have been recently intro., but the names of most of them have not yet been determined. They are apparently hardier than the Chinese actinidias and superior from an ornamental point of view on account of their profusely produced fls. and frs. though the foliage as a rule is smaller and not quite so handsome. Prop. by seeds and probably, like actinidias, by greenwood cuttings in summer and also by hardwood cuttings and layers.

Hémsleyi, Baill. Climbing, to 20 ft. young branches pubescent at first, soon glabrous. lvs. slender petioled, ovate to oblong-ovate, acuminate, denticulate, glabrous above, brownish pubescent on the veins beneath, 2–4 in. long. fls. white, about ½in. across, 4–12 in. stalked axillary cymes: fr. globose, black, about ½in across. Cent. China. H. 1. 29:2808.



993 Cleome spinosa.

integrifòlia, Maxim. Quite glabrous: lvs. ovate to ovate-lanceolate, acuminate, finely serrulate or entire, dark green above, glaucous beneath, 1½–3 in. long.

fls. solitary or in 2- or 3-fld cymes on slender stalks, white, ⅓–½in. across: fr. globose, black. W. China.
ALFRED REHDER.

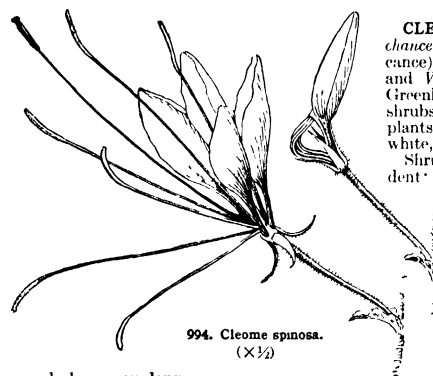
CLEÒME (meaning uncertain). *Capparidàceæ* Odd spider-flowered plants sometimes grown in the flower-garden

Sub-shrubs or annual herbs, simple or branched, glabrous or glandular, with simple lvs. or 3–7 lfts., and white, green, yellow or purplish fls borne singly or in racemes; petals entire, with claws.—Seventy tropical species, in both hemispheres The genus is distinguished from Gynandropsis by its short torus, which often bears an appendage, and by the 4–6, rarely 10, stamens

The garden cleomes are chiefly interesting for their long purple spidery stamens and showy rose-colored petals. They succeed in sandy soils and sunny situations, and can be used like castor-oil plants to fill up large gaps in a border *C spinosa* is the best, and has lately been planted considerably in public parks amongst shrubbery Propagated by seeds, which are produced freely in long slender pods borne on long stalks

A *Lfts more than 3.*

spinòsa, Jacq (*C púngens*, Willd *C gigantèa*, Hort, not Linn) GIANT SPIDER PLANT Figs 993, 994 Clammy, strong-scented, 3–4 ft high lfts usually 5, sometimes 7, oblong-lanceolate, with a pair of short stipular spines under the petioles of most of the lvs, and in the tropics some little prickles on the petioles also fls rose-purple, varying to white, petals 4, obovate, clawed, ½in long, stamens 2–3 in long, blue or purple N C to La (naturalized from Trop Amer) and escaped from gardens B M 1640 G C III 45: 115.—A tender biennial north, but annual in the tropics The plant recently intro as *C gigantea* is not the true species, which is a green-fld S American plant as yet apparently unknown in the trade in this country *C spinosa* differs widely in the extent and character of its spines The fls vary in the development of the style, Fig 994 shows a fully perfected style



994. Cleome spinosa. (×½)

speciosíssima, Deppe Annual or half-shrubby, sometimes 5 ft high sts strongly hairy without spines, lfts 5–7, lanceolate, dentate, narrowed at the base, conspicuously hairy on both sides fls light purple or purplish rose July to fall Mex B R 1312.—Said to be the showiest of cleomes Under this name a very different plant is passing, the lfts of which have only minute hairs but rather numerous spines.

AA *Lfts 3*

serrulàta, Pursh (*C. integrifòlia*, Torr & Gray) ROCKY MOUNTAIN BEE-PLANT. Glabrous, 2–3 or even 6 ft. high lfts 3, lanceolate to obovate-oblong, entire, or rarely with a few minute teeth: bracts much narrower than in *C. spinosa*: petals rose, rarely white, 3-toothed; receptacle with a flat, conspicuous appendage Along streams in saline soils of prairies.—In cult over 30 years as a bee-plant.

C dendroídea, Schult Tree-like, 10–14 ft fls blackish purple. Brazil B M 4296.—*C gigantèa*, Linn Shrubby, 4–5 ft, downy: lfts 7, lanceolate, lance-oblong or oblanceolate, the entire lf. shorter than petiole fls greenish, petals linear, 2 in or more long, cohering by their margins and opening only on one side, sepals long-linear, glandular, becoming revolute. Trop Amer B M. 3137.—*C speciosa*, HBK=Gynandropsis
N. TAYLOR.†



995. Clerodendron Thomsonæ. (×½)

CLERODÉNDRON (Greek, *chance* and *tree* of no significance) Includes *Siphonántha* and *Volkamèria* *Verbenàceæ*. Greenhouse climbers and hardy shrubs and other ornamental plants, grown for the showy white, violet or red flowers

Shrubs or trees, often scandent: lvs opposite or verticillate, mostly entire or not compound fls in mostly terminal cymes or panicles; calyx campanulate or rarely tubular, shallowly 5-toothed or 5-lobed, corolla-tube usually slender and cylindrical, the limb 5-parted and spreading, the lobes somewhat unequal, stamens 4, affixed on the corolla-tube, long-exserted and curved, style exserted, 2-cleft at the end, ovary 4-loculed fr a drupe inclosed in the calyx.—About 100 species, in the tropics, mostly of the eastern hemisphere

Clerodendrons are divided into two garden sections,—those with a shrubby habit, and the twining kinds The culture is about the same for both kinds They may be grown from seeds or from cuttings of the half-ripened wood In either case, use 2-inch pots filled with a mixture of equal parts of leaf-mold or peat and good sharp sand Place a cutting or a seed in each pot, and press moderately firm Leave the pots in a tight case with a temperature of 70°, and keep the soil at all times fairly moist When the pots are filled with roots, shift into a 4-inch pot, using a compost consisting of fibrous loam two parts, leaf-mold and sand one part each, and a fifth part of well-rotted manure Pot rather firm, as this insures a stronger growth, and during the growing season keep in a night temperature of 65°.—Clerodendrons may be flowered in any size pot desired, and some of the species, notably *C Balfouri* (or properly *C. Thomsonæ*), can be had in flower from Easter until late September This species is probably the best and most useful, either for decorative work or exhibition purposes, when it is grown in large pots, a good rough material may be used for potting A good stiff fibrous loam with about one-third part of decayed manure is best When the season's growth is completed, gradually withhold water for two months and lower the night temperature from 65° to 55°. Many of the leaves under the above treatment will drop and the wood will become firm. If plants are wanted in flower about Easter,

give them a thorough soaking with water about January 1, and raise the temperature again to 65° by night, letting it rise during the day to 75° to 80°. Syringe the plants two or three times a day, which will encourage the young growths to start all over the ripened wood. When this takes place, the plant will either have to be repotted or fed liberally with liquid manure and fertilizers, repotting usually resulting in larger panicles of flowers. If feeding is resorted to, a handful of green cow-manure to a watering-pot containing two and a half or three gallons of water is sufficient; and if any of the popular fertilizers are used for a change, a small handful to the same amount of water will answer. Water twice in between with clean water. Plants for a succession may be started when the first are beginning to show the crimson at the end of the flower, and so on until the end of July or first of August. —Clerodendrons are not subject to insect pests if kept thoroughly syringed during their growing season. If this is neglected, the shrubby kinds may become affected with brown-scale or mealy-bug, which should be immediately treated with the usual hydrocyanic gas fumigation. (George F. Stewart.)

INDEX

Balfouri, 1.
Bungei, 15.
coronaria, 4.
delectum, 1.
delicatum, 1.
fallax, 13
Fargesii, 7
fœtidum, 15
fragrans, 4
incisum, 10.
inerme, 8
infortunatum, 5.
Kaempferi, 12
macrosiphon, 10
myrmecophilum, 14.
serotinum, 6
Siphonanthus, 11.
speciosum, 3
splendens, 2
squamatum, 12.
Thomsonæ, 1
tomentosum, 9
trichotomum, 6, 7.
viscosum, 5

A *Plant of twining habit.*

1 **Thŏmsonæ,** Balfour (*C. Bálfouri*, Hort) Fig 995. Tall, twining, glabrous evergreen shrub lvs opposite, oblong-ovate and acuminate, strongly several-nerved, entire, petioled fls in axillary, and terminal forking lax cymes, calyx strongly 5-angled, narrowed at the apex, white; corolla-limb light crimson and spreading; corolla-tube 1 in long; stamens ¾in long. W Afr B M 5313 R H. 1867.310, 1902:504 G M 46·173 G W. 4, p. 439; 8, p. 173; 13, p 340. F.E. 28:261 —A warmhouse plant of great merit, and the most popular of the tender species Blooms profusely on the young wood. Var **delĕctum,** Hort (*C delĕctum* and *C delicātum*, Hort). Fl-clusters very large; calyx pure white or green-tinged; corolla large, rose-magenta

2. **splĕndens,** Don (*Siphonánthus splĕndens*, Hiern). A most excellent stove climber. sts. slender, woody, glabrous, slightly angled lvs opposite, variable, oblong-cordate, or elliptic, 4–6 in long, dark green, petiole rather short. fls in dense many-flowered cymes on leafy growths from the ripened wood of the previous year, bright scarlet passing into bright yellow, an inch or more in diam; stamens 1 in long Trop. Afr. B R. 28:7 R.H. 1902·504. H U. 5, p. 325.



996. Clerodendron trichotomum. (×½)

3. **speciōsum,** Hort. A garden hybrid between *C. splendens* and *C. Thomsonæ*, intermediate in habit and foliage. the fls. are produced in profusion, are dull red, and are continuously borne throughout the summer months; old calices more or less persistent, and ornamental pale red after fls. are past.—As figured in R. H 1873, 471 and Gn. 1877, 404, this recedes very little from typical *C. splendens*, according to Baker, but the *C. speciosum hybridum* of I. H. 1869, t593 is intermediate between *C. splendens* and *C. Thomsonæ*.

AA. *Plant of erect or self-supporting habit.*

B. *Corolla-tube not much if any longer than the large calyx: fls. white or light blush*

4. **frăgrans,** Vent (*C. coronāria*, Hort.? *Volkamèria frágrans*, Vent). Pubescent, half shrubby, with angled branches, 3–5 ft.. lvs broadly ovate, with truncate or cordate base, acuminate, coarsely toothed: fls. white or blush, in terminal, compact, hydrangea-like corymbs, usually double, deliciously scented China, Japan. B M 1834 —Very desirable and fragrant plant for the coolhouse. Hardy in S Lvs ill-scented

5 **infortunātum,** Gaertn (*C. viscōsum*, Vent) Height 5–7 ft, pubescent, with square branches: lvs opposite and stalked, cordate-ovate, acuminate, entire or toothed, hairy fls in a loose villous terminal panicle, white, with a flesh-colored center, flaring, the tube projecting beyond the loose, hairy, large, 5-angled calyx E. Indies B M. 1805 — Fls sweet-scented. Greenhouse.

6 **trichŏtomum,** Thunb (*C. serótinum*, Carr *Volkamèria japónica*, Hort, not Thunb) Fig. 996. Slender but erect, graceful, pubescent sub-shrub, 4–10 ft high or even higher lvs mostly opposite, soft and flaccid, ovate-acuminate, narrowed at the base, very closely serrate or entire, hairy. fls. white, with a reddish brown calyx, on forking, slender, reddish peduncles, the corolla-tube sometimes twice as long as the calyx; segms of calyx turning red and affording pleasing contrast to bright blue frs. Japan B M 6561. Gn 43.504; 51, p 320; 75, pp 67, 447 G 26 492 J H III. 55·355 F E 29.653. R H 1867, p. 351.—A very handsome, hardy shrub or small tree. In the N. it kills to the ground, but sprouts up if the crown is protected

7 **Fărgesii,** Dode (*C. trichŏtomum* var. *Fárgesii*, Hort). A recent shrub, reported as being hardy in England, rapid-growing lvs. dark green or purplish, opposite, petioled, the blade ovate and acute or acuminate, strongly veined, abruptly narrowed at the base, entire: fls in panicles in summer, whitish, fragrant; sepals lance-ovate, becoming reflexed: fr. globular,

size of a sweet pea seed, peacock-blue, set on the purple or crimson old calyx. China. G.M 54:817. R.H. 1911, p. 522, 523.

8 **inérme,** Gærtn Tall shrub or becoming small tree: lvs opposite or ternate, obovate or elliptic, entire, scentless, privet-like, 1½ in or less long fls white, fragrant, on 3–7-fld. axillary peduncles, corolla-tube ¾in. long, the lobes very short fr. ½in. long, smooth, separating into 4 parts India, where it is said to be used for hedges — Offered in S Calif.



997. Clerodendron fallax (×⅓)

BB. *Corolla-tube markedly longer than the small calyx (usually 2–3 times or more longer).*

c *Fls white*

9 **tomentósum,** R. Br. Shrubby and erect (often becoming a small tree), pubescent, often purplish: lvs opposite and petioled, ovate-elliptic to sub-lanceolate, short-acuminate, 2–4 in long, entire or sparingly toothed, pubescent on both sides, but thickly so on the under side fls in opposite, forking compact clusters, the calyx not enlarged, the slim, corolla-tube long-exserted (3–4 times length of calyx), and the clear white corolla-lobes reflexed-curled, anthers yellow, protruding Austral B M 1518 —Cult in S Calif

10 **macrósiphon,** Hook f (*C. inclsum* var *macrosiphon,* Baker) Elegant erect shrub, finely pubescent lvs opposite, oblanceolate-oblong, acuminate, notched or pinnatifid: fls in a nearly sessile terminal cyme or head, pure white; calyx green, very small; corolla-tube very narrow, 4–5 in long, hairy, the limb 1-sided, ½in. long; filaments 2 in long, red E. Afr B M 6695 — Warmhouse plant of merit, but the handsome fls are short-lived.

11. **Siphonánthus,** R. Br. (*Siphonánthus indica,* Willd.). Turk's Turban. Tube-Flower Shrub, 2–8 ft. high, open-branched: lvs opposite or verticillate, nearly sessile, narrowly lanceolate, entire or nearly so fls. long-tubed and white (tube 3–4 in. long) in very large terminal racemes, the lobes ⅔in long, obovate-oblong: fr a showy, red and purple berry, which persists a long time. E. Indies. Hardy in Fla.

cc. *Fls. red, orange or distinctly lilac.*

12. **squamàtum,** Vahl (*C. Kaempferi,* Sieb.). Shrub 6–10 ft., thinly pubescent lvs. large, opposite, round-cordate, entire or denticulate, acuminate. infl and fls. brilliant scarlet; fls. with small red calyx and reflexed, spreading, unequal corolla-lobes; corolla-tube 1 in. or less long, very slender: drupe blue-black or greenish blue, rather fleshy. China B.R. 649 R B. 22:253. Gn 42.562. Gt. 5:352.—Very showy. Cult, in warm greenhouses, and in the open in S. Calif. and S. Fla. The fls. are in an erect branchy, panicle-like cluster.

13. **fállax,** Lindl. Fig. 997 A highly ornamental species st. erect, shrubby, branching after flowering, bluntly 4-angled: lvs. large, cordate-ovate, hairy, rich dark green, often 1 ft in length and supported by a stout hairy petiole. infl erect, often 18 in. or more in length; fls bright scarlet, numerous, 1½–2 in. diam., tube narrow, lobes reflexed Java G C III. 45:324. Gn. 59, p 179, desc G W 10, p 247 —Should be in every collection of warmhouse plants, as it may be induced to bloom practically all the year round; it should be given a fairly light position, with slight shade from strong sun

14. **myrmecóphilum,** Ridley Shrub, sparingly branched, 3 ft., with terete sts and white bark lvs opposite and alternate, 1 ft long, linear-oblong, shining dark green, with a dozen pairs of conspicuous nerves short-petioled. fls yellow-red, in a large, showy terminal pubescent panicle, calyx about ⅓in long; corolla-tube considerably longer than calyx, corolla-lobes ½in. long, obovate to oblong and obtuse; filaments red, much exserted Singapore B M. 7887 G C III 33 291; 35 237 R H 1907, p 443 G 26.359 G M 47 259 Gng 13 376 A F. 25.78.—The hollow sts afford nesting-places for ants, whence the name *myrmecophilum* ("ant-loving") —Blooms well in 6-in. pots in a warmhouse, producing panicles 8 in. long on plants 2 ft high

15 **fœtidum,** Bunge (*C Bunge,* Steud). Shrub, 3–6 ft, pubescent, spiny, of a dwarf spreading habit, sparsely branched lvs opposite, broad-ovate and acuminate, stalked, coarsely toothed, often 1 ft. long, dark green above and red-hairy beneath fls rosy-red, ¾in across, tube 3–4 times as long as calyx, in a dense capitate corymb 4–8 in across China B.M 4880 F S 9 863 G 27 152, 30 361 —Cool greenhouse, hardy in middle and southern states August Killed to the ground in the latitude of Philadelphia, but sprouts up and blooms Fls not fetid, but name given because of the odor of the bruised lvs Spreads by suckers from the root, and soon forms a mass of beautiful free flowering growths.

L H B

CLÉTHRA (ancient Greek name of the Alder, transferred to this genus on account of the resemblance of the leaves) *Clethràcex* White Alder Shrubs or small trees grown for their handsome spikes of white fragrant flowers appearing in summer

Leaves alternate, usually serrate, deciduous or persistent fls white, in terminal often panicled racemes, petals 5, erect, stamens 10: caps splitting into 3 valves, many-seeded — About 25 species in Amer., E Asia, Madeira Only a few hardy deciduous species are generally cult., valuable for their showy spikes of white fragrant fls, appearing late in summer. They grow best in a moist, peaty or sandy soil Prop. by seeds, sown in spring in pans in sandy and peaty soil, and by greenwood cuttings under glass, growing best if taken from forced plants in early spring and placed in slight bottom heat, also, in-



998. Clethra tomentosa. (×⅓)

creased by layers and by division of large plants. Handsome when forced under glass.

A. *Lvs. deciduous: stamens exserted.*

B. *Racemes usually solitary, stamens pubescent.*

acuminàta, Michx. Tall shrub or small tree, to 15 ft : lvs petioled, oval or oblong, acuminate, rounded or narrowed at the base, sharply serrate, pubescent beneath at least on the veins, 3–7 in long: racemes usually solitary, nodding, sepals acute, style glabrous. July–Sept Alleghany Mts, Va to Ga. L.B C. 15:1427.

BB. *Racemes usually paniculed.*

c. *The lvs. with 7–10 pairs of veins, 1½–4 in. long: sepals obtusish; stamens glabrous.*

tomentòsa, Lam. (*C. alnifòlia* var. *tomentòsa,* Michx.). Fig 998 Shrub, 2–8 ft.: lvs. short-petioled, obovate, acute or short-acuminate, cuneate, serrate usually above the middle, pubescent above, tomentose beneath, 2–4 in long: racemes few or solitary, style pubescent Aug, Sept. N. C to Fla and Ala B M. 3743. G F. 4.65 (adapted in Fig 998). R H 1912, p. 519

alnifòlia, Linn SWEET PEPPERBUSH. Shrub, 3–10 ft : lvs. short-petioled, cuneate, obovate or oblong, sharply serrate, mostly glabrous or nearly so, 2–4 in. long fls fragrant, in erect, usually panicled racemes. July–Sept. Maine to Fla M D G 1890 65, 1903: 473, 474. G. 26.63 J H. III. 31.375 Em 126 Var. **paniculàta,** Arb. Kew. (*C paniculàta,* Ait.) Lvs cuneate-lanceolate, less toothed, green and glabrous on both sides: racemes panicled. Var **ròsea,** Rehd. With pinkish fls

cc. *The lvs. with 10–15 pairs of veins, 3–6 in long*

barbinérvis, Sieb. & Zucc (*C canéscens,* Authors, not Reinw) Shrub or tree, to 30 ft : branches glabrous lvs petioled, cuneate, obovate or oblong-obovate, acuminate, sharply dentate-serrate, pubescent beneath at least on the veins, 3–6 in long racemes panicled, fls. fragrant; pedicels about as long as the fls, sepals obtuse, filaments glabrous July–Sept. E Asia Gt 19:654.

Fárgesii, Franch Shrub, to 12 ft : young branchlets tomentose or nearly glabrous: petioles ½–1 in long: lvs. oblong-ovate or elliptic-oblong, acuminate, broadly cuneate or rounded at base, sharply serrate, slightly pubescent beneath or nearly glabrous, 3–6 in long: fls. white, in panicled racemes 5–7 in. long, sepals pointed, filaments hairy, style glabrous. Cent China. —One of the most ornamental species on account of its very long racemes

AA *Lvs. evergreen: stamens included.*

arbòrea, Ait. Shrub or small tree, to 20 ft.: lvs. cuneate, narrow-elliptic, acuminate, serrate, almost glabrous, shining above, 3–4 in. long. racemes panicled; fls fragrant Aug.-Oct Madeira. B.M 1057. G C. III. 52.100. J H. III 64.245. G.M. 49:97, 52:127 Gt. 52, p 209. Gn 76, p. 428 —It stands only a few degrees of frost.

C monostchya, Rehd & Wilson Allied to C Fargesii Lvs. cuneate, elliptic-oblong to oblong-lanceolate, glabrous or nearly so. racemes usually solitary, style appressed pilose Cent China —*C. quercifòlia,* Schlecht. Shrub lvs obovate-oblong, tomentose beneath: racemes panicled Mex B R 28 23 —*C tinifòlia,* Swartz Shrub lvs oblong, entire, tomentose beneath racemes panicled. Jamaica —The last two are evergreen and hardy only in subtropical regions.

ALFRED REHDER.

CLEYÈRA (after Andrew Cleyer, Dutch physician of the seventeenth century). *Ternstræmeàceæ.* Greenhouse evergreen shrubs distinguished by the petals free or scarcely coalesced, the pilose anthers numerous ovules, and scarcely bracted fls : sepals 5, with 2 bractlets; petals 5, stigmas 2–3. Berries 2–3-celled.— About 9 species

ochnàcea, DC. (*C. japónica,* Sieb. & Zucc) Height about 6 ft.: lvs oval-oblong, acute at both ends, veined above, entire Himalayas.—A tender shrub rarely cult in northern greenhouses. In the S. it is cult. outdoors. It has glossy foliage, numerous creamy white, fragrant fls., borne in June, and red berries, which last all winter —*C. japónica* was distinguished by DeCandolle by its oblong-lanceolate lvs, which are veinless, and minutely serrate at the apex. Var. **tricolor,** Hort, has dark green lvs, with grayish markings, and a margin of white and rose, the variegation being more brilliant in younger lvs.

WILHELM MILLER.

CLIÁNTHUS (Greek, *glory-flower*) *Leguminòsæ.* GLORY PEA. GLORY VINE. PARROT'S BILL Tender half-trailing shrubs, with large, showy flowers of unique appearance Swainsona is an allied genus, but its general appearance is very different and it has acuminate, not obtuse petals. Interesting plants, with pinnate lvs. of many lfts, and fls in racemes, scarcely papilionaceous. pod stalked, many-seeded.—Two or 3 species

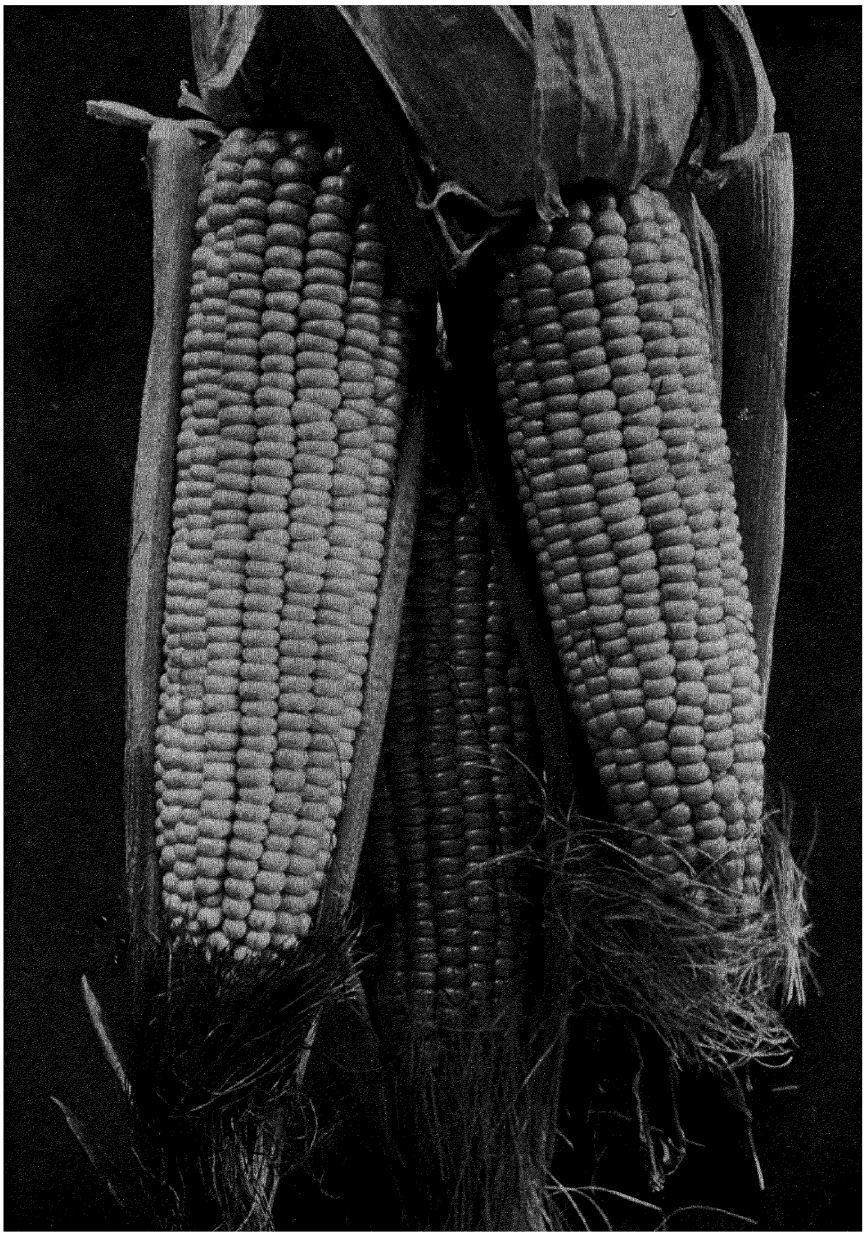
Chanthus Dampieri is somewhat difficult to grow on its own roots. In Germany, a method has been found whereby it is as easy to succeed with this species as with the better-known *C. puniceus.* The method consists of using small seedling plants of *Colutea arborescens* as stocks, these are cut over near the soil and seedlings of *C. Dampieri,* while in the cotyledon stage, are separated from the root, the base cut wedge-shape and inserted in a cut made in the colutea stock. While the union is taking place, the pots should be placed under a bell-jar *C puniceus* is an old-fashioned greenhouse plant, grown sometimes to cover rafters or trellis work, but more frequently trained around sticks placed about the edge of the pot. The flowers, not very unlike those of the common Erythrina, are freely produced in hanging clusters Cuttings rooted in early spring may be grown into good-sized plants during the summer Water should be given sparingly during the dull months Pruning, repotting and tying the shoots should be done just before the growth begins A sharp lookout should be kept for the red spider, frequent syringings being the only remedy for this pest. Propagated by seeds and cuttings. (G. W Oliver.)



999 Clianthus Dampieri. (×⅔)

Dampièri, A. Cunn. GLORY PEA Fig. 999. Height 2–4 ft : plant glaucous and hoary, with long whitish silky hairs. sts slightly tinged with red petioles longer than in *C puniceus,* lfts 15–21, nearly opposite, sessile, usually acute, stipules larger than in *C. puniceus* fls 4–6 in a raceme, large, drooping, about 3 in. long, rich crimson or scarlet, with a handsome velvety, purple-black area on the raised center. Austral. B. M. 5051. R H. 1868·230 Gt 48, p 272. Gn. 20.86. Var. **germánicus,** Hort, is also sold, and is probably var **marginàtus,** Hort., which has one petal white, margined scarlet. See Gn 37 298 and p. 299 for an account of grafting this species on stocks of *C. puniceus.* Var. **tricolor,** Hort. Keel white except the tip, which is bright scarlet. Gn W. 20·409 (desc)

puníceus, Banks & Soland. PARROT'S BILL. RED KOWHAI. Height 3–6 ft, much branched: plant glabrous lfts 16–28, each with a very short petiole, alternate (at least toward the end of the lf), blunt or



XXVIII. Stowell Evergreen sweet corn.

slightly notched: fls 8 or more in a raceme, crimson, fading with age, at least 3 in. long. New Zeal. B.M. 3584.—Cult. in eastern greenhouses, and a favorite Californian outdoor shrub. Blooms all winter in Golden Gate Park, San Francisco. A white-fld. form has been grown in Calif., but is not so popular as the type. It is commonly cult. in New Zeal. Var. **magnificus**, Hort. Clusters of bright scarlet fls.

WILHELM MILLER.
N. TAYLOR.†

CLIDÈMIA (old Greek name). *Melastomàceæ.* About 100 Trop American species of horticulturally rather unimportant plants in a family famous for its foliage plants. Lvs broad, entire, 5–7-nerved, opposite, petioled; fls in panicles or axillary clusters, white, pink, or purple; petals 5 or 6, stamens 10 or 12: branching shrubs, mostly hairy. **C. vittàta,** Lind. & André, has large, oval, pointed lvs. with 5 strong nerves, and a narrow band of white down each side of the midrib. I H. 22.219. R.H. 1876, p. 233.

CLIFF BRAKE: *Pellæa.*

CLIFTÒNIA (after Dr. Francis Clifton, an English physician, d 1736) *Cyrillàceæ.* BUCKWHEAT TREE. Glabrous evergreen shrub or small tree, rarely cult. for its early appearing racemes of white or pinkish fragrant fls.: lvs. alternate, short-petioled, without stipules, entire; fls. in terminal racemes; sepals and petals 5–8, stamens 10, shorter than the petals, the filaments flattened below, ovary superior, 3–4-celled, with a 3–4-lobed nearly sessile stigma: fr. indehiscent, ovoid, with 3–4 wings and as many seeds. The only species is **C. monophýlla,** Sarg. (*C. ligústrina,* Spreng. *C. nítida,* Gaertn. *Mylocáryum ligústrinum,* Sims). Occasionally 50 ft. tall; lvs. oblong-lanceolate, obtuse, cuneate at the base, dark green above, 1½–2 in. long; racemes 1–2½ in. long, fls. white or pinkish, fragrant, about ½in. across; fr. ¼in. long. Feb., March; fr. in Aug., Sept. Ga. to Fla. and La., swamps. S.S. 2. 52. B.M. 1625.—Little known in cult. and now not in the trade, but well worth cult. for its early, delicate and fragrant fls., also the buckwheat-like frs. are attractive. Hardy as far north as Philadelphia. Thrives best in humid sandy and peaty soil. Prop. by seeds and probably like Cyrilla by cuttings of half-ripened wood under glass with slight bottom heat.

ALFRED REHDER.

CLIMBERS are distinguished from twiners by having some means of attachment, as tendrils or other special devices, while twiners rise by twisting their stems round their support. In a wider sense, the word is often used synonymously with "vines," including all plants that use other plants or other objects for support, by whatever mechanism or method. By "trailers," nurserymen commonly mean low-growing vines, and by "climbers," tall-growing vines. See *Vines.*

CLIMBING FERN: *Lygodium.* **Climbing Fumitory:** *Adlumia fungosa.* **Climbing Hempweed:** *Mikania scandens.* **Climbing Lily.** *Gloriosa superba.*

CLINOSTÍGMA (Greek, *inclined stigma*). *Palmàceæ,* tribe *Arèceæ.* Low spineless palms with the habit and somewhat the appearance of small kentias; feather-leaved.

Trunks not over 8 ft., usually conspicuously ringed: lvs. usually 3–4 ft. long, rarely more, and pinnate; lfts. scythe-shaped, or lanceolate, 2-parted or obliquely truncate at the apex, not revolute at the base; rachis scaly, convex beneath, grooved above. fls. monœcious in the same spadix, sessile along its branches, the male usually 2 together, the female solitary; spadix long and usually much branched, in the male there are 3 imbricate outer segms. and 3 valvate inner segms. to the perianth, with 6 stamens surrounding an abortive ovary: fr. obliquely globular.—Species 3, one from Austral., one from Samoa, and another from Fiji. Only the following is known in cult., and it is a rare palm. Its graceful lvs. and convenient dwarf habit should commend it to the trade. For cult. see *Kentia.*

Mooreànum, F. Muell. (*Kéntia Mooreàna,* F. Muell.). Dwarf palm, 3–4 ft. high; lvs. 3–4 ft. long, segms. numerous, about 1 ft. long, longitudinally plicate when young; spadix at first closely sessile, very much branched when older. New S. Wales, confined to Lord Howe's Isl.—This graceful and recent palm resembles *Howea Forsteriana* somewhat in habit of growth, but its arching lvs. spread wider, and its sts. are dark purplish, and its pinnæ tough and leathery. The palm is free and clean in growth.

N. TAYLOR.

CLINTÒNIA (after DeWitt Clinton, the famous Governor of New York and promoter of the Erie Canal). *Liliàceæ.* A small group of low-growing, herbaceous plants of North America and Asia, with a few tufted, broad shining leaves, and usually umbels of flowers.

Perianth-segms. equal or nearly so; stamens 6, inserted at the base of the perianth-segms.; ovary 2–3-celled with 2 to several ovules in each cavity; fls. on scapes: root-stocks slender; fr. a globose or oval berry. For *C. pulchélla* and other species of the abandoned genus Clintonia of Hort., see *Downingia,* a very different genus belonging to Campanulaceæ.

Clintonias grow in cool, moist woods, and fanciers can secure them from some dealers in native plants. It is difficult to tell the species apart by the leaves.

A. *Scape bearing an umbel of fls.*

B. *Fls. greenish yellow.*

boreàlis, Raf. Height 1–2 ft.; fls. 3–6, nodding, green, margined yellow. Labrador to Winnipeg and south to N. C. B.M. 1403 (as *Smilacina borealis*).—This is one of the choicer plants of cool, moist woods, known to plant lovers chiefly by its handsome umbels of blue berries found in autumn, which are borne above the large, dark green, shining lvs. The commonest species, but not easily grown below elevations of 1,000 ft.

BB. *Fls. white, with green spots.*

umbellulàta, Torr. Fls. 10–20 or more, smaller than in *C. borealis,* erect or nearly so, white, with green or purplish spots. Alleghany Mts. from N. Y. to Ga. B.M. 1155 (as *Smilacina borealis*).—This species has the smallest fls. of the group, and is the only one that has but a single pair of ovules in each cell of the ovary.

BBB. *Fls. deep rose.*

Andrewsiàna, Torr. One to 1½ ft. high, bearing 4 sessile, oblong, acute lvs., and 20 or more nearly erect fls. which are in dense umbels. Calif., to S. Ore., in deep, cool woods, in clayey soil rich in mold. B.M. 7092.—The showiest of the group. Cult. to some extent.

AA. *Scape bearing 1 white fl.*

unifìora, Kunth. The only species in which the scape is shorter than the lvs.; fls. nearly erect, rarely there are 2 fls.; lvs. narrow, obovate-lanceolate, hairy. Calif. to Alaska.

WILHELM MILLER.
N. TAYLOR.†

CLITÒRIA (derivation recondite). *Legumindsæ.* BUTTERFLY-PEA. Glasshouse vines with pea-like flowers, and also hardy perennials.

A widespread and variable genus of 30 species allied to Centrosema, and characterized by the calyx-tube being cylindrical and longer than the lobes: standard narrowed at the base, not appendaged on the back; stamens in one group, the anthers all alike; style often bearded. The most important garden plant is *C. Ternatea,* a warmhouse annual twiner, reaching 15 ft., and requiring no special cult. It has very showy blue fls.

A. *Lfts. 5.*

Ternatèa, Linn. (*C. cærùlea,* Hort. *Ternatèa vulgàris,* HBK.). Lfts. 5, oblong, obtuse, short-petioled: fls. 1 in. or more long, rich blue, with beautiful markings, especially on the standard. B.M. 1542 Gn 38.132. P M. 7:147 and 13:79.—Name from Ternate, one of the Molucca Isls. and not from ternate, meaning 3-leafleted.



1000. Clivia miniata.

Hardy in Cent. Fla., where it is usually a biennial. **C. álba,** Hort., is a white form. More or less double forms have been known for over a century.

AA. *Lfts 3.*

mariàna, Linn. Hardy perennial, smooth, erect, or slightly twining, 1–3 ft. high· lfts. 3, obovate or ovate-lanceolate· fls light blue, 2 in. long, on short peduncles: pod straight, few-seeded. Summer Dry banks, N. Y. to Fla. and west to Mo. Also India and Burma.—Rarely sold by dealers in native plants.

arboréscens, Ait. St. shrubby, the rusty colored branches twining lvs. trifoliolate, the lfts elliptical or oval· fls racemose, showy, purple, the standard more than 2 in long Trop. Amer. B M 3165.—An excellent warmhouse climber, grown chiefly in botanic gardens.

WILHELM MILLER.
N. TAYLOR †

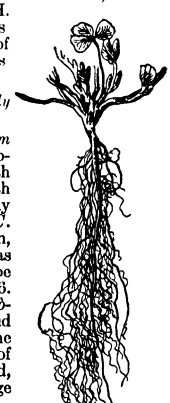
CLÍVIA (after a Duchess of Northumberland and member of the Clive family). Syn., *Imantophýllum. Amaryllidàceæ* Tender bulbous plants with handsome evergreen foliage and showy, bright red or red and yellow flowers in large umbels.

Bulb imperfect, mostly of old lf.-bases: perianth funnelform, curved or straight, the segms much longer than the tube; ovules 5–6 in each cell· fr. a berry, differing in this from the capsular fr of Nerine.—Three species from S Afr. J. G. Baker, Amaryllideæ, p. 61.

Clivias make excellent house plants, but, like amaryllis, are too costly to be very popular. They have the advantage over amaryllis of having attractive foliage all the year round, and are more certain to bloom well. They have thick, fleshy roots, like an agapanthus. All the species are well worth growing, because of their handsome umbels of flowers, produced during the spring and early summer months. *Clivia miniata* is the species most commonly grown. There are several distinct forms of this, with larger and deeper colored flowers. Established plants may be grown in the same pots for several years, if the plants are fed during the growing period with weak liquid manure In potting, the soil given should be of a lasting nature, not easily soured, nor likely to become sodden. In arranging the drainage, place one large piece, concave side down, over the hole, and around this arrange several smaller pieces. Over these place one or two handfuls of pieces small enough to go through a No. 2 sieve The best time to pot is after the flowers have been produced. The plants should then be kept for some time in a humid atmosphere to encourage growth, receiving an abundance of water after they are well started After growth has been completed, they will winter safely in an ordinary greenhouse temperature (not under 40°), if kept rather dry at the root For propagation, choose old plants which have become crowded in their pots, so that the entire plant can be pulled to pieces After trimming the roots, put the growths in small pots and keep in heat, to encourage root action Clivias are well suited for planting permanently in the front part of greenhouse borders The soil for this purpose should be rich and well firmed about the roots Withhold water as much as possible during the resting period, or the plants will produce leaves at the expense of the flowers. (G. W Oliver)

A *Fls. erect; perianth broadly funnel-shaped.*

miniàta, Regel (*Imantophýllum miniàtum,* Hook). Fig 1000 Lvs 16–20, in a tuft, sword-shaped, tapering to a point, 1½ ft long, 1½–2 in broad· fls 12–20, in an umbel; perianth erect, bright scarlet, with a yellow throat, tube broadly funnel-shaped, longer than *C. nobilis;* segms about 2 in long, the inner ones broader than the outer; stamens shorter than the segms ; style not exserted berries ovoid, bright red, 1 in long. Natal. B M 4783 R H 1859, pp 126–7, 1869 250, and 1894, p. 572. F S. 9.949, 23.2373 I H 26.343, 36.80; 37.102; 40:177.—*I cyrtanthiflórum,* Van Houtte (F S. 18 1877), is a hybrid between this species and the next It has a curved perianth, with the inner segms of the limb twice as broad as the outer; stamens longer than the corolla R H. 8 259 (desc) Var **aùrea,** Hort. Fls yellow with a deeper shade at base of the segms Var **striàta,** Hort Lvs freely variegated.



1001.
Trifolium pratense.
Root-system

AA. *Fls. pendulous, perianth narrowly funnel-shaped.*

nóbilis, Lindl. (*Imantophýllum Autoni,* Hook.). Lvs. about 12, strap-shaped, very obtuse, with a roughish edge. fls 40–60, in an umbel; perianth curved and drooping, tube narrowly funnel-shaped, shorter than in *C. miniata;* segms tipped with green, about 1 in long; stamens as long as the segms ; style exserted. Cape Colony. B M. 2856. L.B.C. 20:1906. Intro. to cult. 1828.—*I. cyrtanthiflórum,* Van Houtte (F S. 18:1877), said to be a hybrid between this and the above, shows little if any influence of *C. miniata.* It has the narrow-tubed, pendulous fls. and the greenish tinge of *C. nobilis* R H 1894, p. 573.

C. Gárdeni, Hook. Very much as in C. nobilis but with the corolla-lobes obviously spreading, stamens as long as the perianth-segms , anthers oblong, yellow B M. 4895.—A desirable plant.

WILHELM MILLER.
N. TAYLOR.†

CLOTBUR, a weed *Xanthium*

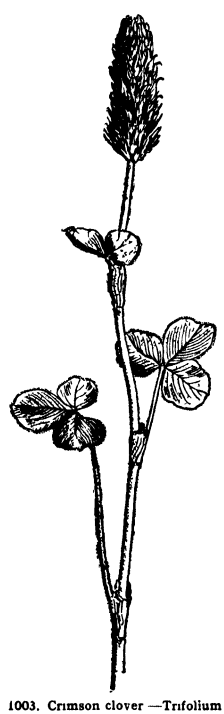
CLOVE PINK: The carnation, *Dianthus Caryophyllus.*

CLOVER. Species of *Trifòlium* (Leguminosæ), particularly those that are useful in agriculture The word is also applied to species of related genera, as Medicago. The sweet clover is Melilotus Bush and Japan clover are Lespedezas. Prairie clover is a Petalostemon

About 300 species of Trifolium have been described These are widely dispersed in temperate climates The flowers are papilionaceous but small, and are disposed in dense heads or spikes The leaves are digitately or palmately 3-foliolate. The common European red clover is *T pratènse,* Linn , now thoroughly naturalized in North America, but supposed not to be native here It is valuable both for stock feed (as pasturage and hay), and also as a green manure As a manure crop, to be plowed under, it is particularly useful because of its deep root-system and its power (in common with other leguminous plants) of fixing the nitrogen of the air by means of its roots Fig 1001 illustrates the root system Fig 1002 shows the root of a fifteen-months-old plant that grew in hard clay soil It is 22 inches long, and some of the root was left in the ground The mammoth red clover (*T mèdium,* Linn) is perhaps an offshoot of *T. pratense.* It is usually a larger plant, with zigzag stem, entire and spotted leaflets, and longer-stalked head. White clover, or shamrock, is *T rèpens,* Linn , introduced from Europe, and supposed to be native to North America as well Alsike clover, *T hybridum,* Linn., is of Old World nativity The crimson or scarlet clover (*T. incarnàtum,* Linn.), Fig. 1003, an annual from southern Europe, is now much grown as a catch- or cover-crop in orchards See *Cover-crops* It is also highly ornamental, and is worthy the attention of the florist. For agricultural discussion of the clovers, see Vol II, Cyclo Amer. Agric L H. B.



1002 The penetrating root of the red clover



1003. Crimson clover —Trifolium incarnatum (×⅓)

CLOVES are the dried flower-buds (Fig 1004) of a handsome tree of the myrtle family *Jambosa Caryophyllus* or *Eugènia caryophyllata,* better known as *Caryophyllus aromaticus,* a native of the Spice Islands, but now cultivated in the West Indies and elsewhere See *Eugenia* Caryophyllus, the ancient name of the clove, means "nut-leaf." The carnation, or "clove pink," was named *Dianthus Caryophyllus* because of its clove-like odor, and it has become the type of the great order Caryophyllaceæ, which, however, is far removed botanically from the Myrtaceæ. The word "gilliflower" is a corruption of caryophyllus, and, until Shakespeare's time and after, was applied to the carnation, but now-a-days it usually refers to certain cruciferous plants of the genera Cheiranthus and Matthiola



1004 Clove

1 Spray of leaves and flowers, 2 The expanded flower, 3 An unopened bud, or clove

The clove bark of pharmacy is secured from *Dicypellium caryophyllatum,* of Brazil, one of the Lauraceæ

The word clove is used among gardeners for a small secondary bulb employed for propagating, specially for the little bulb that forms in a scale-axil of a larger bulb.

CLUB-MOSS *Lycopodium*

CLÙYTIA (after Cluyt, Dutch botanist of 16th century) *Euphorbiàceæ* Evergreen greenhouse shrubs from S Afr , rarely cult , chiefly in botanical gardens Habit often ericoid lvs alternate, small, entire fls clustered in the axils, staminate with petals; calyx imbricate; stamens about 5, ovules 3 Prop by cuttings **C. pulchélla,** Linn , is a small shrub· lvs ovate and somewhat acute, petioled, glabrous, entire· fls axillary, small, white B M 1945

J B S NORTON.

CLYTÓSTOMA (Greek *klytos,* splendid or beauteous and *stoma* mouth, alluding to the beautiful flowers) *Bignoniàceæ* Ornamental vines, grown for their beautiful flowers

Evergreen shrubs, climbing by leaf-tendrils: lvs. opposite, with 1 pair of short-stalked entire lfts , the rachis elongated into a slender simple tendril, sometimes wanting· fls. in 2's, axillary, or terminal or in panicles; calyx campanulate with 5 small or subulate teeth; corolla funnelform-campanulate with imbricate rounded lobes, stamens 4, with spreading anther-cells, disk short, ovary conical, warty, 2-celled, with

the ovules in 2 rows: caps. compressed, prickly, septicid, with numerous nearly orbicular winged seeds.—About 8 species in S Amer, usually described under Bignonia in horticultural writings Closely related to Bignonia, from which it differs chiefly in its simple



1005. Cnicus benedictus.

slender tendrils, the short disk, the small or subulate calyx-teeth and the prickly pod Suited for cult in subtropical or tropical regions only, or as a stove plant in the N. For cult and prop., see *Bignonia*

callistegioides, Bur. & Schum (*Bignònia callistegioìdes*, Cham *B speciòsa*, Graham *B picta*, Lindl. *B Lindleyi*, DC) Large climber lfts elliptic-oblong, acuminate, undulate, glabrous, lustrous, reticulate below, about 3 in long fls on 2-fld terminal peduncles; calyx campanulate, with subulate teeth, corolla pale purple, streaked, about 3 in long, the tube yellowish streaked purplish, limb 2–3 in broad, with the lobes spreading, broadly oval, obtuse and wavy, disk crenate. Spring and early summer. S. Brazil, Argentina B M. 3888 B.R 28 45. H U 3 227 P M 10:125. F S. 9.907.—Will stand a little frost, when grown in the open in the S.

purpûreum, Rehd (*Bignònia purpùrea*, Lodd) Large climber· lfts sometimes 3, ovate-oblong or obovate-oblong, short-acuminate, bright green above, paler below, entire, occasionally toothed, about 3 in long. fls. on axillary 2-fld peduncles or sometimes in clusters; calyx tubular-campanulate, with short triangular teeth, corolla mauve-colored with white eye, with a rather slender tube 1 in. long, lobes spreading, orbicular-obovate. Uruguay. B.M. 5800 G C. III. 24:399.

ALFRED REHDER

CNÌCUS (Latin name of Safflower, early applied to thistles) *Compósitæ*. BLESSED THISTLE. A monotypic genus allied to Centaurea, and distinguished from it botanically by its heads being quite sessile and surrounded just below by bristly leaves. Its habit in the garden is very different from the bachelor's button, being thistle-like, and more interesting than ornamental. A hardy annual low-growing herb, rough, branching and pilose Once thought to counteract poison. Culture easy. Fit for wild gardens and rockeries.

benedíctus, (Linn *Cárduus benedíctus*, Authors. *Centaurèa benedicta*, Linn *Carbènia benedicta*, Adans.). Fig. 1005 Height 2 ft · lvs. alternate, sinuate-pinnatifid, oblong, the lobes and teeth spiny heads terminal, yellow, 1 in. wide, the fls exclusively tubular Medit. regions and Caucasus Sometimes cult., also seen in waste places of S Atlantic states and Calif as a weed adventive from Eu.

C rhaphilèpis, Heimsl, S Mex, has recently been cult abroad It is described as a handsome plant with deeply cut spiny-toothed lvs about 2 ft long, gray-tomentose beneath st colored, much branched fl-heads 3–3½ in long, the involucral bracts scarlet and spine-tipped, fls scarcely exserted, the filaments carmine Under the above definition of Cnicus, this plant must fall in another genus It has been placed in Carduus by E L Greene, as C raphilepis.

N TAYLOR †

COBÆA (after Father Cobo, Spanish Jesuit of the seventeenth century, naturalist, and resident of America for many years). Syn *Rosenbérgia* Sometimes incorrectly spelled Cobœa *Polemoniàceæ* Attractive climbers, one or two species commonly grown in the open and under glass for the large bell-shaped flowers

Shrubby plants climbing by lf-tendrils, but known in cult as herbs lvs alternate, pinnate calyx large, 5-parted, corolla bell-shaped, the limb 5-lobed caps 3-valved, angled. fls solitary on long peduncles, bracted at the base —A genus of about 10 Trop American climbers (monographed by Brand in Engler's Pflanzenreich, hft. 27, 1907), of which *C scandens*, a tender perennial plant, is amongst the dozen most popular vines commonly treated as annuals. This is the only genus of climbers in the order Prop by seeds which should be placed in moist earth, edge down It is a rapid grower.

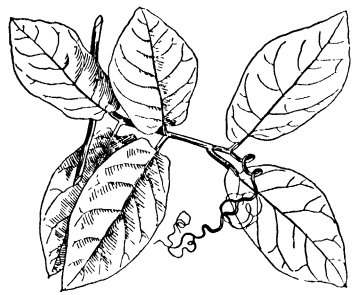
scándens, Cav (*Rosenbérgia scándens*, House) Figs 1006–1008 Height 10–20 ft lfts in 2 or 3 pairs, the lowest close to the st, and more or less eared fls bell-shaped, 1–1½ in across, light violet or greenish purple, with protruding style and stamens tendrils



1006. Cobæa scandens. (×⅓)

branched. Mex B.M. 851. F S. 14·1467 —There is a white-fld form (*C dlba*, Hort.), and one with variegated lvs , var. *variegàta*, Hort —The terminal lft. is represented by a tendril (Fig 1007). Sometimes there are indications of tendrils on other lfts. (Fig 1008), making the plant an interesting one for students of morphology.

stipulàris, Benth. (*Rosenbérgia stipulàris*, House). Resembles the preceding species but the sepals ovate, tapering to a broadly acuminate apex (the sepals of *C. scandens* being broadly ovate or suborbicular). Mex.



1007 Normal leaf of Cobæa scandens

macrostòma, Pav (Sometimes erroneously written *macrostema* and *macrostemma*) Sts climbing 6–10 ft · lvs alternate, of 3 pairs of obovate lfts fls solitary, on a 2-lvd long peduncle, the petals yellow-green, stamens at least 1½ in longer than the corolla Guatemala B M 3780

C minor Martens & Galleotti A small vine of which little is known, but cult in Amer in botanic gardens and fanciers' collections It has small fls , borne on stalks shorter than the lvs Mex —*C Pringlei*, House (Rosenbergia Pringlei, House) A glabrous, high-twining vine lfts 6, the basal pair oblong-lanceolate, hastately clasping peduncles 4–5 in long, calyx-lobes green, herbaceous, scarcely 1 in long and half as broad, corolla pure white, 2 in long, stamens exserted less than ½in Mex

WILHELM MILLER
N TAYLOR †

COBNUT. *Corylus*

COBÚRGIA: *Stenomesson*

COCA. The leaves of *Erythroxylon Coca*, used in medicine Sold chiefly as a fluid extract Cocaine is the famous local anesthetic See *Erythroxylon*

COCCÍNIA (Latin, *scarlet*, referring to the ornamental gourds) *Cucurbitàceæ* Tender perennial vines, usually with tuberous roots, grown for ornament mostly indoors

Leaves angled or lobed, sometimes glandular: fls white or yellowish, large, staminate and pistillate on different plants or sometimes on different branches of the same plant; calyx short, often campanulate. fr a small, scarlet gourd, sometimes marbled, with an insipid pulp —Twenty species from the tropics of Asia and Afr A. Cogniaux in DC., Mon Phan 3 528 *C cordifolia* is treated as a tender annual, requiring an early start and no special cult The genus is sometimes referred to Cephalandra.

A *Tendrils simple male fls solitary: lvs small*

cordifòlia, Cogn (*C indica*, Wight & Arn). Height about 10 ft , perfectly smooth· lvs small, 1–2 in long, glossy, ivy-like, short-petioled, obtusely 5-angled· fl white, bell-shaped, the staminate solitary: fr roundish at both ends, about 2 in long, 1 in thick India.

AA *Tendrils bifid male fls. in racemes: lvs. large.*

palmàta, Cogn (*Cephalándra palmàta*, Lond.). Attaining 30 ft . lvs large, 3–4 in long and wide, long-petioled, palmately 5-lobed: fls yellowish· fr. ovate, acute Natal —Intro. by P. Henderson & Co , 1890. A rare greenhouse plant.

C Dinteri, André, with palmate lvs and handsome scarlet frs., may be in cult. S. Afr. R H. 1900 268

WILHELM MILLER.
N. TAYLOR †

COCCÓLOBA (Greek, *lobed berry*, referring to the ends of the pear-shaped fruit). Sometimes spelled *Coccolobis* Including *Campdèria*. *Polygonàceæ* Tropical shrubs, trees or rarely tall woody climbers, grown for their fruits and usually large glossy leathery leaves

Leaves alternate, always entire fls small, in axillary or terminal spike-like racemes, usually some shade of green or yellow-green; sepals 5, herbaceous; petals 0; stamens 8, exceeding the perianth· fr berry-like, with a small stone, often edible —About 125 species in the American tropics and reaching to Fla *C. platyclada* is now referred to *Muehlenbeckia*, which see

Coccoloba uvifera, the sea-grape or shore-grape of the West Indies, bears an edible fruit, and has particularly beautiful foliage It is the most important of the genus and is offered by dealers in tropical plants It will not stand the frost and its cultivation out-of-doors is limited to the frostless region of California and Florida. It can be easily grown in any greenhouse North All species are easily propagated by seeds, which are very plentiful with most of the species Some species may be increased by cuttings of ripe wood, which root easily in sand under the usual conditions, in a frame or propagating-house Layering may also be employed to increase the stock The various species grow naturally in both clayey and sandy soils, preferring moist rich earth, and a high temperature *C uvifera* frequents the seashore, and is found growing in sand and broken shells apparently lacking altogether in plant-food. Rich sandy soil of a light character seems to be best for all the species so far known in cultivation Plants are readily transplanted from the open ground, but pot-grown plants are to be preferred (E N Reasoner)

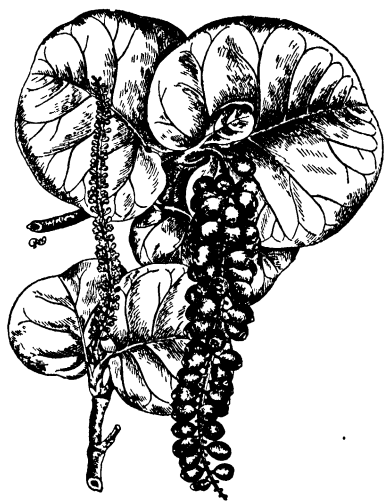
uvífera, Linn SEA-GRAPE SHORE-GRAPE UVADEL MAR Fig 1009 Tree, reaching 20 ft or more, with many flexuous branches lvs large, often 5 in long by 7 in wide, broadly heart-shaped, wavy margined,



1008. Monstrous or abnormal leaf of Cobæa.

glossy, leathery, glabrous, the midrib red at the base; petioles short, with sheathing stipules at the base: racemes 6 in. long, erect in fl , nodding in fr , fls 1½ in across, white, fragrant, petals 5, stamens 8; styles 3· berries 9 or more in a raceme, small, about ¾in long, pear-shaped, reddish purple, dotted green, sweetish acid nut roundish, with a short, sharp point on top, and vertical wrinkles Sandy seashores of Trop Amer especially S. Fla. and W. Indies B M 3130 —The wood is used in cabinet-work, and, when boiled, gives a red color

floridàna, Meissn. (*C laurifòlia,* Jacq). PIGEON PLUM. Tree, 25–30 ft · lvs 1½–3 in. long, 1–2 in. wide, ovate or elliptical, glabrous, narrowed at both ends, obtuse, margin slightly recurved· berries small, ½in long, pear-shaped, edible, but not marketable. S. Fla., the Bahamas, and northern coast of S. Amer.



1009. Coccoloba uvifera. (×⅓)

pubéscens, Linn (*C grandifòlia,* Jacq). A high, sparingly branched tree. lvs. cordate-orbicular, 3–6 in. long, rusty-pubescent beneath, chiefly on the prominent veins. fls racemose. fr berry-like, about ¾in. diam. Trop Amer April B M 3166

C caracasàna, Meissn , or a closely related species, has recently been intro to the trade by Franceschi, of Santa Barbara, Calif It is described as having "larger fr. than other known species, like a good-sized plum " Venezuela.

WILHELM MILLER.
N. TAYLOR †

COCCOTHRÌNAX (a *berry* and *Thrinax,* in reference to the berry-like fruit) *Palmàceæ* Small or medium-sized palms, with fan-leaves.

Trees (or rarely stemless) with slender sts., clothed above with the persistent petiole-sheaths,. lvs terminal, pale beneath, thin and brittle, divided into narrow, acute, 2-parted obliquely folded lobes; petioles compressed, slightly rounded and ridged on the 2 surfaces, thin and smooth on the margins· spadix interfoliar, paniculate, shorter than the petioles: fls. perfect, minute, solitary, perianth cup-like, obscurely 6-lobed, deciduous, stamens 9, exserted; ovary superior, ovoid, 1-celled: fr berry-like, subglobose, 1-seeded, in ripening becoming thick and juicy, shining black or purple-black; albumen channeled —A genus of a few species, made from Thrinax; Fla. and S.

Gárberi, Sarg (*Thrìnax Gárberi,* Chapm. *T. argéntea* var *Gárberi,* Chapm). SILVER-PALM Stemless lvs. only 10–12 in across, fan-shaped, silvery beneath. An attractive dwarf palm, early showing its characteristic form, native on shore of Biscayne Bay, Fla ; perhaps a depauperate form of *C. jucúnda,* Sarg (*Thrìnax argéntea,* Chapm , not Roem & Sch), which has lvs. 20–32 in across; it bears the fls on rigid spreading short pedicels, the perianth is white, anthers light yellow, and ovary orange· fr. ¾in. or less diam , becoming succulent and bright violet and later almost black and shining, ripening 6 months after the flowering: petiole slender, flexible, rounded on upper side and obscurely ribbed on lower side, extending as a thin undulate rachis that ends in a short obtuse point.

L. H. B

CÓCCULUS (diminutive of *kokkos,* berry, the fruit being berry-like) Syn , *Cébatha, Epibatèrium. Menispermàceæ.* Shrubs grown for their handsome foliage and the ornamental red or black fruits

Twining or erect· lvs. alternate, petioled, entire or lobed, with entire margin, deciduous or persistent, palminerved fls inconspicuous, dioecious, in axillary panicles or racemes, sometimes terminal; sepals, petals and stamens 6· carpels 3–6, distinct, developing into berry-like, 1-seeded drupes; seed reniform —About 12 species in N Amer , E and S Asia, Afr and Hawaii, chiefly in tropical and subtropical regions Only a few species are cult , thriving in almost any somewhat moist soil, the evergreen kinds are sometimes grown in pots, in a sandy compost of peat and loam Prop by seeds or by cuttings of half-ripened wood in summer, under glass, with bottom heat

"Cocculus indicus" is the trade name of the berries used by the Chinese in catching fish The berries contain an acrid poison, which intoxicates or stuns the fish until they can be caught The berries are imported from the East Indies to adulterate porter, and "Cocculus indicus" is a trade name with druggists, not a botanical one, just as "Cassia lignea" is a trade name of a kind of cinnamon bark, derived, not from a cassia, but from a species of Cinnamomum The name "Cocculus indicus" was given by Bauhin, but binomial nomenclature began later, with Linnæus, in 1753 The plant which produces the berries is *Anamirta Cocculus*

carolínus, DC (*Cébatha carolìna,* Brit *Epibatèrium carolìnum,* Britt) CAROLINA MOONSEED A rapid-growing, twining shrub, attaining 12 ft , with pubescent branches lvs long-petioled, usually ovate, sometimes cordate, obtuse, entire or 3-, rarely 5-lobed, pubescent, glabrous above at length petals emarginate: fr red, ¼in diam Along streams from Va and Ill to Fla and Texas —Decorative in fall, with its bright red fr. Not hardy north of N Y

trílobus, DC. (*C orbiculàtus,* Schneid. *Cebatha orbiculàta,* Kuntze *C Thúnbergii,* DC) Slender climber with pubescent branches· lvs broadly ovate to oblong-ovate, truncate or subcordate at the base, obtuse, often emarginate, usually entire, pubescent on both sides petals bifid at the apex fr bluish black, about ¼in thick, in short-stalked axillary clusters Japan B M 8489 I T 6.231 —Quite hardy at the Arnold Arboretum, keeps its lvs green until very late in autumn

C diversifòlius, Miq , not DC =Sinomenium acutum —*C heterophyllus,* Hemsl & Wilson=Sinomenium acutum —*C. japónicus,* DC =Stephania hernandifolia —*C laurifòlius,* DC Erect shrub, to 15 ft , glabrous lvs evergreen, oblong, acute at both ends Himalayas Decorative, with its bright green, shining foliage Only hardy in subtropical regions

ALFRED REHDER.

COCHLEÀRIA (Greek, *cochlear,* a spoon, referring to the leaves). *Cruciferæ* More or less fleshy seaside small herbs, including scurvy-grass and related things; scarcely cultivated.



1010. Cochlearia danica.

Annual or perennial: lvs. simple· fls small, white, yellowish or purplish, in racemes. fr. an inflated silicle, with very convex valves, the seeds several in each cell and usually 2-rowed —About 15 species in Eu and N. Amer. Formerly the horse-radish was referred here, but it is now placed by some in Radicula, by others in Roripa, and by still others in Nasturtium.

officinàlis, Linn SCURVY-GRASS. Hardy biennial, 2–12 in high, but cult as an annual: root-lvs petioled, cordate; st -lvs oblong, more or less toothed and sometimes with a short-winged petiole. fls early spring; calyx-lobes erect Arctic regions.—Prop. by seed, which is small, oval, slightly angular, rough-skinned, reddish brown The germinating power lasts 4 years. The green parts of the plant are strongly acrid, and have a tarry flavor. The seed is sown in a cool, shady position, where the plants are to stand The lvs are rarely eaten as salad, but the plant is mostly grown for its anti-scorbutic properties. Not to be confounded with water-cress.

dánica, Linn Fig. 1010. Annual, scarcely 6–8 in. high: lvs rounded, kidney-shaped, scarcely 1 in. long in large specimens, usually much smaller North temperate and arctic regions L B C. 15:1482 —It is covered in early summer with a profusion of small white fls. A valuable plant for ornament northward.

N. TAYLOR.†

COCHLÌODA (Greek for *spiral,* in reference to the structure of the lip) *Orchidàceæ.* A small group of orchids found at high elevations in South America, little grown, requiring treatment given Odontoglossum.

Pseudobulbous. fls bright rose-color or scarlet, in long racemes, sepals equal or the side ones more or less joined, petals all much alike, lip clawed, the blade spreading and the side lobes rounded and perhaps reflexed, the middle lobe narrow —Some of the species are retained by various authors in Odontoglossum and Mesopinidium

Noetzliàna, Rolfe Pseudobulbs ovate-oblong, compressed, about 2 in long, monodiphyllous lvs linear: peduncles arcuate, fls numerous, in graceful racemes, orange-scarlet, about 1 in across, sepals oblong, petals rather ovate, labellum 3-lobed, disk yellow, otherwise similar in color to the petals Andes B M 7474 Gt. 43 1403 G C III 16 71 O R 12.309

rósea, Hort Plants similar to *C Noetzliana:* fls. rose-color Peru B M 6084 J H 18 66.

vulcánica, Benth & Hook Peduncles more or less erect fls larger than in the preceding, bright rose-color; labellum 3-lobed, provided with 4 ridges Peru B M. 6001

C brasiliénsis, Rolfe Pseudobulbs tufted, oblong lvs oblong-lanceolate scapes erect or arching, with 6–13 greenish fls Brazil — —*C Flóryi,* Rolfe Natural hybrid between C Noetzliana and C. rosea Fls cinnabar-red with yellow crest, sepals lanceolate, petals elliptic oblong

OAKES AMES.

COCHLIOGLÓSSA. *Orchidàceæ* A garden hybrid between *Cochlioda Noetzliana* and *Odontoglossum sceptrum* or *O prænitens,* known as *Cochlioglossa moorebeekiensis* Fls star-shaped, the petals and sepals yellow with pale brown spots, lip has the characters of that of *Odontoglossum sceptrum,* but a little longer and less attractive Shows no marks of *Cochlioda Noetzliana.*

COCHLIOSTÈMA (Greek, *spiral stamens*). *Commelinàceæ* Curious and gorgeous plants cultivated under glass

Cochliostemas are epiphytes, with the habit of Billbergia and great axillary panicles of large fls of peculiar structure and beauty They are stemless herbs from Ecuador, with large, oblong-lanceolate lvs , sheathing at the base, and fls which individually last only a short time, although a succession is produced for several weeks; sepals 3, oblong, obtuse, concave; petals 3, nearly equal, wider than the sepals, margined with long hairs; staminodes 3, villous, 2 erect, linear, the third short, plumose; staminal column hooded, with incurved margins, inclosing 3 spirally twisted anthers; style slender, curved —Gardeners recognize 2 species, although they are considered by some botanists as forms of one. Recorded as the most beautiful cult. plants of the family.

These are handsome stove-flowering perennial plants, closely related to the commelinas, and are of comparatively easy culture, thriving well in ordinary stove temperature in a mixture of two parts loam and one part fibrous peat, with a little well-decayed cow- or sheep-manure added when potting mature plants They like a copious supply of water at the roots during the summer months, and at no season must they be allowed to become dry Propagation is effected by division of the plants in early spring, or by seeds, to obtain which the flowers must be artificially fertilized. —They seed freely when fertilized at the proper time. Only a few of the stronger or larger flowers should be allowed to bear seed. Sometimes a simple shaking of the flower-stalk will accomplish the necessary work of fertilizing, but it is safer to employ the regular method to insure thorough impregnation. The seeds ripen within six weeks' time, and they can be sown soon thereafter, in shallow pans of light, peaty soil, and placed in a warm, close atmosphere until germinated. As soon as the seedlings are large enough, they should be potted singly into thumb-pots, and shifted on as often as they require it, when they will flower in six to twelve months. The chief reason why cochliostemas are grown in America so little is, probably, that it is necessary to keep a much more humid atmosphere in stove-houses than in England, and this is very much against all stove-flowering plants, causing the season of blossoming to be very short (Edward J. Canning)

A *Lvs. red beneath· panicle hairy; fls very fragrant*

odoratíssimum, Lem Lvs lighter green above than in *C. Jacobianum,* and deep purplish red beneath, narrower, and with a similar margin. fls very numerous; sepals more leaf-like, hairy, green, with a reddish tip. I.H 6:217. R H. 1869, p 170

AA *Lvs green beneath panicle not hairy; fls. less fragrant*

Jacobiànum, C Koch and Lind. Height 1–3 ft.· lvs. in a rosette, spreading or recurved, dilated and sheathing at the base, margined brown or purplish, 3–4 ft long, 6 in broad at the base, 4 in broad at the middle peduncles stout, white, tinged purple, 1 ft long bracts large, opposite and whorled, 3–4 in long, acuminate, concave. panicle-branches 4–6 in. long; fls 2–2½ in across, sepals purplish, petals violet-blue Autumn B M 5705 R H 1868 71 G C 1868 323,desc. F S 18·1837–9.

WILHELM MILLER.

COCHLOSPÉRMUM: *Maximiliànea.*

COCKLE. In North America, a name for *Lychnis Githago,* or corn-cockle, a familiar handsome-flowered weed of wheat-fields The name is also applied to the darnel, *Lolium temulentum.*

COCKLE-BUR: *Xanthium,* a weed.

COCKSCOMB: *Celosia.*

COCKSFOOT GRASS: Barnyard Grass, *Panicum Crus-Galli.*

COCOA: Products of *Theobroma Cacao.*

COCOA PLUM: *Chrysobalanus Icaco.*

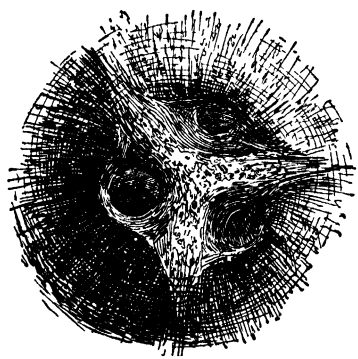
COCO-GRASS: *Cyperus rotundus.*

COCONUT. Plate XXVII Figs 1011, 1012, 1014, 1015 The coconut, *Cocos nucifera,* is the most important of cultivated palms Its nearest relatives, whether or not regarded as in the same genus, are natives of tropical America For this and for other reasons which have been presented by Cook, it must be believed that the coconut is a native of America, and that it was carried westward across the Pacific in prehistoric times While the nut will float and retain its power of germination for a considerable time, its propagation from island to island in known cases has practically always been the deliberate work of men, and it is probable that men were

also responsible for its crossing the Pacific. It was a cultivated plant in Polynesia and Malaya, and in many places the chief crop at the time of the discovery of this part of the world by Europeans. But it reached Ceylon recently enough so that its introduction is a matter of fairly reliable legend. It is now grown in all tropical countries except the interior of continents Its cultivation extends somewhat beyond the tropics, both north and south, but its growth at these extremes, in Florida, India and Madagascar, is not thrifty enough to give it any industrial importance. Within the last two decades, the rise in the price of oils and the discovery of new uses for coconut-oil have caused a tremendous increase in the area devoted to the plantation and cultivation of coconuts.

Climatic conditions favorable for the coconut.

The coconut makes on the climate the characteristic demands of a typically tropical plant It thrives where the mean annual temperature is 72° F or higher, and where there are no great differences in temperature between seasons. Except where supply of ground water



1011. End of a mature coconut. The nut sprouts usually from the largest eye.

makes it independent of local rainfall, the coconut demands an annual rainfall of at least one meter (about 40 in.); and this precipitation should be well distributed through the year In most of the best coconut countries, the rainfall is considerably more than one meter. The coconut can endure exceedingly drying conditions for short periods, and is accordingly adapted to the intense light of the seashore, to resisting strong winds, and to enduring salt water about its roots for short periods of time Moreover, it will live through prolonged droughts. But long dry seasons cut down the crops; and the damage done by droughts lasts for as much as two or three years after the return of rain. A dry season of five or six months every other year will keep the crop at all times down to not more than 40 per cent of what it would be if the supply of water were constant. If there is an ample supply of soil-water, dryness of the atmosphere is favorable to the best production Seacoasts usually have higher land back of them, and the ground-water from the higher country circulates through the soil toward the sea Near the shore it comes near enough to the surface to be reached by the roots of the coconut. For this reason, coconuts thrive on the seashore under climatic conditions that prevent good development in the interior. This is the principal ground for the idea that coconuts thrive only near the sea Around the bases of volcanoes in the interior, similar soil conditions are met with, and such localities are admirably adapted to this crop.

Propagation and cultivation.

The coconut is produced only by seed. Nuts for this purpose should of course be selected from conspicuously good trees They are usually planted in seed-beds, although, on a small scale, there are various other local methods of handling them during germination. The best treatment is to take them from the seed-bed when the plumule is not more than 6 inches high, which will usually be after about six months To avoid the expense of keeping the groves clean while the trees are small, it is common practice to leave the nuts for a longer time in the seed-beds, but the transplanting of older seedlings, even with the greatest practicable care, sets them back for several months. In the Jaffna district of northern Ceylon, the nuts are transplanted from the first seed-beds to others in which they have more room, and are not put in their permanent places until they are three or four years old.

In the first years after the coconuts are transplanted, it is good policy to raise catch-crops between the trees. But these crops should be so chosen that they will not compete with the coconut for light or water, and from the profit they pay, a return should be made to the soil of fertilizers at least sufficient to replace what they have removed By the time the grove is four years old, the coconuts will shade the ground and it will no longer be possible to raise catch-crops on a large scale Then, but not before this time, it is good practice to use the grove for pasture. The returns from live-stock should be at least sufficient to pay for keeping the plantation in good condition and cattle will themselves do a large part of the work in keeping down the other vegetation. Pasturing of other live-stock in coconut groves is in general not to be recommended It is not customary anywhere in the tropics to give to coconut plantations such cultivation as is given to orchards in temperate countries It has even been believed that any but the most shallow cultivation would be detrimental by destroying the roots near the surface, and that machine-cultivation was likely to be too expensive to be profitable, in view of the time that it would have to be kept up before the coconut begins to pay returns Limited experience in the Philippines indicates that real cultivation produces very much the same results with coconuts as it does with other crops Coconuts respond, as do other crops, to the application of manures containing potash, nitrogen, and phosphorus. So far as the very limited evidence shows, the demand for these three fertilizing elements is in the order given. With ordinarily good treatment, coconuts come into bearing in seven or eight years. Single trees of standard varieties will bear fruit in five years, while others will require ten If the coconut is treated as a wild crop, which is by no means uncommon, and little or no attention is given it after the first three years, it will be ten or fifteen years, as a rule, before a full crop is produced and even then the crop will be an inferior one.

Pests.

With the increase in the industry in the tropical world, and with the increase in commerce, there have been created conditions favorable to the development and spread of pests Twenty years ago, serious coconut pests were practically unknown, and only eight years ago, Prudhomme, in an excellent general treatment of the coconut industry, listed as serious pests only two or three insects and no other organisms There are now known as serious pests various species of Rhynchophorus, known as palm weevils, Oryctes, called the rhinoceros beetle; a scale, *Aspidiotus destructor*, closely related to the San José scale, at least two fungi, and the organisms causing bud-rot The latter have been determined in the West Indies to be *Bacillus Coli*, and in India to be a fungus, *Pythium palmivorum*. Besides these, there are a large number of minor or local pests, including weevils and other beetles, the

larvæ of moths and butterflies, insects of other groups, and fungi. Damage is also done in places by crustaceans, and by rats and other higher animals Forests made up of one kind of tree practically do not exist in nature in the tropics, and when such forests are made, as has been done with the coconut, the prevention of devastation by pests will be accomplished only by greater care than is ordinarily demanded to protect the crops of temperate lands.

Varieties.

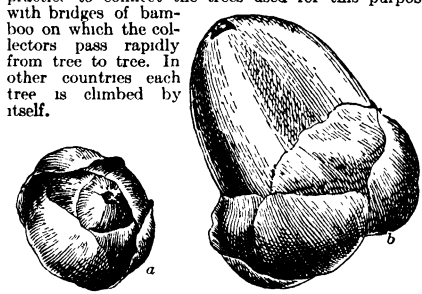
A very large number of varieties of coconuts is known in different parts of the tropics, but a careful comparative study of their merits has never been made on a large scale and with nuts from many different sources The best experiment began less than a decade ago in Madagascar In several localities in the Philippines, there are strains of very large nuts, of which, as a plantation average extending over years, 3,300 produce a ton of copra. In favorable seasons the production has been at the rate of a ton from 2,800 nuts There are reports of similar large nuts from other countries, but no data as to their yield on a plantation scale In the parts of the Philippines having the greatest coconut industry, it requires 5,600 to 6,000 nuts to produce a ton of copra, and the same figures apply to Ceylon and various other coconut countries. In still other places the nuts are so small that 7,000 are required to the ton. There are varieties characterized by shape and by color, but these characteristics seem not to be related to the yield either of copra or oil. The nuts of the Laccadive and Maldive Islands are reputed to produce a particularly good fiber Throughout the eastern tropics, coconuts are locally used to produce liquor For this purpose, early maturing varieties that are likely also to produce very small nuts, but numerous clusters, are selected There are varieties in Ceylon and the Philippines which bear at the age of four years, while the varieties in extensive cultivation and used for the production of copra can none of them be relied upon to produce a crop in less than seven years and not in less than ten years unless properly treated A Philippine variety known as Makapunó has the interior of the nuts completely filled with a soft, sweet tissue, used as a table delicacy Such nuts sell locally for about 10 cents, while the ordinary nut is worth 2 or 3 cents

Uses and products of the coconut.

The local uses of the coconut are almost unlimited. Besides being of practical utility in a very large number of ways to the people of the Malay-Polynesian region, it has, as a result of its practical importance, acquired a prominent place in the rites and superstitions of the people of this part of the world Thus Murray tells of a tribe of Papuans, among whom it is not proper for a man to eat a person whom he has killed, this privilege being reserved for his associates, but a man may eat the heart of his own victim if he sits on one coconut and balances himself with his feet on two others while he prepares and devours it.

The products of great industrial importance are toddy and its derivatives, coir, and copra and its products

Toddy is an usual English name of the fresh beverage obtained from the unopen flower-clusters In the Philippines it is known as "tubâ" The mode of securing it differs somewhat in the three countries in which it is secured on an industrial scale, the Philippines, Java and Ceylon. In all of them, the spathe is bent down gradually and the tip is then cut off A thin slice is afterward cut off with a sharp knife, usually twice a day. After a few days of this treatment, the irritation results in a flow of sap from the cut surface. This sap falls into a jar or bamboo tube from which it is collected, as a rule twice a day, and a very thin slice is removed from the end at each time of collection. This continues until the whole inflorescence has been removed by the series of slices. The amount of toddy collected depends on the vigor of the tree, on the weather, and on the skill of the workman Under fairly favorable conditions, a good workman will secure a quart or more a day from one inflorescence The technique of this business seems to be better developed in the Philippines than elsewhere, with the result that more toddy is secured in a given time from the tree. The toddy is used as a fresh beverage or as a source of alcohol, or less frequently of sugar, or still more rarely of vinegar; it is also a common source of yeast in the East Indies The toddy, as it falls from the cut branch, contains about 16 per cent of sucrose This inverts very rapidly if permitted to do so, and the invert sugar is in turn rapidly fermented to alcohol In parts of the Philippines, the production of strong liquor in this way is a business of some importance If sugar is to be produced, care is taken to keep the vessels clean and approximately sterile, and the inversion is often prevented by the use of tanbark from one of the mangroves, usually Bruguiera. If alcohol is the product desired, the same bamboo tubes are used over and over without cleaning In the Philippines it is common practice to connect the trees used for this purpose with bridges of bamboo on which the collectors pass rapidly from tree to tree. In other countries each tree is climbed by itself.



(Nat size at this stage.) (Nat size.)

1012 Stages in the growth of a coconut.

Coir is produced for local use in many parts of the world, but as an article of commerce comes chiefly from Ceylon This fiber was the old staple cordage material of the Polynesian region As a fiber material, it is conspicuous for its elasticity, being able to stretch 26 or 25 per cent without exceeding the limit of elasticity It is also remarkable for lightness, for resistance to decay, and for the short length of the individual cells It is accordingly a valuable fiber for use in ropes subject to abrupt strains, for calking boats, and for a stuffing fiber Its stiffness and durability make it especially serviceable for the manufacture of mats, and this is its chief commercial use.

Copra —The principal coconut product exported from most producing regions is copra, which is the dried meat or hard endosperm of the fruit To produce the best copra, nuts should be thoroughly and uniformly ripe, and this condition is best guaranteed by permitting them to ripen on the trees until they fall, and then to collect and use them at frequent intervals However, it is far more common practice to harvest them before they fall, going through the groves at regular intervals This is most commonly done every three months. The nuts are cut down in various ways The simplest method is the use of a long pole made of detachable joints of bamboo and bearing at the top a sharp and recurved knife. A nut-gatherer then goes from tree to tree and cuts down the nuts that are ready, without leaving the ground. This method is the local one used in certain parts of the Philippines.

Elsewhere in the Philippines and in many other places, the practice is to climb each tree, using notches cut at convenient heights for this purpose If these notches are cut with sufficient care, it probably can be done without real damage to the tree, but in practice such care is not usually taken, and the notches are very often centers from which decay of the trunk begins. In other places the nut-gatherers climb the trees without notches. To do this easily, they usually bind their ankles together with a thong, or pass a rope around the hips and around the tree, or use both of these devices The old story of the harvesting of coconuts by the use of monkeys is not altogether a myth. In the Sunda islands and in Sarawak, monkeys are sometimes trained for this purpose; and from Sarawak, these trained monkeys are occasionally exported to the Straits settlements In some of the islands of the south seas, the entire nuts, husk and all, are split into halves with an axe, and in Ceylon a machine for this purpose has come into limited use. Elsewhere, the first step in the preparation of copra is the removal of the husks This is usually done with the aid of a piece of iron, three cornered and moderately sharp, mounted on an erect stick and standing at about the height of the knee. This implement is in universal use in the Philippines, and elsewhere in the East, and has of late years come into use in the tropics of the New World. A machine to remove the husks has also been invented, but the most that is claimed for it is that a workman can husk a thousand nuts a day, and this is only the standard day's work for a nut-husker in the Philippines by the old method After the removal of the husk, the nut is split into two halves by a sharp blow with a heavy knife The water is allowed to run out on the ground —Methods of drying copra fall under three heads sun-drying, grill-drying, and kiln-drying Centrifugal dryers have also been tried and are said to give good results Sun-drying is the oldest method, and is a good one where the climate is such that the drying can be trusted to go on without interruption Under favorable conditions it produces the finest grade of copra, Cochin sun-dried being the standard of excellence Most Philippine copra is grill-dried A hole is dug in the ground on which is placed a grating usually made of bamboo, and the whole protected by a roof Coconut husks and shells are used for fuel The heat and smoke rise directly from the fire to the coconuts Sun-drying takes usually five to nine days; if more than this is required, the method is unsafe Smoke-drying is finished as a rule in a single day or in parts of two days Smoke-dried copra is unsuited for the manufacture of food products and accordingly sells at a lower price than the best copra It is a good way of making poor copra, for if any copra is imperfectly dried or is even in part the product of unripe nuts, it ferments with a considerable loss of oil, and this fermentation is decidedly checked by smoking Kilns for drying coconuts are of various patterns in different countries, and if properly handled always produce a high grade of copra There is one kiln in the Philippines which handles more than three tons of copra at a charge, and dries it in six or eight hours By all methods, it is customary to make two stages of the drying, one immediately after the nuts are opened, and the other after the meat has shrunk enough to be easily removed from the shells The ultimate use of copra is the manufacture of oil, an industry which has been developed to the greatest extent in France In all coconut countries there is a local business in manufacturing oil This is done by various primitive methods, some of which produce a food or toilet product of the highest possible quality. In the manufacture of such oil, the utmost care is taken and the product is of purely local use Oil for wider distribution is manufactured with less care, by methods characteristic of the different countries To prepare oil for world commerce, such establishments as have long been used in European countries, and to a less extent in the United States, have more recently been founded in the producing lands. The oil has a variety of uses. It was formerly consumed almost entirely in the manufacture of soap and candles Principally during the last decade, methods of refining and separation have been developed, by which excellent butter-substitutes are made. As the butter produced in this way is palatable and most digestible, and is cheaper than real butter, these products have found a ready sale, with the result that there has been a great increase in the demand for good grades of copra and a consequent improvement in the general quality produced in most countries, and an increase in the price of all grades. It seems probable that the market will for some time continue to increase more rapidly than the supply

Other products —A well-known product is desiccated coconut Among producing countries, Ceylon is the only one which has taken up the manufacture of this article It is prepared directly from the fresh meat of ripe nuts Very large numbers of coconuts are also put upon the market of temperate countries as "cocoanuts," usually after the removal of the husk The United States is the chief market for these nuts and the export of them is accordingly a conspicuous feature of the business in lands situated where delivery in the United States is economically possible, that is in the West Indies and to a much less extent in the islands of the Pacific An exportation of this kind is also assuming large proportions with Australia as a market For all kinds of coconut produce, Ceylon long held first place and the business of producing coconuts, copra and oil, as well as coir, and desiccated coconut, has reached a better development in Ceylon than anywhere else However, during the last few years, the Philippines have far outstripped Ceylon in the production of copra. The export from the Philippines in the year ending June 30, 1912, was more than 160,000 tons In this year, copra was for the first time the foremost export of the islands, taking from abacá the place which it has held almost without interruption for the last fifty years E B COPELAND.

CÒCOS (Portuguese, *monkey*, from the nut, which suggests a monkey's face) *Palmàceæ* This genus includes the coconut tree, *C nucifera*, and a few pinnate palms cultivated for ornament in the North under glass, and in southern Florida and southern California as avenue and ornamental trees See page 3567

Low or tall palms, with slender or robust ringed spineless trunks, often clothed with the bases of the lvs : lvs. terminal, pinnatisect, segms. ensiform or lanceolate, equidistant or in groups, 1- to many-nerved, entire at the apex, or with 1 lateral tooth, or more or less deeply lobed, the margins smooth, recurved at the base, rachis 3-sided, acute above, convex on the back; petiole concave above, smooth or spiny on the margins, sheath short, open, fibrous spadices erect, at length drooping, the branches erect or drooping, spathes 2, the lower one the shorter, split at the apex, the upper one fusiform or clavate, woody, furrowed on the back; bracts variable, fls white or yellow. fr large or medium, ovoid or ellipsoidal, terete or obtusely 3-angled, often fibrous-coated as in the coconut —Species 56 in Trop and Subtrop S Amer , 1 in the tropics around the world The genus is allied to Maximiliana and Attalea, and distinguished by its male fls having lanceolate petals, 6 included stamens, and a 1-seeded fr. G C. H. 23 439

The coconut is the example most commonly cited of dispersal of seeds by water Its buoyant, impervious husk is said to enable it to cross an ocean without losing its germinating power Its structure is interesting and at first puzzling. Although it is a dry, indehiscent, one-seeded fruit, it seems very unlike an achene, as

for example, in the Compositæ. Structurally, it is more like a drupe, for the fibrous husk is formed from the outer part of the pericarp, and the hard shell inclosing the meat from the inner In other words the husk is exocarp and the shell endocarp. The milk of the coconut is unsolidified endosperm In the cereal grains it is the endosperm which affords most of the material used for human food Only a part of the liquid matter of the coconut solidifies, and the milk is left in the center The eyes of the coconut (Fig 1011) mark the positions of the micropyles, and germination takes place only through the larger one. Palm pistils are three-carpelled and each carpel in Cocos has one ovule The marks of the three carpels are seen in Fig 1011, but only one ovule develops into a seed. Fig 1012 tells the story of the growth of a coconut In *a*, the young nut is enveloped by three petals and three sepals. At *b*, the pericarp has far outgrown the sepals and petals. Sometimes the floral envelopes remain when the nut is picked Coconuts, like many other fruits, often grow to a considerable size without pollination, and then perish.

Of the species cultivated for ornament, *C. Weddelliana* is by far the most important It is sold in great quantities from 3- and 4-inch pots when the plants are 12 to 15 inches high They are favorite house-plants, as their culture is easy, and they grow slowly and retain their beauty a long while They are much used in fern-dishes As a house-plant, *C Weddelliana* is probably the most popular species of all the smaller palms It is especially suitable for table decoration In distinguishing tropical from subtropical regions, the coconut is an excellent guide It flourishes best where frost is never known, although there are magnificent specimens at Miami and Palm Beach, Florida, both places having rare but sharp frosts The oil extracted from the nuts is an important article of commerce The fiber refuse is much used by florists and gardeners Being open, spongy, very retentive of moisture, clean and easily handled, it is a favorite material in which to root bedding-plants and to start very small seeds, but it is not used for permanent potting See U S Dept Agric , Bull of Div. of Ent (new series) 38 20-3, for a report of diseased coconuts For culture of Cocos under glass, see *Palms*

Cocos in Florida —The species of the *C. australis* group (as known in the trade) are dry-land palms, the best and most beautiful palms adapted to poor sandy soils in Florida In moist and rich ground they are subject to diseases, particularly to blight On dry land, they thrive with great vigor, and although slow growers, they are strikingly beautiful specimens when only a few years old They look best in groups of five or even a dozen planted together (about 12 to 15 feet apart) After they have formed trunks 5 to 10 feet high they are very impressive, particularly when the background consists of tall bamboos or dark evergreens such as *Magnolia grandiflora* or live-oaks. All the species of this group have leaves more or less glaucous, silvery white or bluish green The leaflets are often very hard to the touch—very rigid The petiole at its base is provided with short blunt spines The roots are brown and quite numerous, but the root-system is very shallow, the trunks do not rest deep in the ground as is the case with the Sabal and Phœnix species, and for this reason they are easily blown over or they acquire a leaning disposition In planting these palms, they should be set in a saucer-like cavity, which can be filled up gradually Both young and old plants are easily transplanted in November and December, but it is always advisable to plant only young specimens Few palms require so little care and fertilizer as these Cocos species. A good application of stable manure as a mulch when the rainy season begins helps them along wonderfully, or they many be fertilized with a combination consisting of equal parts of ammonia, phosphoric acid and potash. The flowers are always inclosed in a club-like spathe varying in size from a large walking-stick to a baseball club These spathes burst open with a crack and reveal the much-branched flower-spike, varying in color from a creamy white, yellowish, lavender-crimson to a deep violet The fruits also vary in size and color Some of them are not larger than a large pea, others as large as a plum, some are yellowish and others orange and red in color (H. Nehrling)

Cocos in California —After passing through a severe test during the first week in January of the year 1913, the several species of Cocos palms are in a condition in which one may safely judge of their comparative hardiness In the Cocos palms found in local gardens are two very distinct groups These two groups may each contain but one species having several varie-



1013. Cocos Weddelliana.

ties, or they may consist of several species as they are known "in the trade," and it is upon the latter basis they are here dealt with (1) The dwarf group is commonly and widely represented by the one known as *C australis* and the other and less-known kinds are catalogued as *C. Alphonsi*, *C Bonnettii*, *C. campestris*, *C Gaertneri*, and *C. Yatay.* Occasionally two others, *C. odorata* and *C. pulposa*, are listed All those named are quite hardy and may safely be planted from Los Angeles to San Francisco without fear of losing them through freezing, though in places some may get "scorched" while young With age all become quite hardy (2) To a taller and more striking group, belong those of which *C. plumosa* is the best known and, unfortunately, most widely planted type. These are *C. botryophora*, *C coronata*, *C Datil*, *C. flexuosa*, *C. plumosa*, and *C. Romanzoffiana* Of these six four have proved quite tender and three quite hardy, the latter lot resistant to at least a half-dozen degrees more of cold than the former The tender ones are: *C. botryophora*, *C. coronata*, *C plumosa*, and *C. Romanzoffiana*. Those proving hardy over all of southern California in 1913 were *C Datil* and *C flexuosa*, the latter the

only one at all common. To these may be added the true *C. australis*, not known here in the trade at all, a tall-growing species, and not the dwarf one commonly sold under this name. J Harrison Wright, of Riverside, has grown this novel species and assures the writer of its hardiness in his garden where *C plumosa* succumbs in comparatively mild winters. These notes are based upon a close study of these species and varieties as observed during the past few winters in the gardens of Los Angeles and Pasadena in Southern California. (Ernest Braunton.)

INDEX.

aurea, 8.	coronata, 2, 11.	nucifera, 8.
australis, 2, 7.	Datil, 2, 10	plumosa, 2, 4.
botryophora, 2.	eriospatha, 1.	Romanzoffiana, 6.
butyracea, 5	flexuosa, 2	Weddelliana, 3.
campestris, 12.	insignis, 13.	Yatay, 9.

A. *Filaments present on the rachis.*

1 **eriospàtha,** Mart St 9–15 ft. high, 10–14 in. thick, capitately thickened with the persistent bases of the petioles. lvs ample, glaucous, finely pectinate, margins of the rachis with excurrent filaments, segms about 1 in apart, the lower elongated, linear, 20–24 in long, very long-acuminate, the upper narrowly linear, short, attenuate, 1 ft long, 2 lines wide, all rigid, faintly nervose-striate spadix thick, branched but very compact. S Brazil —"The hardiest of the genus and one of the hardiest palms in S Calif. Fronds bluish· fr. pulp tastes like apricots"—F. Franceschi, Santa Barbara Some of the *C. australis* of the trade may belong here.

AA. *Filaments absent.*

B. *Rachis abruptly contracted above the insertion of the lowest lfts.*

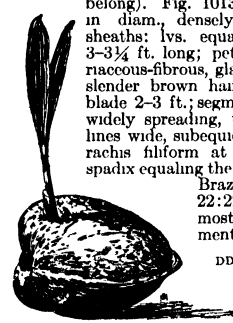
2 **flexuòsa,** Mart St 9–12 ft high, 2–3½ in diam., arcuate-ascending, naked just above the base, thence densely clothed with dead petiole bases lvs lax, 3–6 ft long, petiole flat above, arcuate, at first tomentose, later smooth; rachis abruptly narrowed above the insertion of the lowest lf-segm, thence linear-filiform at the apex, excurrent, segms 70–90 on each side, rigid in opposite groups, the middle 10–14 in long, ⅓in wide, the upper 4 in long, ⅛in wide spadix long-peduncled and rather loose. Brazil —Cult in northern greenhouses Similar in habit to *S plumosa*, but with more finely cut lvs, and in S. Eu considered to stand more frost Probably the *C. flexuosa* planted in this country is not the true species *C flexuosa* of Martius, but of Hort, a hardy form of *C. Romanzoffiana,* Cham, which latter according to the late Barbosa-Rodriguez is a polymorphic species including, besides this *flexuosa* type, all our garden forms known as *C plumosa,* Hook., *C coronata,* Hort., not Mart, *C botryophora,* Hort, *C Datil,* Grisch & Drude, and *C. australis,* Mart. The foregoing description has been drawn from Martius and not from cult. specimens The true *C flexuosa* of Martius is a slender-stemmed palm from tropical Brazil The true *C. australis* of Martius is native in Paraguay; it is like *C. plumosa* in appearance but hardier.

BB. *Rachis not abruptly contracted.*

C. *Lfts flaccid.*

D. *Arrangement of lfts. equidistant.*

3. **Weddelliàna,** Wendl. (*Glaziòva Martiàna,* Glaz., to which genus Martius considers the species to belong). Fig. 1013. St. 4–7 ft. high, 1¼ in diam., densely covered with persistent sheaths: lvs. equally pectinate-pinnatisect, 3–3¼ ft. long; petiole 8–20 in; sheath coriaceous-fibrous, glabrous or tomentose, with slender brown hairs, at length evanescent; blade 2–3 ft.; segms. about 50 on each side, widely spreading, the middle 5 in. long, 2 lines wide, subequidistant, glaucous beneath; rachis filiform at the apex, brown-scaly: spadix equaling the lvs, stiff and erect Trop. Brazil. R H. 1879, p 434 I H. 22:220. A G 16 345 —The most important of small ornamental palms for the N.



1014. Coconut germinating.

DD. *Arrangement of lfts. in groups of 2–4.*

4 **plumòsa,** Hook St. 30–36 ft high, 10–12 in. thick, ringed at intervals of a foot, clothed near the apex with remnants of the dead petioles lvs. erect-spreading, 12–15 ft. long, recurving; petiole a third to half as long as the blade, segms linear-acuminate, sparse, solitary or mostly in groups of 2–4, 1½ ft. long, deflexed near the apex spadix usually 3 ft. long and much branched, the branchlets pendular Cent Brazil. B M 5180 —The chief avenue palm of the genus A quick grower, ultimately 50 ft high in S. Fla and Calif The slender smooth boles and heads of graceful recurving lvs make this a very attractive tree.

CC *Lfts rigid*

D. *Form of lfts sword-shaped*

5 **butyràcea,** Linn Sts very tall, naked: lvs pinnate, lfts simple. spathe cylindrical-oblong, 4–6 ft; spadix as long as the spathe, 4–6 ft, branches of the spadix about 1 ft., thickly clustered and somewhat pendulous Venezuela —Rare and perhaps confused with *Scheelea butyracea.* Little known, although long ago described.

6 **Romanzoffiàna,** Cham. Sts 30–40 ft high, somewhat fusiform above: lvs. about half as long as the caudex, the withered ones deflexed, pendent, the upper spreading, often arching; segms conduplicate at the base, ensiform: spadix about 6 ft. long, at first inclosed in a stout pendulous spathe which appears among the lowest lvs. S Brazil near the sea; according to recent characterizations, it comprises a wide variety of forms, as explained under No 2



1015. Coconuts.

DD. *Form of lfts. linear apex obtuse: petiole glaucous.*

7. **australis,** Mart. PINDO PALM. Height about 30 ft.: st erect, columnar, equal, strongly annular above: lvs. 9–12 ft. long, the sheath fibrous and glabrous; petiole naked; segms. linear, glaucous, rather rigid: fr as large as a pigeon's egg, outer pulp sweet, edible, seed oily Paraguay. G C. III 18.739. A F. 5 515, 7:805. R H. 1876, p 155.—A good grower. Cult. under glass and outdoors in Fla. and Calif

8. **nucifera,** Linn. COCO PALM COCONUT TREE Figs. 1014 (adapted from Cook), 1015. Caudex 40–100 ft. high, flexuous, thickened at the base: lvs 12–18 ft long; lfts. linear-lanceolate, 2–3 ft., coriaceous, flaccid; petiole 3–5 ft, stout. Seashores within the tropics and at Miami and Palm Beach, Fla. Indigenous to Cocos or Keeling Isls of the Indian Ocean, but recently thought to be native of Trop Amer See O F Cook, Contr U. S Nat Herb, 7·257–93 (1901); 14 271–342 (1910). R H 1895, p 457 Mn 2·171 G F 7 15.—Produces the coconuts of commerce. Var **aurea,** Hort, is a form remarkable for its orange-yellow sheaths, petioles and midribs." It is known in cult only in England

DDD. *Form of lfts narrowly lanceolate.*

E *Lvs long, 6–15 ft. in mature specimens.*

F. *Petiole spinose-serrate segms. of lf less numerous.*

9 **Yatay,** Mart St 12–15 ft high, over 1 ft. diam, naked below, covered with dead sheaths above. lvs recurved, spreading 6–9 ft, sheath 1 ft long, fibrous at the mouth, petiole 1½ ft long, spinose-serrate, the spines increasing in length towards the lower end of petiole, segms 50–60 on a side, crowded below, then equidistant, linear-lanceolate, the uppermost long-setaceous filiform, the middle ones 2½ ft. long, 2–5 in wide, the upper 20 in long, ¼in wide, all rigid, glaucous beneath. spadix about 4½ ft. long with at least 150 branches Brazil, Argentina

FF. *Petiole not spinose-serrate segms. of lf. very numerous*

10 **Datil,** Drude & Griseb. St 30 ft high, 8–12 in diam lvs 12–15 ft long, sheath about 16 in long, petiole 1½ ft long, 1⅔ in wide, ⅔in thick, segms. linear-acuminate, glaucous, densely crowded in groups of 3 or 4, 150–160 on each side, the lowest 2 ft, middle 2¼ ft and apical 1 ft, the uppermost filiform, all narrow, stiff and rigid, the dried lvs glaucous green or whitish spadix 3–3½ ft long with at least 300 spirally twisted branches Argentina, Isls and river banks.—The frs are edible, resembling those of the date palm Hardier in S Calif. than *C plumosa, C flexuosa,* and *C Romanzoffiana*

11 **coronata,** Hort, not Mart. Trunk at length 18–30 ft high, 8 in diam, erect, deeply ringed: lvs. erect-spreading, 6–9 ft long, short-petioled, arranged in a close, 5-ranked spiral, the long-persistent bases of the petioles forming a spiral-twisted column below the crown; lf-segms in groups of 2 or 3, folded together from the base (conduplicate), linear-lanceolate, coriaceous, densely crowded, about 100 on each side; midrib 4-sided below, 3-sided above: spadix about 2½–3 ft. with not more than 60 branches. Brazil.

EE. *Lvs. shorter, 3–4½ ft. in mature specimens.*

F *Apex of lfts. obtuse.*

12 **campestris,** Mart St. 8–10 ft. high, thickened, scaly: lvs. spreading-recurved, rigid, 3–4½ ft long; rachis elevated, triangular above, convex below; segms narrowly lanceolate, 30–40 on each side, obtuse at the apex and shortly cordate-acuminate: spadix about 2½ ft long, with 10–14 branches. Brazil.—Hardier than *C nucifera,* but scarcely known in cult in N. Amer Perhaps hardy as far north as N C.

FF. *Apex of lfts acuminate.*

13 **insignis,** Mart. (*Glaziova insignis,* Hort.) St. 3–6 ft high, 1½ in diam · lvs 4½–6 ft. long, sheath densely brown-lanate; petiole shorter than or equaling the sheath, a fourth or fifth as long as the rachis, segms. equidistant, 50 on each side, narrowly lanceolate, obliquely acuminate and caudate, silvery glaucous beneath: spadix about 3 ft. long, with about 50 branches Brazil

The following are trade names of rare or botanically little-known plants not sufficiently described *C Alphonsei*—*C Arechavaletàna,* Barb, is described as somewhat like C Romanzoffiana but taller and making larger crowns It is a native of Uruguay—*C Blumenàna*=*C eriospatha*—*C Bonnetii*—*C Gaertneri*=(?)—*C Geriva,* Hort G C III 27 293 figures C Geriva, a remarkable Cocos (?) with 4 branches Nothing further is known of this plant It may be C Gerika, Rodr =C botryophora, Mart—*C Maximiliàna,* Hort =(?)—*C odoràta,* Rodr St short lfts in 3's or 5's, linear-lanceolate, petioles spiny fr yellowish green or pink, pulp scented. Brazil R H 1893, p 345—*C pulpòsa,* is supposed to be very like C eriospatha This species is scarcely known in this country—*C Yurumajnas*=(?).

N TAYLOR †

CODIÆUM (probably from Greek for *head,* the colored leaves being used for crowning-wreaths, or from the Malayan name). *Euphorbiàceæ* CROTON. VARIEGATED LAUREL. Tropical shrubs or trees grown for the variegated and interesting foliage, as greenhouse plants or for summer bedding outdoors

Leaves alternate, simple, somewhat thick and leathery, pinnately veined, glabrous: juice somewhat milky fls monœcious, in slender axillary racemes; staminate fls with petals, calyx imbricate, stamens 20–30, erect in the bud, pistillate fls apetalous, ovary 3-celled, 3-ovuled.—Six species of Malaya and Pacific Isls, not closely related to any other commonly cult. Euphorbiaceæ. Differs from the true crotons in the erect stamens, glabrous foliage and more or less milky juice

The almost endless variety of codieums (or crotons of gardens) are probably all from one botanical species, greatly varied by selection and crossing Although a great many of these bear Latin binomials they intergrade so that it is often difficult to separate them or to make a reliable classification, however, they may be grouped conveniently as below. Totally different leaf forms and color variations often appear on the same plant The latest botanical treatment is by Pax in Das Pflanzenreich, hft. 17, and is followed in this article.

The crotons are prized chiefly for the varied and brilliant markings of the leaves The young leaves are usually green and yellow, changing later to red, although in some the markings remain yellow or with red only in the petiole They are usually kept not over 2 to 3 feet high, but if given opportunity will grow into considerable trees in the greenhouse. They are good subjects for massing in the open and develop most brilliant colors in our bright hot summers, however, they will not stand frost

Codieums (or crotons, as they are popularly known in America) are beautiful plants with many forms of handsome and odd foliage of the most brilliant coloring The colors range from almost pure white to light and deep yellow, orange, pink, red and crimson, in the most charming combinations In some cases one color predominates, as in Carrièrei (yellow), Czar Alexander III (crimson), Hawkeri (light yellow) These varieties of distinct coloring make beautiful specimen plants for jardinieres; and their beauty is enhanced when used in jardinieres of appropriate color As exhibition plants they are very effective, and may be grown to specimens 5 or 6 feet high, or even larger In smaller sizes, codieums are much used as table plants, for which purpose well-colored tops are rooted and grown on until they are from 12 to 15 inches high The narrow-leaved varieties are most used for this purpose Codieums are very attractive in vases and window-boxes and for mantel and table decorations They are also

very valuable as bedding plants. Planted in clumps or masses, the effect of the combination of rich colors is charming. They should be planted in any good, rich, not too heavy soil, and regularly syringed to keep down red spider They color best when fully exposed to the sun, and should not be planted out until about the 10th of June in the neighborhood of New York and Philadelphia. If something is needed to make the beds look attractive early in the season, it is a good plan to plant pansies in April, to remain until it is time to plant the codieums. Some of the tender varieties, such as Reedii, albicans, and a few others, are inclined to burn in the extremely hot weather, but nearly all the sorts do well bedded out Among the very best for this purpose are Queen Victoria, Dayspring, Baron Rothschild, Andreanum, Lady Zetland, Carrièrei, Barryi, Hawkeri, fasciatum, ametumense —The house culture of codieums is very simple. It is neces-



1016. Codiæum variegatum Baronne de Rothschild. (An example of form platyphyllum.)

sary that a night temperature be maintained of 70° to 75°, and that the air be kept moist by frequent syringings Cuttings of half-ripened wood may be easily rooted at any time from October until June, a bottom heat of 80° being just what they need When very fine specimens are desired, root strong and shapely tops by making an incision in the stem and tying moss around the wounded part; it will be rooted ready to pot in about three weeks By this method all the foliage may be retained, and a perfect plant will result. The more light the plant receives, the better will be the color, but with some kinds of glass it is necessary to shade lightly to prevent burning of the leaves. They may be grown finely in a house glazed with ground glass, which admits the light and does not require shading It is well to syringe two or three times a week with tobacco water, to kill mealy bug and red spider. Little's Antipest, or any emulsion of coal-oil, is a good insecticide for codieums New varieties from seed, the result of crossing existing sorts, are continually being raised. Seed ripens freely under glass in North America, and there is no doubt that the list of about eighty choice varieties now in cultivation will be largely added to in the near future. (Robert Craig.)

variegàtum, Blume, var. **pictum,** Muell. Arg. (*C. mèdium,* Baill. *C. variegàtum* var. *genuinum,* Muell. Arg., in part *C. pictum,* Hook. *Cròton variegàtus,* Linn. *Cròton pictus,* Lodd. *Phyllaùrea Codiæum,* Lour.). Lvs. ovate to linear, marked with various colors, entire or lobed.—Cult. throughout the Old World tropics as well as in Eu. and Amer. The wild form with green lvs. is var. *moluccànum,* Muell Arg. (*C. moluccànum,* Decne.). B M. 3051. L B.C 9:870.

A. *Foliage plane or recurved, entire, not appendiculate.*

B. *Lvs. 2–3, rarely 4 times as long as broad, usually broadest above the middle Form* **platyphyllum,** *Pax.*

C. *The lvs. with practically no red coloration.*

Hort vars : aureo-maculatum, aureo-marmoratum, Baron Frank Seilliere, Barryi, Bergmanii, Bruce Findlay, Carrièrei, Delight, Exquisite, fasciatum, fucatum, Golden Queen, grande, Hawkeri, Henryanum, Hookeri, invictum, Jamesii, lacteum, magnolifolium, maximum, medium variegatum, Orvilla, ovalifolium, Princess Waldeck, superbiens, tournfordensis, Truffautii.

CC. *The lvs., at least when older, red colored.*

Hort. vars : Andreanum, acubæfolium, Austinianum, Baronne James de Rothschild (Fig 1016), B Compte, Beauty, Dayspring, Dormannianum, Hilleanum, Le Tzar, Magnificent, Marquis de Guadiaro, Me Lucien Linden, Mortii, Mrs Iceton, Nestor, Newmannii, Penninckii; pictum, Pilgrimii, Prince Henry, recurvifolium, Reidii, Reginæ, roseo-pictum, Stewartii, Williamsii

CCC *The lvs. broad, color not specified.*

Hort. vars Compte de Germiny, d'Haenei, Dr. Friedenthal, Hendersonii, Kreutzeanum, Makoyanum, marmoratum, Prince Royal, Sanderi, Seemannii, Sinai, Stroemeri, verum, Watsonii

BB. *Lvs. lanceolate to narrowly lanceolate, 5 or more times as long as wide Form* **ambiguum,** *Pax.*

C. *The lvs with practically no red coloration*

Hort vars albo-lineatum, angustissimum, ametumense, bellulum, Burtonii, concinnum, Countess, Crown Prince, Davisii, Duvalii, eburneum, elongatum, eminens, Goednoughtii, irregulare, latimaculatum, maculatum, Monarch, Mooreanum, Mrs Swan, volutum, Weismanii, Wilsonii

CC. *The lvs , at least when older, red-colored.*

Hort. vars : albicans, amabile, Broomfieldii, Challengerii, Chantrieri, chrysophyllum, Cooperi, Drouetii, Duvivieri, Flamingo, Hanburyanum, imperiale, inimitabile, insigne, Jubilee, Lady Zetland, lancifolium, Macfarlanei, magnificum, Massangeanum, multicolor, musaicum, Nevillæ, princeps, Queen Victoria, recurvatum, Sunshine, triumphans, triumphans Harwoodianum, Vervætii, Victory, Veitchii, Youngii

CCC. *The lvs. medium width, lanceolate, color not specified.*

Hort vars : Boucheanum, Eckhautei, Eclipse, Excellenz, Flambeau, Gaerdtii, Grusonii, Imperator, Leopoldii, Margarete Daniel, marginatum, nerifolium, Oberstleutnant Brode, Ohlendorffii, Pres Chereau, Said Pascha, Spindlerianum, splendidum, undulatum.

BBB. *Lvs linear, 1 cm (⅜in) or less broad. Form* **tæniosum,** *Muell. Arg.*

C. *The lvs. with practically no red coloration.*

Hort. vars.: aigburthiense, aureo-punctatum, Dodgsonæ (in part), elegantissimum, Elvira, gloriosum, Hermon, Johannis, Phillipsii, superbum, Van Oosterzeei.

CC. *The lvs. with red color, at least when old.*

Hort. vars.: Bragæanum, elegans, majesticum, Mrs. Dorman, nobile, Princess of Wales, Rodeckianum, ruberrimum, sceptre.

CCC. *The lvs. narrow linear, color not specified.*

Hort. vars.. Donai, Fascination, Grayii, Khasingii, lineare, pendulinum.

AA. *Foliage lobed, or with margin crisped or spirally twisted, or with a hair-like or lf.-like apical appendage.*

B. *Lvs entire, with margin crisped, or the whole lf. spirally twisted, without appendage. Form* **crispum,** *Muell Arg*

Hort vars : caudatum tortile, Chelsonii, Cronstadii, Elysian, Eyrei, Katharina, Madam Seilliere, Rex, spirale (in part) (Fig. 1019), Warrenii.

BB. *Lvs more or less 3-lobed, at least constricted in the middle (panduriform) Form* **lobatum,** *Pax.*

c *The lvs panduriform or indistinctly lobed.*

Hort vars.. Bismarckii, irregulare, lyratum, montifontanense, multicolor, Princess Matilda, Russelii, Thomsonii

cc. *The lvs distinctly 3-lobed.*

Hort. vars · Craigii, Disraeli, Evansianum, Fred Sander, Goldiei, hastiferum, illustre, Lord Derby, maculatum Katonii, trilobum.

BBB *Lvs entire or nearly so, the midrib projecting, usually below the apex, as a horn-like appendage. Form* **cornutum,** *André.*

Hort vars · appendiculatum, chrysophyllum (in part), cornutum, excurrens, Mrs McLeod, paradoxum, Prince of Wales, spirale (Fig 1019)

BBBB *Lvs constricted to the midrib, or with the apically projecting midrib, bearing a second or even third plane, or cucullate, lamina Form* **appendiculatum,** *Celak*

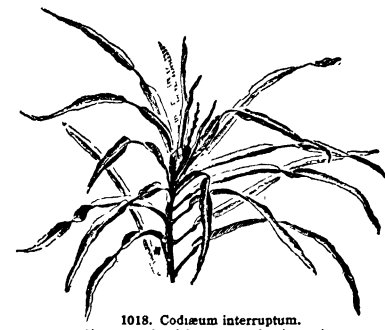
Hort. vars : Dodgsonæ, interruptum (Fig 1018), elegans, irregulare, Laingii, Mrs McLeod (in part), multiforme, mutabile, picturatum, Rodeckianum (in part), Smitzianum.

The following varieties are in the American trade or frequently cultivated in this country A great many variations in spelling of names occur, chiefly due to different terminations to agree with either Croton or Codiæum Such slightly different forms of names have been omitted The brief descriptive phrases do not include the more important characters given in the above classification When yellow and red are both mentioned, the foliage is generally at first yellow-marked and later the yellow changing to red with ground-color green or dark red-green The measurements are approximate, and of course, more or less unreliable and show respectively width and length of leaves in inches It is intended here to account for the Latin-form names, that might be confused with tenable species-names, but practically all the prevailing vernacular names have been inserted.



1017
Codiæum Disraeli
(An example of form lobatum.)

Asgberth Gem (= following?)
Asgburthiense. Yellow midrib and spots, ⅛×11. A F. 16·255 Gng 9 19
Albicans White variegated, crimson beneath, 3×18.
Albo-lineatum. Yellow center changing to white, 1×12. A F 16 255 Gng 9 19
Amabile ("often called variable") Lvs often distorted and curved to one side, variegated with yellow and two distinct shades of green and red, 1½×11
Andreanum Yellow to red veins, 2½×9. I.H. 22.201. A F 23 241. Gng 13.81. R H. 1876, p. 234.



1018. Codiæum interruptum.
(An example of form appendiculatum.)

Angustissimum (Angustifolium) Yellow margin and ribs, ¼×15 G C 1871 612
Antetumense Yellow midrib and cross veins, 1×11
Aucubæfolium Yellow, red-blotched, 2½×8 I H 19, p 327.
Aureo-maculatum Yellow-spotted, 1½×3½
Aureum Yellow-marked
Baron Adolph Seilliere Lvs large, veins pale yellow, soon white
Baronne James de Rothschild (Baron Rothschild, etc , Baron A de Rothschild (?)) Fig 1016 Yellow, red veins, etc , 2½×7. A F 23 242 R H 1879 450, 1898 180 F E 18 379 I H 26 365
Barryi Yellow, changing to white, midrib, veins and dots, 2×7.
B Compte Large, yellow, red blotches, 2½×7
Beauty Yellow to pink center, margin and mottling, ovate, 2×6
Bergmanii Cream-yellow with green blotches I H 27 389
Broomfieldii Various yellow marks, midrib red-tinted, 2×10
Burtonii Yellow mottled, lanceolate, 3×15
Carrierei Margin, midrib, dots and some veins yellow, oblong, 1½×11 I H 27, p 90, desc
Caudatum tortile Yellow variegated with some red, long, narrow, spiral lvs R B 35 240 Gn 11, p 83 Gt 33 9
Challenger (Challengerii?, Imperator?) Midribs creamy white changing to red
Chelsonii Yellow, red midrib and mottling, ⅛×10. A F 16 255 Gng 9 19
Chrysophyllum (perhaps two vars under this name). Irregular, large, yellow, red blotch, 2×12
Compte de Germiny Lvs broad
Cooperi Yellow, red center and spots, ¾×10 Gn 10, p 139
Cornutum Yellow midrib and dots, often wavy, spiral or even lobed, ¾×4 I H 19, p 188
Countess (Countess Superba?) Yellow spotted, tapering, ⅔×14
Cronstadii Yellow variegated, tapering, spiral, ⅔in wide. A F 16 255, 23 275 Gt 31 309
Crown Prince Yellow veins, 2×16
Czar Alexander III See Le Tzar
Darwinii White midrib and variegation, ¾×12
Dayspring Yellow, red-mottled, margin green, ovate, 1½×8.
Delight Yellow changing to white, with green margin, lanceolate, 2×8.
Disraeli Fig 1017 Variously lobed, yellow, red veins and spots, 3×12 Gn 10, p 141 F M 1876 207
Dodgsonæ Yellow midrib, margin and spots, often spiral, excurrent midrib often foliaceous, ⅔×12
Dormannianum Lvs small, bronze-red and yellow.
Earl of Derby See Lord Derby
Earlscourt
Edmontonense Lvs narrow, brilliantly colored
Elegans (Parvifolium, see Interruptum) Yellow, red midrib and margin, ½×6
Elegantissimum Yellow center and dots, petiole red, rarely with apical seta, ⅛×14 I H 29 469
Elvira. Yellow center and variegation, sometimes with apical seta and twisted, ⅛×10
Elysian Yellow midrib and dots, ⅔×14, twisted
Evansianum Yellow, red-veined and mottled, 3-lobed. Gn W. 4 409.
Excelsior
Excurrens Greenish yellow variegated, oblong, midrib projecting.

Euterpe.
Fascatum Yellow veins, broad ovate. A.F. 23:241.
Flambeau Medium width, lanceolate.
Flamingo Irregular yellow central stripe, 1½×8.
Gloriosum (Prince of Wales) Lvs long-narrow, variously yellow-marked, sometimes spiral and appendaged. Gng 9 19. Gn. 14, p 543. A F 16, p 255
Golden Ring
Goldiei Yellow veins, 3-lobed, 3×10.
Grande Yellow veins and spots
Grayii Resembling Majesticum
Hanburyanum Yellow, rose marks and blotches, 2½×15. Gng. 7 324
Harwoodianum (Trumphans Harwoodianum). Yellow, crimson midrib
Hawkerii Light yellow, green margins and tips, broad-lanceolate, 6 in long J H III. 61 129 G.Z 23, p 265
Henryanum Yellow-mottled, ovate, 3×9
Hermon Yellow midrib and spots, ½×10
Hulleanum Purplish green, crimson marks, oblong or spatulate, 3×9 I H 19, p 326
Hookerianum (Hookeri) Irregular yellow center and blotches, broad lance-ovate G C 1871 1067 Gn 3, p 45 I H 19, p 40. G 7 137 F 1871, p 199
Illustre Yellow markings, 3-lobed, midrib excurrent. G Z 28 2
Imperator See Challenger
Immutabile Yellow, red midrib and veins all dark red, 1×6.



1019. Codiæum spirale. (An example of forms crispum and cornutum.)

Insigne. Yellow midrib and veins, margin red, narrow-oblong
Interruptum Fig 1018 Yellow, red midrib, ¾×12 Sometimes distorted or spiral, midrib excurrent. I H 19, p 170 F. 1872, p. 209 A F 16 1510 Journ Bot. 19 220
Invicta Lemon-color, broad lf
Irregulare Lf form irregular, often contracted below middle, midrib and spots yellow I H 19, p 135
Jamesii Irregular yellow blotch changing to white, 3×10
Johannis (Taeniosum) Center and margin yellow lvs long, narrow F 1872, p 161 Gng 9 19 I.H. 19, p 169. F.S. 19, p 12. Gt 34 24 A F. 13 1070
Katonii (Maculatum Katonii). Lvs. partly trilobed, yellow-spotted F 1879, p 27
Lady Zetland Yellow, red margin, midrib and veins, ¾×11
Laingii Lf base yellow, remainder green to dark red, spiral, midrib excurrent or appendaged
Le Tzar. Lf. broad, veins and most of lf. yellow, red. I. H. 35 70
Lord Derby (Earl of Derby?) Trilobed, base and center yellow, red, ½–4×8.
MacFarlanei Yellow, red-blotched, 1×12
Maculatum Katonii See Katonii
Madam Seilliere Lvs. lanceolate, spirally twisted, variegated. A.F. 13 1068
Magnolifolium A few yellow spots and veins, 3×6
Majesticum Yellow, red margin, midrib and mottling, linear, 15 in long G Z 18, p 97 G 2 163 F 1876, p 53 F.M. 1874 103
Makoyanum Broad lvs chocolate and carmine marking.
Marquis de Castellane
Maximum Border and veins yellow or yellow with green blotches, 12 in long. I H 14, p. 534, 19, p 168. B H 19 65.
Memphis.
Montefontainense (Montfortiense?) Somewhat 3-lobed, veins yellow, red, 1½×6
Mortii Midrib and veins yellow, light red, 3×10
Mrs. Chas Heine
Mrs Craige Lippincott. Lvs lance-ovate, veins colored. A.F. 23 274 Gng 13 98
Mrs Dorman Midrib scarlet, margins green, linear, ½×12. A.F. 16.255 Gng 9 19
Mrs. H. F. Watson. Lvs large, variously marked with yellow and red.
Mrs Iceton. Very dark red with rose mottling, 2×4½
Mrs McLeod Constricted in middle, midrib yellow, red, projecting, ½×10.
Mrs. Swan. Central yellow stripe and blotch, petioles red, 1×12
Multicolor Like Irregulare but with red coloration developed. I H 19, p 120 F 1872, p 89
Musaicum Yellow, red-veined and mottled, or with green blotches on colored ground, 1½×8 R H 1882 240
Nestor Serrated central yellow, red blotch and spots, 2½×12.
Neuillæ Green-red mottling on yellow
Newmannii Lvs short, broad, dark crimson
Noble Lvs linear, yellow, red variegated. A F. 16·255. Gng. 9 19 F 1878, p 133
Orvilla Green mottling on yellow, 1×4½
Ovalifolium Yellow variegated Gt 24, p 221 F. 1875 8
Pictum Lvs broad oblong-acuminate, less than 10 inches long, blotches of green and blackish on red B M 3051.
Picturatum Similar to Interruptum Gt 25 375
Pilgrimii Yellow-blotched, overspread with pink, 3×9
Princeps (mutabile) Yellow, red midrib and margins, lvs. narrow, variable in form, sometimes appendaged F 1879, p 69. Gn 13 621, desc
Princess Matilda Lvs subtrilobed, yellow, red blotch, base nearly white, petioles red
Princess of Wales Yellow midrib and mottling, changing to white, with pink reverse, linear, ½×12 Gng 13 84 A F 23 275
Punctatum
Queen Victoria Yellow, red veins and mottling, 1½×10 A F 23 241
Recurvifolium Lvs acuminate, recurved at the tip, yellow, red veins and blotches
Reginæ Lvs short and broad, yellow, crimson and brown colored F 1879, p 59
Reidii Yellow, red variegation and veins, rose tints, 4×8. A F 23 242
Rodeckianum Variously mottled and marked with yellow and red, ¾×12, sometimes twisted and appendaged
Roseo-pictum Yellow, red, with green blotches between veins. I H 26 364, 43, p 159
Ruberrimum Crimson marked with creamy white, linear
Rubro-lineatum Yellow, with crimson tints, oblong-lanceolate, "1 in to 1¼ in long."
Rubro-striatum
Sceptre Lvs linear, yellow spots, red midrib
Sinitzianum Yellow spots changing to white, projecting midrib appendaged, 1½×10 Gt 30 278 G Z 26 145 J H III 48 435.
Sollerii
Spirale Fig 1019 Midrib yellow, red or green, lvs spiral, midrib excurrent, ⅔×10 V 9, p 203 F 1874, p 211 F M 1874 126. A F 23 242 Gt 24 26
Splendens "Lvs broad, yellow and dull red on green"
Stewartii Yellow veins and margin, midrib and petiole red
Sunshine (Sunbeam?) Yellow, red veins and mottling, 2×9.
Superbissimum
Superbum Lvs linear, drooping, green and yellow mottled A F 16 255, 23 p 275, 21 674 Gng 12 471, 9 19
Thomsonii Irregular central yellow area or all yellow, subtrilobed, 2×6
Tortula See Caudatum tortile
Trucolor Lvs oblong spatulate, margin sinuous, center yellow, lower surface reddish
Triumphans Lvs oblong, green and red
Undulatum Lvs long and broad, undulate, veins red to purple. I H 19, p 265 F 1870, p 207 G 9 106 Gn 3, p 118
Veitchii Yellow, red midrib and wide veins, some mottling, 1½×10 Gn 17, p 565 F 1870, p 206 I H 19, p 134 R H 1867, p 190 V 9, p 203
Victory Yellow, red midrib and blotches, 2½×12
Volutum Yellow midrib and veins, 1×6, with long tip rolled backward Gt 24 61 V 9, p 202 F 1874, p 138 G Z 20, p 33. F M 1875 154
Warreni Yellow, red variegated, 1×20 spiral P F G 1882 111 G 11 121, 13 705 A F 16 255 G W 12 62 Gn W. 6 457 Gn 36, p 337
Weismanii Yellow midrib and veins, petiole red, margin undulate, 1×10 I H 20, p. 80 F S 19, p 14 F 1873 55 Gt. 22, p 149
Williamsii. Yellow, red and pink variegated, ovate-oblong, 3×12
Wilsonii. Green overspread with yellow, linear lanceolate, 1×18
Youngii Irregular yellow, red blotches, 1×15 Gn 4, p 129

Others not in American trade: *appendiculatum* Horned, green. G Z 21 241 F 1879, p. 67 R H 1877, p 88 F W. 1877, p 130 —*aureo-lineatum* Yellow margins and veins —*Baron Frank Seilliere.* Yellow to white veins on reddish green I H 27, p 72, desc Gn. 21, p 289 —*bellulum* Yellow, green margins I H 22 210 —*Bragæanum* Yellow and green, red midrib, linear, 18 in long —*Chantrieri.* Linear, yellow red spots I H. 27, p 73, desc —*contortum.*

Lvs. ovate, tips recurved, veins and margins yellow —*Craigii.* 3-lobed. Gng. 13 97. A F 23 238 —*Crasus* Oblanceolate, yellow-blotched —*Drouetii* Linear, border and veins yellow, red. I H 27, p. 73, desc —*Duvalii* Lvs lance-linear, veins light yellow I H 27, p 73, desc.—*Dumerii.* Short-oblong, chiefly red. —*eburneum* Central irregular, white band —*elongatum* Narrow lanceolate, yellow veins, margins, and spots I H 24 209 — *eminens* Lanceolate, midrib and pair of veins white —*Exquisite.* Broad-ovate, margins and variegation yellow —*Eyrei* Recurved and spiral, yellow variegated, petiole red —*Fascination* Long-linear A F 23 243 Gng 13 119 —*formosum.* Yellow, red-spotted —*fucatum.* Obovate, yellow blotched, petiole red — *Goedenoughtii* Yellow variegated.—*Golden Queen* Yellow midrib and few veins and dots, petiole red, 2½×9 —*hastiferum.* Two acute lobes at broad base, yellow veins and blotches. I H 22 216 *heroicum* Yellow, red —*imperiale* Oblong, yellow, red margins and veins, horned F 1876, p 209 —*interruptum elegans* I H 27, p 90, desc R H 1880 170 —*Jubilee.* Center, veins and margins, yellow, red, 2×13 —*Junius* Long, narrow, yellow and red-colored. —*Katharina* Spiral, red variegated, 2×10 —*lacteum* Oblanceolate, margin sinuous, midrib and veins yellow F S 19, p 8 — *lanciifolium* Lanceolate, yellow- and red-marked, 1½×15 — *latimaculatum* Lanceolate, yellow-marked, petiole red I H 27, p. 73, desc —*limbatum* Yellow margins and spots —*Lord Beltheen* Lanceolate, Gng 7 323 F E 18 379 —*lyratum* Slightly 3-lobed, yellow veins I H 24 293 —*maculatum* Lanceolate, 12 in long, yellow-spotted —*magnificum* Yellow, red irregular central mark I H 29 447 —*Magnificent* Central part yellow, red, 2½×7 — *Marquis de Guadiaro.* Irregular yellow, red cente I H 37 96 — *Mavangeanum* Lanceolate, 10 in long, yellow, red, with green blotches I H 26 347 S H 1 124 —*medium variegatum.* Ovate, margins and veins yellow —*Me Lucien Linden* Yellow, red-variegated I H 38 140 —*Monarch* Lanceolate, 2½×12, yellow spots —*Mooreanum* Oblanceolate, yellow edge and veins. G Z 22 25 —*ornatum* Yellow, red center, veins and blotches — *paradoxum* Horned, yellow variegated F 1879, p 68 —*Pennocki.* Obovate, red with green marks R B 33 304 —*Phillipsii.* Lance-linear, base and center yellow, ¾×9 —*Prince Henry* Tip recurved, variously red- and yellow-marked —*Princess Waldeck.* Ovate, 4 in long, yellow center —*recurvatum* Tip recurved, yellow along the red midrib —*Rex* Spiral, yellow, red mottled, 2½×10 — *Russellii* Constricted in the middle, yellow, red spots and veins. I H III 27, p 493 —*Sanderi* Ovate, large, irregular blotches G 22 197 —*splendidum* Lvs broad, lanceolate, yellow, red — *superbum* Oblong, yellow, red-variegated Gng 13 84 —*Torquatum* —*Torrianum* Yellow, red veins, ribs and margins — *tournfordiense* Ovate, wide yellow center and base Gn 65, p 42 —*trilobum* Lobed, yellow blotched R H 1877, p 89 F 1877, p 56 G Z 21 97 —*Truffautii* Yellow to white veins, lvs broad — *Van Oosterzeei* Lance-linear, yellow-spotted I H 30 502 — *Veriaii* Yellow, red midrib and spots, lanceolate I H 23 253 — *vittatum* Irregular yellow center, petiole red —*Wigmannii* Yellow blotches, ½×9

J B S NORTON

CODLIN. Used in England to mean a small, green, half-wild, inferior apple. It is used in distinction to grafted or dessert fruit It is about equivalent to the American popular use of the word "crab." The word is also used in England as the name of a particular variety or group of varieties, as Keswick Codlin. The word codlin is known in America only in connection with the apple-worm insect, the codlin-moth. Sometimes written *Codling.*

CODONÁNTHE (Greek for *bellflower*) *Gesneràceæ.* A dozen or more trailing or scandent herbs or subshrubs of Brazil, Guiana, Cent. Amer, and W Indies, 1 or 2 of which may be found in choice collections of stove plants Plants with long branches, opposite entire and fleshy or thick mostly small lvs, and whitish fls borne singly in the axils· corolla with a declined or curved tube, the throat broad or open, and the limb with 5 rounded nearly equal lobes, exceeding the 5 narrow lobes of the calyx, stamens attached in corolla-tube, not exserted. fr berry-like. *C gràcilis,* Hanst, with creamy white spotted orange fls and lvs often blotched red beneath, is the species most likely to be seen Cult of Gesneria and similar things. L. H B

CODONÓPSIS (Greek, *bell-like,* alluding to the shape of the flowers) *Campanulàceæ* Twining or decumbent perennials, more or less hardy in the open, with showy blue, whitish or greenish flowers.

Herbs, with tuberous rhizomes: lvs alternate or irregularly opposite, petiolate, mostly crenate fls axillary or terminal, stalked, calyx-tube hemispherical, the limb 5-parted and the lobes leafy; corolla-tube broadly tubular or bell-shaped, 5-parted (rarely 4- or 6-parted), stamens free, the filaments dilated at base; stigma 3–5-lobed: fr a dry or somewhat fleshy 3–5-valved caps.—Eighteen or 20 species in Cent. and E. Asia. A few of the species may occur in choice border-collections; they need protection N.

ovàta, Benth. Six to 12 in, decumbent and branches becoming erect: lvs ovate, small (¾in. or less long), both alternate and opposite, acute or obtuse, hairy, short-petioled: fls pale blue, speckled inside, 1¼in or less long, broadly bell-shaped, on long terminal peduncles Himalayas.—Offered in England; half-hardy to hardy

C clematìdea, Schr Two to 3 ft, from mts. of Asia; one of the hardiest lvs ovate-acuminate, petioled fls white tinged blue. Much like C ovata.—*C convolvulàcea,* Kurz Sts thin and wiry fls. bright blue, 1 in across, numerous. Upper Burma —*C. lanceolàta,* Benth & Hook (Campanumœa lanceolata, Sieb & Zucc) Twining, 2–3 ft fls hanging, greenish white and purple-veined, 1–2 in long and 1 in wide, in a short simple raceme lvs alternate, oblong-lanceolate, nearly or quite entire Burma, China. F S. 9 927 —*C Tángshen,* Oliver Climbing, with long thickened rhizome, the sts slender and 2 ft or more long lvs ovate or broad-lanceolate, toothed fls solitary, stalked, bell-shaped, 1½ in long, greenish, spotted and striped purple inside China B M 8090. Root used in China as a tonic —*C viridiflòra,* Fedde Allied to C. convolvulacea twining, slender lvs mostly opposite, ovate or oblong-acuminate, sinuate-dentate fls solitary, very long-peduncled, rather small, rotate, and deeply parted, lilac W China — *C viridiflòra,* Maxim Small climber, free-flowering fls. bell-shaped, whitish green, gray and violet. E. Asia

L H B.

CŒLIA (Greek, *koilos,* hollow· referring to the pollen masses). *Orchidàceæ* Epiphytic orchids of minor importance, culture of Epidendrum.



1020 Cœlia Baueriana.

The cœlias are divided into 2 strongly marked groups with widely different kinds of infl *C macrostachya* is a type of the first section, with long racemes of numerous small, horizontal fls, which are much exceeded by the long spreading bracts, and the base of the column short *C bella* is typical of the second section, with the fls few, larger, erect, in groups of about 3, longer than their bracts, and the base of the column produced to twice its own length, which gives the fls a tubular appearance —A half-dozen species in Cent and S Amer

A. *Fls small, in a long raceme.*

macrostàchya, Lindl Pseudobulbs 2½ in. long, almost round, with brown scales at the base. lvs about 3, from the top of the pseudobulb, 1 ft or more long, lanceolate, arching, broader than in *C. bella,* and not channeled sepals red; petals white. Mex R H. 1878 210 B M 4712. J F. 4:423

Baueriàna, Lindl Fig. 1020. Pseudobulbs 1–2 in long, 2–3-lvd · lvs 10–18 in long, linear, acute· racemes of numerous small white fragrant fls; ovary 3-winged, sepals ovate-lanceolate, the petals ovate-oblong; lip with the claw yellow, the blade triangular. W. Indies and Mex B R. 28 36.

AA. *Fls. white, tipped purple, few, large*

bélia Reichb f. Pseudobulbs smaller and more constricted at the top: lvs. 6–10 in. long, narrower, chan-

neled above, arching. fls 2 in long, erect, 3 or 4 in number, with the mid-lobe of the lip orange-colored. Guatemala B M. 6628.

C. densiflòra, Rolfe. Characterized by a dense-fld. raceme, wingless ovary and oblong mentum. Cent Amer.

GEORGE V. NASH.†

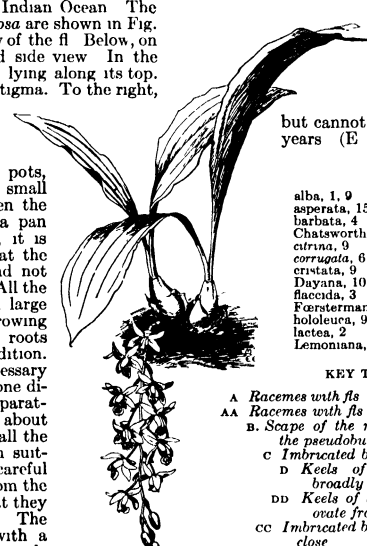


1021 Details of Cœlogyne speciosa

CŒLÓGYNE (*hollow pistil*) *Orchidàceæ* Popular epiphytic warmhouse orchids of the eastern hemisphere

Pseudobulbs tufted or at intervals on the st fls in racemes, opening simultaneously or in succession; sepals and petals similar, spreading or reflexed; lip 3-lobed, the lateral lobes erect, inclosing the slender column, the middle lobe flat or recurved, keeled, column slightly curved, winged above; pollinia 4.—Species about 115, distributed from N India to Ceylon, middle China, and in the islands of the Indian Ocean The botanical details of *Cœlogyne speciosa* are shown in Fig. 1021 At the top is a general view of the fl Below, on the left, is the column, front and side view In the center is the lip, with the column lying along its top. Below the lip, on the left, is the stigma. To the right, on the bottom row, are the pollinia, front and back view; and at the right center are separate pollen masses

Cœlogynes may be grown in pots, baskets or pans, using pots for small plants, and larger receptacles when the plants require them, but when a pan larger than 12-inch is necessary, it is best to use perforated ones so that the material may be well aerated and not become unsuitable for the roots All the species are of rambling habit and large specimens may soon be had by growing on, provided the material at the roots is kept in a sweet healthy condition. When, however, it becomes necessary to divide a plant, this is best done directly after flowering, carefully separating the running shoots, cutting off about three of the last-made bulbs with all the roots attached, planting these in suitable-sized receptacles, being very careful to point the growing end away from the edge, or toward the center, so that they will not so readily outgrow again The material to use is osmundine with a little sphagnum moss if it can be made to grow, packing all very firm about the roots so that too much water will not be held about the roots. Place in the shady part of a warm house until root-action begins; but, during the hot summer months, the varieties of *C cristata* may with great benefit be placed in a frame in a shady place outdoors, there to remain until danger of frost in October. Treated in this way, the plants will bloom much better. They should all be placed on inverted pots when outside to exclude vermin When brought indoors the bulbs will be finishing up for bloom, and as they are terrestrial plants, weak manure-water should be given at every watering. A glance at the roots and their structure will show how they differ from the epiphytal orchids such as the cattleyas. Cœlogynes, being evergreen, should never be quite dry at the roots, or shriveling will result, this always is the case after flowering or repotting; but, when growth commences, they soon plump up again It is often desired to grow these plants in baskets Space can then be made for them overhead in the coolhouses in winter, bringing a few at a time into warmth, thus having succession of bloom for three months for cutting, house or conservatory decoration, where they last a long time There are more than 100 kinds of cœlogynes, many of which are but of botanical interest *C. pandurata*, *C Dayana* and *C Sanderiana* are warmhouse plants and should be kept at a minimum temperature of 60° in winter *C. nervosa*, *C flaccida*, *C nitida*, and *C Massangeana* are coolhouse plants, often grown in collections, but *C. cristata* and its forms are the most valued, especially the variety *maxima* once so scarce, but now plentiful, this makes large bulbs and longer spikes of bloom The Chatsworth variety, by some considered the same as *maxima*, *hololeuca* or *alba* as it is most often known in gardens, is a pure white form, perhaps the whitest of all orchids This is inclined to ramble, owing to the length of rhizome between each bulb or growth, and needs attention in repotting frequently, it is also the latest to flower. *C. Lemoniana* has a pretty lemon-yellow blotch on the lip instead of the usual orange and is very pretty by contrast with the other forms When it is desired to increase the stock of plants, the back bulbs taken off at potting time may be planted similar to the other pieces and will grow on, but cannot be expected to bloom for two years (E O. Orpet.)



1022. Cœlogyne Massangeana. (×⅓)

INDEX

alba, 1, 9
asperata, 15
barbata, 4
Chatsworthii, 9
citrina, 9
corrugata, 6
cristata, 9
Dayana, 10
flaccida, 3
Foerstermannii, 8
hololeuca, 9
lactea, 2
Lemoniana, 9
Lowii, 15
Massangeana, 12
maxima, 5, 9
Mayeriana, 14.
nervosa, 6
nitida, 5
ocellata, 5
pandurata, 13
Parishii, 16
salmoncolor, 1
Sanderiana, 7
speciosa, 1
tomentosa, 11.

KEY TO THE SPECIES

A	*Racemes with fls opening in succession*	1 **speciosa**
AA	*Racemes with fls opening all at once*	
B.	*Scape of the raceme naked between the pseudobulb and lowest fl -bract*	
C	*Imbricated bracts below fls none*	
D	*Keels of lip extending into broadly ovate front lobe*	2 **lactea**
DD	*Keels of lip not extending into ovate front lobe*	3 **flaccida**
CC	*Imbricated bracts below fls several, close*	4 **barbata**
BB	*Scape of raceme with 1 or few scales between pseudobulb and lowest fl. -bract*	

c. *Lip with a large eye-like spot* .... 5. **nitida**
cc. *Lip with no eye-like spot*
d. *Keels of lip lacerated or fimbriated.*
e. *The scape arising from large lvs*
f *Fl-bracts persistent* ... . 6 **nervosa**
ff *Fl-bracts deciduous* . . 7 **Sanderiana**
ee. *The scape without large lvs.*
f. *Sepals about as long as broad, keels of the lip only slightly cut* 8 **Fœrster-**
ff. *Sepals about twice as long as broad, keels of lip strongly cut* . .... 9 **mannii** **cristata**
dd. *Keels of lip warty*
e *Peduncle, rachis and ovaries tomentose*
f. *The scape arising from large lvs* 10 **Dayana**
ff. *The scape without large lvs*
g. *The keels in middle lobe of lip papillose* 11 **tomentosa**
gg. *The keels in middle lip cut into tooth-like segms* . 12 **Massangeana**
ee. *Peduncle, rachis and ovaries glabrous*
f. *Pseudobulbs elliptic to ovate-oblong, compressed*
g *Middle lobe of lip separated from lateral lobes by a distinct claw* 13 **pandurata**
gg. *Middle lobe of lip sessile* 14 **Mayeriana**
ff *Pseudobulbs fusiform, 4-sided*
g *Raceme many-fld, nodding* 15 **asperata**
gg *Raceme few-fld, erect* 16 **Parishii**

1 **speciòsa,** Lindl (*C. salmonicolor,* Reichb) Pseudobulbs ovoid, distinctly angled, 2–3 in long, 1-lvd.: lvs up to a foot long racemes with 1, 2 or 3 fls; sepals oblong, translucent, pale yellow-brown; petals pale yellow-brown, linear, reflexed; lateral lobes of lip erect, reticulated, with dull copper-brown on a blush-salmon ground, mid-lobe roundish, partly broad-margined with white, disk with 2 fringed ridges and umber-brown markings. Java B M. 4889 Gn 49, p 62 B.R 33 23. C O. 3. Var **álba,** Hort. A light-colored form.

2. **lácteа,** Reichb f. Pseudobulbs ovate, somewhat 4-sided, sulcate, 2-lvd, 3 in long lvs up to 10 in long, 2 in broad fls 6–12, sepals and petals spreading, cream-white, the sepals oblong-ovate, acuminate, the petals much narrower, linear-lanceolate, lip about as long as petals, the lateral lobes semi-ovate, truncate, the middle lobe about equaling one-half the whole length of the lip, triangular at the apex, acute, reflexed, keels 3, undulate, extending to the center of middle lobe Burma.

3. **flàccida,** Lindl. Pseudobulbs ovate, angulate, 2–3 in long· lvs. lanceolate, about 8–10 in long: raceme 7–12-fld, cream-white, the sepals oblong, the petals linear-oblong, fls 1½ in. across; sepals and petals pendulous, lip with 3 ridges, the lateral lobes white, streaked red-brown inside, the middle lobe reflexed, acute, a bright yellow blotch on the disk. Nepal. B M. 3318 B R. 27.31. C L.A. 6:166.

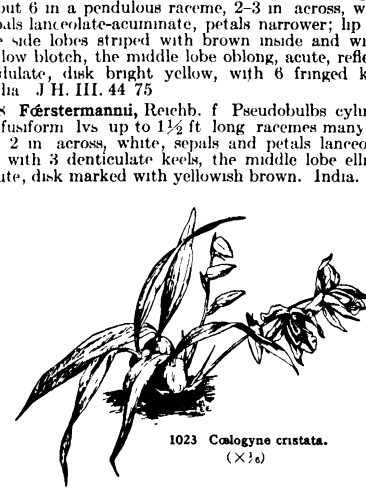
4 **barbàta,** Griff. Pseudobulbs about 2 in. long, ovate. lvs broadly lanceolate, 10–12 in long: raceme 6–10-fld; sepals and petals white, the sepals ovate-oblong, the petals linear; mid-lobe of lip brownish inside, curiously fringed with brown; crests 3. Khasia hills

5 **nítida,** Hook. f (*C. ocellàta,* Lindl). Pseudobulbs pyriform or nearly so: lvs up to 1 ft long, narrowly lanceolate. racemes erect, 5–8-fld.; fls 2 in. across, white, the sepals oblong, the petals linear-oblong; lip with bright orange-yellow spots on each of the lateral lobes and 2 smaller spots at the base of the mid-lobe, disk with 3 keels, the front lobe of lip with 5 Himalayas, at an elevation of 7,000 ft B.M. 3767 C L A. 1.55 Var. **máxima,** Reichb. Racemes longer; fls. larger. J.H. III 52 25

6 **nervòsa,** A Rich (*C. corrugàta,* Wight). Pseudobulbs ovate-pointed, 2½–3 in long lvs 6–12 in long: racemes 3–6-fld.; fls white, 2–2½ in across; sepals and petals nearly equal, oblong and acute, lip with the lateral lobes striped red inside, the middle lobe ovate, acuminate; disk yellow, with 3 white fringed keels. India B M. 5601.

7 **Sanderiàna,** Reichb. f Pseudobulbs ovate and wrinkled or costate, 2–3 in long lvs a foot long: fls about 6 in a pendulous raceme, 2–3 in across, white; sepals lanceolate-acuminate, petals narrower; lip with the side lobes striped with brown inside and with a yellow blotch, the middle lobe oblong, acute, reflexed, undulate, disk bright yellow, with 6 fringed keels. India J H. III. 44 75

8 **Fœrstermannii,** Reichb. f Pseudobulbs cylindric or fusiform lvs up to 1½ ft long racemes many-fld; fls 2 in across, white, sepals and petals lanceolate; lip with 3 denticulate keels, the middle lobe elliptic, acute, disk marked with yellowish brown. India.



1023 Cœlogyne cristata.
(×⅓)

9 **cristàta,** Lindl Fig 1023 Pseudobulbs 1½–2 in. long, ovoid-oblong, scattered on a scaly rhizome lvs. 8–12 in long racemes 5–9-fld, drooping, fls. white; sepals and petals lanceolate-oblong, undulate, acute, with 5 orange fringed keels, the lateral lobes slightly incurved, the mid-lobe transversely oval, denticulate. Nepal J H III 31 349 P G 1 55 A G 14 331; 15 513 A F 4 497, 6 87, 9 1111, 13 1133, 16·1445. C L A 6.163 F E 9 331 B R 27 57 G C III 47 40 O R 18·169 Gng 2·393; 4 225 Var. **hololeùca,** Hort (var *álba*), has white fls, labellum without yellow. C O 1*a* Var **Lemoniàna,** Hort (var *citrina,* Hort), has citron-yellow fringes. J H III 57 537 Var **Châtsworthii,** Hort, has large pseudobulbs and large fls of good substance Var. **máxima,** Hort, has very large fls —*C. cristata* is one of the best and most popular of orchids It is one of the easiest to grow Can be grown with cattleyas

10 **Dayàna,** Reichb f. Pseudobulbs cylindric-fusiform, 5-10 in long lvs up to 2½ ft. long, oblong-lanceolate racemes many-fld, pendulous, fls 2–2½ in. across, sepals and petals pale yellow, margins reflexed, the petals much narrower than sepals, lip with 6 erect ridges fringed with brown, the lateral lobes brown, streaked with white inside, the middle lobe nearly quadrate, reflexed, apiculate. Borneo. G C III 15 695. A F. 35 380

11. **tomentòsa,** Lindl. Pseudobulbs elongated, ovoid, 2–3 in long lvs up to a foot long, 3–5-nerved racemes pendulous, tomentose; fls 15–20, 2–2½ in. across; sepals

and petals pale orange-red, sepals lanceolate, petals linear-lanceolate; lip with lateral lobes oblong, rounded, streaked with red on inside, the middle lobe reniform or transverse-elliptic, sessile; keels 3, crenulate, lateral ones converging in the middle lobe and sometimes bearing 2 branches. Perak, Borneo, Sumatra.

12. **Massangeàna,** Reichb. f. Fig. 1622. Pseudobulbs pyriform, 3–5 in. long: lvs elliptical, large, tapering toward the base, up to 20 in long racemes many-fld, pendulous, pubescent, fls. 2–3 in. across, sepals and petals pale yellow, the sepals oblong-lanceolate, the petals linear-oblong; lip with lateral lobes brownish within, lined or streaked with yellow, mid-lobe with a verrucose brown and yellow disk from which extend 3 denticulate keels. Assam B M 6979. C O 4

13 **panduràta,** Lindl Pseudobulbs 3–4 in. long, oval-oblong, compressed. lvs 15–20 in long, cuneate-oblong. racemes many-fld, pendulous; fls up to 4 in across, sepals and petals green, linear-oblong, acute; lip fiddle-shaped, with black veins and stains on yellowish green ground, the mid-lobe crisped, black-warty; disk 2-keeled Borneo B M 5084 F S 20.2139 J H. III 30 377. A F 6.633 C O. 6. Gt. 49:1480.

14. **Mayeriàna,** Reichb f. Pseudobulbs ovate-oblong, about 2 in long, compressed, 2-lvd. lvs 8–10 in long, cuneate-obovate raceme 8–10-fld, erect or nodding, fls about 2½ in across, green, veined black-brown, sepals oblong, acuminate, the petals shorter and narrower, the margins reflexed; lip nearly as long as sepals, the lateral lobes concealing only the base of the column, the middle lobe sessile, oblong-elliptic, crisped, keels 3, papillose Singapore

15 **asperàta,** Lindl (*C. Lòwii,* Paxt) Large species (18–24 in. high). pseudobulbs ovate-oblong, 5–6 in long or more lvs up to 2½ ft long, lanceolate, acute raceme 7–10-fld, pendulous; fls 3 in. across, cream-colored, sepals and petals lanceolate, lip with the lateral lobes white, streaked red-brown inside, the middle lobe nearly orbicular, the crisped margin pale yellow streaked red-brown; disk with 2 or 3 orange-red warty ridges Borneo P M. 16 227. G.C. III 46·34

16 **Pàrishii,** Hook f Like No 13, but racemes not drooping, pseudobulb 4-angled, 4–6 in long lvs up to a foot long, lanceolate, acuminate. racemes 4–7-fld., erect, fls. about 2 in. across, pale yellow-green, sepals lanceolate, acuminate; petals linear-lanceolate, lip fiddle-shaped, black-spotted, the middle lobe apiculate, undulate; disk with 5 raised lines. Moulmein B M 5323

C álbo-lùtea, Rolfe Fls showy, very fragrant, pure white, with lobes yellow Mts of N India.—*C Brymeriàna,* Hort A garden hybrid between C. Dayana and C. asperata.—*C burfordiénsis,* Hort (C pandurata × C asperata) Fls pale green, the spiny crest black, the ridges green and yellow G C III 49 331.—*C. chrysotróphis,* Schltr Scape much shorter than the lvs, few-fld. Sumatra.—*C Còlmanii,* Hort A garden hybrid between C. speciosa major and C cristata alba.—*C Cúmingii,* Lindl Fls white, the disk citron-yellow, sepals and petals lanceolate Singapore B R 27 29 B M 4645.—*C fràgrans,* Hort A trade name —*C fulginòsa,* Lindl Fls appearing in succession, 2 in across, light brownish white, the lip fringed N India B M 4440 J F 1 7.—*C Garderiàna,* Lindl = Neogyne.—*C Lawrenceàna,* Rolfe Fl single, sepals and petals yellow, 2–2¾ in long, the sepals lanceolate-oblong, the petals linear, lateral lobes of lip brown, the middle lobe white, the disk marbled with brown Annam B M 8164 G C III 47 335.—*C Mooreàna,* Sander Racemes 4–8-fld, fls white, disk golden yellow, covered with clavate processes Annam B M 8297.—*C ochràcea,* Lindl Fls about 2 in across, fragrant, white, the lip blotched and streaked orange-yellow N India. B R 32 69 B M 4661 J F 4 342.—*C perakénsis,* Rolfe Racemes many-fld, sepals light buff, lanceolate-oblong, about ½ in long, petals light green, linear, a little shorter than sepals, lip light yellow, with a deep yellow blotch on disk Perak. B M 8203.—*C præcox,* Lindl, var *álba* A nearly white form.—*C Sánderæ,* Kránzl. Fls. white, sepals oblong-lanceolate, petals narrower, linear, lip yellow, marked with golden, the keels red-brown. Burma. G C III 13 361.—*C Veitchii,* Rolfe Racemes many-fld., pendulous, fls nearly globose, white, the sepals and petals much incurved, lip longer than sepals, the lateral lobes obtuse, the middle lobe ovate, revolute, disk obscurely 3-keeled New Guinea. B M. 7764.—*C venùsta,* Rolfe. Racemes many-fld, pendulous, fls. pale yellow, the lip white, marked with yellow. S. W China B M. 8262.—*C. vrèscens,* Rolfe. Resembling C Parishii Fls pale green with dark dots on the lip. Annam. GEORGE V. NASH.

COFFÈA (from the Arabian name for the drink, itself conjecturally derived from Caffa, a district in southern Abyssinia). *Rubiàceæ* Woody plants, producing the coffee of commerce; as a horticultural subject, sometimes cultivated for the ornamental appearance; and also in collections of economic plants

Shrubs or small trees, natives of Trop Asia and Afr: lvs mostly opposite, rarely in whorls of 3, elliptical, acute, usually coriaceous and glossy: fls clustered in the axils, cream or cream-white and fragrant; calyx-limb 5-, rarely 4-, parted, the corolla salver-shaped, the corolla-tube cylindrical, the throat sometimes villous, stamens inserted in or below the throat of the corolla fr a berry; seeds 2, horny, which are the well-known coffee of commerce.—From 25–40 species, in Trop. Afr. and Asia, the species not yet clearly defined, nor well understood horticulturally

Coffee-production is based mostly on *C. arabica* and *C liberica,* both widely cultivated throughout the tropics, and in greenhouses northward The coffee industry, one of the most important industries in the tropics, reaches the enormous figure of $200,000,000 or sometimes a little more than this See the treatment in Vol II Cyclo. Amer Agri.

The coffee plant and its product. (T. B. McClelland)

The main source of coffee is *Coffea arabica,* an evergreen shrub, growing 10 to 15 feet high The younger plants have one main trunk or stem, but from this others frequently develop later, which are similar in form and habit to the first The lateral branches are opposite, horizontal and in pairs, very rarely in whorls of three The pairs of branches are in whorls on the main stem The leaves, which are opposite and borne in pairs, are 4 to 7 centimeters (about 1½ to 3 inches) broad by 10 to 20 centimeters (4 to 8 inches) long, the length being usually slightly more than two and a half times the breadth They are elliptical, acuminate at tip and attenuate at base There are eight to eleven pairs of main lateral veins In the axils where the veins join the midrib are small pores, open below and slightly swollen above The tip of the leaf is frequently curled and is rather abruptly contracted The margin is entire and wavy The leaves, which are perennial, are a dark glossy green, and though thin are firm in texture

There are usually two or three large blossomings and several small ones extending over a period of several months The pure white and delicately fragrant star-like flowers are borne on very short pedicels in one to four axillary clusters of one to four flowers each. These flower-clusters are subtended by two to four common calyculi The tube of the corolla is 8 to 10 millimeters (about ⅛ to ⅜ inch) long Its segments are about 7 millimeters (nearly ⅓ inch) broad by 15 to 18 millimeters (⅝ to ¾ inch) long The style is 17 to 22 millimeters (⅔ to nearly 1 inch) long The stigma is two-branched, each branch being 5 millimeters (about ⅕ inch) long The linear anthers, corresponding in number to the petals, are 9 millimeters long and are supported on filaments 5 to 7 millimeters long. The size varies somewhat with favorable or unfavorable conditions The short annular calyx with its denticulate limb is so small as almost to escape notice

Under *Coffea arabica* are included a number of varieties quite distinct in growth and product from the other varieties of the same species, such as Maragogipe, Mocha, Pointed Bourbon (sometimes classified as *C. laurina*) and others.

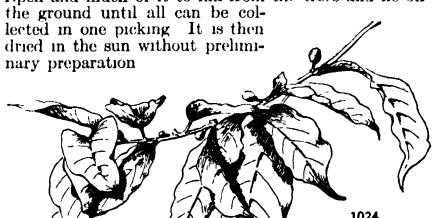
Maragogipe coffee, as its name indicates, is of Brazilian origin, having been discovered in 1870 near the town from which its name is derived. On account of the large size of the bean it has commanded a fancy price on the market, but this variety is considered to be a small yielder. The flowers, fruits, and leaves are all larger than the ordinary Arabian coffee and the

leaves curl noticeably. Its flavor is not considered superior to that of the ordinary Arabian coffee.

Mocha coffee, with its shorter internodes and smaller flowers, fruits, and leaves is a distinct variety. The "beans" are much less oval and are more rounded and hold a high reputation for quality.

Normally two coffee "beans" or seeds are produced in each red cherry-like drupe. Some drupes, however, contain three beans and others only one. When only one is formed it is called "peaberry," and is oval in shape instead of being flat on one side and convex on the other as is the bean when two are produced. The peaberries are sorted out by machinery and are sold at a fancy price on account of being a little different in appearance from the other coffee, but any claim to superiority of flavor is without foundation There is one variety of coffee that produces a number of beans in each drupe, and the corolla-segments may range up to ten As the number of beans increases, the size and the attractiveness of appearance decrease, so that this is a very undesirable variation

The fruits require six and one-half to seven months to mature The ripening of the coffee, in relation to the blossoming, extends over several months Where the West Indian or wet process for curing the coffee is followed, the ripe cherries are picked every fortnight While fresh they are passed through a machine which pulps and separates the coffee in its parchment from the pulp The former is then fermented and washed to remove a slimy covering After thorough drying in the sun or in heated driers, the parchment coffee may be stored or it may have the thin brittle parchment or horn-skin and the silver-skin removed by special machinery If desired it may be further polished and artificially colored. After being sized and having the better grades cleaned of inferior beans, it is ready for roasting. In some places where the dry or old preparation is followed the coffee is allowed to ripen and much of it to fall from the trees and lie on the ground until all can be collected in one picking It is then dried in the sun without preliminary preparation



1024. Coffea arabica. (×½)

Although coffee has been used as a beverage for hundreds of years by a few persons, as a world beverage it is comparatively modern In 1825 the estimated production did not exceed 218,255,400 pounds. In 1906–1907 the production was estimated as 3,164,041,920 pounds, or an increase of 1,350 per cent in eighty-one years.

Brazil produces about three-fourths of the world's coffee crop. Then follow in order of importance Venezuela, Colombia, Guatemala, Mexico, Haiti, Salvador, Dutch East Indies, Porto Rico, British India, Costa Rica, Nicaragua, and other countries.

In Bulletin No. 79, Bureau of Statistics, United States Department of Agriculture, may be found a very extensive bibliography of coffee. In the Netherlands the per capita consumption is more than 15 pounds; in the United States under 11½ pounds, in Japan 003 pound.

A. *Corolla 5-parted, sometimes 4-parted.*

B. *Segms. of corolla narrow: lvs. oblong, 4–5 in. long, 1½ in wide.*

arábica, Linn COMMON OR ARABIAN COFFEE. Fig 1024 Lvs 3–6 in long, rather thin, oblong, nearly 3 times as long as broad, more or less abruptly contracted near the apex to a point about ½in. long: segms. of corolla over twice as long as wide· fr a 2-seeded, deep crimson berry, but the "berries" or beans of commerce are the seeds. The commercial varieties of coffee are based largely on the size, shape, color and flavor of the seeds, and hence the fr is very variable, but the typical fr. may be considered to be oval and ½in. long. Indigenous in Abyssinia, Mozambique and Angola; supposed to have been intro in early Mohammedan times from Abyssinia to Arabia, whence it became known to Europeans in the 16th century This species furnished until recently the entire commercial product. B M. 1303 Gng 6 55 —A variegat d form, var **variegàta,** Hort , is more showy than the type. It is offered by dealers in tropical plants As coffee grows wild in Afr it is a small tree 10–15 ft. high, with the trunk 9–12 in thick at the base Often cult. under glass in the N. for its economic interest, and in S Calif it is a good outdoor ornamental shrub, esteemed for its shining lvs , fragrant white fls , and red berries.

BB. *Segms of corolla wide lvs ovate.*

bengalénsis, Roxbg BENGAL COFFEE Lvs ovate, barely twice as long as broad, acute, but not having a long, abrupt point fls in 2's or 3's; segms of corolla barely twice as long as wide E Indies, Malaya. B M 4917 —This has much showier fls than *C. arabica.* A small shrub with glabrous, dichotomous branches. Mts of N. E India, whence it was brought to Calcutta and much cult for a time It is now neglected, the berries being of inferior quality and the plants not productive enough.

AA *Corolla 6-, 7-, or 8-parted.*

B. *Fls in dense clusters or glomes: lvs. short-pointed.*

libèrica, Hiern. LIBERIAN COFFEE Lvs longer than in *C arabica,* and wider above the middle, with a proportionately shorter and less abruptly contracted point: fls 15 or more in a dense cluster, corolla-segms usually 7 Trop. Afr. Trans Linn. Soc II 1 171 (1876). G C II. 6:105. R H. 1890, pp 104–5 —Said to be more robust and productive than *C. arabica,* with berries larger and of finer flavor It is a more tropical plant than the common coffee, and can be grown at lower levels

Zanguebàriæ, Lour (*C. zanzibarénsis,* Hort). A glabrous, erect, closely branched shrub or small tree, to 6 ft., the branches ashy lvs ovate or obovate, obtuse or shortly pointed, 2–4 in long, ¾–1½ in. wide, the lateral veins about 6 pairs. fls white, axillary, in dense clusters; corolla-lobes 6–7. berry red, turning black.

BB. *Fls. solitary or in 3's lvs long-pointed, 2½–5 in. long*

stenophýlla, Don Lvs 4–6 in. long, 1–1½ in. broad, narrower than in *C arabica,* with a relatively longer and more tapering point corolla-segms usually 9. W. Afr B M 7475 —This is said to yield berries of finer flavor than the Liberian coffee, and quite as freely, but the bush is longer in coming into bearing. This is a promising rival to the *C arabica* of commerce. Seeds have been distributed by British botanical gardens, but are not known to be for sale at present in Amer

*C madagascaréns*e, Hort , and *C robústa,* Hort , are names of uncertain status.

WILHELM MILLER.

COFFEE. *Coffea.* N. TAYLOR.†

COFFEE BERRY. A name of *Glycine hispida,* which should be abandoned in favor of soybean Various leguminous seeds are used as coffee substitutes and are so named, cf. *Cassia, Canavalia* and others.

COFFEE PEA. A western name for chick pea, *Cicer arietinum*, which is used as a substitute for coffee.

COFFEE-TREE *Gymnocladus.*

COHOSH: *Actæa* The blue cohosh is *Caulophyllum.*

COHUNE: *Attalea Cohune*, it is a source of oil.

COIR: Fiber of coconut, which see.

CÒIX (an old Greek name). *Gramineæ.* Tall, broad-leaved, branched grasses with bead-like inflorescence, one of them grown in gardens

Plant loose-growing at the end of each peduncle is an indurated, globular, or oval, hollow bead, developed from a lf.-sheath; from an orifice at the tip projects the staminate spike pistillate fls inclosed in the bead, the styles projecting —Species about 3, E Indies, the following widely distributed in all tropical countries.

Lácryma-Jòbi, Linn JOB'S TEARS Fig 1025 Annual, 2-4 ft the beads or "tears," pearly white to lead-color, containing the seed, are about ½in long Dept Agric., Div. Agrost , 20 14 —Cult for ornament and as a curiosity The hard bony frs are used as beads and made into necklaces, to which are attributed marvelous properties. Var. **aùrea zebrìna,** has yellow-striped blades A S HITCHCOCK.

CÒLA (native name). *Sterculiàceæ* COLA Also called Kola, Korra, Gorra. One species is much grown in the tropics for the stimulating cola nut

The genus consists entirely of plants with unisexual or polygamous fls in axillary or terminal clusters calyx 4-5-cleft; petals none fr of 4-5 leathery or woody oblong carpels —Probably about 40 species, of Trop. Afr trees chiefly interesting for the cola nuts, which are said to sustain the natives in great feats of endurance The tree grows on the east coast of Afr , but is very abundant on the west coast, and is now cult in the W Indies Within the tropics the trade in this nut is said to be immense It has become famous in the U S through many preparations for medicinal purposes and summer drinks The seeds are about the size and appearance of a horse-chestnut, and have a bitter taste Although repeatedly intro to Kew, England, the plant never flowered there until 1868

Colas require a rich, well-drained soil Those introduced into the West Indies and other parts of America, especially *C. acuminata*, thrive best on a sandy loam. The trees are grown from seeds, which are large and fleshy, keeping well for some weeks after ripening As the tree is difficult to transplant, the seeds may be planted singly in small pots, and the young trees kept growing thus until wanted for permanent planting. Propagation may also be effected by cuttings of ripe wood, which should be placed in bottom heat, and treated in the usual way. (E N. Reasoner)

acuminàta, Schott & Endl. About 40 ft high in Afr , resembling an apple tree· lvs alternate, petiole 1-3 in. long; blade 4-6 in long, 1-2 in broad, leathery, with prominent ribs below; older lvs entire, obovate, acute; younger lvs often once or twice cut near the base about half way to the midrib. fls yellow, 15 or more in axillary and terminal panicles, about ½in. across, with a slender green tube and a showy yellow 6- or 5-cut limb, which is a part of the calyx. fr. 5-6 in. long. B.M. 5699 N. TAYLOR.†

CÒLAX (Greek, *parasite*). *Orchidàceæ.* Epiphytic orchids, much like Lycaste.

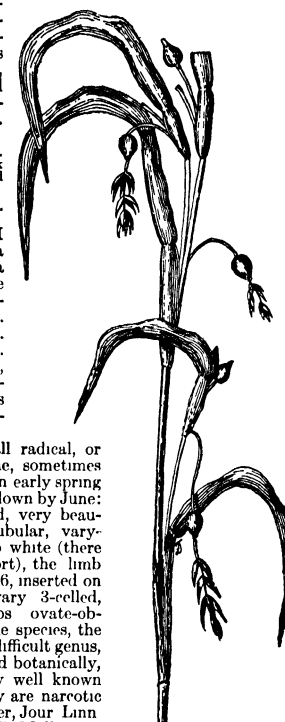
Pseudobulbous: fls in an upright raceme, arising from the base of the new shoot, sepals and petals similar, the lateral sepal forming a distinct foot with the base of the column; lip 3-lobed, clawed, with a transverse hairy process; pollinia 4.—A Brazilian genus of 2 species.

jugòsus, Lindl. (*Maxillària jugòsa*, Lindl. *Lycáste jugòsa*, Benth.). Pseudobulbs ovoid, 2-3 in. long, 2-lvd.: lvs. 5-9 in. long, lanceolate: raceme 2-3-fld.; fls. 2-3 in across; sepals white, obtuse, oval-oblong; petals white, obovate-oblong, spotted and barred with violet-purple; lip white, shorter than petals, the side lobes streaked violet-purple, the middle lobe semi-circular, with numerous pubescent keels, streaked and blotched violet-purple B.M. 5661. I.H. 19:96

C. tripterus, Rolfe. Ovary 3-winged, disk of lip bearing a broad fleshy callus Brazil

GEORGE V. NASH.

CÓLCHICUM (from Colchis, a country in Asia Minor, where the genus is most plentiful) *Liliàceæ.* MEADOW SAFFRON. AUTUMN CROCUS. Autumn flowering, rarely spring-flowering, bulbous plants with crocus-like blossoms



1025. Coix Lacryma-Jobi. (×½)

Leaves either all radical, or radical and cauline, sometimes ciliate, appearing in early spring and usually dying down by June: fls various colored, very beautiful; perianth tubular, varying from purple to white (there is 1 yellow-fld sort), the limb 6-parted; stamens 6, inserted on the perianth, ovary 3-celled, many-ovuled caps ovate-oblong in most of the species, the seeds globose.—A difficult genus, very much confused botanically, but horticulturally well known and popular They are narcotic poisons J G Baker, Jour Linn Soc 17 1880 G B Mallett, in Flora and Sylva, 1 108, 1903, has an excellent horticultural account of the genus

Colchicums are most charming and interesting plants of easy culture The bloom comes in August and September, at a season when the herbaceous beds begin to lose their freshness, and, although individual flowers are fugacious, others follow in quick succession, thus prolonging the time of flowering Opening, as they do, without foliage, some help is required from the greenery of other plants; for this purpose any low-growing, not too dense kind, may be used, such as the dwarf artemisias, sedums, or *Phlox subulata.* Colchicums are most effective in masses, which can be established by thick planting, or as the result of many years' growth. They can be grown in rockwork, in beds, or in grass which is not too thick nor too often mown; they will thrive in partial shade, but succeed best in an open sunny border They should be planted in August or early September, in deep well-enriched soil, a light sandy loam, with the tip of the long bulbs 2 to 3 inches below the surface; some protection should be given in winter. They remain in good condition for many years, and should not be disturbed unless they show signs of deterioration, fewer flowers and poor foliage. Then

they should be lifted and separated, just after the leaves die, end of June or early July. This is the usual method of propagation, but they can also be increased from seeds, sown just after ripening, June to July, the seedlings may not appear until the following spring. Seedlings bloom when three to five years old. The bulbs are obtainable from the Dutch growers at moderate prices, and they must be imported early; otherwise they are apt to bloom in the cases *C. autumnale*, with rosy purple flowers, is a well-known and the most commonly cultivated species. There are numerous varieties, of which the best are the white, the double white and the double purple. Belonging to this same group and not differing much except in size and shading of the flower, are *C byzantinum*, *C montanum*, and *C umbrosum*. *C. speciosum*, a native of the Caucasus, is the finest in every way of the genus. The flowers are much larger and of better shape, and the color, a rosy pink, is much more delicate; the habit of growth is robust, and the plant is most easily handled *C. Parkinsonii* is distinct from the above varieties inasmuch as the flowers are tessellated, purple and white, giving a curious checker-board appearance which is unique, the leaves are much smaller and are wavy. *C. agrippinum*, *C Bivonæ*, *C cilicicum* and *C Sibthorpii*, are other species having checkered flowers more or less similar to *C Parkinsonii* (*Bulbocodium*=*Bulbocodium vernum* Monograph by J G. Baker in Jour. Linn Soc., vol 17 (1880) (B M. Watson)

INDEX.

agrippinum, 7.
alpinum, 18
autumnale, 13.
Bertolonii, 1
Bivonæ, 8
Bornmuelleri, 12
byzantinum, 11
chionense, 5
cilicicum, 11
crocıflorum, 2
Decaisnei, 14
fasciculare, 16
luteum, 4
maximum, 10
montanum, 1, 18.
Parkinsonii, 6
Sibthorpii, 9
speciosum, 10.
Stevenii, 3
superbum, 8
tessellatum, 6, 7.
Troodii, 15
umbrosum, 17.
variegatum, 5.

A *Blooming in spring lvs appearing with the fls.*

B *Color rosy lilac size of anthers small.*

C *Anthers oblong, purple.*

1 **montànum,** Linn (*C Bertolònii*, Stev) An important and variable species, with many synonyms and variations Baker makes 7 forms Corn ovoid, ½–1 in. thick, the tunics brown, membrananceous, the inner ones produced to a point 2–4 in above the neck. lvs 2–3, rarely 4–6, linear or lanceolate, about 2–3 in long at the time of flowering, finally 6–9 in long fls 1–4, in spring and autumn Oct –June Medit region, from Spain to Persia B M 6143 —It appears in early spring with the snowdrops and crocuses

2 **crocıflòrum,** Regel, not Sims nor Schott & Kotschy Corn ovate-oblong lvs all radical, sheathing at the base, a few sometimes on the st, flat and linear, margins minutely and usually distantly toothed corolla white, with violet-purple stripes, especially within, the tube about 2 in long, the limb scarcely 1–1½ in. long; style exceeding the stamens. Feb., March. Cent. Asia.

CC. *Anthers linear, yellow.*

3. **Stèvenii,** Kunth Corm narrower than in No 1, about ½–¾ in thick· lvs. at length 4–5 in. long; fls. Oct –Jan. Syria, Arabia, Persia —Less popular than No. 1.

BB. *Color yellow· size of anthers large.*

4. **lûteum,** Baker. This is the only yellow-fld form in the genus, all the others ranging from purple to white Although it belongs to the Medit. group, with lvs. and fls produced at the same time and in spring, it is a native of W India at an elevation of 7,000–8,000 ft. Corm tunics dark brown, sometimes almost black. lvs. 3 or 4, wider and less tapering than in No. 1, at the time of flowering 3–4 in. long, finally 6–7 in. long. B.M. 6153.—Very desirable.

AA. *Blooming in autumn: lvs. appearing after the fls.*

B. *Perianth tessellated or checkered.*

C. *Tessellation distinct.*

D. *Lvs spreading or prostrate.*

5 **variegàtum,** Linn Lvs 2–3, lanceolate, about 6 in. long, 12–15 lines wide, lying flat on the ground; margins wavy fls 2–3 from each spathe, 4 in across, rose-color with a white tube. Isls of the Levant and Asia Minor. B M 1028 Variable The plant known as *C. chionense* is apparently a form of it. Corm size of walnut.

6. **Pârkinsonii,** Hook f (B M. 6090) (*C. tessellàtum*, Authors), is the best of all the tessellated forms, the tessellation being more sharply defined and more delicate than the type. It is a smaller plant, and has shorter and more strongly undulated lvs, which lie closer to the ground Of this plant Parkinson said in his "Paradisus Terrestris," 1629 "This most beautifull saffron flower riseth up with his flowers in the Autumne, as the others before specified doe, although not of so large a size, yet farre more pleasant and delightfull in the thicke, deep blew, or purple coloured beautifull spots therein, which make it excell all others whatsoever the leaves rise up in the Spring, being smaller then the former, for the most part 3 in number, and of a paler or fresher green color, lying close upon the ground, broad at the bottome, a little pointed at the end, and twining or folding themselves in and out at the edges, as if they were indented I have not seen any seede it hath borne the root is like unto the others of this kinde, but small and long, and not so great it flowereth later for the most part then any of the other, even not until November, and is very hard to be preserved with us, in that for the most part the roote waxeth lesse and lesse every yeare, our cold Country being so contrary unto his naturall, that it will scarce shew his flower, yet when it flowereth any thing early, that it may have any comfort of a warm Sunne, it is the glory of all these kindes"



1026. Colchicum autumnale. (×⅓)

DD *Lvs ascending*

E. *Margin of lvs wavy.*

7. **agrippìnum,** Baker (*C tessellàtum*, Hort). Corms a trifle thicker than in No. 5 lvs 3–4, 6–9 in. long, 12–15 lines wide, margin wavy fls 2–4 from each spathe F S 11.1153 —This is a marked form of *C. variegatum*, of garden origin, which has similar fls., but a more robust habit and more nearly erect lvs.

EE. *Margin of lvs flat, not wavy.*

8. **Bivònæ,** Guss Lvs 6–9, nearly 1 ft. long, 9–15 lines wide, rather hooded at the apex, margin flat, not wavy· fls 1–6 from each spathe, rose-purple faintly checkered with a darker color, 4–6 in. long. Medit. region. Var. **supérbum,** Hort, an excellent form, is advertised in English catalogues. F S R. 1.108.

CC. *Tessellation less distinct.*

9. **Sibthorpii,** Baker. Easily distinguished from Nos. 5, 7, and 8 by the much broader segms. of the perianth, and by the lvs., which are nearly erect, obtuse, and not at all wavy: lvs. 5–6, dull green, finally 1 ft. or more long, 1½–2½ in. wide, narrowed gradually to the base: spathe striped with green, and tinged with lilac at the tip. fls. 1–5 from each spathe; perianth-tube often 6 in. long. Mts. of Greece. B.M 7181. F.S.R. 1:108. —A large, cup-shaped fl., showing no open spaces between the broad, overlapping segms. Very handsome.

BB. *Perianth not tessellated.*

C. *Size of fls. large, 3 in. or more across.*

D. *Lvs. broad, 3–4 in wide.*

E. *Number of fls. 1–4.*

10. **speciosum,** Stev. Corm 2 in thick, the largest of the genus: st 1 ft high: lvs. 4–5, 12–15 in. long, 3–4 in. wide, narowed from the middle to the base, shining green: fls. 1–4 from each spathe, violet, with a white eye, but varying almost to pure pink, often 6 in across. Caucasus. B.M 6078 F S 23·2385 F M 1876:235. Gn 11:80 —Commonly considered the finest species of the genus; blooms Sept. and Oct. Var. **máximum,** Hort. Plant 7½ in. high.

EE. *Number of fls. 12–20.*

11. **byzantinum,** Ker-Gawl. Closely allied to the above, but with wider lvs., smaller and paler fls., and broad, short anthers: st. 6 in. high. lvs. 5–6, oblong, dark green, striate, 9–12 in. long, 3–4 in. wide: fls. smaller than in No 10, usually 3–4 in. across, lilac-purple, and often 12–20 from each spathe Transylvania and Constantinople. B.M. 1122.—Corn large, depressed. *C. cilicicum,* Hort., has rosy fls., somewhat tessellated. G.C. III. 23:35.

DD. *Lvs. narrow, 1–2 in. wide.*

12. **Bornmülleri,** Freyn. Lvs. elliptic-lanceolate, 3–4 in. long, 1–2 in. broad: fls 8 in. long and 5 in across, the limb pale rose or lilac-rose at first, subsequently deeper purple, the corolla-tube white. Asia Minor. Early spring —One of the rarest and finest of the group, suitable for the rock-garden.

13 **autumnale,** Linn Fig 1026; 442, p. 433. St. 3–4 in. high: lvs. 3–4, rarely 5–6, 9–12 in. long, 1½–2 in wide: fls. 1–4, rarely 5–6, from each spathe, purple, with a white variety, about 4 in. across; perianth veined Eu. and N. Afr. B M. 2673 (as *C crociflorum*). —Possibly the commonest in the American trade. It has beautiful double forms in purple and pure white. F S. 19:1936.

14. **Decaisnei,** Boiss. Corm ovate, membranaceous: lower lvs broadly lanceolate, the upper ones narrower and acutish, entire, 1–1½ in. broad: fls. pale-rose, or flesh-colored, the tube elongate-elliptic, the stamens a little shorter than the perianth; anthers yellow, linear; style only slightly exceeding the stamens. N. Afr. and the eastern Medit. region. Nov.–Jan.—Planted in masses with *C. crociflorum* for rock-gardens, it is very effective.

CC *Size of fls. small, about 2 in. across.*

D. *Number of fls. from each spathe more than 1 or 2.*

E. *Perianth-segms. acute.*

15. **Troödii,** Kotschy. Corm medium-sized: lvs. 3–4, 6–12 in. long, 9–12 lines wide, dark green above: fls. 4–5 or even 12, lilac-purple, about 2 in. across; perianth segms lanceolate-acute. Cyprus. B M. 6901 shows a pure white variety.

16. **fasciculare,** Boiss. Corm oblong: lvs. 5–7, broadly lanceolate, channeled, the apex acutish, frequently ciliate, about 1 in. wide· fls. many, in clusters, the corolla 2½ in. long, white, 6–10-nerved; stamens equaling the corolla, but slightly exceeded by the style branches. Feb. Syria.

EE. *Perianth-segms. obtuse.*

17. **umbrosum,** Stev. Corm small: lvs. 4–5, 6–9 in. long, 9–12 lines wide· fls 1–5 from each spathe, lilac, about 2 in. across, perianth-segms. oblanceolate, obtuse, with 8–12 veins. Caucasus.

DD. *Number of fls from each spathe 1 or 2.*

18. **alpinum,** DC. (*C. montanum,* All. not Linn). Lvs. 2, rarely 3, nearly erect or spreading, 4–8 in long, 3–6 lines wide, obtuse, channeled, shining green, narrowed from the middle to the base: fls 1 or 2 from each spathe, about 2 in across, lilac; segms. oblanceolate, obtuse, 3–4 lines wide, with 10–15 veins. Mts. of France and Switzerland.

C gigantèum, Hort. A plant with magnificent pink fls —Is not certainly referable to any species The name appears in several catalogues, but is unknown in botanical literature See F S R. 1 108 —*C hydrophilum,* Hort An early spring-flowering species, bulb size of a walnut lvs and fls appearing together, the fls bright clear rose and taller than the lvs , the latter growing after the fls are gone and attaining a length of 6 in , fls in clusters of 3–15, stamens half as long as the segms Taurus Mts G C III 29 102 —*C sieheánum,* Hort A late autumn-flowering species with rich reddish purple fls Asia Minor —*C serotrifólium,* Hort Similar to some of the forms of C. speciosum, but earlier in flowering.

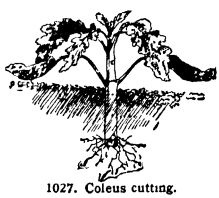
WILHELM MILLER.
N. TAYLOR.†

COLDFRAME. An unheated covered frame (see *Frame*) used (1) for the starting of plants in spring in advance of settled weather but not so early as in a hotbed; (2) for receiving plants from a hotbed or greenhouse, holding them as an intermediate station until they may go in the field, (3) carrying hardy plants over winter, as spinach, lettuce, (4) providing a general store-place for hardy or semi-hardy stuff from greenhouse and garden; (5) affording a propagating-bed in spring and summer for seeds or cuttings Usually the coldframe is topped with glass, as is the hotbed, but prepared paper or cloth is sometimes used Coldframes are usually of temporary construction L H. B

COLD-STORAGE, REFRIGERATION, RETARDING. Dealers in bulbs, cut-flowers, nursery stock, fruits and vegetables employ cold-storage to retard the growth of bulbs and plants, or to preserve cut-flowers and produce, by using specially constructed sheds, refrigerators, ice-boxes, or the public cold-storage warehouses. The nursery stock thus stored can be packed and shipped from the cold to warmer parts of the country in good season for planting, when it would be impossible to dig and ship such stock without the storage system Sheds for the storage of nursery stock have earthen floors, are ventilated and lighted from the ridge-and-furrow roof and heated to exclude frost, the maximum temperature being 35° to 40.° Large trees are stood upright, the smaller stock usually laid lengthwise in compartments. The roots are covered with sphagnum, or a mixture of sphagnum and excelsior or cedar shingletow, the shingletow or excelsior alone will not make good covering for this purpose See *Nursery.*

The roots and bulbs commonly placed in cold-storage are those used by florists for forcing, such as lily bulbs, lily-of-the-valley pips, and the like. By placing these in cold-storage, growers can secure a continuous succession of bloom throughout the year. Lily bulbs are stored in the original cases packed in soil, the cases being cleated to provide circulation of air, and held at 34°. The *multiflorum* and *formosum* varieties of *Lilium longiflorum* can be held in storage three to four months, and the *giganteum* type of this lily ten to eleven months, *L. auratum* four months, *L. speciosum* and varieties eight months The sizes (circumference) of storage lily bulbs and number of bulbs to the case are as follows:

L longiflorum and its varieties *multiflorum, formosum* and *giganteum*, 6- to 8-inch, 400, 7- to 9-inch, 300, 9- to 11-inch, 200, in *L longiflorum giganteum* there is an 8- to 10-inch size which runs 225 to the case; *L auratum* 8- to 9-inch, 160, 9- to 11-inch, 100, 11- to 13-inch, 75; *L speciosum*, 8- to 9-inch, 200, 9- to 11-inch, 100, 11- to 13-inch, 75. Lily-of-the-valley pips are packed in a mixture of sphagnum and sand, one-fourth of the latter being used to three-fourths of the moss and held at 28°. These are packed 500, 1,000 and 2,000 to the case and can be kept in storage eleven months. Canna roots, dahlias and gladioli should be held at 35° to 40°.



1027. Coleus cutting.

Cut-flowers, such as roses, carnations, orchids, violets, and lilies, used by florists, are preserved for varying periods in ice-boxes or refrigerators, the usual temperature being 35° to 40°. Peonies cut when the buds show color, leaves removed from the lower part of the stem, wrapped in paper, and the lower bare portions of the stems placed in water, will keep several weeks at a temperature of 32° to 33°. *Lilium candidum* in bud can be treated the same way.

Fruits and vegetables are stored at 33° to 35°. Warehousemen say that cold-storage merchandise keeps best and is easiest to handle in packages containing about a bushel. See *Storage*.

MICHAEL BARKER

COLE. A generic name, little known in North America, for plants of the cabbage tribe, cole-oil is secured from species of Brassica.

CÒLEA (Sir G. Lowry Cole, Governor of Mauritius) *Bignoniàceæ*. Glabrous evergreen trees or shrubs of Madagascar, Mauritius and the Seychelles, members of which may occur in collections of warmhouse (or stove) plants. Lvs. opposite or verticillate, pinnate, with many entire lfts. fls. medium-sized, yellow, white or rose-color in lax or dense cymes or fascicles, corolla funnelform, somewhat bilabiate, with 5 rounded spreading lobes, perfect stamens 4, didynamous.—Probably 15 species, but little known in cult. They thrive in a fibrous earth and prop by means of mature shoots in sand over bottom-heat.

CÒLEUS (Greek for *sheath*, referring to the monadelphous stamens). *Labiàtæ*. Common window-garden and greenhouse showy-leaved herbs, and a few less known species grown for the handsome flowers.

Herbs or small shrubs, annual or perennial, upright. lvs. opposite, dentate or serrate, petioled or sessile. st. 4-angled. fls. mostly blue or lilac, in terminal spike-like racemes, small and middle-sized and usually bluish, the 5-toothed calyx deflexed in fr.; corolla bilabiate, the lower lobes longer and concave, and inclosing the essential organs, stamens 4, didynamous and declinate, the filaments united into a tube, the anther-cells confluent, ovary 4-parted, subtended by a gland-like disk, the style 2-lobed.—Probably 150 species, in the tropics of the eastern hemisphere, being especially abundant in Afr., E. India and adjacent isls. Some species produce tubers that are eaten in the same way as potatoes.



1029. A good young coleus plant.

The common coleuses are of the most easy culture. They root readily from short cuttings, cut either to a joint or in the middle of an internode (Fig. 1027). Few conservatory plants are more ready to root than this. They may be rooted at any time of the year when new wood is to be secured. Formerly coleuses were much used for bedding, but the introduction of better plants for this purpose has lessened their popularity. They require a long season, they are likely to burn in the hot summers of the interior country; they have a weedy habit. However, they withstand shearing and therefore are useful for carpet-bedding. The leading variety for this purpose is still the old Golden Bedder, whose golden yellow foliage is used as filling for fancy designs.—Coleus plants make excellent specimens for the window-garden and conservatory. Best results are secured when new plants are started from cuttings each spring. They also grow readily from seeds, many interesting leaf-forms and colors arising. The old plants become leggy, lose their leaves, and lack brightness of color. They are very subject to mealy-bug. They are also liable to root-gall (the work of a nematode worm), as shown in Fig. 1028. When plants are thus affected, take cuttings and burn the old plants, and either bake or freeze the earth in which they grew.



A *Common garden coleus, with red, purple, yellow, green and variegated foliage*

1028. A coleus attacked by root-galls.

Blùmei, Benth. (*C. Verschaffèltii*, Lem. *C. scutellarioìdes* var. *Blùmei*, Miq.) This species, founded on cult. plants in Java, is probably to be regarded, as now understood, as an assemblage or combination of species. The horticultural forms are perhaps derived in part (as suggested by Briquet and by Koorders) from *C. lacìniatus*, *C. bùcolor*, and others, and perhaps they are to be considered also in connection with *C. atropurpùreus*, Benth., of Malaysia, and its relatives. The entire garden material needs to be worked over in comparison with authentic native oriental specimens. Portraits of *C. Blumei* of botanical interest are B.M. 4754, I.H. 27:3-7, 35, 46, 39, 164, F.S. 22, 228778. A soft perennial herb or sub-shrub, growing 2-3 ft. high, little branched. lvs. ovate, narrowed or broad at base and long-acuminate, sharply and nearly regularly toothed, variously colored with yellow, dull red and purplish. An extreme form of this is var. **Verschaffèltii,** Lem., Fig. 1030, which is more robust and branchy, the lvs. more brilliantly colored, acute but not acuminate, truncate or even cordate at base, and irregularly cut-dentate, with rounded teeth, giving the margin a crispy effect (I.H. 8:293). In some forms, the lvs. are laciniate.

AA. *Other species of Coleus, now and then in cult. (Still other species may be expected to appear in the trade.)*

thyrsoídeus, Baker. Tender shrub, 2–3 ft. high: sts. pubescent: lvs. cordate-acuminate, coarsely crenate, lower ones 7 in. long. fls. bright blue, in racemes which contain as many as 18 forking cymes with about 10 fls. in each Cent. Afr. B M. 7672 —Considered to have much merit for cult., either under glass, or in the open far S. Winter.

shirénsis, Baker. Perennial herb, densely pubescent, 3 ft., much like the above in habit· sts. angular, pale green turning to brown: lvs. glandular, pungently aromatic, broadly ovate, acuminate, membranous, 2–3 in. long, deeply crenate, pubescent beneath but scantily so above· fls dark blue (also described as light blue), in large erect terminal panicles. Cent Afr. B M 8024 —Winter.

Mahónii, Baker Shrub, to 2 ft, pubescent, the branchlets slender: lvs. petioled, ovate, acute, 2–3 in. long, crenate, membranous, pale and finely pubescent beneath and green and nearly glabrous above· fls small, purple with golden anthers, in a large graceful panicle Cent Afr.—Winter

Pénzigii, Damm. Soft perennial herb, white-hairy: lvs ovate, membranous, narrowed abruptly at base, crenate; petiole winged· fls. bright lilac (also described as ashy blue) in a long and lax racemose panicle, the whorls being about 8-fld. Nile Land. L. H. B

COLIC-ROOT: *Aletris farinosa.*

COLLÀBIUM (*neck* and *lip*, referring to a peculiarity of the fl.). *Orchidàceæ* Two terrestrial orchids, of Java and Borneo, rarely cult, requiring the treatment given Catasetum. *Lf* single, plicate fls. or clusters racemose, on a tall scape; lateral petals attached to the foot or base of the incurved column, lip at its base encircling the column (whence the generic name); pollinia 2 *C nebulòsum,* Blume Sts. fleshy, about 2 in. long· lf. broadly ovate, acuminate, the petiole rounded· scape about 2 ft, erect, fls. numerous in scattered clusters or whorls, spurred, about ½in long, the lip 3-lobed, white and a little fringed, the sepals and



1030. Coleus Blumei var. Verschaffeltii.

petals greenish with reddish margins. Java. *C. simplex,* Reichb. *Lf.* oblong, acute, wavy, green with darker blotches: fls racemose at the apex of the scape; lip white; sepals and petals greenish yellow with purple and brown blotches. Borneo.

COLLARDS. A kind of kale. Probably several somewhat different plants pass as collards, the characteristic being that they produce tufts or rosettes of leaves that are removed and used as greens. Usually referred to *Brassica oleracea* var. *acephala.* See *Brassica.*

In the South, a form of the plant known as Georgia collards is much grown for domestic use and the southern market. The plant grows 2 to 4 feet high and forms no head, but the central leaves often form a kind of loose rosette. These tender leaves are eaten as a potherb, as all other kales are. Fig. 1031, shows a Georgia collard, with a heavy crown. The seeds of collard may be started in a frame under glass, or in a seed-bed in the open As far south as the orange-belt, they are usually started in February and March, in order that the plants may mature before the dry, hot weather. Farther north they are started in July or August and the plants are ready for use before cold weather Transplant to rows 3½ to 4 feet apart, and 3 feet apart in the row Till as for cabbage.



1031. Collards.

Young cabbage plants are sometimes eaten as "greens" under the name of collards, and cabbage seeds are sown for this specific purpose. In the North, where heading cabbages can be raised, collards of whatever kind are not greatly prized. L. H. B.

COLLÈTIA (Philibert Collet, 1643–1718, French botanist). *Rhamnàceæ.* Odd spiny shrubs grown under glass, and in the open in California and other warm regions

Leaves small and simple (or wanting), opposite branches short, often flattened, arranged in opposite pairs, thickened, spiny (sometimes called lvs.) fls small, perfect, yellowish or white, nodding on 1-fld. pedicels, single or fascicled in the axils or beneath the flattened divaricate spines; calyx bell-shaped or tubular, 4–5-parted, petals 4–6 or 0, inserted on the calyx, stamens 4–6, disk joined to calyx-tube, inconspicuous or the margin rolled-in, ovary 3-lobed and 3-celled, standing in the disk, the stigma 3-lobed fr a coriaceous dry drupe-like caps —About a dozen species in S Amer., mostly in the tropical parts The colletias are said to start readily from cuttings of half-ripened wood, as well as from seeds. They are to be grown as single or detached specimens, because of their oddity

cruciàta, Gill. & Hook (*C. hórrida,* Hort.). Very curious shrub, 3–4 ft, with elliptic flattened very broad-spiny decurrent branches: lvs few, elliptic, entire· fls. small, white, a few together at the base of the spines, borne profusely in spring S. Brazil, Uruguay. B M. 5033.

spinòsa, Lam Shrub, to 10 ft, with strong awl-shaped very sharp spines lvs. elliptic, small, sessile, serrate, mostly vanishing at blooming time fls. larger, urn-shaped, borne singly or nearly so beneath the spines. S. Brazil, Uruguay.

ulícina, Gill. & Hook Smaller, 3–4 ft.: spines as in *C spinosa,* but more numerous, thicker, and hairy: fls. cylindrical, in clusters near tops of the branches. Andes of Chile.

Ephédra, Vent. Small stiff bush: branches erect, spiny: lvs. wanting: fls (in very early spring) sessile at

the nodes, spicate-glomerate, calyx top-shaped, the lobes spreading. Peru, Chile. L.B.C. 19:1830.—Reported as cult. in Calif L. H. B.

COLLIGUÀYA (Chilean name) *Euphorbiàceæ* Small trees of the Chilean region, scarcely in cult., although the fragrant wood of some species is used Seeds of this and related genera which have springing movements, due to contained insect larvæ, are sometimes known as "jumping beans" Juice milky: fls monœcious, apetalous, calyx imbricate or none in staminate fls; stamens 1–5, ovary 2–4-celled, cells 1-ovuled. The following may be expected in botanical collections, although probably not in the trade: *C. odorífera*, Molina Lvs serrate, ovate to oblong *C. brasiliénsis*, Klotzsch. Lvs serrulate, linear-lanceolate. *C. integérrima*, Gill. & Hook. Lvs linear, entire.

J B S Norton.

COLLÍNSIA (after Zaccheus Collins, American philanthropist and promoter of science, Philadelphia, 1764–1831) *Scrophulariàceæ*. Hardy flower-garden annuals mostly from California and western North America

Leaves simple, verticillate in 3's, or opposite. fls in the axils, solitary or in whorls, racemose in some species, calyx bell-shaped, corolla deeply bi-labiate, stamens 4, the fifth rudimentary and glandular —About 25 species They are not far removed botanically from Pentstemon and Chelone From the former, the genus differs in having the fifth sterile stamen reduced to a mere gland

The collinsias are free-flowering and of the easiest culture They may be sown outdoors in the fall in well-drained soil, and will bloom earlier than if sown in spring Their flowers borne in midsummer range in color from white through lilac and rose to violet, with clear, bright blue also, at least on one lip of the flower There is no yellow.



1032. Collinsia bicolor.

A. *Fl.-stalks very short, giving the clusters a dense appearance*

B. *Corolla strongly declined; throat as wide as long*

bícolor, Benth Fig 1032. Height 1–2 ft hairy, glabrous, or sticky. sts weak and bending lvs more or less toothed, and oblong or lanceolate, sessile, finely toothed, opposite or in 3's. fls typically purple and white, with 5 or 6 well-marked color varieties. Var **álba,** Hort (Fig. 1033), has pure white fls., or the lower lip greenish or yellowish. Var **multícolor,** Voss (*C multicolor*, Lindl & Paxt), has variegated fls, the same fl being white, lilac, rose or violet on either lip or both Var. **multícolor marmoràta,** has the lower lip white, suffused lilac, and upper lip light lilac, spotted and striped carmine Calif., below 2,000 ft B M. 3488 P M 3 195. B R 1734 —This is the most widely distributed and variable species, and the one on which the genus was founded. Calif, mostly in moist ground

BB. *Corolla less strongly declined, throat much longer than broad*

bartsiæfòlia, Benth. Height 1½ ft, the st. usually stiff and simple: sticky and somewhat glandular, rarely hairy lvs from ovate-oblong to linear: fl.-whorls 2–5, purplish or whitish seeds not wrinkled. Calif.

AA. *Fl.-stalks ½in long or more, giving the clusters a looser look.*

vérna, Nutt Height about 6 in lvs ovate or oblong or the lowest rounded and slender-stalked, and the upper ovate-lanceolate and partly clasping. whorls about 6-fld; fl.-stalks longer than the fls; throat of the corolla as long as the calyx-lobes, lower lip bright blue, upper lip white or purplish seeds thick, not flattened, oblong, arched. Moist woods, W. N Y and Pa. to Wis and Ky. B M 4927.



1033. Collinsia bicolor var. alba (×½)

grandiflòra, Douglas Height 4–12 in lvs thickish, the lowest roundish and stalked: whorls 3–9-fld, fl.-stalks about as long as the fls; lower lip deep blue or violet; upper lip white or purple; throat of the corolla sac-like, as broad as long, or as long as the upper lip: seeds roundish, smooth. Shady hills of Calif B R 1107.

Wilhelm Miller.
N. Taylor †

COLLINSÒNIA (after Peter Collinson, English botanist, correspondent of Linnæus and John Bartram) *Labiàtæ*. Horse-Balm Horse-Weed. Stone-Root. Native perennial herbs

Plants of small importance horticulturally, with large, odorous, ovate, serrate, mostly long-stalked lvs, thick roots, and simple or panicled, naked, terminal racemes of yellow or whitish fls —Three species in E N Amer, one of which is sometimes offered by dealers in native plants, but is not especially ornamental They are of simple cult

canadénsis, Linn Citronella Height 2–4 ft lvs. 4–9 in long, broadly ovate to oblong racemes paniculed; calyx in fl 1 line, in fr 4 or 5 lines long, corolla light yellow, lemon-scented, ½in long Rich woods, Canada to Wis, Kans, and south to Fla L H B

COLLÒMIA (Greek for *glue*, alluding to the mucilaginous character of the wetted seeds) *Polemoniàceæ*. In Asa Gray's late treatment, Collomia is included with Gilia, although at first kept distinct by him (Proc. Amer Acad Arts & Sci XVII, 223), and this disposition is followed here, particularly since none of the species seems to be known in the trade as Collomia. Engler & Prantl keep the genus distinct, however, ascribing to it eighteen species from western North America and Chile Such as are cultivated will be found in this Cyclopedia under *Gilia*. The Collomias are annual, biennial and perennial.

COLOCÀSIA (old Greek substantive name) *Aràceæ*. Perennial herbs with cordate-peltate leaves, which are often handsomely colored in cultivation, grown under glass, and one of the forms much used for planting out when large-leaved tropical effects are desired; also grown for the edible tubers.

Plants tuberous or with an erect caudex: lf.-blades peltate, ovate or sagittate-cordate, basal lobes rounded: blade of spathe 2–5 times longer than tube; spadix shorter than spathe, terminating in a club-shaped or subulate appendage destitute of stamens Differs from Alocasia and Caladium in floral characters—Species 5. Tropics.

Colocasia includes the plants known as *Caladium esculentum*, which are much grown for subtropical bedding. *C. odorata* (which is an Alocasia) has very large,

thick stems, which may be wintered over safely without leaves, or at most with one or two, the stems, to save space, being placed close together in boxes *C. esculenta* rests during the winter and is kept under a greenhouse bench or anywhere out of the reach of frost or damp All of the tall-growing colocasias are of the easiest culture As they are very rank-growing plants they are not much grown in greenhouses, but are chiefly planted out-of-doors for summer display. They do best in damp rich soil. The dwarf species and forms are suited for pot growth, but little is seen of them except in public gardens Consult *Caladium* for further treatment (G W Oliver.)



1034. Colocasia antiquorum var. esculenta. (Caladium esculentum).

Colocasias furnish the much-cultivated taro of the Pacific tropics, this edible product being the large starchy roots. From it is made the poi of Hawaii In Japan and other countries the tubers of colocasias are much cultivated, and are handled and eaten much as we use potatoes (see Georgeson, A G 13 81) The young leaves of some kinds are boiled and eaten The dasheen is of the same group It has been recently introduced from tropical America, and is receiving considerable attention for cultivation in the South The tubers may also be forced for the tender shoots Cf Bull. 164 Bur. Plant Ind U S Dept Agric (1910), and subsequent publications of Off. Foreign Seed and Pl Intro

antiquòrum, Schott Lvs. peltate-ovate, basal lobes half as long as the apical one, connate two-thirds to three-fourths their length, separated by a broad, triangular, obtusish sinus India B M. 7364.

Var **euchlòra,** Schott (*C euchlòra,* C Koch). Petioles violet, blade black-green, with violet margins.

Var **Fontanèsii,** Schott (*Alocàsia violàcea,* Hort. *Caladium violàceum,* Hort *C. álbo-violàceum,* Hort ?). Petioles violet, blade dull green, with violet margins B M 7732 —Multiplies rapidly by whip-like runners and grows well in shallow water

Var. **illústris,** Engler (*C. illústris,* Hort). Black Caladium Petioles violet, blade more oblong-ovate, with black-green spots between the primary veins. F.M , 1874 107 —Very beautiful in masses, but fls have offensive odor

Var. **esculénta,** Schott (*Caládium esculéntum,* Vent. *Colocàsia esculénta,* Schott). Elephant's Ear. Fig. 1034 Spadix with an appendage half as long as the staminate infl.: lvs. bright green, often 3 ft. or more long, nearly as wide. Hawaii and Fiji G. 2:62, 571; 7:44

affínis, Schott. Blade thin, membranaceous, rounded-ovate or ovate, the apical lobe scarcely a fourth or a third longer than wide; basal lobes connate nearly their entire length, bright green above, glaucous beneath; blade only 4–6 in long Himalaya —Not hardy in Cent. Fla.

Var. **Jénningsii,** Engler (*Alocàsia Jénningsii,* Veitch). Petiole purplish, with transverse purple lines; blade cordate, emarginate, with large, oblong or triangular black-green or black-violet spots between the primary lateral veins. I H. 16:585. F S. 17.1818–19. —Not hardy in Cent Fla.

nèo-guineénsis, André Remarkable for its tufted habit, the shortness of the lf -stalks, its short-stalked infl , and the beautiful green tone of its smooth and shiny lvs , spotted with creamy white. New Guinea I H 27 380

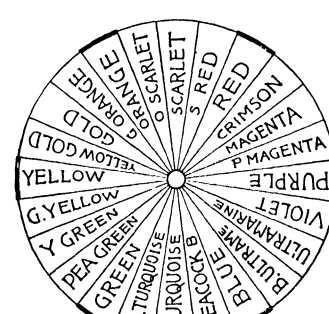
Márchallii, Engler (*Alocàsia Márchallii,* Hort. *A hýbrida,* Bull). Hybrid, probably of *C. affinis* and *C. antiquorum.* Larger in all parts than *C. affinis,* the petioles pale green, very slightly emarginate, with large, confluent spots

C bataviénsis=Alocasia batavíensis(?) —*C Caracasàna,* Engler =Xanthosoma —*C javánica,* Hort =(?) —*C. Mafaffa,* Hort = Xanthosoma —*C margináta,* Hort =Caladium bicolor —*C monorrhiza,* Hort =(?) —*C odòra* Bronga =Alocasia odora, Koch. Tree-like, the st or caudex 3–6 ft and 6 in diam lvs green, cordate, stalked, bearing peduncles in pairs in their axils E Asia B M 3935 —*C odorâta,* Hort =Alocasia macrorrhiza

George V. Nash †

COLOCYNTH: *Citrullus*

COLOR IN FLOWERS. The range of simple color among flowers is not very extensive There are singular and almost unaccountable intervals in that range where color is conspicuously absent in every genus Indeed, there is no such thing as a pure green flower, nor a pure blue one, neither is there any flower to match the remarkable blue-green or green-blue so familiar in the plumage of certain birds, this has no existence at all in the vegetable world The range of color, therefore, among flowers is strictly circumscribed A simple color is a hue not complicated with any other tint or shade or hue Roughly described, the hues comprise yellow, gold-yellow, orange, scarlet, red, crimson, magenta, purple, violet, and ultramarine, these together with blue, peacock-blue, green, and yellow-green (hues which do not appear in the floral world) compose a circle of color from which all tints and shades are derived Fig 1035 In other words, the admixture of white with a hue produces a tint, and the admixture of black, a shade Fig 1036 A reduction of the range of hues given above to its simplest terms would comprise only yellow, orange, red, purple, blue, and green, six primary colors Fig 1037 Although pioneer investigators of the nature of color



1035. The intermediate hues.

resolved these six hues into three—yellow, red, and blue,—the restriction was made at the cost of absolute purity in the other three hues which they chose to name secondary colors There is no possible way of producing absolutely pure orange, violet, or green, by a combination of pigments

The generic character of flower-colors is comprehended in the hues just named, although such names are of little consequence so long as identification is without question Unfortunately scientists and artists have not yet established a standard nomenclature of color, and as a consequence the name of a particular hue is largely determined by a consensus of public opinion, which, very naturally, is not always correct.

WITH BLACK	WITH WHITE	CLEAR COLOR
OLD GOLD	SULPHUR	YELLOW
OCHRE	STRAW Y.	COLD Y.
BURNT ORANGE	SALMON	ORANGE
TERRA COTTA	SHRIMP P.	SCARLET
CARDINAL	PINK	RED
MAROON	C PINK	CRIMSON
PLUM	P. LILAC	MAGENTA
DARK B PLUM	LILAC	PURPLE
LOGWOOD VIOLET	B. LILAC	VIOLET
INDIGO	V. BLUE	ULTRAM'E

1036. Color phases in flowers.

Classification of colors.

It is essential, therefore, to accept both popular and scientific estimates of color if the subject is to be considered in its relation to flowers The scientific determination of simple colors is expressed by certain arbitrary numbered lines in the spectrum Thus, yellow is at line 580, gold-yellow at 605, orange at 630, scarlet at 655, red at 680, green at 530, peacock-blue at 505, violet at 430, ultramarine at 455, and blue at 480 These numbers indicate the wave-lengths of the respective hues, with the micron (one-millionth part of an inch) as the unit This identification of color, however satisfactory from a scientific point of view, is both intangible and impracticable in every other respect The flower-petal or the artist's pigment matched with the spectrum is the only proper medium through which to convey an adequate knowledge of a given hue to the layman, and it must be remembered that everyone is hypothetically the layman who is not directly associated with the particular science or art under consideration The colors of certain flower-petals as matched with the spectrum lines are as follows

Yellow (580) —*Œnothera biennis, Brassica nigra, Ranunculus acris, Helianthus decapetalus,* a single dandelion ray

Gold-yellow (590).—*Rudbeckia hirta,* golden calendula

Gold-yellow (585) —*Kerria japonica*

Gold-orange (600) —Golden eschscholtzia.

Gold-orange (615) —*Crocus susianus*

Orange (635) —*Tropæolum majus* (deepest orange hue), the common type.

Scarlet (645) —Mme. Crozy canna, scarlet geranium and tropæolum, berry of *Cornus canadensis*

Red (680) —Red azalea, red carnation, tube of *Rhododendron nudiflorum*

Red (690) —Red gladiolus.

Crimson —Crimson peony, American Beauty rose (dilute).

Magenta —Magenta cineraria, *Polygala sanguinea.*

Purple —Purple cineraria, *Mimulus ringens.*

Violet (425) —*Viola cuculata* and *Campanula rotundifolia* (light)

Violet (430).—*Verbena ernoides.*

Ultramarine violet (440) —*Centaurea Cyanus,* the bluest phase (light).

Ultramarine blue (455).—*Scilla sibirica* (light)

Ultramarine blue (435).—*Gentiana Andrewsii,* (bluest tip of petal).

Blue (475).—*Myosotis palustris,* bluest phase (pale).

Such a list is manifestly imperfect; to state the case accurately, few flowers are "on the line," three of the colors have no numbered lines, and many of the plant species or varieties are not and can not be explicitly cited For example, the red carnation must be a red and not a scarlet-red variety, and its coloring should match that of the *Rhododendron nudiflorum* tube; the same rule applies to the red gladiolus. It is equally the case that many flowers show only a modification or a dilution of the hue they are chosen to represent; the blue of the forget-me-not at best is extremely dilute.

A list of artists' pigments is more to the point. It has the great advantage of nomenclatorial fixity and it does not include hues subject to change. The representative colors are

Lemon, zinc, ultramarine, pale cadmium, and light malori yellows

Medium cadmium and malori gold-yellows.

Cadmium orange and deep malori orange-yellow.

Orange mineral.

Scarlet-vermilion.

Carmine or alizarin lake (no single pigment is exactly normal red), these incline to scarlet.

Crimson lake

Magenta. a mixture of crimson and mauve lakes in nearly equal parts

Mauve lake· a true purple.

Violet ultramarine

Guimet's French ultramarine.

Cobalt blue

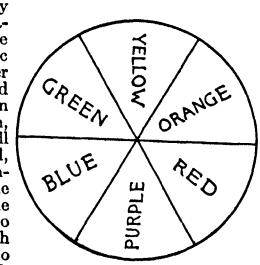
Emerald-green.

The color harmonies.

If the simple colors, yellow, orange, red, purple, blue, and green, are arranged in a circle (Fig. 1037), those lying opposite each other harmonize by reason of absolute contrast Blue and orange, for example, are complementary colors and theoretically they balance each other It by no means follows, however, that a mass of orange nasturtiums and blue forget-me-nots must therefore look well together; the very massing of such hues would make that impossible in spite of the fact that the misty grayish character of a clump of blue forget-me-nots is the reverse of aggressive. But the orange of the nasturtium is obtrusive to the last degree, and its environment should be as colorless as possible—even to the point of dull gray or white

If these six simple colors in the circle are again separated by intermediate hues (Fig 1035), so about three of the latter lie between the six original colors, the result will be a circle of twenty-four divisions, having the effect of a rainbow This will perfectly illustrate the principle of color harmony and color discord. Besides the opposing colors which harmonize by contrast, there are neighboring colors which harmonize by analogy.

For example, any four or five colors lying side by side in the circle are bound together harmoniously by reason of their near relationship. Therefore, all these four or five colors may be combined—and nature does combine them—with esthetic results But skip over four of the colors and attempt a combination of the first and sixth, and the result will prove to be a discord, the bond of relationship is broken, and the eye is disturbed by the aggressiveness of two colors between which there is evidently no bond of sympathy. It

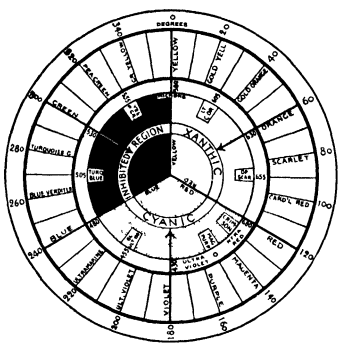


1037. Harmony by contrast.

would be safe to say, therefore, that the circle demonstrates the fact that its colors situated at right angles with each other are discordant, and those lying nearly parallel with each other are harmonious

This is the theoretical side of color harmony. The practical side is scarcely different, it simply modifies the theory. Brilliant blue and orange, which are theoretically harmonious, are scarcely as agreeable in each other's company as the rule would imply. The trouble, however, lies with the brilliancy The golden calendula and the deep purple aster in association are violent and aggressive. Remove the one and the other and substitute pale-tinted flowers of these hues and the result will be harmonious

Flower families are very likely to sustain harmonies of analogy. Hyacinths, sweet peas, and nasturtiums



1038 The circle of 360° in colors.

represent groups with very nearly related hues or tints There is a predominating influence of crimson-pink among sweet peas, of lilac among hyacinths, and of orange among nasturtiums, yet the influence at times (in a particular variety) is wholly wanting and is replaced by an analogous tint or hue It would be a rather nice bit of color adjustment which would result in a harmony superior to that of a careless grouping together of flowers gathered at random from any one of these three genera.

But the theory that analogous colors harmonize is correct only when not carried to excess Attempts to force deep-hued flowers into harmony often lead to contrary results A range of color from crimson to ultramarine depends for its harmony upon the careful grading of intermediate hues Such colors, in full force, might do violence to each other. It is tempting the hardness of a diamond to pound it with a hammer. It is taxing crimson too heavily to expect it to show its beauty in the presence of strong violet! The effort should rather be to merge the individualities of the crimson and the purple flowers into a group and effect a play of color between the two

The theory that colors at right angles on the wheel are discordant is also subject to some modification. Relatively the right-angled colors must be crude and strong to affect the eye objectionably Yellow and red in the rose is an agreeable color-combination Yellow and red dahlias crowded together are certainly harsh and unneighborly.

A country bouquet of asters, marigolds, fuchsias and dahlias is bad, because the country garden is not a part of it. Atmosphere, space, and a stretch of green foliage make a world of difference.

It is wisest to try the effect of one color upon another before allowing two or three strong hues to wage war with each other. It will be found quickly that white is a peacemaker, and green is an invaluable mediator With these colors at command, the chances of discord are reduced to a minimum. Everything also depends upon simplicity in color-combinations It is questionable whether a combination of more than two colors can be ever esthetically a success. The adjustment of many colors needs the hand of an expert.

The restriction of color in flowers.

The very strict limitation of range in flower-colors demands careful study if it would be thoroughly understood Augustin Pyramus de Candolle divided flower-colors into two classes, which he named xanthic (red, scarlet, orange, gold-orange, yellow, and green-yellow), and cyanic (green-blue, blue, ultramarine-violet, violet, purple, and red) Further, he explained, flowers of the yellow (xanthic) series could pass into red or white but never into blue, and those of the blue (cyanic) series could pass into red or white but never into yellow. The theory is correct but it requires both modification and revision Gold-orange must evidently displace yellow, and ultramarine-violet displace blue as series names; furthermore, the passage into red should not exceed scarlet-red in the xanthic series, or crimson-red in the cyanic series. Pure red logically should be the zero point between the two divisions, and not be included in either unless connected by analogous hues.

Gold-orange and ultramarine-violet are respectively the type-colors of the two series because each occupies a median position with equal influence on either hand. Red, occupying the median position between the two series, should and does exercise an equal influence on both, a casual glance at the chromatic scale demonstrates the fact Neither the xanthic nor the cyanic series can exclusively claim the respective yellow and blue in absolute purity, for the cogent reason that among flowers yellow is associated with both these divisions, and a true blue scarcely appears at all. Further, if pure red is the zero point between the two series, then the consistent red of the xanthic order is scarlet-red, and that of the cyanic order is crimson-red; a pure red or pure yellow flower, therefore, consistently belongs to either order according to its xanthic or cyanic congeners.

The best proofs of the above statements are to be found among the flowers themselves Asters belong to the cyanic group, but there is no blue aster Tropæolums belong to the xanthic group, but there is no pure yellow nasturtium, there are, however, ultramarine-violet asters and gold-yellow nasturtiums There is a pure yellow, a golden orange, but no white marigold (Tagetes); the species is xanthic The family Cruciferæ is cyanic; it includes pure yellow, deeper yellow, and magenta flowers The genus Hyacinthus is cyanic; it includes no blue flower, but many which are purple, violet, cyanic red, and modified yellow *Viola tricolor* is cyanic, it includes a strong yellow along with intense purple and violet-ultramarine flowers. The genus Zinnia is xanthic, it includes no true yellow flower but many which range through all reds into cyanic crimson. The genus Rosa is cyanic, its flowers range from pure red to magenta-crimson, develop a strong, modified yellow, fuse yellow with crimson, but never approach the xanthic gold-orange. The genus Chrysanthemum is xanthic; its flowers include all yellows, skip pure orange and scarlet, and range from scarlet-red to cyanic red-crimson.

Species belonging to the cyanic group invariably produce white flowers which have an albino origin. Species of the xanthic order produce white flowers which are not albinos but which invariably displace flowers of some strong, pure xanthic hue. For example, geraniums are white, red, scarlet, and pink, but never gold-orange or golden yellow Carnations are white, red, and cardinal-red, but never scarlet, or orange. Chrysanthe-



XXIX. Cranberry-picking in a New Jersey bog.

mums are yellow, white, and pink, but never orange or scarlet. Dahlias are scarlet, red, crimson-red, and even pure yellow, but never pure gold-orange, or orange

It is perfectly evident from the foregoing examples that the range in a given genus, or species, is limited to what may be termed the swing of a pendulum upon the chromatic scale (Fig. 1038). The swing may extend over a quarter of the dial, rarely it does more If it happens that two colors are developed, like violet and yellow, it will still be found that there is but one pendulum-swing and not two Violet will be associated with contiguous hues, but yellow will be developed quite alone.

This, it is reasonable to believe, is direct evidence of a dual or treble origin of color in a flower group Yellow cannot be evolved from violet, or vice versa. Necessarily, if white appears in a xanthic group, it must have evolved alone and independent of any color-range in that group Undoubtedly the range of contiguous colors itself has evolved from a median hue which has spread out, fanlike, in graded variations within strict limits Naturally, such statements conflict with the old theory that all flowers were originally yellow, but they are not inimical to the idea that the earlier ones might have been yellow, and later ones magenta, violent ultramarine, scarlet, and gold-orange. It is important to keep in mind the fact that a steamboat is not evolved from a locomotive

It is further evident that yellow belongs quite as little to the xanthic as it does to the cyanic series, or, to put it more strongly, it belongs to neither Its origin, independent of any "range," was undoubtedly the elimination of blue from chlorophyll Hence, it is not surprising to find it in some modified form associated with both series, and in the cyanic series isolated. The flora of the northeastern United States is essentially cyanic Twenty-one per cent is yellow, 21 per cent magenta and 22 per cent white, the remainder is 8 per cent xanthic and 28 per cent cyanic—the last mostly pink and light violet The record is significant and points directly either to an arrested color development, or to a depauperate color condition in an inclement region, the former seems the more likely. An aggregation of cyanic-flowered plants are found in the north temperate zone, and of xanthic-flowered plants in the torrid zone

Color activity.

Color results from a play of light upon a surface which rejects or absorbs certain rays It is a significant fact that the red end of the spectrum comprehends those hues which are produced by the caloric rays of the sun, and the violet end those hues which are produced by the actinic rays It is not surprising therefore that the coloring of vegetation is intense, and that xanthic flowers predominate under the equator A separation of cyanic and xanthic flowers follows almost identically the thermal lines which band the great continents of the northern hemisphere, cyanic color prevailing north, and xanthic color south of the line marking 80° F. In a word, xanthic flowers belong to a very warm, and cyanic flowers to a temperate or cold climate That they should become mixed in a narrow zone between the extremes is only natural; the rule, therefore, is in no way compromised thereby. That yellow, too, should appear in both cyanic and xanthic groups is not at all surprising In the spectrum it holds a median position between the red and the violet ends; it is neither a hot nor a cold color, and has consequently evolved from its primitive condition as a constituent of the green in chlorophyll under any and all temperatures That is the only way to account for its isolation when connected with cyanic groups.

It would appear, then, that magenta, violet, and ultramarines, together with gold-orange, orange, and red, are primitive colors quite as well as yellow and white. In what order they appeared upon the earth in the petals of flowers, it would be difficult to determine, but it is reasonable to think they appeared as original colors, in weak, perhaps, but absolute purity. Otherwise, the remarkable limitation of color-range must be accounted for by a less logical theory. Upset this limitation, and attempts to produce a blue rose, yellow aster, white nasturtium, or green carnation, should prove successful Recognize the limitation, and the futility of such attempts becomes at once apparent, and the possibility of improving existing "strains" of color is illimitable. At some time or other in the distant past the law of limitations fixed the range of flower-colors; no new law of elasticity has since developed to remove the boundaries and thus aid the floriculturist in his ambition to produce what would prove to be a mere novelty See *Standards of Color*.

F SCHUYLER MATHEWS.

COLTSFOOT *Tussilago Farfara.* Sweet coltsfoot is Petasites, formerly called Nardosmia.

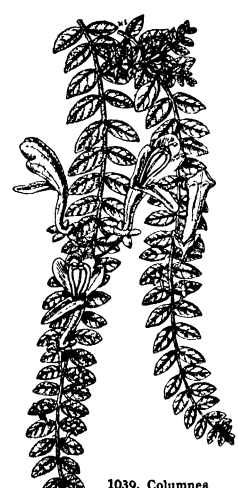
COLUMBINE *Aquilegia.*

COLQUHOÛNIA (after Sir Robert Colquhoun). *Labiàtæ* Tender plants with dense whorls of gaping fls an inch long or more, colored scarlet and yellow Erect or twining shrubs, woolly in all parts when young lvs. large, crenate whorls few-fld , axillary or crowded into a terminal spike or raceme, corolla-tube incurved, the throat inflated.—Two Asian species Prop. by cuttings of growing tips, in sandy soil, under glass in summer.

coccínea, Wall Tall climber, with very long branches, 8–10 ft · lvs stalked, ovate-acuminate, 3–5 in long, crenate, dark green above, roughish, typically with scarcely any woolliness except when young. corolla twice as long as the calyx B M 4514 —*C tomentòsa,* Houll., is probably identical The dense woolliness is perhaps temporary R H 1873 130 shows a handsome terminal spike in addition to axillary clusters, containing about 20 fls —Apparently not advertised, but probably as worthy as the next

vestita, Wall. Very similar to *C coccínea,* except that it is a low-growing, erect plant, and more densely and permanently woolly on the st , calyx and under side of lvs , which are elliptic or elliptic-ovate and cordate —Cult outdoors at Santa Barbara, Calif , where it may be used for the wild garden as it is perfectly hardy Not of much horticultural value

N. TAYLOR †



1039. Columnea gloriosa (×⅛)

COLÚMNEA (after Columna or Colonna, Italian writer on plants, sixteenth century) *Gesneràceæ* Tropical American shrubs and climbers, sometimes grown under glass in choice collections

Flowers widely gaping, showy, often 2 in. long: lvs. opposite, nearly equal or widely unlike: fls. solitary or numerous, axillary, stalked or not, without bracts or with bracts in an involucre; corollas scarlet, carmine or yellowish —A group of 100

species of which half a dozen mostly red- or orange-fld , are cult. abroad and may be known to a few fanciers at home, but are not advertised by the dealers. They are warmhouse evergreens requiring the treatment of Trichosporum (Æschynanthus).

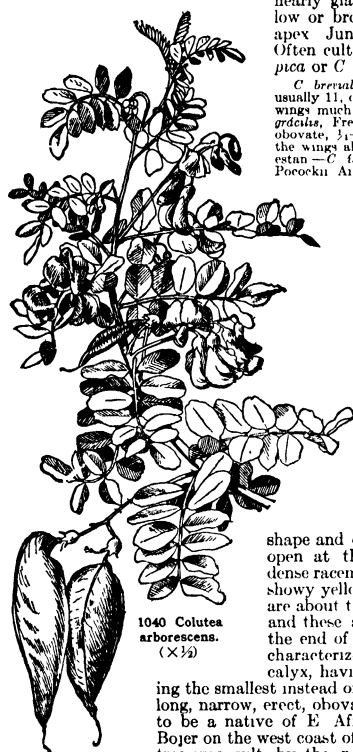
Schiedeàna, Schlecht. The best known species. It has handsome scarlet fls. 2 in. long, sometimes variegated with yellow. It is an herbaceous climber from Mex. B.M. 4045. P.M 9:31.

gloriòsa, Sprague. Fig. 1039. An epiphytic perennial herb: lvs. ovate or ovate-oblong: fls. axillary, solitary, scarlet and yellow. Costa Rica. B. M. 8378.

C glàbra, Oerst, var. *màjor* Fls. scarlet; stamens white Costa Rica —*C magnífica,* Klotzsch & Hanst Corolla bright scarlet; tube inflated about the middle Costa Rica G C III. 43 66 —*C. Oerstediàna,* Klotzsch Epiphytic undershrub or herb fls. scarlet. Costa Rica. B.M 8344. N. Taylor.†

COLÙTEA (*Koloutea,* ancient Greek name). *Leguminòsæ.* Bladder Senna. Shrubs grown chiefly for their attractive yellow or brownish red flowers and the ornamental bladder-like pods

Deciduous, with alternate, odd-pinnate lvs : lfts. many, rather small, stipules small: fls. papilionaceous, in axillary, few-fld , long-peduncled racemes, yellow to brownish red; calyx campanulate, 5-toothed; standard suborbicular with 2 swellings above the claw; 9 stamens connate, 1 free pod inflated, bladder-like, many-seeded —About 15 species in the Medit region to Abyssinia and Himalayas Ornamental free-flowering plants of rapid growth, with pale green or glaucous foliage and yellow or brownish red fls. during summer, followed by large, usually reddish-colored and decorative pods They grow in almost any soil, but prefer a tolerably dry and sunny position; not quite hardy N , the hardiest being *C arborescens* —Prop by seeds sown in spring or by cuttings of mature wood inserted in fall in sandy soil; rarer species and varieties are sometimes grafted on *C. arborescens* in spring under glass.



1040 Colutea arborescens. (×½)

A. *Fls yellow· pod closed at the apex*

arboréscens, Linn. Fig. 1040. Shrub, to 15 ft : lfts. 9–13, elliptic, dull green, mucronulate, usually slightly pubescent beneath, ½–1 in. long: fls. 3–8, about ¾in. long; wings nearly as long as the keel, flat. June–Sept S. Eu., N. Afr., N. B.M 81.—Lvs. have cathartic properties. Var. **crispa,** Kirchn. Dwarf, with crisped lvs. Var. **bullàta,** Rehd. (*C. bullàta,* Hort.). Dwarf and compact: lfts. 5–7, obovate or nearly orbicular and somewhat bullate.

cilícica, Boiss. (*C longialàta,* Koehne. *C. melanocàlyx,* Hort., not Boiss). Shrub: lfts. bluish green, usually 11, oval or broadly ovate, rounded or truncate and mucronulate at the apex, ½–¾in. long: fls. bright yellow, 3–6, about ¾in. long; wings longer than the keel. June–Aug. Asia Minor. G.C. III. 16:155.

AA. *Fls. orange-yellow or brownish red, wings shorter than the keel.*

mèdia, Willd. Shrub, to 10 ft : lfts. 7–13, obovate, grayish green or glaucous, ⅓–⅔in. long, nearly glabrous: fls. 3–6, orange or reddish yellow, the standard with brownish markings pod closed at the apex. June–Sept.—Probably hybrid of garden origin between *C. arborescens* and the following, often cult. under the names of the following species.

orientàlis, Mill. (*C cruénta,* Ait). Shrub, to 6 ft.: lfts 7–11, obovate, glaucous, thickish, ½–½in long, nearly glabrous fls 3–5, reddish yellow or brownish red pod open at the apex June–Sept S E. Eu , Orient —Often cult under the name of *C. halepica* or *C istria*

C brevialàta, Lange Shrub, to 4 ft lfts. usually 11, oval, ½–¾in long fls 2–6, yellow, wings much shorter than keel S France —*C gràcilis,* Freyn & Sintenis Ifts usually 11, obovate, ⅓–⅓in long fls 2–5, yellow, with the wings almost as long as the keel Turkestan —*C istria,* Mill (*C halepica,* Lam *C Pocockii* Ait) To 4 ft lfts glaucous, small and numerous fls yellow, nearly 1 in long, wing longer than the keel —*C nepalénsis,* Hook Similar to *C arborescens* racemes drooping B M 2622. B R 1727 Tender.

Alfred Rehder

COLVÍLLEA (after Sir Charles Colville, governor of Mauritius). *Leguminòsæ* Showy-flowered tropical tree, a worthy rival of the royal poinciana, which is closely allied, but easily distinguished, especially by its round and full, not flat, legume

Colvillea has drooping racemes, 1½ ft. long, densely crowded with perhaps 200 fls of curious shape and of a splendid scarlet, the fls open at the st. end of the pendent dense raceme, and display masses of long showy yellow stamens, the unopened fls are about the size and shape of a filbert, and these are gradually smaller towards the end of the raceme —Only 1 species, characterized by its large, oblique, colored calyx, having 4 segms , the standard being the smallest instead of the largest part, wings very long, narrow, erect, obovate pod 2-valved - Supposed to be a native of E Afr , but discovered in 1824 by Bojer on the west coast of Madagascar, where a single tree was cult. by the natives It flowered there in April or May. Its cult is similar to that of cesalpinia. Prop. in the S only by seeds Not common in cult. outside of botanic gardens and fanciers' collections

racemòsa, Bojer Tree, 40–50 ft high, with the general aspect of *Poinciana regia* but with a thicker trunk and ampler foliage. branches very long and spreading· lvs. about 3 ft long, alternate, remote, twice pinnate, with 20–30 pairs of pinnæ which are opposite, 4 in. long, and have 20–28 pairs of lfts , each ½in. long: keel very small, almost covered by the wings; free stamens 10, 3 inserted below the standard, 2 under the wings, 1 under the keel, and 4 under the ovary. B.M. 3325–6. Wilhelm Miller.

COMÁNDRA (name alludes to the hairs in the fl). *Santalàceæ.* Perhaps a half-dozen leafy herbs or subshrubs, one in Eu., and the others in N. Amer , more or less parasitically attached to the roots of other plants, one or two of which may be of interest to horticulturists Lvs. alternate, almost sessile· fls whitish or greenish, small, perfect, in terminal cymes or umbellate panicles; calyx 4–5-cleft, lined or constricted

above the ovary, and the tube sometimes conspicuously continued to a neck or top on the fr ; petals wanting; stamens of same number as calyx-lobes, the anthers connected by hairs to the calyx-lobes. fr nut-like or drupe-like. **C. umbellàta,** Nutt. (Fig 1041), 6–18 in. high, in dry mostly open ground in the eastern states, is an attractive plant when allowed to spread naturally in patches in waste places rootstock not showing above ground (*C Richardsiàna,* Fern , has a superficial rootstock). lvs thin, oblong, pale beneath: fls. whitish

L H. B.



1041 **Comandra umbellata.** (×½)

COMARÉLLA: *Potentilla*

COMAROSTÀPHYLIS *Arctostaphylos*

COMÀRUM (an old Greek name). *Rosàceæ* One species allied to Potentilla, and often referred to that genus but differing in the lateral style unknown in Potentilla. **C. palústre,** Linn (*Potentilla palústris,* Scop), the marsh cinquefoil, is a decumbent herb growing in swales in the northern states (also in the Old World), with pinnate, 5–7-foliolate lvs (lfts dentate), and solitary or cymose purple fls ½ in across petals shorter than the calyx-lobes, acute, stamens numerous An odd and interesting but not showy plant, sometimes planted in bogs Mn 3·97 —The fr somewhat resembles a strawberry, but is spongy instead of juicy. In some parts of Scotland, it is said to be called cowberry and is rubbed on the inside of milk-pails to thicken the milk **C. Salesòvii,** Bunge (*Potentilla Salesoviàna* Steph), of the Himalayan region and Thibet, 11,000–14,000 ft altitude, is a suffruticose silky-hairy plant worthy of cult , but little known in gardens: lvs. pinnate; lfts. 7–9, oblong, obtuse, crenate-serrate: fls white, in an ample paniculate cyme Probably better placed in Potentilla. B.M. 7258.

N. Taylor.†

COMBRÈTUM (old Latin name). *Combretàceæ* Tropical shrubs and trees, many of which are climbers by means of the persistent leaf-stalks

Leaves mostly opposite, in some species verticillate in 3's or 4's, entire fls in spikes or racemes, polygamous; calyx bell-shaped; petals usually 4, stamens usually 8 fr winged and indehiscent, 1-seeded. —A genus of 250 species from Asia, Afr. and Amer , particularly S Afr. The combretums are warmhouse plants, little known in this country Prop by cuttings of firm wood One climbing species is in the American trade **C. coccíneum,** Lam (*C purpùreum,* Vahl. *Poivrea coccínea,* DC.), from Madagascar. Lvs oblong-lanceolate, acuminate, evergreen. fls. small, brilliant red, the long-exserted stamens forming the chief feature of beauty; the handsome loose spikes often in panicles; parts of the fl. in 10's. B.M. 2102 L B.C. 6 563 —Handsome. *C. butyrosum* yields a butter-like substance, used by the Kafirs as food. *C. sundaicum* in recent years has attained some prominence as a reputed anti-opium remedy.

N. Taylor.†

COMFREY: *Symphytum*

COMMELÌNA (bears the name of early Dutch botanists) Also written Commelyna. *Commelinàceæ.* Day-Flower. Perennial or annual herbs, of which a very few are cultivated in the open or under glass for their interesting flowers

Upright, spreading or procumbent, usually more or less succulent, often rooting at the joints. lvs alternate, sessile or short-petioled, clasping the st , a lf subtending the sessile fl -cluster and forming a clasping folded spathe: fls. opening for a day, mostly blue (varying to white and rose), irregular; outer perianth parts (calyx) 3, colored, 2 of them somewhat united, inner parts (petals) 3, one of them small and 2 broad and with long claws, stamens usually 6, but only 3 of them fertile, filaments not hairy fr. a 2–3-celled caps on a recurved pedicel —Nearly or quite 100 species, in warm regions around the globe, a few of them reaching cool-temperate climates The cult species are perennials The hothouse species appear not to be offered in this country or to be much cult. Allied to Tradescantia and Zebrina

Commelinas are mostly of easy culture, thriving well in any light rich soil The evergreen stove and greenhouse species are readily propagated in March or April by cuttings inserted in an ordinary propagating-bed and kept close for a few days, while the tuberous-rooted half-hardy herbaceous species may be propagated either by division of the tubers or by seeds sown in a frame early in April and afterwards transplanting the seedlings in the herbaceous border. In the fall, they should be lifted and the tubers stored away in the same manner as dahlias Of the tuberous-rooted species, *C cœlestis* is perhaps the best, its bright blue flowers being very effective, especially when planted in masses (Edward J Canning)



1042. **Commelina cœlestis.** (×½)

A *Plant hardy in the open*

nudiflòra, Linn (*C Séllowii,* Walp *C Sellowiàna,* Schlecht). Creeping, rooting at the joints, glabrous or practically so lvs lanceolate to ovate-lanceolate, acute or acuminate, the lf-sheaths often ciliate: spathe-lf acute or acuminate, broad at base, petioled fls few in each cluster, ½in or less across, blue: caps 3-celled and 5-seeded N J southward and widely dispersed in other parts of the world.—Sometimes offered as an outdoor plant. A rose-colored form is reported.

communis, Linn. Much like the last and often confused with it more erect and less rooting at joints fls larger. caps 2-celled and 4-seeded. N. Y. southward, and widely distributed; perhaps an intro. from Asia.

AA. *Plant tender or only half-hardy.*

tuberòsa, Linn. Diffuse and branching, from a tuberous root: lvs. narrow-lanceolate, 2–3 in. long: spathe-lf. cordate-ovate to lanceolate, conduplicate, more or less hairy; sheaths pubescent. fls. rich blue. Mts of Mex.—The plant sold under this name is recommended as a free-flowering border plant in England, the tubers to be lifted in autumn and stored in dry sand for the winter.

cœléstis, Willd. Fig. 1042. Erect, root more or less tuberous, 10–18 in. high, branching, with clasping, long, broad-lanceolate pointed lvs. and blue fls (2–10 together) on elongating axillary pubescent peduncles: spathe-lf. ovate, folded; sheaths ciliate Mts of Mex.—Runs into several forms. Var. **álba,** Hort., has white fls. Var. **variegàta,** Hort., has fls. blue and white *C. cœlestis* is a half-hardy plant, in the N. requiring protection of a greenhouse, although it may be planted out. Prop. by seed, cuttings and tubers.

L. H. B.

COMPARÉTTIA (Andreas Comparetti, 1746–1811, Italian botanist). *Orchidàceæ.* A small group of graceful epiphytes.

Pseudobulbs, 1–3-lvd.: racemes simple or branched; fls. small, lateral sepals united in a single piece, lengthened at the base into a conspicuous horn, lateral petals converging; labellum large, produced into a double spur, which is hidden in the horn made by the sepals; column free, semi-terete, erect, pollinia 2.—Four species, Mex. to Brazil Grown on blocks or in baskets in a light intermediate or warmhouse

coccínea, Lindl. Pseudobulbs small, bearing lanceolate, coriaceous lvs, purple beneath: racemes several-fld; fls. 1 in across; petals and sepals light yellow, margined orange-red, labellum large, broader than long, crimson. Brazil. B R. 24·68. I.H. 13:472.

falcàta, Poep et Endl. (*C. ròsea,* Lindl). Similar in habit to *C. coccinea:* fls 1 in across, deep crimson; labellum broad; racemes pendent. Peru. B.M. 4980. A.F. 6.609. Lind. 4.163 F.S. 2:109.

macroplèctron, Reichb f. Fls 10 or more, 2 in. across, dorsal sepal whitish, often spotted with purple; midlobe of labellum cleft, suborbicular, magenta-rose, dotted at the angled base; spurs conspicuous. Colombia B M. 6679. Var **punctatíssima,** Hort., has the fls. copiously rose-spotted. C.O. 1. GEORGE V. NASH.†

COMPASS PLANT: *Silphium.*

COMPOST. Mixed and rotted vegetable matter, particularly manure and litter, used as a fertilizer and amendment

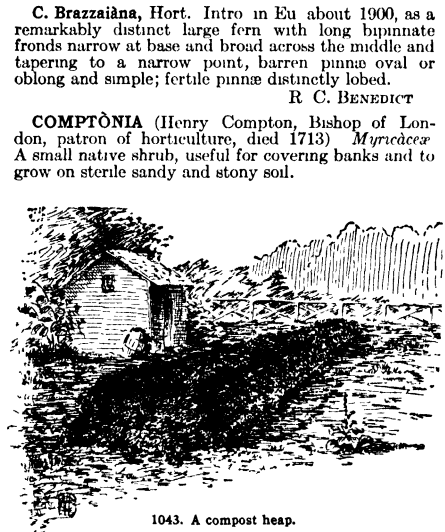
The mixture of bulky fertilizing materials known as compost, while of little importance to the general farmer, plays an important part in garden practices. Many of the garden crops must be made in a very short time, or are of delicate feeding habits Their food, therefore, must be easily assimilable It is good practice to pile all coarse manures, sods, weeds, or any rubbish available for the purpose, in big flat heaps (Fig. 1043), to ferment and rot before being applied to the garden soil If desired, chemical manures, especially superphosphate (dissolved bone or South Carolina rock) and potash (muriate or kainit), may be added to make the compost the richer By spading or forking the heaps over a few times at reasonable intervals, a homogeneous mass is easily obtained, which can be applied in greatest liberality without fear, or more sparingly, in accordance with the needs of the particular crop. Of equal, if not still greater importance, is the compost heap which gives soil for greenhouse benches, flats, hotbeds and coldframes. This compost is principally made of sods shaved off a rich pasture or meadow and piled in alternate layers with stable manure, more of the latter being used for forcing succulent crops, and less in growing plants which should be short and stocky, like cabbage or tomato plants. Garden litter may be added to the pile, as leaves and trimmings All compost heaps, during dry weather, need frequent and thorough moistening with water, or, better, with liquid manure Turn several times during the year, to ensure thorough rotting of the materials T. GREINER.

COMPTÈRIS. The only published reference to this generic name and species is in G C. III. 29: May 21, 1901, suppl 2, where its introduction to cultivation by L. Linden is noted. The name Compteris may be a corruption, or the plant may have been a young form of some known form. The description below is quoted from The Gardeners' Chronicle

C. Brazzaiàna, Hort. Intro in Eu about 1900, as a remarkably distinct large fern with long bipinnate fronds narrow at base and broad across the middle and tapering to a narrow point, barren pinnæ oval or oblong and simple; fertile pinnæ distinctly lobed.

R C. BENEDICT

COMPTÒNIA (Henry Compton, Bishop of London, patron of horticulture, died 1713) *Myricàceæ* A small native shrub, useful for covering banks and to grow on sterile sandy and stony soil.



1043. A compost heap.

The genus is allied to Myrica, and by some not regarded as sufficiently different in botanical characters to justify separate generic rank branching brown-twigged bush, dioecious or monoecious, with globular fertile catkins, the 1-celled ovary surrounded by 8 linear persistent scales or bractlets lvs long-oblong, pinnatifid. fr. a bur-like axillary head of few small nuts The only species is **C. asplenifòlia,** Gaertn. (*C peregrìna,* Coulter *Myrica asplenifòlia,* Linn.) SWEET FERN In dry, sterile soil in the E. and N U S, also in the trade It is an attractive undershrub (1–3 ft.) with fern-like, scented foliage and brownish heads of imperfect fls: roots long and cord-like staminate catkins 1 in. or less long, slender, in clusters at the ends of the branchlets. L. H. B.

CONÁNDRON (*cone-shaped anther*) *Gesneriàceæ* Almost stemless herb with radical glabrous rugose lvs Differs from Streptocarpus, its nearest horticultural relative, in having a straight, not twisted pod. For cult. see *Streptocarpus* It should be grown in shade and is hardy only south of N. C

C. ramondioìdes, Sieb. & Zucc., of Japanese mountains, is the only species It is an interesting little tuberous-rooted herb, with oblong, rugose, irregularly toothed root-lvs. and scapes bearing 6–12 white or purple, dodecatheon-like fls. cymes nodding or drooping pubescent; corolla 1 in. diam.: seeds very minute.

B M 6484.—This is one of several groups of rare and widely scattered herbs, of which Ramondia, Haberlea, Wulfenia, Didymocarpus, Shortia and Schizocodon are examples. Conandron is adapted to growing in shady rockeries Scapes less than 1 ft. high. Little known in cult, but is in the trade. N. TAYLOR †

CONE-FLOWER: *Rudbeckia.* **Purple Cone-Flower:** *Echinacea.*

CONGÈA (from an East Indian vernacular name). *Verbenàceæ* A few species of climbing shrubs in Burma and the Malayan peninsula. lvs opposite and entire: fls in peduncled capitate cymes which are combined in large terminal panicles, the bracts at the base of the cyme-peduncles large and often showy; calyx funnel-form, 5-toothed; corolla-tube slender, seldom much exceeding the calyx, usually hairy in the throat, 2-lipped, the upper lip of 2 narrow upright lobes and the lower of 3 shorter broader lobes, stamens 4, exserted, ovary incompletely 2-celled fr a small roundish nearly dry drupe **C. tomentòsa,** Roxbg, is grown in India and is said to be suitable for growing in a stove or warm conservatory in Britain a strong climber, conspicuous for the pink and changing tints of the large elliptic persistent bracts in the loose woody terminal panicles lvs 3 in long, ovate-acute, soft-hairy beneath: corolla white, calyx hairy Burma G C. III 54 399 — Evergreen infl retained for several weeks. Allied to *Petræa volubilis*

CONIFERS *Arboriculture*

CONIOGRÁMME (Greek, *dust-line*) Formerly *Dictyogramma Polypodiàceæ* A few Japanese and Pacific island ferns, with naked sori, which follow the course of the free or reticulated veins The species are sometimes referred to Gymnogramma Strong-growing indoor-ferns, useful for specimen plants

japónica, Diels Lvs simply pinnate or bipinnate at the base, 1½–2 ft high, the pinnæ 6–12 in long and an inch wide, sori extending from the midrib to the edge Japan and Formosa —Also known as *Gymnogramma japonica* An interesting fern of rather strong growth, and very distinct in appearance Grows best in a moderate temperature—for example, 55–60°— and requires an open and well-drained soil of peaty character R C BENEDICT †

CONÌUM (Greek name) *Umbelliferæ* Two weedy biennial plants, widely distributed *C. maculàtum,* Linn, is the poison hemlock, "by which," as Gray writes, "criminals and philosophers were put to death at Athens" It is a rank, much-branched European herb which has run wild in E. N Amer, and which has been offered in the trade as a border plant It is biennial, rank-smelling, and poisonous, and is scarcely worth cult although the finely cut dark foliage is highly ornamental It grows from 2–4 ft high, and has large umbels of small white fls See *Poisonous Plants*

In North America the word hemlock is used for the hemlock spruce, *Tsuga*

CONOCÉPHALUS (Greek, *cone head*). One of the liverworts (Marchantiaceæ), with broad flat forking evergreen thallus, growing on moist banks, like a moss *C. cónicus,* Dumort, is sometimes offered by collectors as a cover for rockeries, but can scarcely be said to be a cultivated plant.

CONOCLÍNIUM: *Eupatorium.*

CONOPHÁLLUS (name refers to the cone-shaped inflorescence) *Aràceæ* A name proposed by Schott for certain aroids, but now made a section of Amorphophallus **C. Kónjac,** Koch, is *Amorphophallus Rivieri* var. *Konjac,* Engler The great tuber is much grown in Japan for the making of flour (see Georgeson, A.G 13:79). *Amorphophallus Rivieri* is figured on p. 276, Vol I.; also in R.H 1871, p. 573; and in B M. 6195 (as *Proteinophallus Rivieri*). Konjak is offered by importers of Japanese plants.

CONSERVATORY. Primarily a glasshouse in which plants that have been brought to perfection—usually in other greenhouses—are to be placed for display or to be kept in condition.

The conservatory should be as near the residence as possible; if not an architectural unit of the house, it may be connected by a corridor or pergola The size of a conservatory depends of course upon the requirements or taste of the family, some are as small as 6 by 10 feet, while others are as large as 35 by 75. The aspect or side of the dwelling best suited to a conservatory is on the east, and preferably against a gable, so that sliding snow from the roof of the dwelling will not give trouble If this is not convenient, the glass roof of the conservatory must be protected with snow-guards A lean-to house is subject to great fluctuations if placed against the south side

Since much attention has been given to the building of conservatories within the past few years, they can now be made attractive in architectural design, and at the same time supply the best possible conditions for the well-being of the plants. A curvilinear roof is usually more attractive and is better for the plants than a flat roof, but abundant ventilation must be provided The roof glass should be ground or, frosted, as plants remain in flower much longer under a subdued light than when exposed to direct sunlight. Even ground glass is not sufficient in summer, some shading being required, roller shades are hard to adjust and not altogether practicable, whitewash applied to the glass outside is unsightly and damages the painted wooden strips in which the glass is laid The following has been found to be an excellent shading mixture: Sixteen ounces white lead, thirty-eight ounces turpentine, two ounces linseed oil, apply to the glass outside with an ordinary paint-brush The advantages of this mixture are that it is not unsightly, is easily applied, and wears off as winter comes on

The heating of a conservatory is an important matter, since even night temperatures must be maintained as in other greenhouses This can easily be arranged if the dwelling is heated by hot water, which is the best for any conservatory, but with steam or hot air it is more difficult, if possible when these methods of heating the dwelling are used, a separate small hot-water system should be installed for the conservatory. The temperature at which conservatories are to be kept depends upon the plants grown in them. Palms, ferns, orchids and ornamental-leaved plants generally require a night temperature of about 60° Flowering plants, such as chrysanthemums, azaleas, primulas and bulbs, do better in a temperature of 45° to 50° at night with a rise of 15° to 20° for both classes of plants by day before opening the ventilators, and these, in winter especially, must be opened with caution, admitting the outside air very sparingly.

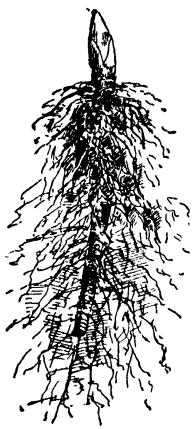
The floor of a conservatory may be of tiles and the interior may be arranged with rugs and easy chairs in the center with the plants arranged on tables around the outside or over the heating-pipes. The catalogues of the principal greenhouse builders show some very artistic arrangements, both inside and outside

A conservatory is often a part of a commercial greenhouse establishment, being in effect the display house or room into which interesting and perfected plants are brought for inspection; and in large cities conservatories are often attached to florists' stores, not only as a display house but because plants will keep in much better health and condition for a much longer time than in the ordinary conditions of the florist's store; but commonly the word is used as above to designate an adjunct to a home. EDWARD J. CANNING.

CONVALLÀRIA (old name *Lilium convallium*, derived from *convallis*, a valley) *Liliàceæ*. LILY-OF-THE-VALLEY. A dainty herb, much prized for its erect racemes of white delicately-scented flowers; perennial

Leaves radical, from a horizontal rootstock, producing upright parts or pips (Fig 1044) fls. white (sometimes pink-tinged), small and short-bell-shaped, with short blunt recurved lobes, nodding, in a short, radical, raceme (Fig 1045), the stamens 6 included, style 1 (Fig 1046); fr a globular small few-seeded red berry. —Commonly considered to be only one species, native in Asia, Eu, and in the higher mts, Va to S. C; of several similar races or types

Lily-of-the-valley is much prized for its delicate, sweet-scented flowers. The rhizome and roots are sold in drug-stores they are poisonous in large doses; in small doses used as a heart tonic The plant is popularly supposed to be the one referred to in the Sermon on the Mount, but this is not to be determined It is essentially a shade-loving plant The species is **C. majàlis,** Linn Lvs oblong or oval, thick and persisting till autumn, forming a dense sod, plane, with more or less bloom; racemes 5–10 in high; berry ¼in diam. R H 1886 84 Gn 47, p 179; 52 182 and p. 319 (the latter in fruit). A F 13.402 Gng. 5.56–7. F.R 2 4. G C. III. 23 : 149 (var *grandiflora*). Lowe, 42 (var *variegata*)



1044. Lily-of-the-valley pip.

The plant is hardy, and is easily grown in partially shaded places and moderately rich ground. Old beds are liable to run out. The roots and runners become crowded, and few good flower-stems are produced It is best to replant the beds every few years with vigorous fresh clumps, which have been grown for the purpose in some out-of-the-way place Five or six strong pips, with their side growths, planted close together, will form a good clump in two years if not allowed to spread too much The mats of clean foliage make attractive carpets under trees and in other shady places If the bed is made rich and top-dressed every fall, it may give good results for four or five years; and plants in such beds thrive in full sunshine One form has prettily striped foliage, very ornamental in the early part of the season Lilies-of-the-valley bloom early in spring. They run wild in many old yards, in cemeteries, and along shady road-sides There are double-flowered forms; also one (var. *prolificans*) with racemes 2 feet long (J. B Keller)

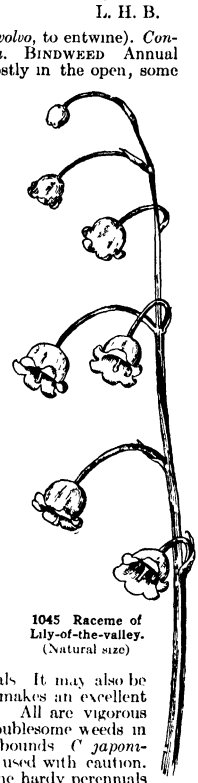
For culture as a florist's flower, see *Lily-of-the-valley.*

Recent studies of this genus by E L Greene, have distinguished 3 other species *C japonica*, Greene, representing the Japanese form of the plant rootstock very short and stout lvs 2 only, subequal, elliptic, cuspidately acute, bright green with no trace of bloom on either surface peduncle short, about equaling the bases of the lvs, raceme few-fld, the bracts small, ovate-lanceolate, perianth widely opening, broadly bell-shaped or almost saucer-shaped, stamens large, very short, the very obtuse anthers longer than the filaments —*C globòsa*, Greene Herbage light green, without trace of bloom lvs with a more fibrous and less fleshy anatomy than those of C. majalis, and of shorter duration, disappearing by the end of summer perianth urn-shaped (not bell-shaped), stamens inserted about the middle of the perianth, extending horizontally (rather than vertically, as in C majalis). Probably N C, but described from plants growing in a wild garden in Washington, D C, later-blooming than C majalis —*C. majuscula*, Greene Differs from C majalis in its very large light green lvs., which have no trace of bloom and an excessively fibrous anatomy which makes the growing lf. to look pleate, more than twice larger than C majalis, later-blooming perianth broadly bell-shaped, filaments very short, nearly hypogynous, erect, anthers large, oblong, obtuse, cordate at base S E. Pa, and southward.

L. H. B.

CONVÓLVULUS (Latin, *convolvo*, to entwine). *Convolvulàceæ* Includes *Calystègia*. BINDWEED Annual and perennial herbs, grown mostly in the open, some are twiners

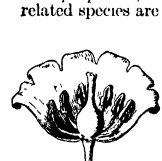
Sometimes suffrutescent, twining, trailing, erect or ascending, with filiform, creeping rootstocks lvs petiolate, entire, toothed or lobed, generally cordate or sagittate: fls. axillary, solitary or loosely cymose, mostly opening only in early morning, corolla campanulate or funnelform, the limb plaited, 5-angled, 5-lobed or entire —A genus of about 175 species, widely distributed in temperate and tropical regions Convolvulus and Calystegia are no longer kept separate As *Convolvulus Sepium* is the type of both genera, they are therefore synonymous When the fls of *C occidentalis* are borne singly, the calyx bracts are broad and Calystegia-like, when borne in clusters the bracts are greatly reduced



1045 Raceme of Lily-of-the-valley. (Natural size)

The species thrive in a variety of soils without especial care The greenhouse species do best in a soil with considerable fiber The hardy perennials are usually propagated by dividing the roots, otherwise by cuttings or seeds, the tender species preferably by cuttings *C tricolor* is the most important of the hardy annuals It may also be started in the greenhouse, and makes an excellent plant for the hanging-basket All are vigorous growers, and may become troublesome weeds in some places if not kept within bounds *C japonicus* and *C Sepium* should be used with caution. This is the chief reason why the hardy perennials are not often found in well-kept gardens, except along wire fences or lattice screens, where the turf is laid up close so as to allow only a narrow border for the roots The double-flowered form of *C japonicus* is seen to best advantage in half-wild places, or on rocky banks, where shrubs make but a stunted growth Here it will grow luxuriantly, forming graceful festoons from branch to branch, and covering the ground with a pretty mantle of green (J B Keller)

C purpureus, the common morning-glory, and many related species are to be found under Ipomœa.



1046 Section of flower of lily-of-the-valley, laid open to show the parts. (×2)

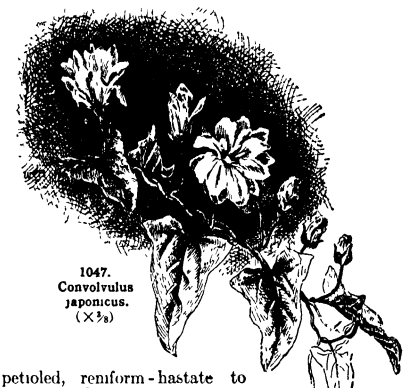
INDEX

americanus, 8
arvalis, 4
atriplicifolius, 2
aureus superbus, 11
Berryi, 2
Binghamiæ, 4
californicus, 1.
Cneorum, 8
compactus, 10.
cyclostegius, 4
deltoideus, 2
gracilentus, 4
Greenei, 4
illecebrosus, 4.
interior, 5
japonicus, 3.
longipes, 4
malacophyllus, 2.
mauritanicus, 6.
minor, 10
occidentalis, 4
oleæfolius, 9
polymorphus, 4.
pubescens, 3
purpuratus, 4.
repens, 5
saxicola, 2.
Scammonia, 7.
Sepium, 5
tricolor, 10
tuberosus, 1
vittatus, 10

A. *Calyx with 2 membranaceous bracts at the base: peduncles usually 1-fld. (Calystegia.)*

B. *St. prostrate, 8 in. to 2 ft. high peduncle usually shorter than the lvs.*

1. **californicus,** Choisy (*C villosus,* Gray. *Calystegia villosa,* Kellogg) Plant densely white-villose throughout· st prostrate, scarcely twining: lvs. slender-



1047. Convolvulus japonicus. (×⅓)

petioled, reniform-hastate to sagittate, the upper acuminate, 1 in or less long, the basal lobes often coarsely toothed bracts oval or ovate, completely inclosing the calyx. fls cream-yellow, 1 in long. Calif —Perennial.

2 **malacophyllus,** Greene Similar to the preceding but foliage velvety,or plushy pubescent. Calif —Perennial Other closely related Californian species are *C saricola,* Eastw , *C deltoideus,* Greene, *C Bérryi,* Eastw and *C atriplicifolius,* House.

BB *St twining or trailing, 3–10 ft high· peduncle exceeding the lvs*

3 **japónicus,** Thunb (*Calystegia pubéscens,* Lindl). California Rose Fig 1047 Hardy perennial herbaceous twiner growth very vigorous, often 20 ft whole plant more or less densely and minutely pubescent. lvs hastate, lanceolate, obtuse or broadly acute, with angular or rounded lobes at the base, variable, occasionally without lobes, rarely sharp lanceolate. fls. bright pink, 1–2 in broad, produced freely during the summer months and remaining expanded for several days Japan and E Asia The double form is now naturalized from S E N. Y to D C and Mo P M. 13.243. F S 2:172 B R 32 42 —The double form is completely sterile, with narrow wavy petals, irregularly arranged, the outer somewhat lacerate. A valuable decorative plant for covering stumps and walls In rich soil the roots spread rapidly, and will smother out all other plants unless confined in tubs The *Calystegia pubescens* of Lindley has been wrongly referred to *Ipomœa hederacea,* but the two plants are very different, the former being perennial and the latter annual See Journ Hort Soc 1:70 (1846) The plant is commonly confounded with *C Sepium*

4 **occidentâlis,** Gray. Hardy perennial, herbaceous or with suffrutescent base: st. twining, several feet high, glabrous or minutely pubescent: lvs from angulate-cordate, with a deep and narrow sinus, to lanceolate-hastate, the posterior lobes often 1–2-toothed: peduncle 1-fld. or proliferously 2–3-fld , bracts ovate or lanceolate, usually completely inclosing the calyx, variable; corolla white or pinkish, 1–2 in. long; stigmas linear. Dry hills, Calif.—Listed as early as 1881. An admirable plant for rockeries. Several related species are native also to Calif *C cyclostegius,* House, *C Binghamiæ,* Greene, *C. polymórphus,* Greene, *C. Grenei,* House, *C. dridus,* Greene, *C purpurâtus,* Greene, *C. villecebrosus,* House, *C. gracilentus,* Greene, and *C. longipes,* Wats.

5 **Sèpium,** Linn. (*Calystegia Sèpium,* R Br.) Rutland Beauty. Fig 1048 Perennial trailer, 3–10 ft. long, glabrous or minutely pubescent· lvs. round-cordate to deltoid-hastate, the basal lobes divaricate, entire or angulate: fls white, rose or pink, with white stripes. F S 8.826 B M 732 A G 12 638 Gn. 50.514.— A very variable species Cosmopolitan in temperate regions. An insidious weed in moist soil. The native forms have been called *C interior,* House, Rocky Mt. region; and *C. americanus,* Greene, in the eastern states, but are difficult to distinguish Var **rèpens,** Gray (*C. rèpens,* Linn) Pubescent. sts. trailing or sprawling: the basal lobes of the lvs. obtuse or rounded. Coastal region from Que. to Fla.

AA *Calyx without bracts peduncle 1–6-fld. (Eucon-volvulus)*

B. *St. prostrate, trailing, glabrous or minutely pubescent.*

6 **mauritânicus,** Boiss Strong perennial roots. st. herbaceous, slender, prostrate, rarely branched, minutely villose lvs alternate, round-ovate, obtuse, short-petioled fls blue to violet-purple, with a lighter throat, 1–2 in. across, very handsome Afr. B M. 5243 F S. 21·2183 Gn 39·52 —A free bloomer through the summer. On dry banks each plant forms a dense tuft which throws up many graceful shoots Not hardy north of Philadelphia

7 **Scammònia,** Linn Hardy perennial trailer, deciduous: st. angular, glabrous lvs cordate-sagittate, gray-green, the lobes entire or dentate· sepals glabrous, ovate, obtuse; corolla white, creamy or light pink Asia Minor —The large tap-roots supply the resinous cathartic drug scammony

BB *St erect or ascending, silky.*

8 **Cneòrum,** Linn. St shrubby, half-hardy, 1–4 ft. high lvs persistent, lanceolate or spatulate, silky gray: infl a loose panicle, 1–6-fld.; fls white or tinged with pink, borne freely during the summer. S Eu — Valuable as a pot-plant for greenhouse or window decoration, or trained to a warm wall Confused with *C oleæfolius*

9 **oleæfòlius,** Desr Tender perennial lvs linear-lanceolate, acute, slightly villose: fls bright pink, borne freely in loose, umbellate panicles in the summer Greece. B M 289 (as *C. linearis*) —Many plants now passing as *C oleæfolius* are *C Cneorum.* The latter may be distinguished by its broader, blunter, silvery-villose lvs., lighter-colored blossoms and taller growth.



1048. Convolvulus Sepium. (×⅛)

10 **tricolor,** Linn. (*C minor,* Hort) Fig. 1049. Hardy annual st. trailing, ascending 6–12 in., angulate, densely covered with long brown-

ish hairs: lvs. linear-oblong or subspatulate, obtuse or rounded at the apex, usually pubescent but sometimes glabrous, the margin ciliate towards the base. peduncle 3-fld., exceeding the lvs , sepals ovate, lanceolate, villose, acute, limb of the corolla azure-blue, throat yellow, margined with white. S Eu. B M 27.—One of the best annuals for the home border. Each plant covers a ground space of 2 ft , and blooms continuously throughout the summer. Fls. remain open all day during pleasant weather There are many variously striped and spotted forms of this popular annual, none of which surpasses the type in beauty. A variety with pure white fls is attractive. Other well-marked horticultural forms are Var **vittàtus,** prettily striped with blue and white F S 3·298 R H 1848 121. Var **compáctus,** dwarf, and valuable for pot culture Gt 47, p 635 A 5-petaled form is also recorded. F S. 8, p. 116, desc.



1049. Convolvulus tricolor. (×⅓)

11. **aùreus supérbus,** Hort. A tender perennial, but may be treated as an annual, since it flowers the first season from seed: st trailing or twining, 4–5 ft long· fls golden. —Valuable as a greenhouse climber and for hanging-baskets. Not sufficiently described for identification.

C althæoides, Linn (C italicus, Roem & Schult) St prostrate, twining or climbing, if it finds support upper lvs pedatifid , lower ovate-cordate, crenate, silvery fls pink May–Aug Medit region B M 359 F S 10 1021 (as var argyreus) R H 1864 111 —*C. ambigens*, House, native from Mont to New Mex and S Calif , is a close relative to C arvensis —*C arvensis*, Linn Slender perennial trailer, 1–3 ft long, glabrous or nearly so lvs ovate-sagittate or hastate, variable fls white or pink Eu and E Asia Naturalized in old fields through the Atlantic states and Calif A troublesome weed in cult grounds—*C canariénsis*, Linn Greenhouse evergreen lvs oblong-cordate, acute, villose fls violet-purple, peduncle 1–6-fld Canary Isls B M 1228 —*C dahùricus*, Herb (Calystegia dahuricus, Fisch) Hardy deciduous twiner, 3 6 ft lvs, oblong-cordate, shortly acute fls pink or rose-violet June, July N Eu B M 2609 F S 10 1075 —*C erubéscens*, Sims (C acaulis, Choisy) Tender biennial lvs oblong, hastate, the basal lobes toothed fls small, 5-lobed, rose-pink Austral B M 1067 —*C macrostégius*, Greene The plants in the trade under this name may be referred to C occidentalis —*C major*, Hort , not Gilib = Ipomœa purpurea —*C ocellatus*, Hook Stove evergreen limb of corolla white, 5-angled, throat reddish purple lvs sessile, linear, acute, 1-veined, villose S Afr B M 4065 —*C scopárius*, Linn — *C Soldanélla*, Linn Sts prostrate lvs. reniform fls pink or rose-colored. Sandy shores, Wash. to Calif., also in Eu and Asia

S W. FLETCHER.
H. D. HOUSE.†

COÒKIA: *Claucena.*

COONTIE: *Zamia integrifolia.*

COOPÈRIA (after Joseph Cooper, English gardener). *Amaryllidàceæ* Tender bulbous plants with the habit of Zephyranthes but night-blooming

Flowers fragrant, solitary, 2 in or more across, waxy-white, tinged red outside, and more or less green within; the perianth subtended by a bract-like spathe, somewhat as in Iris; anthers erect in distinction to versatile in Zephyranthes. lvs appearing with the fls in summer, long, narrow, flat and twisted —Only 2 or 3 species from Texas to New Mex and Mex , usually growing in dry places. The bulbs should be taken up in autumn and stored during the winter in dry soil. Cult. easy and like zephyranthes

A. *Neck of bulb short: perianth-tube 3½ in long or more.*

Drúmmondii, Herb. EVENING STAR Bulb roundish, 1 in thick, with a short neck: lvs narrowly linear, erect, 1 ft long: peduncle slender, fragile, hollow, ½–1 ft. long, spathe 1½–2 in. long, 2-valved at the tip; perianth tube 3–5 in long; limb ¾–1 in long, white, tinged with red outside; segms oblong, cuspidate. Prairies, of wide range. Var. **chlorosòlen, Baker,** has a perianth-tube stouter and tinged with green: limb longer and less wheel-shaped: lvs. a little broader. B.M. 3482.

AA. *Neck of bulb long· perianth-tube less than 2½ in. long.*

pedunculàta, Herb. GIANT PRAIRIE LILY. More robust than *C Drummondii*· bulb with a longer neck, 2–3 in long· lvs about 6, 1 ft. long, ¼in broad: peduncle about 1 ft long, spathe 1–2-valved at the tip, perianth-tube shorter, 1½ in. long, limb nearly as long as the tube, tinged red outside B M 3727. R H 1853·401 —The best species. Fls larger, of purer color, and remaining open a day or two longer.

N. TAYLOR.†

COPAÍFERA (from *copaiba*, Brazilian name of the balsam derived from some of these trees). Syn *Copaiba Leguminòsæ* Sixteen or more spineless trees of Trop. Amer., and Afr , with abruptly pinnate lvs , small mostly white, not papilionaceous fls in panicles, interesting because several of them produce an oleo-resin known as copaiba They are not in cult., except now and then in collections of economic plants

COPERNÍCIA (from *Copernicus*) *Palmàceæ*, tribe *Corỳpheæ* Tall fan-palms with their trunks frequently thickened above the base

Leaves flabellate, the petiole often with small spines; the small young lvs usually undivided, the older much cut palmately. spadix very much branched, the fls single upon it or in small clusters; calyx tubular, more or less deeply 3-toothed fr globose or ovoid, 1-seeded. —Species about 8, all confined to Trop Amer *C. cerifera* is a valuable economic plant, the wood being among the hardest known, and the lvs being the source of a valuable wax For cult , see *Corypha* G C. II 24 362 Beccari, Le Palme Americane, tribe Corypheæ, 1907

cerifera, Mart CARNAUBA PALM St 30–35 ft , with a small swelling near the base lvs 3–4 ft wide, nearly round; rachis none; petiole convex below, concave above, the margins with rather thick spines spadix erect or spreading, 5–6 ft long and thrice branched; fls in clusters on the spathe Trop S Amer —Not well known in the trade; see *Livistona.*

C australis, Becc , a recently described species, said to be more hardy than C cerifera, has been cult at Riverside, Calif Taller, 60–80 ft , infl densely woolly tomentose

N. TAYLOR.

COPRA: material from the coconut, which see (p 811)

COPRÓSMA (Greek name referring to the fetid odor of the plants). *Rubiàceæ*. Shrubs or small trees, often trailing, of New Zealand, Australia and Polynesia, sometimes planted for the pretty fruit or variegated leaves.

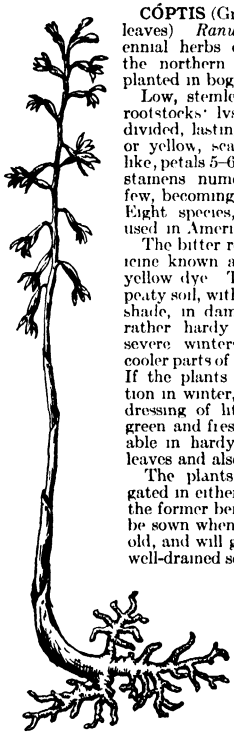
Leaves opposite, mostly small, stalked or almost sessile· fls small, solitary or fascicled, white or greenish, dioecious, corolla-limb 4–5-lobed, the lobes revolute, stamens 4–5. fr. an ovoid or globose usually 2-celled drupe.—About 60 species mostly in New Zeal , extending to Borneo, Hawaii and Juan Fernandez

Coprosmas are greenhouse plants in the North, but they are rarely cultivated. Propagated by hardened cuttings. The soil which is found among kalmia roots, mixed with good loam and sand, if necessary, will suit these plants Cuttings should be rooted in moderate heat in spring, before growth begins. If placed under a handlight or propagating-frame, care must be taken to prevent damping, to which the cuttings are liable. (G. W. Oliver.)

Baŭeri, Endl. (*C. Baueriàna,* Hook. f.) Shrub or small tree, in exposed and rocky places in its native habitat sometimes not more than 1–3 ft high and with branches nearly prostrate, in better conditions often a round-topped tree 20–25 ft. high: lvs. thick, shining green, 1–3 in. long, wide-ovate or oblong, obtuse or notched at the apex, the margins usually revolute: male fls. in dense heads on short axillary peduncles; females 3–6, the heads with shorter peduncles; calyx very small; corolla of female fls tubular, 4-lobed. New Zeal.—In cult. there are two forms, both with variegated lvs.; one has lvs. broadly blotched creamy yellow, at times the green disappearing altogether (var. *variegàta* or *picturàta*); the other (*C. Stóckii*, Hort.) has lvs. blotched yellow-green on a deeper ground. *C. Baueri* is a favorite in S. Calif., and probably the only one grown there; thrives near the sea.

acerôsa, A. Cunn. Low and spreading, much branched, with minute lvs., small white fls., and pretty sky-blue drupes or berries. New Zeal.—Once catalogued in Calif.

Pètriei, Cheesem. Prostrate and creeping, forming mats, the branches to 1½ ft. long; lvs. ¼in. or less long, linear-oblong or -obovate, rigid and thickish; fls. solitary, on the ends of short erect branchlets, the males 4-toothed and without calyx, the females smaller, irregularly toothed and calyculate; drupe ⅓–½in. diam., mostly purplish. New Zeal.—Mentioned abroad for cultivation. L. H. B.



1050. Corallorhiza multiflora. (×⅓)

CÓPTIS (Greek, *to cut*, from the cut leaves) *Ranunculàceæ*. Hardy perennial herbs of the cooler parts of the northern hemisphere, sometimes planted in bogs and moist places.

Low, stemless plants, with slender rootstocks: lvs. radical, compound or divided, lasting over winter: fls. white or yellow, scapose; sepals 5–7, petal-like; petals 5–6, small, linear, hood-like; stamens numerous; carpels stalked, few, becoming an umbel of follicles.—Eight species, only one of which is used in American gardens.

The bitter roots yield the tonic medicine known as "gold thread," also a yellow dye. The plants should have peaty soil, with a little sand, and prefer shade, in damp situations. They are rather hardy. The roots withstand severe winters, being native of the cooler parts of the northern hemisphere. If the plants are given some protection in winter, as in a cold pit or by a dressing of litter, the leaves remain green and fresh. The plants are valuable in hardy borders because of the leaves and also the flowers.

The plants are very easily propagated in either early spring or late fall, the former being preferred. Seeds may be sown when ripe, before they become old, and will grow readily in moist but well-drained soil. They should be only slightly covered with soil but the surface should be kept moist by a close covering with leaves or paper, and partial shade is preferred. The seedlings may be transplanted at any time after the leaves are large, by keeping plenty of soil about the roots.

trifòlia, Salisb. No. st.: rootstock yellow: lvs. compound, long-petioled, lfts. broadly obovate, cuneate, obtuse, the teeth mucronate. fl.-st. slender; sepals white, with yellow base; petals small, club-shaped; follicles 3–7, spreading, equaled by their stalk; seeds black. May–July. Adirondacks and westward. L.B.C. 2.173.—Neat and pretty, with shining lvs.

K. C. Davis.

CORAL BERRY: *Symphoricarpus vulgaris*

CORAL DROPS: *Bessera elegans*

CORALLORHÌZA (Greek for *coral-root*). *Orchidàceæ*. Coral-Root. Low orchids, growing in woods and parasitic on roots, destitute of green foliage, the plant usually brownish or yellowish and inconspicuous.

Flowers small, somewhat 2-lipped, usually obscurely spurred at the base, sepals and petals nearly alike; lip small, slightly adherent to the base of the column; pollinia 4.—Species few, in N. Amer., Eu. and Asia. The coral-roots have little merit as garden plants, although very interesting to the student. They may be grown in rich, shady borders. Two species have been offered by dealers in native plants. **C. multiflòra,** Nutt. (Fig. 1050), is purplish, 1½ ft. or less high, 10–30-fld.; lip deeply 3-lobed; grows in dry woods in northern states. **C. Mertensiàna,** Bong., scape many-fld., 8–15 in. high, the lip entire and broadly oblong; occurs in Brit. Col. and north to Alaska. **C. odontorhiza,** Nutt., provides what is known as crawley-root, said to be used for its diaphoretic and febrifuge properties. it is a slender plant, in woods S., but extending north as far as Canada, light brown or purplish, 6–7 in. tall; lip nearly or quite entire, white spotted with crimson.

L. H. B.

CORAL-PLANT: *Jatropha.*

CORAL-ROOT: *Corallorhiza.*

CORAL-TREE: *Erythrina.*

CÓRCHORUS (name refers to some reputed virtue, as an eye remedy, of one of the species) *Tiliàceæ*. Shrubs or herbs of the tropics, two of which supply jute.

The jute plants are *C. capsularis* Linn. and *C. olitorius*, Linn. The latter differs from the *C. capsularis* in having an elongated, not semi-globose, pod. B.M. 2810. They are annual plants, natives of Asia but cult. throughout the tropics, growing 10–12 ft. high, with a straight st. as thick as the little finger and branched only at the top. Fls. small, yellow, with 4–5 glandless petals and a slender caps., or sometimes the caps. is globose. The young shoots of both are used as pot herbs. *C. olitorius* is much grown for this purpose in Egypt, and is known as Jews' mallow. Jute is made from the fibrous bark of these and other species of Corchorus. It is released from the sts. by retting in stagnant pools. See Cyclo. Amer. Agric., Vol. II, pp. 282, 507.

C. Baldàccii, Fedde, has very recently been mentioned in foreign horticultural literature. It is described as a perennial, woody at the base; lvs. linear-elliptic, pilose above and white-tomentose beneath; fls. solitary, axillary and minute. Italian Somaliland.

The corchorus of trade lists is likely to be Kerria.

CÓRDIA (an early German botanist, Valerius Cordus, born 1515) *Boraginàceæ*. Warm-climate trees, shrubs or almost herbaceous, sometimes planted.

Leaves mostly alternate, petioled, entire or dentate. fls. in dense heads or clusters or scirpoid cymes, perfect or polygamous, the corolla usually white or orange; calyx tubular or campanulate, toothed or lobed; corolla tubular, funnelform or salverform, lobed, the parts and the stamens 4 or more; style 4-lobed. fr. a drupe which is 4-loculed and usually 4-seeded.—Species about 230 in tropical and subtropical regions, mostly

in the western hemisphere. Some of them are vines; some are herbaceous above the base. Species confused.

The cordias are greenhouse plants with showy flowers of easy culture. Grown in the open in the extreme South. Propagated by cuttings of firm wood and by seeds.



1051. Cordia Greggii var. Palmeri. (×⅔)

Sebestèna, Linn. (*C. speciósa,* Willd.) GEIGER TREE. Tall evergreen shrub or small tree, hairy, with rough, ovate, entire or undulate stalked lvs. fls. 1–2 in. long, orange or scarlet, stalked, in large open terminal clusters, the crumpled corolla-lobes and stamens 5–12. drupe inclosed in the hazel-like husk formed by the persistent calyx. Keys of Fla. and south. B.M. 794.

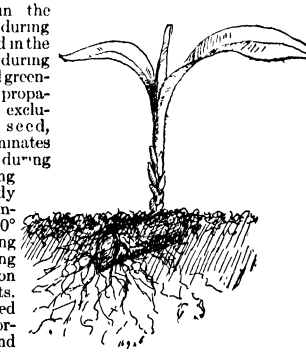
Gréggii, Torr. Much-branched shrub, to 8 ft. lvs. less than 1 in. long, pale, obovate, obtuse, dentate, rugose, long-cuneate at the base. fls. more than 1 in. across, white, in few-fld. contracted capitate clusters but becoming looser as flowering proceeds; corolla-lobes obtuse, stamens 5 or 6, scarcely half the length of the corolla. Mex. Var. **Pálmeri,** Wats. (Fig. 1051, adapted from G.F. 2: 233) has more broadly funnel-form corolla, the limb 1¼ in. broad. lvs. somewhat larger, ovate-oblong and abruptly cuneate at the base, acute or obtuse at the apex. Mex.—Deserving of planting in the southwest country, if hardy.

Other cordias are likely to come into cult. in the southern country. Some of them yield drugs, many of them produce useful timber, and some have edible frs. There are numbers of species in Porto Rico and others of the W. Indies.—*C. Francisci,* Tenore. Tall. lvs. dark green. fls. white. S. Amer.—*C. Myxa,* Linn., from Trop. Asia and Austral., is one of the best woods for kindling fire by friction, and is useful in many other ways. L.H.B.

CORDYLÌNE (*club-like,* referring to the fleshy roots). *Liliàceæ.* DRACÆNA. DRACENA PALM. Greenhouse plants closely related to Dracæna, planted in the open in California and similar climates.

Stems tall, often woody and palm-like, bearing large crowded lvs., to the striking variegation of which the group owes its value. fls. paniculed, stamens 6, pedicels articulated; perianth 6-parted; ovary 3-celled. fr. a berry.—Cult. for the ornamental foliage. The horticultural forms and names have become very numerous. The various species are in the trade under Dracæna, which see for a key to the species of both genera combined. From Dracæna, Cordyline differs in the ovary containing several ovules in each cell, and the solitary pedicels being provided with a 3-bracted involucre. In the following paragraphs, the initial D. indicates that the plant in question is known in the trade as a Dracæna, and C. that it is known as a Cordyline (see *Dracæna*). For a monograph, see Baker, Journ. Linn. Soc. 14: 538 (1875).

Of cordylines or dracænas, propagation is usually effected by cutting the ripened stems or trunks, from which all leaves have been removed, into pieces from 2 to 4 inches long. These are laid either in very light soil or in sand in the propagating-bed, where they receive a bottom heat of about 80°, being barely covered with sand or moss (Fig. 1052). The eyes soon start into growth, and, as soon as they have developed about six leaves, these shoots are cut off with a small heel and again placed in the propagating-bed until rooted, after which they are potted off into small pots in light soil, kept close until they become established. They are then shifted on into larger pots as soon as well rooted. They delight in a mixture of three parts good turfy loam and one part well-decayed cow-manure, with a liberal sprinkling of sharp sand. A warm, moist atmosphere suits them best while growing, but towards fall the finished plants must be gradually exposed to full sunshine and a dry atmosphere, which develops their high colors. The kinds enumerated below are such as are mainly grown in large quantities for decorative purposes, and are sold principally during the winter months, especially during the holiday season, when plants with bright-colored foliage are always in strong demand. *C. amabilis.*—A strong-growing form with broad green foliage, which is prettily variegated with white and deep rose. One of the hardiest varieties, either for decorations in winter or for outdoor work, vases, and the like in summer. *D. fragrans.*—An African species with broad, massive, deep green foliage which makes noble decorative plants, being frequently grown into specimens from 6 to 8 feet high. Its foliage is of heavy texture, making it a useful plant for the dry atmosphere of a living-room. Two handsomely variegated forms of the above are *D. Lindenii* and *D. Massangeana,* both very desirable varieties. *C. terminalis.*—This is the most popular species, and is grown in immense quantities. The foliage on well-matured plants is of an intense rich crimson marked with lighter shadings. *C. australis* (commonly called *C. indivisa*).—Used principally as an outdoor decorative plant in summer, being extensively used for furnishing vases, window-boxes, and the like. It succeeds best when planted out in the open border during summer, potted in the fall and stored during winter in a cool greenhouse. It is propagated almost exclusively from seed, which germinates freely if sown during the early spring months in sandy soil, in a temperature of 60° to 65°, growing them on during the first season in small pots. These, if planted in the open border the second season, make



1052. Stem-cutting of Cordyline.

fine plants for 6- or 7-inch pots There are a number of varieties of *C australis*, among them several handsomely variegated bronze-colored forms, which, however, are but little distributed yet Among the principal varieties and species besides the above which are grown in a commercial way are: Baptistii, Shepherdii, stricta grandis, Youngii, Goldieana, Lord Wolseley, De-Smetiana, Sanderiana, Godseffiana, and Mandæana. (J. D. Eisele.)

INDEX.

alba, 6
alba-lineata, 6.
amabalis, 6
amboyensis, 6.
ancliensis, 6
atropurpurea, 3.
aurea-striata, 3.
australis, 3
Baptistii, 6.
Bausei, 6
bella, 6
brazilensis, 6.
Brownii, 4
calocoma, 3
cannæfolia, 6.
Cantrellii, 6.
congesta, 2
Cooperi, 6.
discolor, 2
Eschscholzxana, 6.
ferrea, 6.
Fraseri, 6
Gladstonei, 6.
grandis, 2.
Guilfoylei, 6.
Haageana, 5.
Hookeri, 3
hybrida, 6
imperialis, 6.
indivisa, 1, 3.
jardinieri, 6.
lineata, 3.
metallica, 6
Murchisonæ, 5.
nigro-rubra, 6.
norwoodiensis, 6.
reginæ, 6
Robinsoniana, 6.
rosea, 6
rubra, 4.
Schuldii, 6.
Scottii, 6.
stricta, 2.
terminalis, 6.
Tii, 6
Veitchii, 3.
Youngii, 6.

A. *Foliage of sessile, thick, sword-shaped lvs.*

B *Lvs. glaucous beneath, broad.*

1 **indivisa,** Kunth Arborescent, 10–20 ft. high: lvs. dark green, densely crowded, 2–6 ft long, 4–6 in broad at the middle, 1½–2 in at the base, rigid, very coriaceous, midrib stout, colored red and white, veins on each side of it 40–50 panicle nodding, bracteoles lanceolate, 3–4 lines long, membranous, perianth 3–4 lines long, white, tube very short, campanulate, segms. equal, sharply recurved berries ½ in diam , blue, ovules 5–6 in each cell New Zeal Gn 49, p 86 Lowe, 52 — Coolhouse, valuable for vases. Rare in cult. See *C. australis*, No. 4.

BB *Lvs green on both sides, narrower.*

2 **stricta,** Endl (*D congesta*, Hort) Slender, 6–12 ft high lvs less crowded than in the next, acuminate, 1–2 ft long, 9–15 lines wide, base 3–6 lines wide, scarcely costate, veins scarcely oblique, margins obscurely dentate panicle terminal and lateral, erect or cernuous, pedicels ½–1 line long, lower bracteoles lanceolate, perianth lilac, 3–4 lines long, campanulate, interior segms longer than the outer, ovules 6–10 in each cell Austral B M 2575 G C III 17 207 — Coolhouse, vases, and the like Var **grândis,** Hort. Large, highly colored Var **discolor,** Hort Like var. *grandis*, but with foliage dark bronzy purple

3 **australis,** Hook (*D indivisa*, Hort *D. calocòma*, Wend) Fig 1053, 359, Vol I Arborescent, 15–40 ft high lvs densely rosulate, 1½–3 ft long, 1½–2½ in. wide, base 6–12 lines wide, acuminate, green; midrib firm, indistinct, nerves on each side of it 12–20, scarcely oblique panicle drooping or erect, terminal, ample; pedicels very short; bracteoles deltoid, ½ line long; perianth white, 3–4 lines long, tube short, campanulate, segms nearly equal, recurved berry white or blush-white, mature seeds often solitary New Zeal B M. 5636. G C III 23·153 Gn 47, p 312, 48, p 197. I H 35 40 (as var *Doucetiana*), 37 114 (as var *Dallerana*), 40 190 (as *C lineata* var *purpurascens*) S H 1, p 487 —Coolhouse, vases Var **aûrea-striàta,** Hort. Variegated with a number of longitudinal yellow stripes Var **atropurpûrea,** Hort Base of lf. and under side of midrib purple Var **lineàta,** Hort Lvs. broader, the sheathing base stained with purple Var **Veitchii,** Hort (*D Veitchi*, Hort) Base of lf and under side of midrib bright crimson. *C Hookeri*, Hort , was a garden form of this species —Much of the *C indivisa* of the American trade has been, in the past, *C. australis*. Known as "cabbage tree" to residents of New Zealand.

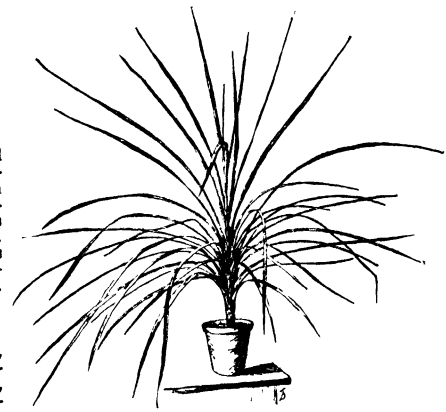
AA. *Foliage of petioled lvs.*

B. *Lvs. oblanceolate; petioles broad.*

4. **rûbra,** Hugel Slender, 10–15 ft. high: lvs contiguous, ascending, 12–15 in long, 18–21 lines wide above the middle, thick, dull green both sides, distinctly costate, veins oblique, petiole broad, deeply grooved, 4–6 in long panicle lateral, nodding, pedicels very short, bracteoles small, deltoid; perianth lilac, 4½–5 lines long, inner segms longer than the outer, ovules 6–8 Country unknown —Cool-house, vases. *D. Brùantii*, Hort , was a garden form of this species R H 1897, pp 514, 515 G C III 22 285 G W. 12, p. 230

BB *Lvs lanceolate; petioles narrow, nearly terete.*

5. **Haageàna,** Koch (*C. Murchisonæ*, F Muell) Slender and small lvs contiguous, ascending, oblong-falcate, 4–8 in. long, 2–2½ in wide at the middle, acute, base rounded or deltoid, thick, dull green



1053. Cordyline australis—C. indivisa of the trade.

throughout, distinctly costate, veins slender, oblique; petiole 3–4 in long, deeply channelled panicle lateral, pedicels 1½–2 lines long, perianth 4–4½ lines long, tinged with lilac, ovules 6–8 in each cell Austral

6 **terminàlis,** Kunth Low and slender, 3–8 ft high lvs contiguous ascending, green or rarely colored, 12–30 in long, 2–5 in wide, elliptical or elliptic-lanceolate, acute, thickish, distinctly costate, veins frequently unequal, strongly oblique, petiole 4–6 in. long, deeply channelled pedicels very short or none, bracteoles deltoid, membranous, perianth 5–6 lines long, white, lilac, or reddish, segms short, ovules 6–10 in each cell berry large, red E Indies A G 16 361 B R 1749 Var **cannæfòlia,** Baker (*D* and *C. cannæfòlia*, Hort) Lvs oblanceolate, 12–15 in by 2–2½ in perianth 2 lines long, segms twice the length of tube Var **férrea,** Baker (*D* and *C férrea*, Hort) Lvs narrow, oblanceolate, 2–2½ in broad, dull purple or variegated, petiole short fls much as in the typical form, but redder and often smaller B M 2053 — *C. Guilfòylei* is a form with lvs tapering both ways, recurved, striped with red, pink or white; white on lower part of lf. and margin of petiole I.H 19, p. 249. Var. **Tìi,** Baker (*D brazilensis*, Schult *C Eschscholziàna*, Mart). Robust lvs large, mostly oblong, 4–6 in. wide panicle large, lower branches compound, perianth 6 lines long, lilac; segms as long as the tube —*D imperiàlis*, Hort , is a form with lvs arching or erect, thick, deep metallic green, rayed all over with bright crimson or pink, handsome. *D. regìnæ*, Hort.

belongs here. The varieties of this species in cult. are almost innumerable Names that have been used for those in the American trade, usually considered as horticultural species, though many of these names are now no longer used, are as follows: **C. amábilis.** Lvs. broad, shining deep green, in age becoming spotted and suffused with rose and white. **C. amboyénsis.** Lvs. oblong-lanceolate, recurved, deep bronze-green, edged with rose-carmine below; petioles tinged with purple. **C. anerliénsis.** Lvs very broad, deep bronze-red, with some white **C. Baptístii.** Fig. 1054. Lvs broad, recurved, deep green, with some pink and yellow stripes sts also variegated I H 26 334 **C. Baûsei.** Lvs broad, dark green, with some white. **C. bélla.** Lvs. small, purplish, marked with red **C. Cántrellii.** Lvs dark metallic crimson, young ones bright carmine. **C. Coôperi.** Lvs deep wine-red, gracefully recurved: common in cult **C. Fràseri.** Lvs somewhat erect, broad, oblong, abruptly acute, blackish purple with bloom, margin below with a deep rosy lake stripe extending down the petiole **C. Gládstonei.** Lvs. broad, brilliant crimson **C. hýbrida.** Lvs broad, variegated, deep green margined with rose, in age deep rose, creamy white in young lvs **C. jardiniére** (*C. terminalis alba* × *C. Guilfoylei*). Lvs very small and compact, narrow, green broadly margined with white **C. metállica.** Lvs erect-arching, oblong, when young uniform rich coppery purple, in age dark purple-bronze, petioles same. F M 1872 24 **C. nìgro-rùbra.** Lvs narrow, linear-lanceolate, dark brown with rosy crimson centers, young often entirely rose **C. norwoodiénsis.** Lvs. striped with yellow, green and crimson, last color principally confined to the margin; petioles brilliant. **C. Robinsoniàna.** Lvs long lanceolate-acuminate, arched, light green, striped with bronze-green and brownish crimson I H 26·342 **C. Schúldii.** Lvs. broad, variegated F E. 7.961 **C. Scóttii.** Lvs. broad, arching, deep green, crimson edged, said to be a hybrid **C. Youngii.** Lvs. broad, spreading, when young bright green streaked with deep red and tinged with rose, in age bright bronze **C. Youngii** var **rósea,** Hort Green, tinged with pink, white or carmine. **C. Youngii** var **álba,** Hort Variegated with white instead of red Crosses with *C. Scottii* are known as *C. stricta, C albo-lineata,* Mrs George Pullman, Mrs. Terry, with *C norwoodiensis,* as Little Gem

C angústa, Hort (C terminalis var) Lvs narrow, arching, dull dark green above, purplish beneath A slender form —*C angustifólia,* Kunth=C stricta —*C auruntiaca,* Hort =(?) —*C Balmoreàna,* Hort Lvs bronzy with white and pinkish stripes —*C Bánksii,* Hook Lvs very long, linear-lanceolate, 3-5 ft long, 2-3 in wide, petioled, green, glaucous beneath, veins conspicuous. G C III 18 613 — *C Berkéleyi,* Hort =(?) —*C Cussonòiæ,* Hort =(?) —*C Chilsonii,* Hort (form of C terminalis) Lvs large, glossy dark green, almost black, becoming suffused and edged with crimson I H 19, p 90 —*C compácta,* Hort (C terminalis form) Lvs recurved, broad, dull green, with bronze and rose stripes in age —*C Dennisonii,* Hort (C terminalis form) Dwarf lvs broad, bronzy purple —*C Elizabethiæ,* Hort =(?) —*C excélsa,* Hort (C terminalis form) Lvs broad, arching, bronzy, margined with crimson —*C Frederica* =(?) —*C frutéscens*=(?) —*C gloriòsa* Hort (C terminalis form) Lvs very large and broad, green, with a peculiar bronze-orange hue —*C helychaódes,* F Muell =C terminalis —*C hibiscoidæfólia,* Otto & Diet =C terminalis —*C Hóutersonii,* Hort =(?) —*C magnífica,* Hort (C terminalis form) Lvs large and broad, bronzy pink, becoming darker —*C Mánnere-Suttoniæ,* F Muell =C terminalis —*C Máyi,* Hort Lvs green, margined with red, young lvs wholly red —*C porphyrophýlla,* Hort (C terminalis form) Lvs deep bronzy purple, glaucous beneath —*C Rèx,* Hort (C terminalis form) Lvs medium width, bronzy green, flushed purple and streaked with carmine —*C rosácea,* Hort (C terminalis form) Lvs recurved, broad, dark bronzy green margined with pink —*C Rumphii*=D Hookerianus. —*C Salmónea*=(?) —*C sepidra,* Seem =C terminalis —*C. Stéberi,* Kunth=C terminalis —*C splèndens,* Hort (C terminalis form) Lvs dense, short, ovate-acute, bronzy green, shaded with rose-carmine.—*C zeelándica,* Hort =C rubra.

K M. WIEGAND.

CORÈMA (Greek, *a broom,* in allusion to its bushy habit) *Empetràceæ* BROOM CROWBERRY. Two species of low heath-like shrubs from E N. Amer and S. W. Eu and the Atlantic Isls., of which the American species is rarely cult. in botanical collections Closely allied to Empetrum and differing chiefly in the apetalous fls. arranged in terminal heads, and in their upright bushy habit Cult and prop like Empetrum **C. Cónradii,** Torr , is a much-branched shrub, to 2 ft. high, with crowded linear lvs. about ⅛in long fls inconspicuous, in terminal heads, the staminate with long exserted purple stamens: fr. a small berry-like drupe, usually with 3 nutlets. H I. 6:531. Hardy N.—*C. álbum,* D Don, has obtuse lvs with revolute edges and resinous dots. fls pink. fr white to purple S W Eu., Azores. ALFRED REHDER



1054. Cordyline terminalis var Baptistii.

COREÓPSIS (Greek, signifying *bug-like,* from the fruit) Including *Calliópsis Compósita* TICKSEED Annual or perennial herbs, flowering in summer or autumn, nearly all natives of eastern North America, some of them popular as flower-garden subjects

Leaves opposite or rarely alternate heads pedunculate and radiate, the broad involucre with bracts of 2 distinct series, the outer narrower or shorter and more herbaceous, the inner broad triangular-ovate or oblong, thin, yellowish green or purplish, and striate; receptacle chaffy, rays very showy, yellow, particolored or rarely rose, neutral, disk-fls yellow, dark or brown; pappus of 2 weak bristles or scales, or a low crown or none: achenes often winged —The genus differs from Bidens only in the reduced or obsolete, not stiff-awned pappus, and lf -segms not serrate Many of the species are in the trade under the name Calliopsis Other genera with this peculiar involucre are Hidalgoa, Dahlia, Thelesperma, Cosmos, and Leptosyne All the kinds are of easiest cult The perennials are hardy border plants The annuals are raised in any garden soil, and bloom freely with little care. They are all showy plants, of 50–70 species.

INDEX.

angustifolia, 2, 9
Atkinsoniana, 4
atropurpurea, 5.
auriculata, 8
bicolor, 5
Boykiniana, 10
cardaminefolia, 3.
coronata, 7.
cardaminefolia, 14.
dichotoma, 2
diversifolia, 6
Drummondii, 6
elegans, 5
glabella, 9
grandiflora, 10.
lanceolata, 9.
linearis, 13.
linifolia, 2
longipes, 10
major, 13
marmorata, 5.
nana, 5
nuda, 5
oblongifolia, 9.
Oemleri, 13.
palmata, 12.
picta, 6
præcox, 12
pubescens, 8.
rosea, 1.
senifolia, 13
tenuifolia, 15.
tinctoria, 5
tripteris, 11
verticillata, 15
villosa, 9.

A *Rays cuneate, lobed.*

B. *Disk yellow, rays rose-purple.*

1. rósea, Nutt. Perennial: diffusely branched from slender, creeping rootstocks, 1–2 ft high, smooth: lvs all narrowly linear, entire or with a few linear teeth or lobes heads small, about 1 in broad or less, short-peduncled; rays narrowly wedge-shaped, lobed at the apex achene narrowly oblong, wingless; pappus an obscure border Mass to Ga

BB *Disk and involucre dark purple, rays yellow or parti-colored, wedge-shaped and lobed.*

C. *Outer involucral bracts very short, lanceolate or triangular.*

D. *Lvs. entire: achenes with lacerate wings and setiform pappus.*

2 angustifólia, Ait (*C dichótoma,* Michx. *C linifólia,* Nutt.) Perennial, strict and tall, 1–3 ft high, glabrous, sparsely branched at the summit lvs entire, thickish, basal oblanceolate to narrowly spatulate, long-petioled, lower cauline elliptical on long petioles, upper narrowly spatulate or linear, sessile or reduced to bracts: heads 1–1½ in broad, rays entirely yellow S U S.

DD *Lvs divided, achenes and pappus not as above.*

3 **cardaminefólia,** Torr & Gray Annual, low and diffusely much branched from the base, 6–24 in high, glabrous numerous basal and lower cauline lvs petioled, pinnatifid, divisions several pairs, short, oval, elliptical, rarely linear, often again divided, upper cauline nearly sessile with narrower and fewer divisions heads as in No 5, but smaller, and often entirely dark achenes broader, winged, pappus minute or none S U S Gn 29, p 498, 37, p 203

4 **Atkinsoniána,** Douglas Perennial or annual st. tall, 2–4 ft high lvs pinnatifid, the divisions linear: heads as in the next achenes with narrow wing or scarious margin, pappus composed of 2 short, subulate teeth Autumn-flowering S W U S. B R 1376



1055. Coreopsis tinctoria—Calliopsis elegans of gardens. (×½)

5. tinctória, Nutt. (*C bícolor,* Reichb *C. élegans,* Hort. *Callíopsis marmoràta,* Hort.). Fig. 1055 Annual: st. tall, strict, 1–3 ft high, branched, glabrous basal lvs few or wanting, cauline petioled, the upper sessile, pinnatifid, divisions from narrowly elliptical to often again divided and narrowly linear: heads ¾–1½, rarely 2, in broad, rays with dark purple base. achenes oblong, wingless, pappus none Cent U. S B M 2512 B R 846. Mn. I, p 85 —A common garden annual, showy and good. Var **nàna,** Hort Dwarf, low and compact Gn 29, p 499 Tom Thumb varieties. Var. **atropurpùrea,** Hook (*C nàna,* Hort.). Rays almost entirely dark. B M 3511.



1056. Coreopsis lanceolata. (×½)

CC. *Outer involucral bracts narrowly linear, about equaling the inner*

6 **Drúmmondii,** Torr. & Gray (*C diversifólia,* Hook *C pícta,* Hort.). Golden Wave Annual: st branched above, 10–24 in high: lvs petioled below, sessile above, pinnatifid, divisions few, short, broadly elliptical, those of the upper lvs linear. heads 1–2 in broad, large, rays usually dark at the base achene oval, wingless, margin cartilaginous incurved, pappus none Texas B M 3474 S B F G II 4:315 Gn 26, p 461, 29, p 498; 37, p 203, 43, p 397 G M. 54 13. G 16 58

BBB. *Disk yellow or brown, rays entirely yellow (except No. 7), peduncles long*

C. *Style-branches acute or obtusish, not acuminate: dark lines at base of rays*

7 **coronàta,** Hook Annual low and often weak, 12–24 in high, much branched from the base, sparsely hirsute lvs thick, the basal usually numerous, petioled, pinnatifid or entire, divisions elliptic, rather obtuse, lateral divisions smaller, the cauline lvs few, spatulate, often entire heads 1½–2 in broad, rays with a few dark lines above the orange base, outer involucre a third to a half shorter than the inner achene orbicular, broadly winged, often echinate, with a thickened callus at base and apex on inner face; pappus very minute. Texas B M 3460 S H 1.270. Gn 26, p 461; 29, p 499

CC *Style-branches cuspidate-acuminate: rays entirely yellow*

8 **pubéscens,** Ell. (*C. auriculàta,* Schkuhr & Hort., not Linn.). Perennial: tall, 1-4 ft high, branched above, pubescent or nearly glabrous, leafy throughout lvs thickish, oval to lanceolate, very acute, petioled or nearly sessile, entire or with small, acute, lateral lobes; basal few. heads 1½–2½ in broad; outer involucre nearly as long as the inner achenes and pappus similar to those of the next species. S U S. Gn 37, p 202.

9 **lanceolàta,** Linn. Fig 1056. Perennial: low, 1–2 ft. high, sparingly branched, glabrous or nearly so, leafy toward base lvs few, large, oblong-spatulate to linear, petioled, barely acute, upper entire, lower usually pinnatifid, divisions very distant: heads 1½–

2½ in. broad; peduncles very long; outer involucre equaling the inner or one-half shorter: achenes orbicular, papillose, broadly winged, pappus of minute scales or obsolete. E U S. Gn 25, p. 165, 33, p, 7; 37, p 203 G W 10, p. 22 V. 18.102 —Used extensively for cut-fls

Var. **glabélla,** Michx. (var. *angustifòlia,* Torr. & Gray) Low· sts scapiform: lvs. narrow and crowded at base of st., 2–4 lines wide.

Var **villòsa,** Michx (*C. oblongifòlia,* Nutt.). **Lvs.** spatulate-obovate to oblong, villous, as is also the **st.,** with jointed hairs.



1057. Coriaria japonica (×½)

10 **grandiflòra,** Nutt. (*C. lóngipes,* Hook *C. Boykiniàna,* Nutt.) Perennial, simple or branched, glabrous, 1–2 ft high, leafy throughout basal lvs few, lower lvs spatulate or lanceolate, entire, upper divided into several linear entire divisions heads 1–2½ in broad achene orbicular, papillose, broadly winged; pappus of 2 small scales S U S B M 3586 Gn 47 7, 62, p 338 Mn 5 201 G. 29 461 J H. III 57: 479 Gn. W 23. 349, 26 113.

AA *Rays elliptical, entire or toothed at apex.*

B. *Color of rays pale yellow lvs petioled.*

11 **trípteris,** Linn Perennial, very large and stout, 4–8 ft. high, branched above, glabrous· lvs petioled, 8 in or less long, trifoliate, or rarely irregularly 5–7-foliate, divisions lanceolate· heads medium, rays pale, disk-fls yellow or dark purple achene oblong, narrowly winged; pappus a fimbriate border Cent. U. S

BB *Color of rays deep yellow. lvs. sessile*

C. *Lvs. 3-cleft to below middle, base entire, 3-ribbed.*

12. **palmàta,** Nutt (*C. præcox,* Fresen.) Perennial, tall and stout, 1½–3 ft high, sparingly branched at the summit: lvs thick, cuneate, 2½ in long, divisions broadly linear, often irregularly again divided· heads 1½–2½ in broad: achenes oblong, narrowly winged; pappus minute or obsolete Cent. U S R H 1845:265.

CC. *Lvs divided to the base*

D. *The lvs. 3-divided, divisions entire, ½–1 in. broad.*

13. **màjor,** Walt. (*C senifòlia,* Michx.). Perennial; **tall and stout, 2–3 ft. high, pubescent, much branched** above. basal lvs wanting, lower cauline small, upper 2–3 in long, palmately 3-divided, divisions equal, lanceolate, acute heads 1¼–2 in broad; rays deep yellow, disk-fls yellow. achenes obovate-elliptical, winged, summit 2-toothed. S E. U S

Var **Òemleri,** Brit Smooth. lf -divisions more attenuate at the base. B M 3484 (as *C. senifolia*)

Var. **lineàris,** Small. Smooth: lf -divisions narrow, 2–4 lines wide

DD. *The lvs dissected, divisions ⅓–3 lines wide.*

14 **delphinifòlia,** Lam Perennial, glabrous, branched above, 1–3 ft high lvs. sessile, 2–3 in long, basal wanting, ternately divided, divisions dissected into linear-filiform segms., which are 1–3 lines wide. head 1–2½ in broad, disk dark achene oblong-obovate, narrowly winged, pappus-teeth short S E U. S.

15 **verticillàta,** Linn (*C. tenuifòlia,* Ehrh.). Perennial; sparingly branched, 1–3 ft high basal lvs wanting, cauline, sessile, similar to the last but segms only ⅓–2⅔ lines wide. heads 1–2 in broad; disk yellow: achenes oblong-obovate, narrowly winged, pappus nearly obsolete E U. S

C aristòsa, Michx , *C aurea,* Ait , and *C trichospérma,* Michx , are now placed under Bidens (which see) —*C atropurpurea,* Hort =Thelesperma sp —*C auriculata,* Linn (*C diversifolia,* DC). Perennial low, stoloniferous, hirsute lvs petioled, short, oval, mostly entire heads large, very long-peduncled probably not in the trade S U S —*C bella,* Hutchins Undershrub about 3 ft high British E Afr —A very handsome species —*C Grántii,* Oliv A compact bushy plant about 2 ft high Fls in the winter Trop Afr B M 8110 G C III 39 162 Gn 60, p 161 —*C Léavenworthii,* Torr & Gray Annual lf -divisions linear-spatulate rays cuneate, lobed, yellow, awns 2, slender achene winged. Fla —*C nudáta,* Nutt Perennial, rush-like lvs mostly basal, long, filiform rays rose-colored wing of achene pectinate S U S —*C radiata,* Hort Plant very dwarf fl-heads with ray-florets rolled up. Of garden origin.

K M WIEGAND.

CORIANDER is the seed-like fruit of *Coriandrum sativum,* Linn , an umbelliferous annual of southern Europe The plant grows 1 to 3 feet high, glabrous, strong-smelling, with leaves divided into almost thread-like divisions, and small white flowers The plant is easily grown in garden soil It occasionally becomes spontaneous about old yards The seeds (fruits) are used as seasoning and flavoring in pastries, confections and liquors, although they are less known in this country than caraway The plant is sometimes grown in American gardens with sweet herbs and other things

CORIÁNDRUM. *Coriander*

CORIÀRIA (*corium,* skin, leather, a shrub used for tanning leather was described as *frutex coriarius,* by Pliny) *Coriariàceæ* Shrubs or perennial herbs grown chiefly for their ornamental fruits

Leaves deciduous, entire, 3-9-nerved, opposite and distichous: fls polygamous-monoecious in slender racemes, small, petals and sepals 5, stamens 10 fr berry-like, consisting of 5 1-seeded nutlets inclosed by the enlarged and colored petals —About 8 species in Himalayas and E Asia, Medit region, N Zeal and S. Amer Ornamental shrubs or herbs, with slender arching branches imitating pinnate lvs , and with very showy yellow, red or black fr The lvs of some species are used for tanning leather, the frs are poisonous in some species, edible in others *C japonica* has proved hardy with slight protection in Mass , and *C terminalis* seems to be of the same hardiness, the other species are more tender They grow in almost any good garden soil, and prefer sunny position. Prop. readily by seeds and greenwood cuttings in summer under glass; also by suckers and layers.

japónica, Gray. Fig 1057. Shrub, 2–3, sometimes to 10 ft branches quadrangular lvs nearly sessile, ovate or ovate-lanceolate, 3-nerved, smooth, 2–4 in long fls. in axillary racemes from the branches of last year· fr. becoming bright red in summer, changing to violet-

black when ripe Japan B M 7509 G F. 10 343 (adapted in Fig 1057). S I F. 2·58 R H 1913, p 79.

terminàlis, Hemsl Herbaceous or suffruticose, 2–3 ft branches quadrangular lvs nearly sessile, broad- to ovate-lanceolate, 5-9-nerved, scabrous on the neath, 1–3 in fls in terminal racemes on the current year fr black Sikkim, W China

xanthocárpa, Rehd & Wilson. Fr yellow Sikkim. B M 8525. R H 1907 160. G C. III 34 282 J H. III 49.443. F S R 3 106 M D 1897 1—A very ornamental plant, keeping its yellow fr. from July until late in fall, being herbaceous, it is easier to protect from frost than the former. Originally intro. into cult. as *C. nepalensis*

C himalayénsis, Hort Said to have persistent lvs and edible frs Possibly not different from *C nepalensis*—*C myrtifólia,* Linn Shrub, 4–10 ft lvs 3-nerved, glabrous fls greenish, from the old wood fr black, poisonous Medit region Yields a black dye—*C nepalénsis,* Wall Shrub, 8–10 ft lvs 3–5-nerved, glabrous fls brownish fr black Himalayas—*C sarmentósa,* Forst Suffruticose, procumbent racemes axillary, on young branches B M 2470—The wineberry shrub of the natives The berries yield a pleasant drink, but the seeds are poisonous Source of the New Zeal toot-poison, which is very destructive to human and animal life—*C thúnca,* Maxim Allied to *C japónica* Shrub to 18 ft lvs oval or broadly elliptic, abruptly short-pointed, 1½–3 in long fr black Cent China

ALFRED REHDER

CÒRIS (ancient name, transferred) *Primulàceæ.* Two low thyme-like herbs of S Eu , sometimes planted in rock-gardens, but apparently not in the trade Lvs small, alternate, linear, spreading or recurved, the margin revolute fls lilac or rose-purple, in terminal densely-fld racemes *C. monspelliénsis,* Linn , of the Medit region, is 6 in high, much branching and spreading, the sts thickly covered with the little narrow lvs

CORK-TREE. *Quercus.*

CÓRMUS *Sorbus*

CORN, MAIZE (SWEET and POP). A tender annual cultivated for its grain, which is used both for human and live-stock food, and for the herbage which is used as forage As a horticultural crop, it is grown primarily for the unripe grain or for pop-corn

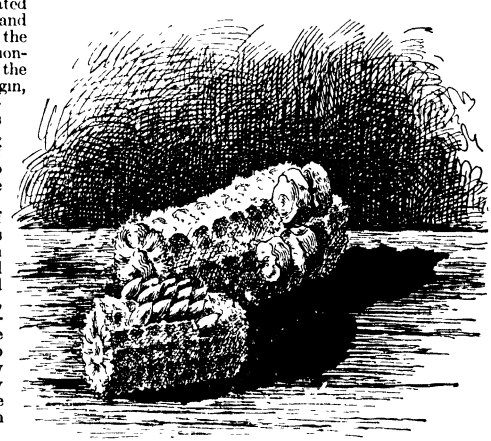
The word maize, Spanish *maiz,* is derived from the name Mahiz, which Columbus adopted for this cereal from the Haytians Maize has not yet been found truly wild Its close relationship to a native Mexican grass called teosinte, *Euchlæna mexicana,* is indicated by the known fertile hybrids between this species and maize as pointed out by Harshberger Teosinte and the only other species which show close botanical relationship to maize are indigenous to Mexico In fact the evidence all shows that maize is of American origin, although its original form has not yet been discovered, nor has its evolution from other types been completely traced DeCandolle concludes that maize is not a native of the Old World but is of American origin, and that it was introduced into the Old World shortly after the discovery of the New, and then was rapidly disseminated

Very early in the exploration and settlement of the New World, the whites learned from the natives the use of maize as food Several of the Indian names for preparations of food from this cereal were adopted or adapted by the settlers and passed into the English language,—as for example hominy, samp, and succotash In the English-speaking colonies, maize was grown as a field crop under the name Indian corn, but later the tendency was to drop the word Indian so that this cereal is now known in American agriculture and commerce by the simple word corn The word corn has thus come to have a specific meaning on this continent which does not attach to it in the British Isles

Corn now holds first rank among the agricultural products of the United States, both in the area devoted to its cultivation and in the value of the annual crop The types known in garden culture in this country are the sweet corns and the pop-corns, the other types, which are more strictly agricultural, may be designated as field corns Sweet corn and pop-corn are also grown as field crops in comparatively limited areas, the sweet corn either as a truck crop or for canning, and the pop-corn to supply the demand for this product in our domestic markets Only the types of sweet corn and pop-corn will receive attention in this article.

Botanical classification

Zea almost uniformly has been considered by botanists as a monotypic genus, its one species being *Zea Mays* But *Z Mays* is an extremely variable species, including groups which are separated by definite characteristics As a working classification, that proposed by Sturtevant is the best which has yet appeared. He describes seven "agricultural species" These are *Zea tunicata,* the pod corns, *Z. everta,* the pop-corns (Fig. 1058), *Z indurata,* the flint corns, *Z indentata,* the dent corns, *Z amilyacea,* the soft corns, *Z saccharata,* the sweet or sugar corns (Figs 1058, 1059, 1060), *Z amylea-saccharata,* the starchy sweet corns *Z canina,* Wats , is a hybrid form, as shown by Harshberger. *Z Mays,* Linn , belongs to the natural order of grasses or Gramineæ Culms 1 or more, solid, erect, 1½–15 ft tall, or more, terminated by a panicle of staminate fls (the tassel) internodes grooved on one side branches ear-bearing or obsolete lvs long, broad, channeled, tapering to the pendulous tips, with short hyaline ligules and open embracing sheaths fls monœcious, awnless, usually proterandrous, staminate fls in clusters of 2–4, often overlapping, 1 fl usually pedicelled, the other sessile or all sessile, glumes herbaceous, palea membranaceous, anthers 3, linear The ear contains the pistillate fls on a hard, thickened, cylindrical spike or spadix (cob), which is inclosed in many spathaceous bracts (husks), spikelets closely sessile, in longitudinal rows, paired in alveoli with hard, corneous margin, fls 2 on a spikelet the lower abortive, glumes membranaceous; style single, filiform, very long (silk), ovary usually sessile ear variable in length and size, often distichous, grain variable in shape and size The color ranges from white through light and dark shades of yellow, red and purple to nearly black



1058. Kernels of corn on the cob—sweet corn behind, pop-corn in front (×½)

Sweet corn (*Zea saccharata*, Sturt.) Figs 1058–1060. This is a well-defined species-group, characterized by horny, more or less crinkled, wrinkled or shriveled kernels, having a semi-transparent or translucent appearance. Sturtevant, in 1899, lists sixty-one distinct varieties. He gives the first variety of sweet corn recorded in American cultivation as being introduced into the region about Plymouth, Massachusetts, from the Indians of the Susquehanna in 1779. Schenck, in 1854, knew two varieties. It appears, therefore, that the distribution of sweet corn into cultivation made little progress prior to the last half of the nineteenth century, green field corn having largely occupied its place prior to that period.

Sweet corn is preeminently a garden vegetable, although the large kinds are sometimes grown for silage or stover. As a garden vegetable, it is used when it has reached the "roasting ear" stage, the kernel then being well filled and plump but soft, and "in the milk." The kernel is the only part used for human food. When sweet corn is used as a fresh vegetable, it is often cooked and served on the cob. Dried sweet corn, though never an important article of commerce, was formerly much used, especially by the rural population. It is gradually being generally abandoned for canned corn, for other cereal preparations or for other vegetables, but recently desiccated corn has been put upon the market and is finding sale in certain districts, particularly in the South and in mining and lumber camps. It is practically unknown outside North America.

In the last quarter of the last century, canned sweet corn came to be an important article of domestic commerce in the United States and Canada. The total pack for the United States and Canada for the year 1898 was 4,398,563 cases, each containing two dozen two-pound tins. The following statement shows the number of cases packed for the United States for the five-year period from 1907 to 1911:

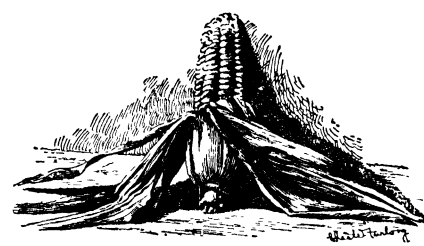
1907 . . .	6,653,744
1908	6,779,000
1909	5,787,000
1910	10,063,000
1911	14,301,000

Comparatively little of this corn was sent abroad, most of it being consumed in the States, Canada, and Alaska. In 1911 Iowa took first rank in the output of canned corn with a pack of 2,774,000 cases, which was nearly 20 per cent of the total output of the United States for that year. Illinois, New York, Maryland, Maine, Ohio, and Indiana followed in the order named. These seven states packed about 88 per cent of the total output of this country in 1911. These figures are the best obtainable and give a general idea of the progress and distribution of the corn-canning industry. Maine produces as good canned corn as is put on the market and grows the crop largely in localities having too short a season to mature the seed.

Sweet corn is commonly grown for canneries under contract, the canning company supplying the seed and guaranteeing it to be good and true to name, while the farmer agrees to grow a certain specified acreage and deliver the whole crop to the cannery at a stipulated price. In Iowa the price now paid the grower is about $7 per ton of good ears. A yield of three to four tons to the acre is considered good. The ears are snapped from the stalks with the husks on and hauled in deep wagon-boxes to the canneries. The stalks, when preserved either as ensilage or as stover, make excellent fodder. The overripe and inferior ears, being unmarketable, are left on the stalks and thereby materially increase their value as a stock food. The stover keeps best in loose shocks, as it is liable to mold when closely packed in large stacks or bays.

As a field crop, sweet corn is grown most extensively on medium heavy loams that are well supplied with humus or organic matter. It luxuriates in rich warm soils. The crop rotation should be planned so as to use the coarse manures with the corn, which is a gross feeder. On the more fertile lands of the central corn-belt, nitrogenous manures may not always be used to advantage with corn, but in the eastern and southern states, where the soil has lost more of its original fertility, stable manure may often be used profitably with this crop at the rate of 8 or 10 cords to the acre, or possibly more.

In the northern part of the corn-belt in the central and western states, that is to say north of the Ohio and Missouri rivers, deep fall plowing of corn land is generally favored, but in experiments at the Illinois and Indiana experiment stations, the depth of plowing has had little influence on the crop. In sections of the eastern states, shallow plowing late in spring is favored, especially if the land be in sod. In warmer, drier regions, as in parts of Nebraska and Kansas, listing has been much practised on stubble ground. The listing plow, having a double mold-board, throws the soil into alternate furrows and ridges, the furrows being 8 or 9



1059 Early Marblehead sweet corn

inches deeper than the tops of the ridges. The corn is planted in the bottom of the furrow, either by means of a one-horse corn-drill or by a corn-drill attachment to the lister plow, consisting of a subsoil plow through the hollow leg of which the corn is dropped.

Great care should be used to secure seed-corn having high vitality as a precaution against the rotting or weak germination of the seed in the soil, should the season be cold and wet after planting. Select the seed-ears early before any hard frosts have come. At this time the large, early, and well-matured ears can be distinguished from the rest of the crop, as the husks about the early-maturing ears will have started to turn brown. Early maturity is a vital point to consider in selecting seed-ears and this quality should never be sacrificed for the size of late unmatured ears. In selecting seed for a field crop, seek systematically for stalks having little or no growth of stools and bearing single, large, and early-maturing ears. For garden use, seed from more productive stalks is desirable, even though the ears be smaller. The seed-ears should be dried at once by artificial heat so that the seed may better withstand unfavorable conditions of temperature or moisture. In many localities so-called kiln-dried seed is much in favor.

In the North, sweet corn should be planted as early as can be done without involving great risk of loss from frosts or from rotting of seed in the soil. In New York, field-planting is generally done from May 10 to May 20; in central Minnesota from May 10 to May 30. The ground having been plowed and prepared so as to make a seed-bed of fine, loose soil 3 inches deep, the seed should be planted to a depth of 1 to 3 inches. The drier and looser the soil, the greater should be the depth of planting. In planting small fields, the ground may be marked in check-rows so that the hills planted

at the intersection of the rows will stand about 3 feet 4 inches to 3 feet 6 inches apart each way, and the corn planted by a hand-planter, which each time it is thrust into the ground drops from four to five kernels, which is usually the number desired Three feet apart is too close to allow the cultivators to work easily For large fields, the check-row type of planter should be used These planters drop and cover the seed in hills at uniform distances apart, planting two rows at one trip across the field Two types of furrow-openers are now used on corn-planters, these are the runner furrow-openers and the disc furrow-openers The former are less satisfactory on sod land or in fields covered with trash, as the runners will often ride out and leave the seed uncovered. It is better to use the disc furrow-opener on such land, besides opening the furrow better, it also pulverizes the soil about the seed Field corn is often planted in drills by planters adapted to this purpose, but sweet corn should be in hills so that the surface of the ground may be kept loose and entirely free from weeds

Till for the purpose of retaining soil-moisture as well as to kill weeds This requires frequent shallow cultivation, pulverizing the surface of the soil so that it will act as a mulch to retard the evaporation of soil-moisture Tillage should begin as soon as the planting is done, using the slanting-tooth harrow and the weeder types of implements until the corn is nearly 6 inches high, providing that the weeds are small and the ground is in friable condition After this time the spring-tooth cultivators or the two-horse cultivators, having preferably three or four shovels on a side, are generally used, depending somewhat upon the kind of soil to be cultivated This type of two-horse cultivator is preferable to the double-shovel type which was formerly much used The two-horse revolving disc cultivator is sometimes used in damp, weedy ground One great objection to this type is that too much earth is thrown toward the corn and the middles between the rows are usually left either untouched or bare of the loose soil which is needed for a mulch For the later cultivations the two-horse surface cultivator is coming more and more into general use

Till at intervals of seven to ten days At first the cultivator may run from 2 inches deep near the plant to 4 inches deep midway between the rows Each successive cultivation should gradually increase in depth towards the middle between the rows, throw ½ inch or more of earth towards the corn and cover the weeds. At the last cultivation the cultivator may be kept a little farther from the corn It should leave the soil pulverized to a depth of 2 to 3 inches over the entire field. The earlier cultivation may be deepened, if necessary, to kill weeds, even though some corn roots are severed, but cutting the roots by deep cultivation near the plants late in the season is to be especially avoided. Till the soil until the corn gets so large as to prevent the use of a two-horse cultivator Occasionally a later cultivation, with a one-horse cultivator, may be necessary if heavy rains leave the surface soil hard and start the weeds Often catch-crops for late pasturage, cover-crops or crops of winter wheat or rye are sown in the cornfield and cultivated in with the last cultivation. The seed is covered deeply by cultivating it in because the weather is apt to be dry at this period. The lower part of the furrow-slice is thus left compact, furnishing a compact seed-bed, in which small grains delight.

The cultivation of sweet corn in the garden should follow the general lines indicated for field culture, but stable manure and commercial fertilizers may be used more liberally. Except on very fertile soils, it is well to put a small amount of a complete commercial fertilizer in each hill and mix it well with the soil before planting the corn A fertilizer which has a large amount of nitrogen in quickly available form should be chosen for this purpose. Dwarf early-maturing varieties may be planted, for early use, as soon as the ground is sufficiently dry and warm A little later, when the ground is warmer, the second-early main crop and late varieties may be planted. Later successional plantings insure a supply of green corn till frost kills the plants.

Corn is not grown commercially as a forcing crop Attempts to force it in winter have not given encouraging results, but it may be successfully forced in spring, following any of the crops of vegetables which are grown under glass, providing the houses are piped so as to maintain the minimum night temperature at 65° F. Provide good drainage Give a liberal application of stable manure and thoroughly mix it with the soil In the latitude of New York the planting may be made as early as the first of March As soon as the first leaf has unfolded, the temperature may be allowed to run high in the sun, if the air is kept moist by wetting the floors and walls. The glass need not be shaded Keep night temperature close to 65° F., not lower and not much higher. After the silk appears, jar the stalks every two or three days, when the atmosphere is dry, and thus insure abundant pollination Early maturing varieties, like Cory, give edible corn in about sixty days when thus treated. Corn may be forced in the same house with tomatoes, eggplant, and other vegetables which require similar range of temperature

Varieties of sweet corn.

Some of the desirable varieties for the garden, the market, and for canning are listed below These varieties are named to show the range of variation and to indicate the leading groups or types, rather than to recommend these particular kinds New varieties are continually supplanting the old

For the home garden —Extra-early Golden Bantam, an extra-early sort, has recently become very popular, on account of its productiveness, good flavor, and desirable size for table use, and because the kernels separate very easily from the cob, many plant it in succession so as to cover the entire season with this variety alone Peep o'Day and Minnesota are other good extra-early varieties Second-early Early Crosby, Early Evergreen Medium or standard season Hickox Improved, Stowell Evergreen, White Evergreen. Late Black Mexican, Country Gentleman.

For market —Extra-early Cory (red cob), White Cob Cory, and Extra-Early Adams, which, though not a sweet corn, is largely grown for early use This last-named variety is recommended in the South because of its comparative freedom from the attacks of the ear worm. Second-early Shaker, Crosby, Early Champion; Early Adams also is extensively grown for market, though not a true sugar corn Midseason and Late. Stowell Evergreen, Country Gentleman, Late Mammoth, Egyptian

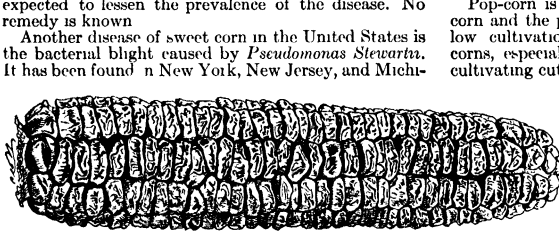
For canning —Stowell Evergreen is the standard variety for canning factories everywhere Country Gentleman is also grown to a considerable extent for fancy canned corn Other varieties that are used for canning include Early Evergreen, White Evergreen, Egyptian, Potter Excelsior, and Hickox Improved.

Diseases and pests of sweet corn

The most widespread and destructive disease of corn in the United States is the smut produced by the parasitic smut-fungus, *Ustilago Zeæ* The sorghum-head smut, *Ustilago Reiliana*, also attacks maize Smut causes most injury when it attacks the ears The grains are transformed into a mass of dark-colored smut spores, and become exceedingly swollen and distorted out of all semblance to their normal outlines Infection may take place at any growing point of the plant from early till late in the season, hence treatment of seed corn by fungicides is of no value as a

remedy for corn smut. The destruction of smutted parts of the plants, and taking especial care that the smut does not become mixed with manure which is used for the corn crop, are measures which may be expected to lessen the prevalence of the disease. No remedy is known

Another disease of sweet corn in the United States is the bacterial blight caused by *Pseudomonas Stewartii*. It has been found in New York, New Jersey, and Michi-



1060 Golden Bantam sweet corn

gan, but thus far has been seriously destructive only on Long Island on early dwarf varieties of sweet corn It is characterized by wilting and complete drying of the whole plant, as if affected by drought, except that the leaves do not roll up. The fibro-vascular bundles become distinctly yellow, and are very noticeable when the stalk is cut open The disease attacks the plant at any period of growth, but is most destructive about the time the silk appears No remedy is known.

These two diseases are of the most economic importance in the United States. Two others of somewhat minor importance which deserve mention are rust and leaf blight. The leaf-blight fungus causes round, brownish, dead spots on the foliage The maize rust, *Puccinia sorghi*, is found principally where rainfall is abundant. It is rather common throughout the corn-belt The fungus is similar in nature to that which causes the rust of small grains It cannot be controlled economically

Over 200 species of insects are known to be injurious to corn, either to some part of the growing plant or to the stored product The corn-ear worm, known South as the cotton-boll worm, is especially injurious to sweet corn It burrows in tender green corn, ruining the ear for either canning or market purposes It is known to do serious damage as far north as western New York and central Iowa Recent experiments in dust-spraying promise well Spraying is done weekly, beginning when silks appear, using equal weight powdered lead arsenate and lime Shallow fall plowing to kill pupæ is a partial remedy. Wire-worms, northern corn-root worms, white grubs, and certain other grass insects attack corn plants One of the best preventive measures is to plan the rotation so that corn does not immediately follow any cereal or grass crop.

Pop-corn (*Zea everta*, Sturt.) Fig 1058 Pop-corn is characterized by the excessive proportion of the corneous endosperm and the small size of the kernel and ear. The kernel split laterally shows the chit and corneous matter enveloping, and in some cases a fine, starchy line The small size of the kernel and the property of popping makes identification certain. This species-group extends throughout North and South America and has claims for prehistoric culture

The preparation of the ground recommended for sweet corn holds for pop-corn. Tillage should be started early in the spring to conserve as much of the soil-moisture as possible, thus protecting the crop against possible injury from drought later in the season.

On good clean ground the pop-corn is very often drilled, dropping the kernels 6 to 8 inches apart in the row. More often, however, it is check-rowed with the rows 3 feet 4 inches apart and from four to six kernels in the hill. The ordinary corn-planters are used with special plates for pop-corn planting. For dwarf varieties of pop-corn such as the Tom Thumb, when planted in home gardens and tilled by hand, the hills may be as near together as 2½ feet

Pop-corn is much slower in germinating than field corn and the plant is not so vigorous a grower. Shallow cultivation is recommended just as for other corns, especially for the later cultivations, since deep cultivating cuts too many roots.

Pop-corn is planted earlier than field corn. It should be planted deep enough to reach the moist soil, usually 1½ to 2 inches, but in a dry season it may need to go 3 inches deep.

The White Rice, which is grown more extensively for market than any other variety, mixes with field corns readily. The resulting hybrid types have larger ears and larger, smoother kernels and give heavier yields than do the pure pop-corns These hybrid types were for a time quite in favor with the commercial growers because of their greater yield Now they are being discriminated against by the buyers because of their inferior popping qualities, and the tendency among the growers is to get back to the pure types, even though they give smaller yields

Pop-corn matures earlier than field corn. For this reason in many sections of the country it is regarded as a surer crop In the region about Odebolt, Iowa, where pop-corn is grown more extensively than in any other district in the world, harvesting sometimes begins as early as the middle of September, but more often it is delayed till the first of October or later to let the corn dry on the stalk There are two methods of harvesting One is to snap the corn and pile it in the crib, then shuck it during the winter. However, this is not generally practised because it makes more work and takes more crib room The other and common method is to pick and shuck the ears from the standing stalks directly into the wagon, the same as with field corn

On account of the heavy expense of hand-picking, some are now using the harvesting apparatus called the corn-picker and husker Opinions differ as to the economy of using this picker The rows should be long and the corn should stand up well to justify its use For hand-picking the price per bushel usually ranges from 10 to 12 cents A good hand can pick about forty bushels in a ten-hour day if the corn is good

It is very important that the pop-corn be thoroughly dried After it is picked it is placed in the crib which usually has ventilators through the center These extend along the middle of the floor, are slatted to admit air, and are about 1½ feet wide by 2½ feet high. The corn is usually left in the crib through the winter season Sometimes it is marketed on the cob Formerly it was a common practice to ship it on the cob in sacks, but now it is generally held over winter in the crib, shelled the next spring and shipped in two-bushel sacks It is usually marketed from June to September.

It is ready to use for popping just as soon as it is dry enough. It can be popped immediately after it is gathered if the season is dry and the corn is allowed to dry sufficiently in the field. Usually it is left on the stalk till it is so dry that it shells some when thrown into the wagon

Various companies make a practice of contracting for a certain number of acres of pop-corn at a certain price in the spring of the year, so that the farmer may know just what price he will get for his corn in the fall or at some stated time at which it is to be delivered. The contracting firm does not as a rule supply the seed but does specify the grade of the corn and objects to the coarse hybrid types

The prices for corn in the ear are ruling from 1 cent to 2 cents a pound; for shelled corn from 1½ cents

to 3 cents a pound. Pop-corn is considered a very profitable crop and less likely to fail than field corn because it matures earlier A good return to the acre would be twenty to twenty-five bushels of ear corn, worth from $20 to $50, averaging about $30 Field corn in the same region averages about fifty-five bushels, worth usually from $20 to $25 an acre.

Varieties.

In 1899, Sturtevant described twenty-five varieties of pop-corn. Tracy, in his "American Varieties of Vegetables for the Years 1901 and 1902," enumerated fifty-four varieties The rice pop-corns are generally used for commercial plantings White Rice is now the leading commercial variety of pop-corn, since it gives the greatest yield and also brings the highest price on the market. In the noted region about Odebolt, Iowa, this variety is grown almost exclusively The following list includes the leading varieties:

White Rice —Ear 4 to 8 inches long This vigorous, late variety is widely cultivated. With other rice corns, it is characterized by deep, tapering, beaked kernels

White Pearl —Ear 4 to 8 inches long Matures somewhat earlier than Rice and later than Dwarf Golden. Kernels round and silvery white

Dwarf Golden —Ear 1 to 3 inches long An early-maturing sort, with broad, golden yellow kernels. A favorite garden variety

Golden Tom Thumb —Ear 2 to 2½ inches long An ornamental variety for home gardens. The stalks only grow to a height of about 20 inches. The kernels are bright and golden yellow.

Other kinds of pop-corn worthy of mention are Golden Queen, Silver Lace, and California Yellow.

S. A. BEACH.

CORN COCKLE: *Lychnis Githago.*

CORNEL, CORNELIAN CHERRY: *Cornus mas.*

CORNFLOWER: *Centaurea Cyanus.*

CORN POPPY of Europe is the weed of the grain fields from which some of the garden poppies have been raised, *Papaver Rhœas.*

CORN-SALAD (*Valerianélla olitòria*, Poll). *Valerianàceæ.* A spring and summer salad and pot-herb plant

Annual mature plant 4–6 in. tall, forking: radical lvs. tufted (the parts used), oblong and obtuse, narrowed at the base, entire or few-toothed, st -lvs narrow, often clasping fls very small, in small terminal cymes, whitish fr (seed) nearly globular, gray, not crested S Eu *V eriocárpa*, Desv , of S Eu and N Afr , is sometimes cult as salad lvs longer and lighter-colored fr (seed) flattened, pale brown, crested. Known also as lamb's lettuce, fetticus, and vetticost.

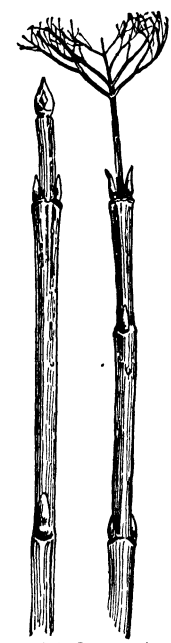
Sow the seed of corn-salad in early spring, at the time of the first sowing of lettuce, and make successional plantings as often as desired. For very early salads the seeds are planted in September, and the young plants are covered with a light mulch and wintered exactly as spinach is often managed Sow in drills a foot or 18 inches apart and cover lightly Work the ground thoroughly, and give an abundance of water The leaves may be blanched, but are usually eaten green. It matures in sixty to sixty-five days during good spring weather. Only one variety is offered by most American seedsmen, but several sorts are known to European gardeners It is sometimes used for a pot-herb, being served like spinach, but is chiefly valuable for salads It is rather tasteless, and is not so popular as cress or lettuce on that account, but persons who prefer a very mild salad, or who would rather taste the salad dressing, will doubtless fancy corn-salad. It is best served in mixture with other herbs, as lettuce, water-cress or white mustard It is easy to grow. There are no special enemies.

F. A. WAUGH.

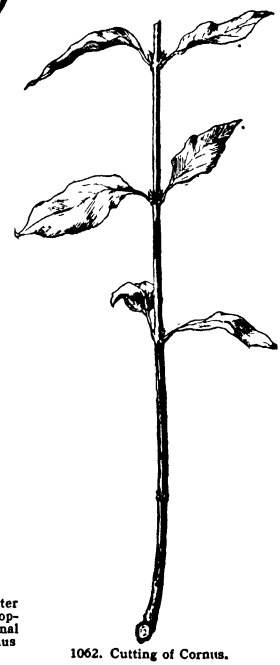
CÓRNUS (ancient Latin name of *Cornus mas*). *Cornàceæ* DOGWOOD Woody plants (one or two infrequently cultivated herbs), grown for their attractive flowers and fruits, some species also for the winter effect of their brightly colored branches.

Shrubs or trees, rarely herbs lvs. opposite, rarely alternate or whorled, deciduous, entire: fls small, 4-merous, usually white, in terminal cymes (Fig 1061) or heads; calyx-teeth minute, petals valvate, style simple, filiform or cylindric; ovary inferior, 2-celled· fr a drupe with a 2-celled stone —About 40 species in the temperate regions of the northern hemisphere and one in Peru Monograph by Wangerin in Engler, Pflanzenreich, hft 41, pp 43–92, quoted below as Wang.

The dogwoods are hardy ornamental shrubs with handsome foliage, often assuming a brilliant fall coloring, and with attractive flowers and fruits Nearly all are very desirable for planting in shrubberies They grow nearly as well in shady places under large trees as in sunny exposed situations, and thrive in almost any soil One of the most beautiful in bloom is *C florida*, with extremely showy flowers in spring *C racemosa* is one of the best for shrubberies, blooming profusely in June The red-branched species, as *C alba*, *C Amomum*, *C Baileyi*, *C. sanguinea* are very attractive in winter Propagated by seeds, which usually do not germinate until the second year The species with willow-like soft wood, as *C alba* and its allies, grow readily from cuttings of mature wood, while the others are sometimes increased by layers They are often grown in this country from nearly ripened cuttings



1061 Cornus winter shoots, showing the opposite buds and terminal flower-clusters – Cornus Baileyi



1062. Cutting of Cornus.

(Fig 1062), handled in frames in summer. Horticultural varieties of other species are mostly budded in summer on seedlings of the type, or grafted in early spring in the propagating-house

Various species of Cornus have many interesting uses. Our native *C florida*, which in flower is the showiest



1063. Cornus alternifolia.

member of the genus, furnishes a useful substitute for quinine. The bark of all parts contains the same substances found in cinchona, but in different proportions. It is inferior in effectiveness and more difficult to secure in large quantities It is sometimes possible to ward off fevers by merely chewing the twigs The powdered bark makes a good tooth-powder, and the fresh twigs can be used for the same purpose The bark mixed with sulfate of iron makes a good black ink The bark of the roots yields a scarlet dye The wood, being hard, heavy, and close-grained, is good for tool handles The cornelian cherry has pulpy fruits resembling cornelian in color and about the size and shape of olives, for which they can be substituted The ripe fruits are soft and rather sweet The name dogwood comes from the fact that a decoction of the bark of *C sanguinea* was used in England to wash mangy dogs The small red berries of *C. suecica* (not in the trade) are eaten by the Esquimaux.

INDEX.

alba, 3, 4.
albocarpa, 17.
alternifolia, 1.
Amomum, 8.
argentea, 1
argentea-marginata, 4, 17
asperifolia, 6.
aurea, 17
aureo-elegantissima, 17
Baileyi, 5
brachypoda, 2, 12.
caerulea, 8
canadensis, 23
candidissima, 10.
capitata, 22
circinata, 7
coloradensis, 3.
controversa, 2.
fastigiata, 11.
femina, 11
flaviramea, 3.
florida, 19
Gouchaultii, 4.
ignorata, 12
japonica, 21
Kesselringii, 4.
Kousa, 21
luteocarpa, 17
macrocarpa, 17
macrophylla, 2, 12
mas, 15, 17
mascula, 17.
nana, 17
nitida, 3
Nuttallii, 20.
obliqua, 9
oblongata, 10
ochroleuca, 1
officinalis, 18
paniculata, 10.
paucinervis, 14
pendula, 3, 19
pumila, 15
Purpusii, 9
quinqueneryis, 14.
racemosa, 10
rubra, 19
rugosa, 7
sanguinea, 16
sericea, 8
sibirica, 4
Spaethii, 4
stolonifera, 3, 9.
stricta, 11
tatarica, 4
Theleryana, 12
Thelycanis, 12
umbraculifera, 1
variegata, 2, 8, 16
viridissima, 16
Wilsoniana, 13

A. *Plants, shrubs or trees.*

B. *Fls. in cymes or panicles without involucre.* (*Svida.*)

C. *Foliage alternate: fls in umbel-like cymes, cream-colored.*

1. **alternifòlia,** Linn. (*Svida alternifòlia*, Small). Fig 1063. Shrub or small tree, to 25 ft.: lvs. slender-petioled, elliptic or ovate, usually cuneate, acuminate, nearly glabrous above, pale or whitish beneath and appressed pubescent, 3–5 in long: cymes 1½–2½ in. wide. fr dark blue, globular, ⅓in. across, on red peduncles May, June New Bruns. to Ga and Ala., west to Minn S S 5.216 Em 463. Wang 51 —Of very distinct habit, the branches being arranged in irregular whorls, forming flat, horizontally spreading tiers, as in the picture. A variety which shows this habit more distinctly than the common form is var **umbraculifera,** Dieck Var **argéntea,** Temple & Beard, is a form with white-marked foliage Var **ochroleùca,** Rehd., has yellowish frs.

2 **controvérsa,** Hemsl. (*C. brachypoda*, Koch, not C A Mey *C macrophylla*, Koehne, not Wall). Tree, to 60 ft.. lvs slender-petioled, broadly ovate or elliptic-ovate, usually rounded at the base, abruptly acuminate, whitish and slightly hairy beneath, 3–5 in long cymes 3–4 in wide. fr. bluish black June. Himalayas to Japan B M 8261 S I F. 1 77. R B 30 63 —With the habit of the former, but of more vigorous growth, not hardy N. Var **variegàta,** Rehd (*C macrophylla variegàta*, Barbier) Lvs edged white Gng 3 67; 16:291 J H. III. 28.129, 47.147.

cc *Foliage opposite.*

D *Fr white or blue.*

E. *The fls. in umbel-like flat cymes.*

F. *Color of fr white or bluish white*

G. *Under side of lvs with appressed hairs, glaucous.*

3. **stolonífera,** Michx (*C álba*, Wang) Red-Osier Dogwood Fig. 1064 Shrub, to 8 ft , usually with dark blood-red branches and prostrate st , stoloniferous: lvs obtuse at the base, ovate or oblong-lanceolate, acuminate, 2–5 in long cymes dense, 1-2 in wide, disk usually red fr white, globose, with the stone broader than high. May, June From Brit N Amer to Ill and Calif G C II 8:679 —Habit bush-like, as in Fig 1064 Var **flaviràmea,** Spaeth Branches yellow There are also varieties with variegated lvs. Var. **nítuda,** Schneid (*C álba* var *nítuda*, Koehne) Branches green lvs glossy above Var **coloradénsis,** Schneid (*C álba* var *C coloradénsis*, Koehne) Branches brownish red, strongly recurved fr bluish white Colo Var. **péndula,** Ell Low shrub with pendulous branches

4 **álba,** Linn (*C tatárica*, Mill) Shrub, to 10 ft , with usually erect st and bright blood-red branches, mostly with glaucous bloom when young lvs obtuse at the base, ovate or elliptic, somewhat bullate or rugose above, acute, 1½–3½ in long cymes dense, small; disk



1064. Cornus stolonifera.

yellow: fr. ovoid, bluish white, sometimes whitish; stone usually higher than broad, flat. Siberia, N. China Var. **argénteo-marginàta,** Rehd (*C álba* var *elegantíssima variegàta,* Hort.) Lvs edged white. Var **Spàethii,** Spaeth Lvs broadly edged yellow. Gn 64, p 378; 69, p. 343 Var **Gouchaùltii,** Rehd. (*C. sibírica Gouchaùltii,* Carr) Lvs variegated with yellowish white and pink Var **sibírica,** Lodd Branches bright coral-red C L A 21, No 4·29. G M 54.249 Var. **Kesselríngii,** Rehd (*C sibírica* var. *Kesselríngii,* Wolf). Branches very dark purple, nearly purplish black. There are also some other varieties with variegated lvs.

GG *Under side of lvs. with woolly hairs*

5. **Bàileyi,** Coult & Evans Fig. 1065. Erect shrub, with reddish branches: lvs ovate to lanceolate, acute or acuminate, white beneath, with woolly and with appressed hairs, 2–5 in. long: fls in small rather compact woolly cymes: stone of the white fr. much broader than high, compressed and flat-topped Pa to Minn and Wyo G F 3 465 (adapted in Fig 1065) —A very handsome species of upright growth, with dark red branches, blooming nearly all summer, and of a distinct grayish hue due to the slightly upward curled lvs The fall color of foliage and winter color of twigs are unequaled Well adapted for sandy soil Early observed on dunes, S Haven, Mich , but brought to the attention of systematists from specimens collected in extreme N E Minn in 1886

6 **asperifòlia,** Michx Shrub, 8–15 ft branches reddish brown lvs slender-petioled, elliptic to ovate, acuminate, rough above, pale and woolly-pubescent beneath, 1–4 in long cymes rather loose, rough-pubescent fr globose, white, stone nearly globose, slightly furrowed Ont to Fla , west to Texas. G F 10 105.

FF. *Color of fr blue or bluish, sometimes partly white or greenish white*

G *Lvs densely woolly-pubescent beneath.*

7. **rugòsa,** Lam (*C circinàta,* L'Her) Shrub, 3–10 ft . the young branches green, blotched purple, older ones purplish lvs orbicular or broadly ovate, acute or short-acuminate, slightly pubescent above, pale and densely pubescent beneath, 2–6 in long cymes rather dense fr light blue or greenish white May, June. Em 464 Wang 61.—Bark has medicinal properties

GG *Lvs pubescent only on the veins or nearly glabrous beneath*

8. **Amòmum,** Mill (*C sericea,* Linn. *C. cærùlea,* Lam) Shrub, 3–10 ft , with purple branches: lvs. usually rounded at the base, elliptic-ovate or elliptic, dark green and nearly glabrous above, pale green beneath, usually with brownish hairs on the veins, 2–4 in long: cyme compact: fr blue or sometimes partly white. June, July Mass to Ga , west to N. Y. and Tenn Em 466 —Bark has medicinal properties. Var **variegàta,** Hort Lvs. variegated with yellowish white.

9 **obliqua,** Raf (*C Púrpusi,* Koehne). Shrub, similar to the preceding, usually broader and more loosely branched branches purple to yellowish red: lvs. usually narrowed at the base, elliptic-ovate to oblong, dark green and glabrous above, glaucous beneath, on the veins usually with whitish or brownish hairs, 2–3½ in long. cyme compact: fr blue or partly white May, June in the S , July in the N Que to Minn and Kans. south to Pa , Ill. and Mo. S.T S. 1:39. R H. 1888:444 (as *C. stolonifera*)

EE *The fls in broad panicles: fr. white or pale blue.*

10 **racemòsa,** Lam. (*C candidíssima,* Marsh , not Mill *C. paniculàta,* L'Her *C oblongàta,* Hort). Shrub 6–15 ft , with gray branches: lvs. cuneate, ovate-lanceolate or lanceolate, acuminate, appressed-pubescent or nearly smooth, whitish beneath, 1½–4 in long petals white, lanceolate: fr white May, June Maine to N C , west to Minn , and Neb Wang. 58 (as *C. femina*).—Free-flowering, very handsome when in bloom, and with its white frs on red peduncles in fall

11. **fémina,** Mill (*C. stricta,* Lam. *C. fastigàta,* Michx.). Shrub, to 15 ft , with purplish branches lvs ovate or ovate-lanceolate, sparingly and minutely appressed-pubescent, green on both sides, 1½–3 in long petals white, ovate-lanceolate fr pale blue. April, May. Va to Ga and Fla —Tender N. Closely allied to the former, and perhaps only variety.

DD. *Fr. black (green in a var. of No. 16).*

E *Fls. in broad panicles.*

12. **brachýpoda,** C A Mey (*C ignoràta,* Shiras. *C macrophýlla,* Hemsl , not Wall *C Thelycànus,* Lebas. *C Theleryàna,* Hort) Shrub or small tree branches yellowish or reddish brown lvs slender-petioled, elliptic-ovate to elliptic-oblong, abruptly acuminate, rounded or broadly cuneate at the base, dark green



1065. Cornus Baileyi (Spray ×⅓)

above and nearly glabrous, glaucous beneath and sparingly appressed hairy, with 6–8 pairs of veins, 2½–6 in long panicle rather loose, 3–6 in across, style below the stigma abruptly enlarged into a disk fr bluish black. Aug Japan, Cent China S T S 1 41 S I.F 1:77. R H 1875, p 395 F 1876, p 123 —One of the handsomest dogwoods on account of its large lvs. and large panicles of white fls ; not quite hardy N

13. **Wilsoniàna,** Wang Tree, to 40 ft branches brownish lvs elliptic, narrowed at the base, acuminate, above sparingly, beneath more densely appressed-pubescent, green or glaucescent beneath, with 3–4 pairs of veins, 2–4 in long panicle 2½–4 in across, style cylindric, scarcely enlarged below the stigma. fr. bluish black. Cent. China Wang 66 —Very handsome, similar to the preceding, but hardier. Page 3567.

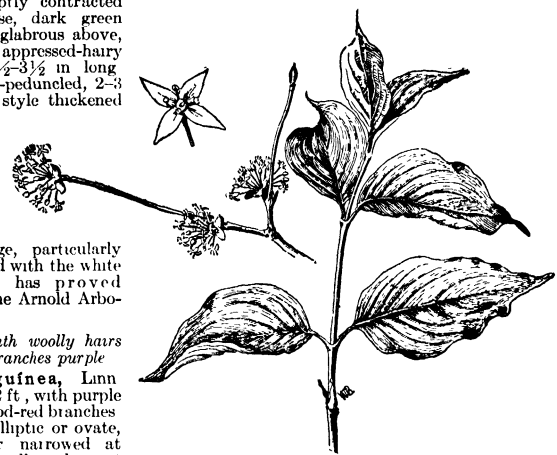
EE *Fls. in umbel-like cymes lvs. green beneath.*

F. *Lvs. with appressed hairs beneath.*

14 **paucinérvis,** Hance (*C. quinquenérvis,* Franch.). Shrub 4–6 ft : young branches quadrangular, usually reddish brown: lvs short-petioled, of firm texture, oblong-obovate to elliptic-lanceolate, acute, cuneate at the base, dark green above, paler beneath with appressed hairs, with 3–4 pairs of veins, 1½–3½ in long: cymes long peduncled; style thickened below the apex:

fr. black. June. Cent. China. G C. III. 50:95. G.M. 54:593 Gt. 1896, p 285. Wang. 72.—Handsome shrub nearly half-evergreen, but not hardy N. P 3567

15. **pùmila,** Koehne (*C. más* var. *nàna*, Dipp). Dense shrub, to 6 ft · branchlets terete, glabrous. lvs. crowded, broadly ovate to oblong-ovate, short-acuminate, abruptly contracted at the base, dark green and nearly glabrous above, paler and appressed-hairy beneath, 1½–3½ in long cymes long-peduncled, 2–3 in broad; style thickened below the apex fr. black July. Origin unknown — Handsome with its dense dark green foliage, particularly when dotted with the white fl.-clusters; has proved hardy at the Arnold Arboretum.



1066. Cornus mas. (Sprays ×½)

FF. *Lvs. with woolly hairs beneath: branches purple*

16 **sanguínea,** Linn Shrub, to 12 ft , with purple or dark blood-red branches lvs broad-elliptic or ovate, rounded or narrowed at the base, usually pubescent on both sides, pale green beneath, 1½–3½ in long fls greenish white, in dense cymes fr black May, June Eu , Orient Var. **variegàta,** Dipp Lvs variegated with yellowish white. G W 9, p 247 Var. **viridíssima,** Dieck With green branches and green fr.

BB. *Fls. in dense heads or umbels, with an involucre.*

C *Color of fls yellow; involucre yellowish, not exceeding the fls* (*Macrocarpium*)

17 **más,** Linn (*C máscula,* Hort) Cornelian Cherry Fig 1066 Shrub or small tree, to 20 ft lvs ovate or elliptic, acute, appressed-pubescent, and green on both sides, 1½–4 in long; fls in sessile opposite umbels, before the lvs ; pedicels not exceeding the involucre· fr. oblong, scarlet, ¾in long, edible March, April S Eu , Orient Mn 5 192 G C II 9·399. H W 3, p 61 —Handsome shrub of dense growth with glossy foliage, very attractive in early spring with its yellow fls , and again in fall with its shining scarlet frs. Var **macrocárpa,** Dipp. Fr. larger. Var **albocárpa,** Schneid. (var *luteocárpa,* Wang) Fr yellowish. Var. **aùrea,** Schelle. Lvs yellow. Var **aùreo-elegantíssima,** Schelle. Lvs variegated with pink or yellow F. 1877: 109 G Z 21:169 Var. **argénteo-marginàta,** Hort. Lvs. bordered white. Var. **nàna,** Simon-Louis. Dwarf form. It has been confused with *C. pumila* (No. 15) which has lenticillate branchlets and usually 4 pairs of veins

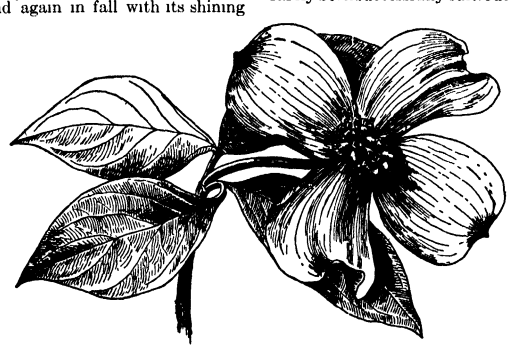
18. **officinàlis,** Sieb. & Zucc. Shrub or small tree, to 15 ft.: lvs. elliptic, acuminate, pale green beneath and with large tufts of dark brown hairs in the axils of the veins· fls like those of the former; peduncls longer than the involucre· fr. scarlet, oblong Japan, China. S Z. 50 —Very similar to the last.

CC. *Color of fls. greenish yellow, sessile, with a showy white involucre, much exceeding the fls*

D. *Frs. in dense clusters, but individually distinct.* (*Benthamidia, Cynoxylon*)

19. **flórida,** Linn. (*Cynóxylon flóridum,* Raf). Flowering Dogwood Fig. 1067. Shrub or small tree with spreading branches, 10–15 ft , rarely to 40 ft.: lvs oval or ovate, acute, dark green and glabrous above, glaucous or whitish beneath, usually only pubescent on the veins, 3–6 in long involucre white or pinkish, 3–4 in wide, bracts 4, obovate, emarginate· fr. ½in long, scarlet May. Mass to Fla , west to Ont. and Texas, also E and S. Mex S S 5 112–13 Em. 468 G F 3·431 B M 526 Gn 33, p 441, 43, p 153; 52, p 177; 53, p 222 J H. III 28.453 , 55 331 F E 23 511 G 34 531 Gn M 5 138 M D G 1898 405 V 5·230, 20 51 —One of the most beautiful American flowering trees, hardy N Var **péndula,** Dipp With pendulous branches F E 17, p 68 V 13 333 Var **rùbra,** André With pink involucre R H 1894·500 A G 18·411 F E. 9 572 B M 8315. G 28 689. Neither variety as hardy as the type.

20 **Núttallii,** Audubon Tree, to 80 ft · lvs ovate or obovate, usually pubescent beneath, 4–5 in. long: involucre white or tinged with pink, 4–6 in across; bracts 4–6, oblong or obovate, sometimes roundish, mostly acute fr bright red or orange, crowned with the broad, persistent calyx Brit Col to S Calif. S S 5 214–15 Gng 6 271 B M 8311 G 27 366 — This species surpasses the former in beauty, but is more tender, particularly while the plants are young, and has rarely been successfully cult. outside of its native country.

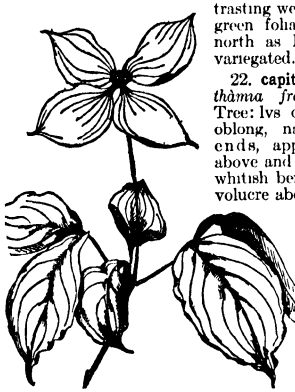


1067. Cornus florida. (×½)

DD *Frs connate into a globular fleshy head.* (*Benthamia*)

21. **Kousa,** Buerg. (*Benthàmia japónica,* Sieb. & Zucc *C. japónica,* Koehne, not Thunb) Fig 1068 Shrub or small tree, to 20 ft · lvs cuneate, elliptic-ovate, acuminate, dark green above, glaucous and appressed-pubescent beneath, 2–4 in long involucre creamy white, 2½–3 in. wide, bracts ovate, acute. frs forming a globular head. June. Japan, China. S.Z. 16. S I.F. 2.59.

Gn. 43:152; 60, p. 165. G C III. 19.783 A.G. 9:329 (adapted in Fig. 1068); 13:674. Gng. 3:149. J.H. III. 35:9; 63:187. M D G. 1899:328–9 R B 30 64 G. 27:367 Gn.W. 8 741 G M 35, suppl. Oct. 8 —Fls very showy, appearing after the lvs. in June and contrasting well with the bright green foliage; hardy as far north as Mass. Sometimes variegated.



1068. Cornus Kousa. (×⅓)

22. **capitàta,** Wall. (*Benthàmia fragifera,* Lindl.). Tree: lvs coriaceous, ellipticoblong, narrowed at both ends, appressed-pubescent above and more densely and whitish beneath, 2–4 in.: involucre about 2½–3 in wide, creamy white; bracts ovate, acute: fr.-head over 1 in across, scarlet June. Himalayas. B R 19:1579 Gn 54, p 310; 60, p. 165, 64, p 135; 70, p 123; 73, p. 411 G C. III 16.501; 45 83, 48 447 J H. III 30 213 M D G. 1898:568 —Evergreen tree, with showy fls and frs; hardy only S

AA. *Plants low herbs: fls in dense heads, with a white (or pinkish) involucre (Arctocrania, Chamæpericlymenum)*

23 **canadénsis,** Linn. Herb, ⅓–⅔ ft high, with creeping rootstock lvs whorled, sessile, elliptic or obovate, glabrous or nearly so, 1–3 in long head greenish, long-peduncled, involucre white, 1–1½ in wide: fr bright red, globose May–July N Amer., south to Ind., Colo., and Calif B M 880 G C III 47 363.—Handsome plant for half-shady places

C Arnoldiana, Rehd (C obliqua×C racemosa). Intermediate between the parents last year's branches purple, older gray or grayish brown fls as profusely as in C racemosa, but the white or bluish white fr appears rather sparingly Originated at the Arnold Arboretum S P S 1 40 —*C australis,* C A Mey. Closely allied and very similar to C sanguinea, but lvs beneath with appressed hairs and branches less brightly colored Asia Minor, Caucasus —*C Bretschneideri,* Henry (C aspera, Wang) Shrub, to 12 ft branches green or purplish lvs ovate to elliptic-ovate, usually rounded at the base, rough-pubescent on both sides, 2–4 in long cyme dense fr bluish black N China Hardy —*C corynostylis,* Koehne=C macrophylla —*C glabrata,* Benth Shrub, to 10 ft branches gray lvs small, nearly glabrous, green and shining on both sides fr white Ore to Calif —*C Hessei,* Koehne Allied to C alba Dwarf, dense shrub lvs crowded, small, very dark green fr bluish white Probably from E Asia —*C Koénigii,* Schneid (C australis var Koenigii, Wang) Allied to C sanguinea Lvs larger, 3–5½ in long, sparingly appressed-puescent beneath Transcaucasia —*C macrophylla,* Wall (C corynostylis, Koehne) Allied to C brachypoda Tree, to 30 ft lvs broadly ovate to elliptic-ovate, acuminate intl cymose, style club-shaped at the apex Himalayas B M, 8281 J H S 27, p 860 Gt 1896, p 285 —*C oblonga,* Wall Shrub or tree, to 30 ft lvs narrow-oblong, nearly glabrous, glaucous beneath, coriaceous fls white, fragrant, in cymose panicles Himalayas —*C pohophylla,* Schneid & Wang Shrub, to 12 ft: branches brown lvs subcoriaceous, elliptic or elliptic-ovate, slightly villous above, beneath more densely so and grayish white, 2½–4½ in long cymes long-peduncled fr black Cent China —*C pubescens,* Nutt Shrub, to 15 ft, with purple branches lvs nearly glabrous above, glaucous and woolly-pubescent beneath fr white Brit Col to Calif —*C Sâsnai,* Rehd (C rugosa×C stolonifera) Intermediate between the parents branches purple lvs more or less woolly beneath fr bluish, rarely white Originated at Rochester, N Y —*C sueica,* Linn (Chamæpericlymenum suecicum, Aschers & Graebn) Allied to C canadensis lvs all opposite. fl.-head purple, the white involucre 1 in or less wide Arctic Amer., N Eu., N Asia. Gn 55, p 239. S E B 4 634.

ALFRED REHDER.

CORÒKIA (from the native name). *Corndceæ.* Evergreen shrubs, adapted to outdoor planting in the S. Upright, with tortuous or straight branches and black bark: lvs alternate or fascicled, stalked, entire fls perfect, small, yellow, in axillary or terminal clusters, calyx-tube top-shaped, the limb 5-lobed, petals 5, each with a scale at base, stamens 5 fr an ovoid or oblong 1–2-celled drupe. Three or four species in New Zeal. **C. Cotoneáster,** Raoul, is offered abroad as a bush of curious growth, very attractive when covered with its very small yellow star-like fls rigid, densely branched, 4–8 ft, the branches crooked and interlaced, tomentose lvs 1 in or less long, the blade orbicular to obovate or oblong-ovate, obtuse or emarginate, shining above, flat-stalked. B M 8425. I T. 2 73.

L. H. B.

CORONÍLLA (Latin, a *little crown* from the arrangement of the flowers) *Leguminòsæ* CROWN VETCH. Shrubs and herbs, some grown in the hardy garden and some in greenhouses, for their yellow or purple bloom.

Annuals or perennials, often woody, smooth or rarely silky-hairy, with odd-pinnate lvs., entire lfts., and purple or yellow fls. in peduncled heads or umbels, calyx 5-toothed, corolla papilionaceous, the standard orbicular and the keel incurved, wings obovate or oblong; stamens 9 and 1 pod jointed, terete or 4-angled, seeds oblong.—Species about 20, Medit. region and Canary Isls., W. Asia. The shrubby *C. Emerus* and *C. glauca* are useful in S. Calif. and the southern states. The species are occasionally grown in borders. *C. glauca* is sometimes grown under glass for spring bloom, after the manner of Cytisus. All are of easy cult.

A. *Fls. yellow.*

B *Plant herbaceous.*

cappadócica, Willd. (*C. iberica,* Bieb.). Low perennial herb, about 1 ft. high, lfts. 9–11, obcordate, ciliate: umbels 7–8-fld., fls. yellow, large, July, Aug. stipules membranaceous, rounded, ciliate-toothed. Asia Minor. L B C 8 789 B M 2646.—A good trailer for rock-gardens and the margins of borders.

BB *Plant shrubby, at least at base*

C *Claw of the petals much longer than the calyx.*

Émerus, Linn (*Émerus màjor,* Mill.) SCORPION SENNA. Fig. 1069. Dense, symmetrical shrub, 3–5 ft. high, the branches green and striate: lvs. deep glossy green, lfts. 5–7, obovate; stipules small, pedunculs. 3-fld., fls. large, yellow, tipped with red. Blooms freely, May-July. Showy, half-hardy. S. Eu. B M 445 Gng. 5 36.—Evergreen in southern states.



1069. Coronilla Emerus.

emeroides, Boiss. & Sprun. (*C. Émerus* var. *emeroides,* Wohlf.) Bush, 3–6 ft. branches glabrous or soft-hairy, lfts. 2–3 pairs, heart-shaped: peduncle 2–3 times as long as the lf., the umbel 5–8-fld.; fls. yellow; claw of petals about twice as long as the calyx: pod 2–3 in. long, very narrow. April, May. S. Eu.

CC *Claw of petals scarcely exceeding the calyx*

júncea, Linn. Glabrous gray-green shrub, branches rush-like, terete, nearly naked. lfts. 3–7, linear-

oblong, obtuse, somewhat fleshy, scattered. fls golden yellow, in 5–7-fld umbels: pod hanging, lance-linear. S. France B R 820 L B C 3:235

mínima, Linn Glabrous, diffuse, soft gray-green sub-shrub, 3 or 4 in high, procumbent lfts 7–13, ovate, obtuse or retuse, scattered or at base of plant. fls. golden yellow in 7–8-fld umbels, sweet-scented. In dry sands. Eu B M 2179

glaûca, Linn. Glabrous shrub 2–4 ft high: stipules small, lanceolate lfts 5–7, obovate, very blunt, glaucous. fls 7–8 in each umbel, yellow, heavy-scented S Eu B M 13.—One of the common garden shrubs of S. Calif, flowering all the year. There is a variegated form.

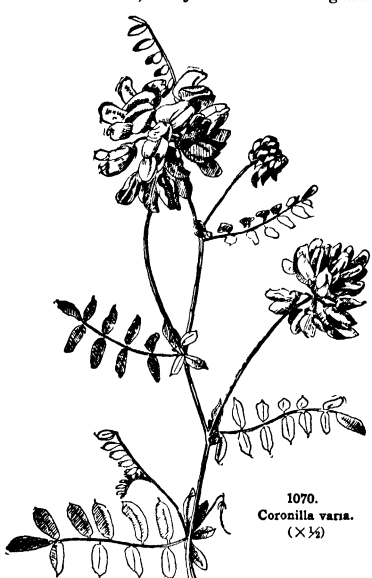
AA. *Fls white and pink*

viminàlis, Salisb Trailing shrub stipules soon deciduous, ovate, membranaceous lfts 13–21, obovate, notched, glaucous umbels 6–10-fld, fls pale red or white with a red stripe on the banner Algeria.—Promising as a florists' plant for cut-fls Fls. all the year in S. Calif.

vària, Linn. CROWN VETCH. Fig 1070. Straggling or ascending smooth herb, 1–2 ft high. lvs sessile, lfts. 11–25, oblong or obovate, blunt and mucronate, ½–¾in long: peduncles longer than lvs., fls in dense umbels, ½in long, pinkish white June–Oct. Eu. B M. 258. Gng 5 337 —Trailing plant for hardy herbaceous border.

JARED G. SMITH.
L H B †

CORRÈA (after Jose Francesco Correa de Serra, Portuguese author, 1750–1823) *Rutàceæ* Tender Australian shrubs, rarely cultivated under glass.



1070.
Coronilla varia.
(×½)

Shrubs, usually with dense, minute, stellate hairs: lvs. opposite, stalked, entire, and with transparent dots: fls. rather large, showy, red, white, yellow or green, usually pendulous, solitary or 2 or 3 together; petals and sepals each 4; stamens 8: carpels 4, nearly distinct.—Seven species. *C. speciosa* is probably the best and most variable species It is a native of barren sandy plains, and belongs to the large and much-neglected class of Australian shrubs

speciòsa, Ait (*C cardnàlis,* F. Muell). Tender shrub, 2–3 ft high: branches slender, brown, opposite, covered with minute rusty hairs: lvs opposite, about 1 in long, elliptic, about a fourth as wide as long, wrinkled, dark green above, whitish below, margin entire, recurved: peduncles opposite, axillary, longer than the lvs, 1-fld, with a pair of leafy bracts, fls 1½ in. long, pendent, tubular, bright scarlet, with a very short limb of 4 spreading, greenish yellow segms, calyx small, cup-shaped, with 4 almost obsolete teeth; stamens 8, exserted, about ¼in. B M 4912 —There are several varieties



1071 Correa alba.
(×½)

álba, Andr Fig 1071 A compact and much-branched shrub, 3–4 ft, the branches rusty-tomentose: lvs variable, orbicular to obovate or elliptic, very blunt, ½–1 in long fls white or pink, 2 or 3 together, not over ½in long, and not so showy as preceding B.R. 515.—Offered in S Calif.

WILHELM MILLER
N TAYLOR †

CORTADÈRIA (from *Cortadero,* the native name in Argentina). *Gramíneæ* PAMPAS-GRASS Large reed-like perennials with numerous long, narrow blades and a large striking plume-like inflorescence Species six, South America. See *Gynerium.*

argéntea, Stapf (*Gynèrium argénteum,* Nees). PAMPAS-GRASS Culms numerous, in large thick tussocks, 3–10 ft high, excluding the panicle lvs. mostly basal, the upper sheaths gradually elongated, blades firm, long and slender, very scabrous on the margins, ⅛–¼ in. wide, tapering to a slender point. panicle large, compact, 1–3 ft., silvery white or in cult varieties tinged with purple, dœcious; spikelets 2–3-fld, the pistillate silky with long hairs, the staminate naked; glumes white and papery, long and slender; lemmas bearing a long slender awn A G. 14.323. G 1.412. G C. III. 40·295; 43:195. Gn 62, p 346; 66, p 375. G.W 3·415. Gn W. 5:85; 23:20. J H. III 35.483; 49·27. R H. 1862, p. 150 V. 3:369, 391. S Brazil and Argentina. *C. Lámbleyi fòlus variegàtis,* Hort. G C. III. 25:335, appears to be a form of *C. argentea.*

Quìla, Stapf (*Gynèrium Quìla,* Nees. *G. jubàtum,* Lem. *G. arcuàto-nebulòsum,* Hort). Differs from pampas-grass in the rather laxer, more graceful plume, with longer, more flexuous, nodding branches, somewhat smaller spikelets, and more delicate glumes, and in the longer, very slender staminodes of the pistillate fls.: plume lavender-colored, 1–2 ft. long, the spikelets 3–5-fld. B M 7607. G C III 26:102. Gn 15, p 179; 55, p. 93. R H. 1885, p 200; 1899:52, 53.—Grows in a dense tuft; perennial, but with biennial culms; the plant has been killed by a temperature of 3° F. Intro by Lemoine, of

Nancy, France. Probable synonyms are *Gynerium roseum Rendlateri* and *G. argenteum carminatum Rendlateri*. F.S. 20:2075. Not so well known as *C. argentea*.
A. S. HITCHCOCK.

CORTÙSA (named by the herbalist Matthiolus after his friend Cortusus, professor of botany at Padua). *Primulàceæ* Scapose, perennial, pubescent herbs with long-stalked, cordate-ovate lvs and purple umbellate fls. **C. Matthiòli,** Linn., from the Swiss Alps, has long been a choice and delicate but not very popular plant, suited for shady parts of the rockery. It was long considered the only species of the genus. It is an herbaceous perennial, about 6 in high, pubescent, rhizomatous, with a few long-stalked, cordate, 7–9-lobed, dentate lvs, and a slender scape bearing an umbel of about 7 small, rosy purple, drooping fls, which appear in early spring B M 987 L B C 10 956. It has some resemblance to *Primula cortusoides*. The genus has possibly 4 species, and is distinguished from Primula and Androsace by its stamens attached to the base of the corolla, and its long-acuminate anthers. Its culture is similar to that of the hardy primulas, but it needs winter protection in the northern states. Prop by division of the roots.

CORYÁNTHES (Greek, *korys*, helmet, and *anthos*, flower, referring to the shape of the lip) *Orchidàceæ*. Epiphytic orchids requiring warmhouse conditions.

Pseudbulbous lvs plicate, lanceolate fls in racemes; sepals spreading, dilated, flexuose, conduplicate, lateral ones largest, distinct at the base, petals small, erect; lip large, tridentate, basal portion forming a hood, continued into the column, distal portion bucket- or pouch-like; column pointing downward, elongated, terete, bicornute at the base, apex recurved, pollinia 2, compressed, caudicle linear, arcuate. The bucket part of the lip is provided with a spout-like structure, by means of which the bucket overflows when about half full of a secretion which drops from a pair of glands near the base of the column. The fls of the species known are not lasting, the sepals being of such delicate texture that although at first they fully expand, they soon collapse and become unsightly. Although much interest attaches to the species of Coryanthes, the genus is not generally cult., since the fls last too short a time and are not particularly brilliant. This complex genus, which is closely related to Stanhopea, is represented by several interesting species inhabiting Trop. Amer. For cult see *Stanhopea*.

macrántha, Hook. Fls. few, in drooping racemes; ground-color rich yellow dotted with red; hood and part of bucket brownish red. Caracas. P M. 5.31. B R 1841. B M 7692 G C. III 28 355. O R. 3 41.

maculàta, Hook. Fls in a drooping raceme; sepals and petals dull, pale yellow, bucket blotched on the inside with dull red. B M. 3102; 3747. B R. 1793. F S. 8.755 (as *C. Albertinæ*). A F. 30:325 C O. 1. Var. **punctàta,** Hort., has the petals and sepals bright yellow, speckled with red, the hood yellow, blotched with reddish orange, the pouch pale, speckled and spotted with red. Demerara. *C Cóbbii* is an unspotted form of this.

C. Balfourùna, Hort. Similar in habit to a stanhopea, with a long pendulous scape bearing 2 or 3 large and curiously shaped fls. Peru.—*C. leucocórys*, Rolfe. Sepals yellowish green, marked with brownish purple, the petals white, marked with light purple, the lip white with the bucket marbled with light rosy purple. Peru. Lmd 7 293.—*C. Mastersiàna*, Lehm. Raceme erect, fls 2 or 3, yellowish, tinged and spotted with copper-red. Colombia. G C. III 29 19.—*C. Sánderi*, Hort. A very large-fld plant allied to C macrantha.—*C. speciòsa*, Hook. Raceme of 2 or 3 fls; sepals and petals pale yellow, lip brown-red, the stalk brownish yellow. Brazil. G.C III. 36 106. B M 2755 (as Gongora). C O. 2.
GEORGE V. NASH.†

CORÝDALIS (Greek, *lark*, the spur of the flower resembling a lark's spur). *Fumariàceæ*. Hardy plants allied to the Dutchman's breeches.

Erect or prostrate herbs, usually perennially rooted, but often annuals. lvs. lobed and finely dissected in nearly all the species· fls. racemose, often yellow, less frequently blue, purple or rose; petals 4, spurred as in the Dutchman's breeches; stamens 6, in 2 groups.—Ninety species, natives of the north temperate regions. They are all of easy cult. They prefer full sunlight but will grow in half-shade. Prop. by division or seed.

INDEX.

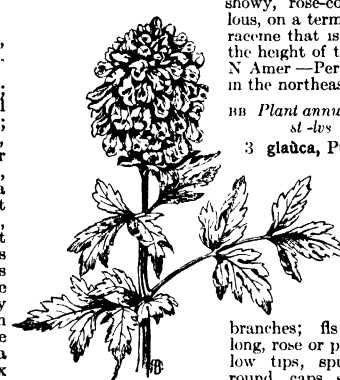
Allenii, 2
aurea, 10
bulbosa, 1
cheilanthifolia, 7.
curvisiliqua, 9.
glauca, 3
lutea, 11
nobilis, 4
occidentalis, 10
ophiocarpa, 8.
solida, 1.
thalictrifolia, 5.
tomentosa, 12.
Wilsonii, 6.

A. *Fls. chiefly purple or rose, sometimes tipped yellow.*

B. *Plant perennial· root tuberous: st.-lvs few.*

1 **bulbôsa,** DC (*C. sólida*, Swartz). Erect, 6 in. high· lvs 3–4, stalked, biternately cut, segms. wedge-shaped or oblong: root solid: fls large, purplish. Spring. Eu.

2 **Allenii,** Fedde. A perennial caulescent herb, with glaucescent foliage: lvs usually alternate with finely divided segms, the whole lf. not over 10 in long. fls. showy, rose-colored, pendulous, on a terminal dense-fld. raceme that is usually about the height of the lvs. N. W. N. Amer.—Perhaps not hardy in the northeastern states.



1072. Corydalis nobilis.

BB *Plant annual· root fibrous: st.-lvs many.*

3 **glaùca,** Pursh. Annual, 1–2 ft. high, very glaucous: lobes of the lvs. mostly spatulate. racemes short, paniced at the naked summit of the branches; fls barely ½in. long, rose or purple with yellow tips, spur short and round, caps slender, linear; seeds with minute, transverse wrinkles. Summer. Rocky or sterile ground, Nova Scotia to Rocky Mts., and even Arctic coast, south to Texas. B M 179 (as Fumaria).—Not advertised for sale, but probably worth cult.

AA *Fls chiefly yellow.*

B. *Foliage not tomentose.*

C. *Plant perennial· root tuberous or woody: st.-lvs. few or none.*

D *The fls at least 1 in long.*

4 **nóbilis,** Pers. Fig. 1072. Perennial, erect: lvs. bipinnately cut, segms. wedge-shaped and lobed at the apex· fls white, tipped with yellow, and a dark purple spot; spur 1 in. long. Spring. Siberia. B.M. 1953 (as *Fumaria nobilis*). G C. II. 19:725.

5. **thalictrifôlia,** Franch., not Jameson. Rhizome woody, elongated. lvs large, long-petiolate, rigid, but spreading, the pinnæ of the finely dissected lvs. petiolulate. fls yellow, in large spreading racemes, which are opposite the lvs; sepals persistent, ovate.—A very showy species from China, the foliage strongly resembling Thalictrum.

6. **Wilsonii,** N. E. Br. A glabrous, often glaucescent perennial, with a rosette of radical much-dissected lvs. about 5 in. long: fls. in an erect raceme 7 in. high, which is usually leafless; corolla deep canary-yellow, about 1 in. long, the blunt spur about ½in. long. G.C. III.

35:306.—Useful for the Alpine garden and more profuse bloomer than *C. tomentosa*, its nearest relative. China.

DD. *The fls. not over ½in. long.*

7. **cheilanthifòlia,** Hemsl. A small low perennial with radical, fern-like, much-dissected, erect lvs about 8 in. long: scape usually taller than the lvs., bearing numerous fls. not over ½in. long, yellow. China. May.—Suitable for moist places in the alpine garden. Probably unknown in U. S. as it is a rare plant in nature.

CC. *Plant annual or biennial: root fibrous: st.-lvs. numerous.*

D. *Height of plants 2 ft. or more.*

8. **ophiocárpa,** Hook. f. & Thoms. Root fibrous, the st. 2–3 ft. and branched. lvs. pinnatisect, 4–8 in long, and glaucous beneath: fls. yellow, in many-fld., lax racemes which are opposite the lvs; sepals orbicular, finely toothed and fimbriate. Moist valleys of the Himalayas.

DD. *Height of plants usually less than 1 ft.*

E. *Raceme spike-like; fls. almost sessile.*

9. **curvisíliqua,** Engelm. Probably a biennial: commonly more robust than *C aurea*, ascending or erect, 1 ft. high or less. fls golden yellow, over ½in long, in a spike-like raceme; spur as long as the body, commonly ascending caps quadrangular, 1½ in. long; seeds turgid to lens-shaped, with acute margins densely and minutely netted. Woods in Texas.

EE. *Raceme not spike-like; fls pedicillate.*

10. **aûrea,** Willd. Annual, 6 in high, commonly low and spreading fls golden yellow, about ½in. long, on rather slender pedicels in a short raceme, spur barely half the length of the body, somewhat decurved caps. spreading or pendulous, about 1 in long, seeds 10–12, turgid, obtuse at margin, the shining surface obscurely netted. Rocky banks of Lower Canada and N New England, northwest to latitude 61°, west to Brit. Col. and Ore., south to Texas, Ariz. and Mex; not Japan — The western forms have the spur almost as long as the body of the corolla and pass into

Var. **occidentàlis,** Engelm. More erect and tufted, from a stouter and sometimes more enduring root. fls. larger; spur commonly ascending caps thicker, seeds less turgid, acutish at margins. Colo., New Mex., W. Texas, Ariz

11. **lûtea,** DC. Erect or spreading, 6–8 in. high, annual, or forming a tufted stock of several years' duration: lvs delicate, pale green, much divided; segms. ovate or wedge-shaped, and 2–3-lobed. fls pale yellow, about ½in long, in short racemes; spur short: pod ¼ or ⅓in long Stony places of S Eu, and runs wild in Eu.

BB *Foliage tomentose.*

12. **tomentòsa,** N. E. Br. A low rock-loving perennial, with a rosette of radical lvs. 4–7 in. long, oblong in outline and tomentose, the tomentum whitish pink, pinnæ finely dissected: racemes erect, 5–7 in. tall; corolla about ¾in. long, light canary-yellow, the spur very blunt and about ¼in. long. China.—A good plant for the rock-garden.

C. angustifòlia, DC., is a little-known perennial with bi-ternately divided lvs and flesh-colored fls =Fumaria angustifolia, Bieb. G C III 35 307 —*C. cáva*, Schweigg & Kort (probably a form of C tuberosa, DC) is somewhat larger than C bulbosa, with pretty fls varying into purplish and white Eu —*C. ochroleùca* Koch. One ft high, blooming June–Sept fls yellow-white, the spur yellow caps. linear petiole winged Italy —*C. Scoùleri*, Hook, grows 3 ft, and is cult. in some European gardens W Amer

N. TAYLOR.†

CORYLÓPSIS (*Corylus* and *opsis*, likeness; in foliage resembling the hazel). *Hamamelidàceæ*. Woody plants, grown chiefly for their yellow fragrant flowers appearing in early spring and for the handsome foliage.

Deciduous shrubs, rarely trees· lvs. alternate, strongly veined, dentate: fls. in nodding racemes with large bracts at the base, appearing before the lvs, yellow; calyx-lobes short; petals clawed, 5, stamens 5, alternating with entire or 2–3-parted short staminodes; styles 2, ovary half-superior, rarely entirely superior. fr. a 2-celled, dehiscent, 2-beaked caps., with 2 shining black seeds.—About 12 species in E. Asia and Himalayas.

These are low ornamental shrubs, with slender branches and pale bluish green distinct foliage; all are very attractive in early spring, when covered with numerous nodding spikes of yellow, fragrant flowers. Not hardy north of New York, except in sheltered positions They grow best in peaty and sandy soil. Propagated by seeds sown in spring, best with slight bottom heat, and by cuttings of half-ripened wood in summer under glass, also by layers, rooting readily in moderately moist, peaty soil.

A. *Fls in many-fld racemes.*

B. *Petals obovate to oblong-obovate.*

C. *Young branchlets and lvs. beneath pubescent, at least on the veins.*

spicâta, Sieb & Zucc. Shrub, to 4 ft. lvs oblique and rounded or cordate at the base, roundish ovate or obovate, sinuate-dentate, glaucous beneath and pubescent, 2–3 in. long· racemes 7–10-fld., 1–2 in long, their bracts ovate; fls bright yellow; stamens slightly longer than the obovate petals; calyx hairy. Japan S Z 19. B M 5458 F S 20 2135 R H 1869, p 230, 1878, p 198; 1907, p. 403 G C. II 15 510, III 25 210 Gn 33, p 441. S I F. 2 26 —This species has larger and handsomer foliage and fls of a deeper yellow, in longer racemes, but *C paucíflora* flowers more profusely and is somewhat hardier.

sinénsis, Hemsl. Shrub, 6–15 ft: lvs obovate to oblong-obovate, abruptly acuminate, obliquely subcordate or cordate at the base, sinuate-denticulate, pubescent at least on the veins and grayish green beneath, 2–4 in. long· racemes about 2 in long, their bracts nearly orbicular; petals orbicular-obovate, slightly longer than style and stamens, calyx hairy Cent China G C III 39 18 Var **glandulífera,** Rehd & Wilson (*C. glandulífera*, Hemsl.) Young branchlets and petioles with scattered glandular bristles: calyx glabrous H I. 29.2819.

CC. *Young branchlets glabrous, lvs glabrous or only with a few silky hairs on the veins beneath when young*

Veitchiàna, Bean. Shrub, 3–6 ft. lvs short-petioled, elliptic, abruptly acuminate, subcordate at the base, sinuate-denticulate, glaucous beneath, 3–4 in long: racemes 1–2 in long, petals obovate, slightly shorter than the stamens; calyx hairy, nectaries 2-parted. Cent. China. B M. 8349. Gn. 76, p. 184.

BB. *Petals with the blade as broad as or broader than long.*

Willmottiæ, Rehd & Wilson Shrub, to 12 ft lvs. oval to obovate, cordate or truncate at the base, sinuate-denticulate, glaucescent beneath, 1–3½ in long racemes 2–3 in long, petals suborbicular, calyx glabrous, nectaries 2-parted, slightly shorter than the sepals Cent China G M 55 191 (as *C multiflora*)

platypétala, Rehd & Wilson. Shrub, 3–8 ft. young branchlets with scattered glandular bristles lvs. on glandular petioles, ovate or broadly ovate, cordate or subcordate at base, sinuate-denticulate, on both sides sparingly silky-hairy when young, soon glabrous 2–4 in long. racemes 1–2 in long, petals hatchet-shaped, ⅛in broad, nectaries emarginate at the apex; stamens and styles much shorter than petals; calyx glabrous. Cent China. Var **lèvis,** Rehd. & Wilson. Branchlets and petioles without any glands W. China.—Less showy than most other species.

AA. *Fls. in 2–3-fld racemes.*

paucifl̀ora, Sieb & Zucc Low, much-branched shrub, 2–3 ft lvs. obliquely cordate, ovate, sinuate-dentate, ciliate, pubescent and glaucous beneath, 1–2 in long: racemes 2–3-fld, ½–¾in long, fls light yellow; petals obovate, about as long as stamens and style. Japan. S Z 20 G.F 5 342. Gt 48.1467. B M. 7736. G.W. 15, p 101 J H III. 48 381 S I.F 2 26.

C. Griffithii, Hemsl (C himalayana, Hook, not Griff). Shrub or small tree, to 20 ft young branchlets and lvs beneath densely pubescent lvs subcordate racemes 1–2½ in long, stamens and styles much shorter than the obovate petals. Himalayas B.M. 6779

ALFRED REHDER.

CÓRYLUS (ancient Greek name). *Betulàceæ.* HAZEL FILBERT COBNUT. Woody plants grown for their handsome rather large foliage and some species for their edible nuts.

Deciduous shrubs, rarely trees: lvs alternate, stipulate, petioled, serrate and usually more or less pubescent fls monœcious, appearing before the lvs; staminate in long, pendulous catkins, formed the previous year, and remaining naked during the winter (Fig 1073), each bract bearing 4 divided stamens; pistillate included in a small, scaly bud with only the red styles protruding (Fig 1071) fr a nut, included or surrounded by a leafy involucre, usually in clusters at the end of short branches —Fifteen species in N Amer, Eu and Asia, all mentioned below Monograph by Winkler in Engler, Pflanzenreich, hft 19, pp 44–56 (1904), quoted below as Winkl



1073. Winter catkins of filbert

Numerous varieties are cultivated in Europe for their edible nuts They are also valuable for planting shrubberies, and thrive in almost any soil The foliage of some species turns bright yellow or red in autumn Propagated by seeds sown in fall, or stratified and sown in spring, the varieties usually by suckers, or by layers, put down in fall or spring, they will be rooted the following fall Budding in summer is sometimes practiced for growing standard trees, and grafting in spring in the greenhouse for scarce varieties They may also be increased by cuttings of mature wood taken off in fall, kept during the winter in sand or moss in a cellar and planted in spring in a warm and sandy soil. Illustrated monograph of the cultivated varieties by Franz Goeschke, Die Haselnuss (1887) See, also, bulletin on Nut-culture by the U S. Dept of Agric For the culture of the nuts, see articles *Filberts* and *Hazels.*

INDEX.

americana, 7.
atropurpurea, 4.
aurea, 4
Avellana, 4, 8
californica, 12
calyculata, 7
chinensis, 3.
Colurna, 2, 3
Crista-Galli, 6.
ferox, 1
fusco-rubra, 4
glandulifera, 2
heterophylla, 4, 6.
laciniata, 4
mandshurica, 9.
maxima, 8
pendula, 4.
pontica, 5.
purpurea, 8
rostrata, 9, 10, 11, 12.
Sieboldiana, 10.
setchuenensis, 6.
thibetica, 1
tubulosa, 8
yunnanensis, 6.

A. *Husk or involucre consisting of 2 distinct bracts (sometimes partly connate).*

B. *Involucre densely spiny· lvs nearly glabrous.*

1. **fèrox,** Wall Tree, to 30 ft.: young branchlets silky-hairy· lvs oblong to obovate-oblong, usually rounded at the base, acuminate, doubly serrate, glabrous except on the veins beneath, with 12–14 pairs of veins, 3–5 in. long: involucre tomentose, forming a spiny bur about 1½ in. across, longer than the small nuts. Himalayas. Winkl. 45. Var. **thibética,** Franch. (*C. thibética,* Batal.). Lvs broadly ovate to obovate: involucre glabrescent. Cent. and W. China. R.H. 1910.204.

BB *Involucre not spiny.*

C. *Bracts of the involucre deeply divided into linear lobes, much longer than the nut tree.*

2. **Colúrna,** Linn. Tree, to 70 ft · petioles ¾–2 in. long, usually glabrescent lvs deeply cordate, roundish ovate to obovate, slightly lobed and doubly crenate-serrate, at length nearly glabrous above, pubescent beneath, 3–5 in long fls 3–10, clustered involucre open at the apex, usually densely beset with glandular hairs nut roundish ovate, ¾in long From S Eu to Transcaspia G C III 40 256 Gn. 31, pp 260–1 H W 2, p 29 G W 14, p 642 Gng 16 163 —Ornamental tree, with regular pyramidal head, not quite hardy N Rarely cult for the fr under name of filbert or of Constantinople or Constantinople nut Var **glandulífera,** DC Petioles and peduncles glandular-setose: lobes of the involucre less acute and more dentate

3 **chinénsis,** Franch (*C Colúrna* var *chinénsis,* Burk) Tree, to 120 ft petioles ½–1 in long, pubescent and setulose lvs ovate to ovate-oblong, cordate and very oblique at the base, glabrous above, pubescent on the veins beneath, doubly serrate, 4–7 in long: fr 4–6, clustered, involucre constricted above the nuts, with recurved and more or less forked lobes, finely pubescent, not glandular. W. China Winkl 49 and 50



1074. Pistillate flowers of Corylus rostrata. (Natural size)

CC *Bracts of the involucre divided into lanceolate or triangular lobes shrubs*

D. *The involucre not or only slightly longer than the nut, open or spreading at the apex*

E. *Lobes of bracts serrate or dentate.*

4 **Avellàna,** Linn Shrub, to 15 ft: lvs slightly cordate, roundish oval or broadly obovate, doubly serrate and often slightly lobed, at length nearly glabrous above, pubescent on the veins beneath: involucre shorter than the nut, deeply and irregularly incised nut roundish ovate, ½–¾in high Eu, N Afr, W Asia. H W 2 16, p 28 Var **atropurpùrea,** Kirchn (var *fusco-rùbra,* Goeschke). Lvs purple Var **aùrea,** Kirchn Lvs. yellow Var **laciniàta,** Kirchn (var. *heterophylla,* Loud) Lvs laciniately incised or lobed Var **péndula,** Goeschke. With pendulous branches G W 2, p. 13 There are also many varieties cult. for their fr

5 **póntica,** Koch Shrub lvs cordate, roundish ovate or broad-oval, doubly serrate, pubescent beneath involucre finely pubescent, with few glandular hairs at the base, campanulate, somewhat longer than the nut, with large spreading lobes nut large, broad-ovate W Asia F S 21 2223–4 (as *C Colurna*) —From this species the cobnuts seem to have originated; also the Spanish nuts are probably mostly cross-breeds between this species and *C Avellana* or *C maxima,* or between the two latter species.

EE *Lobes of the bracts entire or sparingly dentate, triangular.*

6. **heterophýlla,** Fisch Shrub, to 12 ft: petioles about ¾in long· lvs orbicular-obovate, cordate at the base, nearly truncate at the apex and with a very short point, incisely serrate, pubescent on the veins beneath, 2–4 in long involucre somewhat longer than the nuts, striate, glandular-setose near the base Japan to W. China S I F 1 20 —Several varieties apparently not yet in cult occur in China· var *Crista-Gálli,* Burkill, var *setchuenénsis,* Franch, and var. *yunnanénsis,* Franch

DD. *The involucre about twice as long as the nut, usually tightly inclosing the nut*

7. americàna, Walt. Shrub, 3–8 ft.: young branchlets pubescent and glandular bristly lvs slightly cordate or rounded at the base, broadly ovate or oval, irregularly serrate, sparingly pubescent above, finely tomentose beneath, 3–6 in. long. involucre compressed, exceeding the nut, the 2 bracts sometimes more or less connate, with rather short, irregular, toothed lobes: nut roundish ovate, about ½in. high From Canada to Fla west to Ont and Dak Var. **calyculàta,** Winkl. (*C calyculàta,* Dipp) Involucre with 2 very large bracts at the base

AA. *Husk or involucre tubular, narrowed above the nut and forming an elongated beak.*

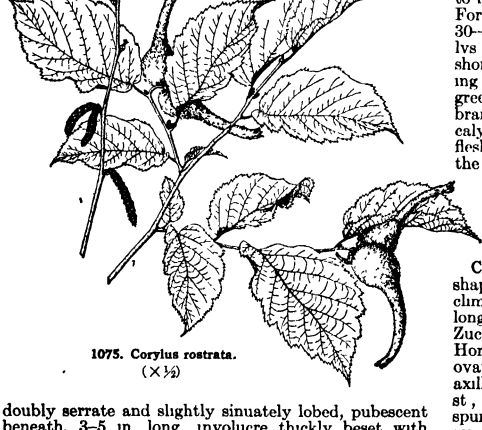
B *Involucre finely pubescent outside with rather wide gradually narrowed beak*

8. máxima, Mill. (*C tubulòsa,* Willd). Shrub, sometimes small tree, to 30 ft · lvs cordate, roundish-ovate, slightly lobed and doubly serrate, 3–6 in long· involucre finely pubescent outside nut oblong, large, kernel with thin red or white skin S Eu H W 2, p 30. Winkl 49. Var **purpùrea,** Rehd (*C Avellàna purpùrea,* Loud. *C máxima* var *atropurpùrea,* Dochnahl). Lvs deep purplish red darker than in *C Avellana atropurpurea* F.E 21 325 —Many varieties, with large nuts, known as filberts or Lambert's filberts The cult. forms are partly hybrids with *C. Avellana*

BB. *Involucre densely beset with bristly hairs, and usually rather abruptly constricted into a narrow beak*

C. *Petioles usually longer than ½in.*

9 mandshùrica, Maxim (*C rostràta* var *mandschùrica,* Regel). Shrub, to 15 ft · young branchlets pubescent: lvs suborbicular to elliptic or obovate,



1075. Corylus rostrata.
(×½)

doubly serrate and slightly sinuately lobed, pubescent beneath, 3–5 in long. involucre thickly beset with brown spreading bristles, about 2 in. long, about 3 times as long as the nut, divided at the the apex into narrow entire segms. Manchuria, Korea. Winkl. 49.

10. Sieboldiàna, Blume (*C. rostràta* var. *Sieboldiàna,* Maxim.). Shrub, to 15 ft.: lvs. elliptic to oblong or obovate, usually rounded at the base, doubly serrate and slightly lobed, 2–4 in ; the young lvs. often with a purple blotch in the middle: involucre with less stiff bristles, about 1½ in. long, 2 or sometimes 3 times as long as the nut, narrowed toward the apex. Japan. S.I F. 1:20.

CC. *Petioles shorter than ½in.*

11. rostràta, Ait. Fig. 1075. Shrub, 2–6 ft.: branchlets pubescent or glabrous, not bristly: lvs. rounded or slightly cordate at the base, oval or obovate, densely serrate and sometimes slightly lobed, nearly glabrous at length, except sparingly pubescent on the veins beneath, 2½–4 in long: involucre densely beset with bristly hairs, beak long and narrow: nut ovoid, ½in long E N Amer , west to Minn and Colo. G F 8.345 (adapted in Fig 1075).

12. califórnica, Rose (*C rostràta* var *califórnica,* DC). Allied to *C rostrata* Shrub, to 20 ft. lvs more villous beneath involucre with a short beak, which is often flaring and sometimes torn Calif to Wash

C colchica, Alboff Low shrub, to 3 ft · lvs ovate or obovate, densely doubly serrate, sparingly pilose involucre connate, with a short lacerated beak, pubescent Caucasus Winkl 53 Not in cult —*C colurnoides,* Schneid (C intermedia, Lodd , not Fingerh , C Colurna×C Avellana) Similar to C Colurna small tree or large shrub bark darker involucre shorter, scarcely glandular Garden origin —*C Fargesii,* Schneid (C mandshurica var Fargesii, Burkill) Tree to 45 ft lvs narrow-obovate to oblong involucre soft-pubescent, sometimes only slightly so W China —*C Jacquemontii,* Decne (C Colurna var lacera, DC) Allied to C chinensis Tree lvs ovate, lobed toward the apex, less pubescent, 5–8 in long involucre pubescent, not constricted, lobes not or rarely forked, often dentate Himalayas

ALFRED REHDER.

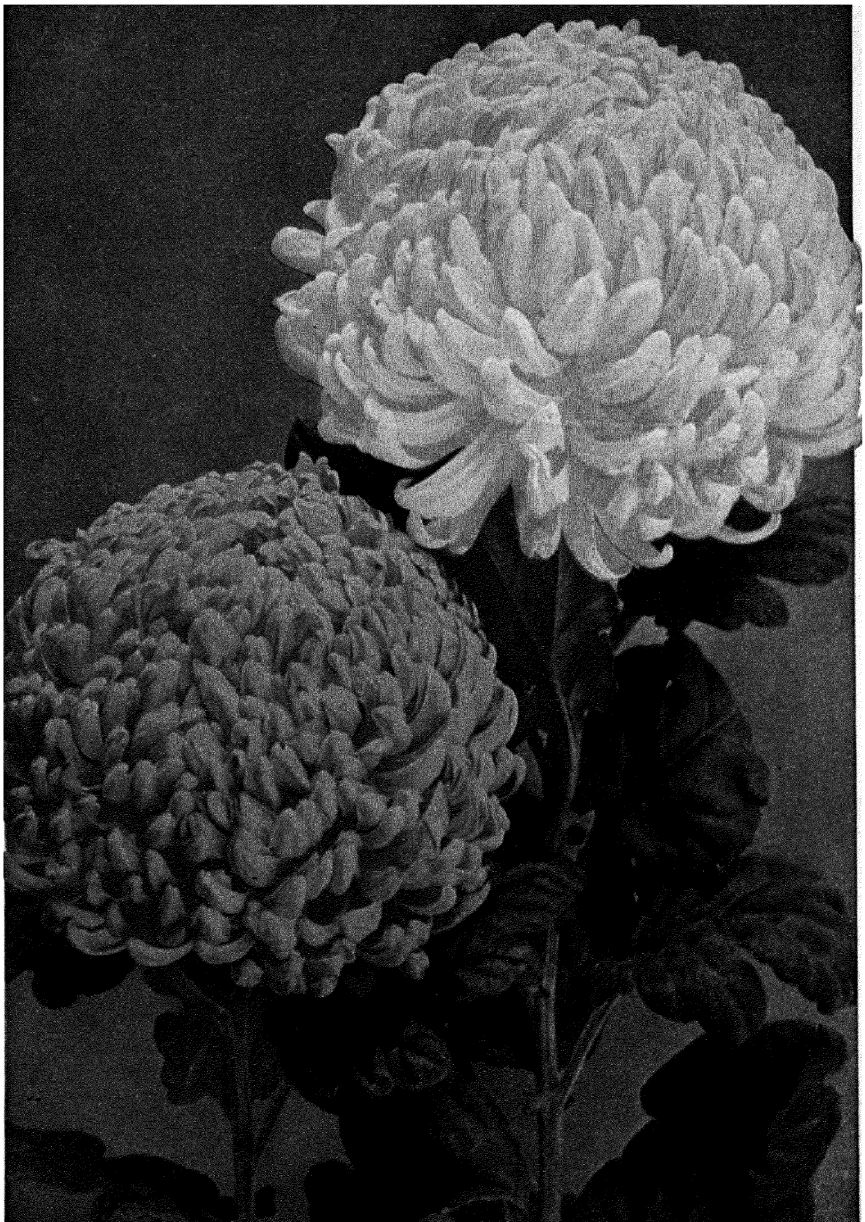
CORYNOCÁRPUS (Greek, *club-fruit,* alluding to the shape). *Anacardiàceæ;* by Engler made the sole representative of *Corynocarpàceæ* A very few New Zeal and Polynesian evergreen trees, one of which is intro in Calif Glabrous lvs large, alternate, simple and entire, without stipules. fls perfect, small, whitish green, inodorous, in terminal or subterminal panicles; calyx-lobes petal-like, unequal, 2 exterior smaller; petals much like the calyx-lobes, stamens 5, opposite the petals and shorter, staminodia 5, petal-like fr drupaceous, narrowly ovoid, 1-seeded, the pulp said to be edible, seed very bitter, poisonous **C. lævigàta,** Forst NEW ZEALAND LAUREL Attractive leafy tree, 30–40 ft , the trunk sometimes more than 2 ft diam : lvs to 8 in long, elliptic-oblong or oblong-ovate, with a short stout petiole, margins slightly recurved, suggesting those of *Magnolia grandiflora* fls very small, greenish or whitish, short-pedicelled, in a terminal branched panicle, petals concave, little exceeding the calyx-lobes drupe 1½ in or less long, orange-colored, fleshy, plum-like N Zeal , in lowlands not far from the sea. B M. 4379.—*C símilis,* Hemsl , and *C. dissimilis,* Hemsl , from New Hebrides and New Caledonia respectively, are not listed among cult. plants L. H B

CORYNOPHÁLLUS: *Hydrosme.*

CORYNÓSTYLIS (Greek, describing the club-shaped style) *Violàceæ* A monotypic genus of woody climbers, with alternate lvs. and terminal racemes of long-stalked violet-like fls **C. Hybánthus,** Mart & Zucc. (*Calýptrion Aublètii,* Ging. *Corynóstylis Aublètii,* Hort.), is native of Trop Amer. The lvs are 2–5 in long, ovate, or orbicular, bright green, serrate: fls. white, in axillary showy racemes which are contiguous along the st , long-spurred, 2 or 3 times as large as a violet, the spur half-twisted F S 21 2213 B M 5960.—A handsome, vigorous warmhouse climber, and cult. in the open in S. Calif Prop by cuttings and seeds

CÓRYPHA (Greek for *summit* or *top,*—where the leaves grow) *Palmàceæ,* tribe *Córypheæ.* Tall fan-leaved palms with a spineless stout trunk

Leaves terminal, large, orbicular, flabellately divided to the middle into numerous linear-lanceolate segms.; segms. induplicate in the bud; rachis none; ligule small; petiole long, stout, concave above, spiny on the



XXX. Chrysanthemum.—Two of the florist's types.

margins; sheaths split: spadix solitary, erect, paniculately much branched; spathes many, tubular, sheathing the peduncle and branches; fls. green, the plant dying after once flowering and fruiting: frs. as large as a cherry, with a fleshy pericarp —Species 6, Trop Asia and Malay Archipelago G C. II. 24:362. These fan-palms are cult the same as Chamærops and Livistona. They are warmhouse plants, prop. by seeds. Large fans, umbrellas and tents are made of the talipot palm by the natives of Ceylon. Coryphas are but little grown commercially, the growth of young plants being slow Good loam well enriched with stable manure, a night temperature of 65° and abundant moisture, are the chief requisites in their cult, with a moderately shaded house during the summer.

elàta, Roxbg (*C. Gebánga,* Blume). Fig 1076. Trunk straight, 60–70 ft high, 2 ft. diam., spirally ridged. lvs. lunate, 8–10 ft diam; segms 80–100, separated nearly to the middle, ensiform, obtuse or bifid, petioles 6–12 ft, with black margins and curved spines spadix about one-fourth the length of the trunk, but narrow. Bengal and Burma.

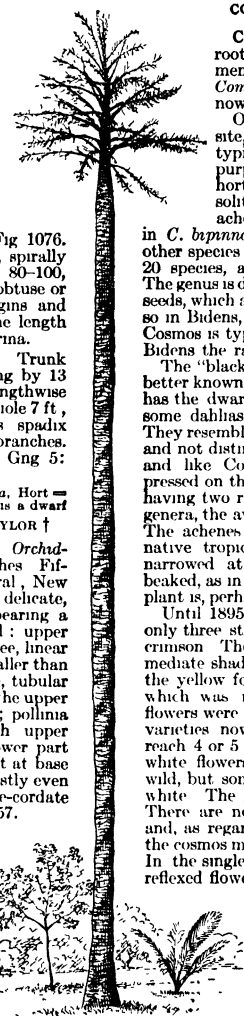
umbraculífera, Linn. TALIPOT PALM. Trunk ringed, 60-80 ft lvs sub-lunate, 6 ft. long by 13 ft wide, palmately pinnatifid, folded lengthwise above the middle, segms obtusely bifid; petiole 7 ft, the spines along its margins often in pairs spadix sometimes 20 ft long, with spreading branches. Malabar coast and Ceylon A F 12.313 Gng 5: 213 —Lvs used as a substitute for paper

C. austrális, R Br =Livistona —*C. macrophýlla,* Hort = (?) —*C. minor,* Jacq =Sabal —*C. Wagana,* Hort, is a dwarf round-lvd plant A G 15 307

N TAYLOR †

CORYSÁNTHES (*helmet-flower,* Greek) *Orchidàceæ* Not to be confounded with Coryanthes Fifteen or more terrestrial orchids of Austral, New Zeal and Malaysia, little cult Dwarf, delicate, tuberous-rooted or fleshy-rooted herbs, bearing a solitary broad lf and a large solitary fl: upper sepal large, helmet-shaped, lateral sepals free, linear or filiform, petals (sometimes wanting) smaller than lateral sepals and similar to them, lip large, tubular at base, the margins inclosing the column, the upper part extended into a broad reflexed limb; pollinia 4 *C. picta,* Lindl, Malaya, is 3–4 in high upper part of fl deep purple and yellow, and lower part with four long awl-like segms and a bract at base of ovary *C. lumbàta,* Hook f, Java, is mostly even lower, with fl purple and white, the ovate-cordate lf with reticulating white veins. B M 5357.

CORYTHOLÒMA (referring to the helmet-shape). *Gesneriàceæ* By some referred to Gesnera: a half-hundred or more leafy-stemmed tuberous herbs of Trop S Amer, with mostly red or speckled tubular fls in terminal umbels or racemes, or solitary or few in the axils lip of corolla erect, concave, disk 5-glandular; stamens didynamous It is doubtful whether any of the species are in the trade. *C. macrópodum,* Sprague, recently mentioned, is a glandular-hirsute herb, 6–9 in high, from a subglobose tuber. lvs 3–5 in. across, suborbicular: fls. in solitary axillary cymes, 5–7-fid, cinnabar-red, the corolla-tube about 1 in long and nearly cylindric, the limb only slightly 2-lipped, the 3 lower lobes blotched purple. S. Brazil. B.M. 8228 —A handsome little plant These plants are probably to be handled after the manner of gloxinias and similar things.



1076. Corypha elata, having spent itself in blooming.

COSMÁNTHUS: *Phacelia.*

CÓSMEA: *Cosmos.*

COSMÍDIUM: *Thelesperma.*

COSMOPHÝLLUM: *Podachænium*

CÓSMOS (from the Greek word with a root idea of orderliness; hence an ornament or beautiful thing). Syn., *Cósmea Compósitæ.* Annual or perennial herbs, now popular as flower-garden subjects.

Often tall, usually glabrous: lvs. opposite, pinnately cut in the garden kinds fls typically shades of rose, crimson and purple, with one yellow species, and white horticultural varieties, long peduncled, solitary or in a loose corymbose panicle: achenes glabrous: chaff of the receptacle in *C. bipinnatus* with a long and slender apex, in other species with a blunt and short apex —Perhaps 20 species, all Trop American, mostly Mexican. The genus is distinguished from Bidens chiefly by the seeds, which are beaked in Cosmos but not distinctly so in Bidens, and by the color of the rays, which in Cosmos is typically some form of crimson, while in Bidens the rays are yellow or white.

The "black cosmos" (*C. diversifolius*) is, perhaps, better known to the trade as a Bidens or Dahlia. It has the dwarf habit and dark red early flowers of some dahlias, but the achenes are very puzzling. They resemble those of Bidens in being four-angled, and not distinctly beaked They are unlike Bidens, and like Cosmos, in being not distinctly compressed on the back They resemble both genera in having two rigid persistent awns, but, unlike these genera, the awns have no retrorse barbs or prickles. The achenes are linear, as in Cosmos and all our native tropical species of Bidens, but, although narrowed at the apex, they are not distinctly beaked, as in most species of the genus Cosmos. The plant is, perhaps, nearest to Bidens.

Until 1895 there were in the two leading species only three strongly marked colors, white, pink and crimson These and the less clearly defined intermediate shades have come from *C. bipinnatus;* and the yellow forms have come from *C. sulphureus,* which was introduced in 1896 At first cosmos flowers were only an inch or two across The best varieties now average 3 inches, and sometimes reach 4 or 5 without thinning or disbudding Pure white flowers of cosmos are rarely if ever found wild, but some of the cultivated varieties are clear white The group is lacking in bright deep reds. There are no full double forms of cosmos as yet, and, as regards strongly marked types of doubling, the cosmos may be decades behind the China asters, In the single forms, flat, incurved, or cupping, and reflexed flowers are to be looked for. Stellate forms are now offered; and also dwarfs, and other variants

It is a mistake to grow cosmos in too rich soil, as one gets too vigorous growth and too few flowers, which are also late A sandy soil is to be preferred as being earlier, and not too rich. It is well to pinch out the leading shoots of young plants in order to make them bushy and symmetrical, instead of tall and straggling In the East, for best results it is still necessary to sow seed indoors in April and transplant outdoors as soon as danger of frost is past. Seed sown in the open ground often fails to produce flowers in some northern localities before frost. The early frost kills the typical species, but some of the new strains are said to resist a degree or two of frost

A. *Rays white, pink or crimson: disk yellow.*

bipinnàtus, Cav. Fig. 1077. Glabrous annual, 7–10 ft. high. lvs. bipinnately cut, lobes linear, remote, entire: involucral scales ovate-lanceolate, acuminate: fls white, pink or crimson seeds smooth, with an abrupt beak much shorter than the body Mex B.M. 1535. Gn. 41:10. R.H. 1892.372.—The older and commoner species. *C. hýbridus,* Hort., is presumably a trade name for mixed varieties of *C. bipinnatus,* but see G.F. 1·474 for note.

AA. *Rays yellow: disk yellow.*

sulphûreus, Cav. Fig. 1078. Pubescent, 4–7 ft. high, much branched: lvs often 1 ft. or more long, 2- or 3-pinnately cut, lobes lanceolate, mucronate, with rachis and midrib ciliate or hispid; pinnæ alternate, entire or 2–3-toothed peduncles 7–10 in long, naked: outer involucral bracts 8, linear, acuminate, green, 2 lines long, inner ones 8, oblong, obtuse, scarious, 5 lines long, fls 2–3 in. across, pale, pure or golden yellow; rays 8, broadly obovate, strongly 3-toothed at the apex, ribbed beneath, anthers of the disk exserted, black, with orange tips: seeds linear, 1 in long, including the slender beak Mex G F 8 485 (adapted in Fig. 1078).—Intro. 1896; parent of the yellow forms.

AAA *Rays dark red. disk red.*

diversifòlius, Otto (*Bidens atrosanguínea,* Ortg. *B. dahlioìdes,* Wats. *Dáhlia Zimapàni,* Roezl) Black Cosmos Tender annual, 12–16 in high, with tubers more slender, and requiring more care in winter than those of common dahlias lvs pinnately parted; lfts. 5–7, entire or slightly serrate, the terminal lfts largest: peduncles each bearing 1 head 6 in or more above foliage, rays dark velvety red, sometimes tinged dark purple Mex B M 5227 Gt 1861 347. F C 2·47. J H. III 33·403 Var **supérba,** Hort, is sold —Prop. almost exclusively by seeds. Wilhelm Miller. †

COSSÍGNIA (Jos Fr Charpentier de Cossigny, 1730–1789, French naturalist) *Sapindàceæ.* Shrubs or little trees of about 3 species, sometimes mentioned for cult. in warmhouses *C. pinnàta,* Comm , of Mauritius, has white fls. in terminal panicled corymbs, and odd-pinnate lvs., with 3–5 oblong and entire lfts.



1077 Cosmos bipinnatus.

COST-ACCOUNTING. The keeping of profit-and-loss records, and the drawing of conclusions from them for the improvement of the business.

In recent years, the application of cost-accounting and efficiency methods to farming operations has opened practically a new approach to the discussion of agricultural problems and is forcing a reorganization in practices and in the sub-divisions of the business. Careful and extended studies have not yet been made of the efficiency principles in most horticultural occupations, but the suggestions drawn from orchard records may show the nature and scope of the work.

Annual inventory.

There is no single account that is more important than the annual inventory. This inventory should list the land and each important building separately The total value of these items should equal the value of the farm It should list each cow, horse and important piece of machinery separately All the cash, notes, mortgages and accounts due the farmer should be recorded with his property. A separate list should be made of all notes, mortgages or accounts due to others. The difference between these and the value of property owned gives the net worth of the farmer A comparison of the net worth at the beginning and end of the year shows the gain or loss for the year unless money or property has been added to the business from some other sources or taken from it.

Cost-accounts.

But an inventory does not show on which enterprises gains or losses have occurred Usually a business is made up of both profitable and unprofitable enterprises, or of enterprises that are unequally profitable In order to know how to develop the business to the best advantage, it is important to know which enterprises pay best for the use of land and labor Cost accounts also have very many uses aside from determining the relative profitableness of different enterprises If all the time spent, labor costs, and other costs, and the receipts are known, it is often possible to see ways of changing the management of a crop so as to increase profits

In order to keep a complete cost-account with any crop, it is necessary to know all the labor of men, teams and machinery for the crop, to know all receipts and expenses caused by the cropping, and to keep track of any outlays contributed to the crop from the farm or other enterprises, also whatever this crop contributes to other enterprises

A work-report of the time of man and horse should be kept in an ordinary account-book At the end of the year, the total time is charged to each crop-account in the ledger The ledger should have wide pages, so that there may be room for full descriptions The left-hand page is used for charges, and the right-hand page for credits

Each evening one should record any cash spent during the day under the proper crop or enterprise The number of hours that have been spent on each enterprise for both man and horse labor are also recorded in the form shown on the next page For convenience, the horse time is reduced to terms of one horse A three-horse team working 10 hours is put down as 30 hours If one desires, he may keep an account with only one enterprise. It is better to keep accounts with all the enterprises on the farm, so that one may study each part of his business and the business as a whole

The best method of discussing the subject is to show an account as kept by a farmer The following account with a 3-acre apple orchard was kept by a New York farmer in 1912.—

WORK REPORT FOR APPLE ORCHARD.—THREE ACRES

1912		Man Hrs	Man Min	Horse Hrs	Horse Min.
April 1	Manured	9	45	18	
May 8	"	2	30	5	
15	Pruned	3			
25	Brush hauled and burned	1	30	3	
27	Sprayed . .	16	30	13	
28	" . .	4	30	5	
31	"	10	15	10	
June 1	"	13	45	3	45
3	"	16	30	9	
4	"	9	30	5	
5	"	14		7	
7	Cleaned and put up sprayer	1	15		
July 31	Removed borers .	7	15		
Aug 19	Thinned	11	30		
20	"	4			
	Manured	8	30	17	
Sept 7	Picked	4	15		
Oct 11	Hauled barrels	8		16	
12	Picked and packed	34	30	2	30
14	" " "	7		2	
15	" " "	11	30	5	
	Hauled to station	2	30	5	
17	Picked and packed	15	15	4	
18	" " "	12	30		30
19	" " "	28	30	2	
21	" " "	22	15		
25	" " "	19	30	1	
26	" " "	25	30	1	
28	" " "	36			
30	" " "	34	30		
	Hauled to station	5	30	11	
31	Picked and packed	21	30	1	
Nov 4	Selling	2		1	30
6	Packed	7	30		
	Picked up drops	17		3	
8	Hauled to station	10	15	8	
12	Got ready for shipping	7	30		
13	Hauled to station	4	30	9	
14	" "	9		10	
15	" "	9	30	14	
Dec. 10	Hauled manure	2		4	
	Total hrs and mins	492	45	196	15



1078 Cosmos sulphureus (×⅓)

LEFT-HAND PAGE

1912		
Jan 1	Inventory—barrels on hand	$12 00
Mar 25	100 lbs arsenate of lead	8 10
April 5	Freight on arsenate of lead	34
	1 bbl lime-sulfur, $8, freight 28 cts	8 28
June 10	3 loads manure	1 50
Sept 5	6½ loads manure .	3 25
Oct 11	Freight on barrels .	6 00
18	150 barrels	75 00
31	Barrel liners, 60 cts , freight, 25 cts	85
Nov 8	Postage	20
Dec 2	Post-cards for advertising	3 52
	Adv , "Apples for sale"	37
	Telephone	25
31	Use of land	40 00
	493 hrs man-labor @ 18 3 cts	90 22
	196 hrs horse-labor @ 13 3 cts	26 07
	196 hrs equipment-labor @ 5 1 cts	10 00
	Interest on costs	3 00
	Total	$288 95
	Gain	51 47
		$340 42

RIGHT-HAND PAGE

Aug 11	4 empty barrels sold	$1 58
12	1 bus King, $1 1 bus Snow, 75 cts	1 75
17	12 bus drop apples	3 00
	2 empty barrels	1 10
21	2 bus Spy, 1 bus Baldwin	2 25
22	25 bus drops	6 25
Oct 25	Mrs Franklin, 7 bbls Baldwin, 2 bbls King, 2 bbls Greening, 1 bbls Spy, 1 bbl Spitz	35 25
	Archdeacon & Co , 6 bbls Snow, not	9 39
Nov 4	1 bbl King $2 25, 1 bbl Baldwin, $1 85, 1 bbl Spy, $2 75	6 85
11	2 bbls Baldwin	3 95
	15 bus Baldwin culls	75
20	12 bbls Baldwin, $26 50, 4 bbls Greening, $8 25, 1 bbl Spy, $2 25, 1 bbl Wagener, $1 75	38 75
21	3 bus culls	1 00
	111 bbls (1 bbl Spitzenberg, 1 bbl King, 6 bbls Wagener, 1 bbl Fall Pippin, 9 bbls Hubbardston, 69 bbls Baldwin, 24 bbls Greening)	188 70
22	2 bbls Baldwin Bill not collected	
23	5 bbls (1 bbl King, 2 bbls Baldwin, 1 bbl Greening, 1 bbl Spy) .	12 75
26	5 bbls Baldwin	7 85
	3 bus Hubbardston, 6 bus King	5 25
	Kept for home use, 3 bus Snow, 20 bus. Baldwin . . .	11 50
	25 bus drops to chickens .	2 50
	Total	$340 42

This mere keeping of cost-accounts is not the end. The accounts must be studied The following are a few of the facts that the farmer used in the preceding records and the suggestions derived from them·

Total crop	Bus	Total crop	Bus
Baldwin	421	Brought forward	611
Greening	93	Wagener	21
Hubbardston	30	Spitzenberg	6
Spy	23	Fall Pippin	3
King	22		
Snow	22		641
		Drops and culls	105
Carried forward	611		

From the foregoing records he was able to determine the yields per tree of different varieties

Yields per acre good apples, 214 bushels.
Yield per acre culls and drops, 33 bushels.
Per cent of culls and drops, 14
Total receipts, good apples, less cost of barrels, $233 07.
Average price per bushel, good apples, without barrels, 36 cents
Hours of man-labor, per acre, 164.
Hours of horse-labor, per acre, 65.
Profit, per acre, $17
Profit, per hour, of man-labor, 10 cts.
Cost per bushel, good apples, without barrels, 28 cents.
Profit, per bushel, 8 cents.

It will be seen that the cost of barrels was very high owing to buying late in the season. Ten cents a barrel extra cost is more than equal to the profit on a bushel of apples, or one-third the entire profit. Usually the profit on an enterprise can be greatly changed by small changes in cost.

The profit per acre is in addition to pay for use of land. If all the profit is expressed in terms of land, the orchard paid $27 per acre rent, or gave a profit of $14 per acre

If the profit is all expressed in terms of labor, the orchard paid 28 cents per hour for time spent on it, or gave a profit of 10 cents per hour.

Records similar to those given above may be kept with each crop or enterprise on the farm. If this is done, an account is kept with horses from which the cost of an hour of horse-labor is determined. At the end of the year, the labor on each crop for the year is charged at this rate. Similarly, the cost of man-labor is found and charged. The cost of machinery-labor is charged in proportion to the hours that horses worked for the enterprise This is how the costs per hour given above were determined. But if a complete set of accounts is not kept, the charge for labor of men and horses is placed at the usual rate of pay for such work in the region, including the cost of board. References. 'Farm Management," G. F. Warren, pp 428–93 (1913) Minnesota Bulletins, Nos. 97, 117, and 124. "Farm Accounts," J A. Vye. G. F. WARREN.

COSTMARY: The rayless form of *Chrysanthemum Balsamita*, known as var. *tanacetoides*

CÓSTUS (old classical name). *Zingiberàceæ* SPIRAL FLAG. Perennial thick-rooted tropical herbs, cultivated under glass for their flowing-limbed showy flowers, which are in terminal bracteate spikes

Stems short or tall and leafy (plant rarely acaulescent), roots often tuberous: fls. golden yellow, red, saffron-colored or white; corolla tubular, cleft, not showy; 1 staminodium, enlarged and bell-shaped, usually with a crispy limb, and forming the showy part of the fl (called the lip), cleft down the back; ovary 3-loculed; filaments petaloid.—About 100 species, widely distributed in the tropics. More or less fleshy plants, prized in warm-houses, and grown in the open in S Fla and other warm regions Monogr. by Schumann in Engler's Pflanzenreich hft. 20 (1904)

This interesting genus of tropical herbs thrives in any rich moist soil, but luxuriates in that of a gravelly or sandy character, when under partial shade. The plants are readily propagated by cutting the canes, or stalks, into short pieces of an inch or two in length, and planting in sifted peat, or fine moss and sand, covering but lightly. The roots may also be divided, but this is a slow means of propagation. Specimen plants require rather high temperature to bring out the rich colors of the leaves, which in some species are prettily marked with a purplish tint, and are usually arranged spirally on the ascending stem This gives rise to the name "spiral flag." (E. N. Reasoner.)

speciòsus, Smith. Somewhat woody at base, 4–10 ft., stout, erect. lvs. oblong or oblanceolate, acuminate, nearly 1 ft long, silky beneath. bracts red: fl. large, with a flowing white limb and yellowish center, 3–4 in. across, not lasting. E. Indies. I.H. 43:56. Gn. 47·166

ígneus, N E Br One to 2 ft lvs. oblong or elliptic-lanceolate, 4–6 in. long. bracts not colored nor conspicuous. fls clustered, orange-red. Brazil. I H. 31.511. B M 6821 J H III 28:11.

Few species of Costus are offered in this country, but others may occur in special collections —*C. Friedrichsenii*, Petersen 6ft or more lvs sessile, lanceolate, acuminate, 1½ ft or less long fls very large, bright yellow in thick terminal spikes Gt 52 15–21 Cent Amer (?) —*C. macránthus*, Gagnep 5–6 ft lvs spirally placed, lanceolate fls very small with red tube and orange-red yellow-tipped lobes, the lip tubular and purple, in cone-like spikes 3 in long Martinique.—*C. musáicus*, Hort Lvs obliquely lanceolate, 4–5 in long, dark green, marked and tessellated with silvery gray W. Afr.—*C. zebrínus* is very likely the same as last. L H B



1979. Cotinus Coggygria. (×¼)

CÓTINUS (ancient Greek name of a tree with red wood). *Anacardiàceæ*. SMOKE-TREE CHITTAM-WOOD Woody plants, grown chiefly for the attractive feathery fruiting panicles and for the handsome foliage turning brilliant colors in autumn

Deciduous shrubs or trees with a strong-smelling juice: lvs. slender-petioled, entire, without stipules fls dioecious or polygamous, small, greenish or yellowish, in large and loose terminal panicles, the pedicels of the numerous sterile fls lengthen after the fls have dropped and become clothed with spreading hairs, petals 5, twice as long as the pointed calyx-lobes, the 5 stamens shorter than the petals, inserted between the lobes of the disk; ovary superior with 3 short styles fr. a small compressed oblique-obovate dry drupelet with the style on one side — Two species, one in N Amer and one in S Eu to Cent Asia Formerly usually included under Rhus, which differs chiefly in its usually compound and more or less serrate lvs , the globose fr with terminal style, the absence of plumose pedicels and in the milky juice. Often planted, particularly the European species, for its loose feathery panicles which give almost the effect of a dense cloud of smoke, from which the shrub derives its name The panicles of the American species are much less showy, but the autumnal coloring is more brilliant. Both species hardy as far north as Mass , the American being somewhat more tender. They prefer a sunny, and in the N , a somewhat sheltered position and well-drained soil, and are adapted for planting in dry and rocky ground. Prop. by seeds; also by root-cuttings and layers.

Coggýgria, Scop (*C. Cótinus*, Sarg *C. Coccýgea*, Koch *Rhus Cótinus*, Linn) SMOKE-TREE Fig. 1079. Spreading, rather dense shrub, to 15 ft : lvs. slender-petioled, oval or ob-

ovate, abruptly narrowed at the base, rounded at the apex, glabrous, 1½–3½ in long panicles to 8 in long, densely plumose, usually purplish: frs few, about ⅛ in long June, July. fr. Aug., Sept S Eu to Cent. China and Himalayas Gn 34, p 162, 54, p 505, 71, p 552. Gng. 5·118 M D G 1902 217 G C III. 29 92 H W 3, p 32 Var **atropurpùrea,** Dipp Panicles with dark purple hairs. Var. **péndula,** Dipp.



1080 Cotoneaster horizontalis

Branches pendulous Var **pubéscens,** Engler Lvs., at least beneath, and often also the young branches, pubescent

americànus, Nutt (*C. cotinoìdes,* Brit *Rhùs cotinoìdes,* Nutt.) Upright shrub or small tree, to 35 ft lvs gradually narrowed at the base, obovate to elliptic-obovate, rounded at the apex, silky beneath when young, at maturity glabrous or nearly so, 4–6 in long panicles 5–6 in long, with short and rather inconspicuous pale purple or brownish hairs June, July Ala to W Texas and E Tenn S S 3.98, 99 —The autumnal tints orange and scarlet, as in the preceding species, but more brilliant ALFRED REHDER

COTONEÁSTER (*cotoneum,* quince, and *aster,* similar the leaves of some species resemble those of the quince) *Rosàceæ,* subfamily *Pòmeæ* Shrubs, rarely small trees, chiefly grown for their ornamental red or black fruits and some species also for their foliage which turns brilliant colors in autumn

Leaves alternate, deciduous or persistent, short-petioled, entire, stipulate fls solitary or in cymes, terminal, on short lateral branchlets, white or pinkish· petals 5, stamens about 20 fr a black or red pomaceous drupe, with 2–5 stones —About 40 species, in the temperate regions of Eu and Asia, also in N Afr., but none in Japan

Cotoneasters are ornamental shrubs, many of them with decorative fruits remaining usually through the whole winter, while only a few, like the hardy *C. hupehensis* and *C. multiflora* and the tender *C. frigida,* and also *C. racemiflora* and *C. salicifolia,* are conspicuous with abundant white flowers Of the species with decorative red fruits, *C. tomentosa, C. racemiflora* and *C. integerrima* are quite hardy, and *C. Simonsii, C. acuminata, C. rotundifolia, C. microphylla* and others are hardy at least as far north as New York, while *C. frigida* and its allies are the most tender The foliage of some of the species assumes brilliant colors in autumn; dark crimson in *C. Simonsii, C. horizontalis, C. dvaricata* and *C. Dielsiana;* scarlet and orange in *C. foveolata,* bright yellow in *C. Zabelii.* The half-evergreen *C. horizontalis* and *C. adpressa,* and the evergreen *C. Dammeri* and *C. microphylla,* with its allied species, are well adapted for rockeries on account of their low, spreading or prostrate habit. Cotoneasters thrive in any good, well-drained garden soil, but dislike very moist and shady positions. Propagation is effected by seeds, sown in fall or stratified; the evergreen species grow readily from cuttings of half-ripened wood in August under glass; increased also by layers, put down in fall, or by grafting on *C. vulgaris,* hawthorn, mountain ash or quince.

INDEX.

acuminata, 3, 5.
acutifolia, 12, 13.
adpressa, 1
applanata, 16.
bullata, 6
buxifolia, 23
calocarpa, 16
commixta, 15.
congesta, 24
Dammeri, 22
Dielsiana, 10.
divaricata, 4
elegans, 10
floccosa, 20
floribunda, 6
Fontanesii, 18
foveolata, 14
Franchetii, 11
frigida, 21
glacialis, 24
glaciosa, 20
horizontalis, 1, 2.
humifusa, 22
hupehensis, 17.
integerrima, 7.
lanata, 23
laxiflora, 15.
lucida, 12
macrophylla, 6.
major, 10
melanocarpa, 15
microcarpa, 18
microphylla, 2 3, 24
mougeotii, 6
multiflora, 16
nigra, 15
nummularia, 18.
orbicularis, 18.
pannosa, 19
pekinensis, 13.
perpusilla, 2.
prostrata, 23.
racemiflora, 18.
radicans, 22.
reflexa, 16
rotundifolia, 23.
rugosa, 20
salicifolia, 20.
Simonsii, 3
sinensis, 12
soongarica, 18.
speciosa, 8
thymifolia, 24.
tomentosa, 8
villosula, 13.
vulgaris, 7
Wheleri, 18, 23.
Zabelii, 9.

A. *Petals upright, small, usually pinkish; cymes usually few-fld or nodding, if many-fld (Orthopetalum.)*

B *Fr red.*

C *Under side of lvs glabrous or only pubescent.*

D *Habit prostrate*

1 **adprèssa,** Bois (*C. horizontalis* var *adprèssa* Schneid.) Prostrate shrub, with creeping and often rooting sts irregularly branched lvs oval, acutish, wavy at the margin, nearly glabrous, ½–¾in long. fls 1–2, pinkish fr subglobose, usually with 2 stones. June fr Aug., Sept W China V F 116 —Hardy at the Arnold Arboretum

2 **horizontàlis,** Decne Fig 1080 Low shrub: branches almost horizontal and densely distichously branched lvs round-oval, acute at both ends, glabrous above, sparingly setosely hairy beneath, ⅓–⅔in long: fls erect, 1–2, pink. fr ovoid, bright red, usually with 3 stones, smaller than in the preceding species June; fr Sept., Oct China R H 1885, p 136; 1889·348, fig 1 G C III 32 91 Gn 66, p 107 Var **perpusílla.** Schneid Lvs less than ⅓in long fr ¼in across — Like the preceding species, one of the most effective fruiting shrubs for rockeries

DD *Habit upright*

E *Lvs small, not exceeding 1 in., nearly glabrous beneath*

3 **Simonsii,** Baker (*C. acuminàta* var *Simonsii* Decne.) Shrub, with spreading branches, to 4 ft lvs roundish oval, acute, glabrous above, ½–1 in long, semi-persistent cymes 2–5-fld., fls white, slightly pinkish, calyx appressed-pubescent fr bright red, usually with 3–4 stones June, July Himalayas Refug Bot 1 55 B M 8010 (excl fls; as *C. rotundifolia).* One of the best red-fruiting species, often under the name *C. Simondsii* or *C. Symonsi*

4 **divaricàta,** Rehd & Wilson Upright shrub, to 6 ft lvs deciduous, oval or broadly oval, acute or obtusish, broadly cuneate at the base, lustrous above, ½–¾in long fls usually 3, pink, calyx appressed-pubescent fr ovoid, nearly sessile, bright red, ¼in. long, usually with 2 stones June, fr Sept Cent and W China —Very handsome when studded with its bright red frs., hardy at the Arnold Arboretum.

EE *Lvs larger, 1½–3 in. long, deciduous*

5 **acuminàta,** Lindl Erect shrub, to 6 ft.: lvs. oblong to ovate-oblong, acute or acuminate, appressed-hairy on both sides, dull above to light green beneath: cymes 2–5-fld., nodding; fls white or slightly pinkish; calyx pubescent fr deep scarlet, turbinate, with 2–3 stones June; fr. Sept., Oct. Himalayas. L B.C. 10 919 (as *Mespilus*). R H. 1889:348, fig. 5 (as *C nepalensis*)

6 **bullàta,** Bois Spreading shrub, to 6 ft · lvs. ovate, acuminate, rounded or broadly cuneate at the base, rugose and finally nearly glabrous above, reticulate, pale grayish green and pubescent beneath fls pinkish, few, calyx glabrous fr. red, subglobose, with 4–5

stones. May, June; fr. Sept., Oct. W. China. V.F. 119. Var. **floribúnda,** Rehd. & Wilson (*C. moupinénsis floribúnda,* Stapf) Cymes many-fld; calyx slightly pubescent. B.M. 8284. Var. **macrophýlla,** Rehd. & Wilson. Lvs. elliptic to lanceolate-oblong, narrowed at the base, often nearly glabrous, 2–6 in. long: cymes many-fld.—The varieties are much handsomer than the type.

CC. *Under side of lvs whitish or grayish tomentose: young branchlets densely pubescent*

D. *Lvs. ¾–2½ in long, rounded at base.*

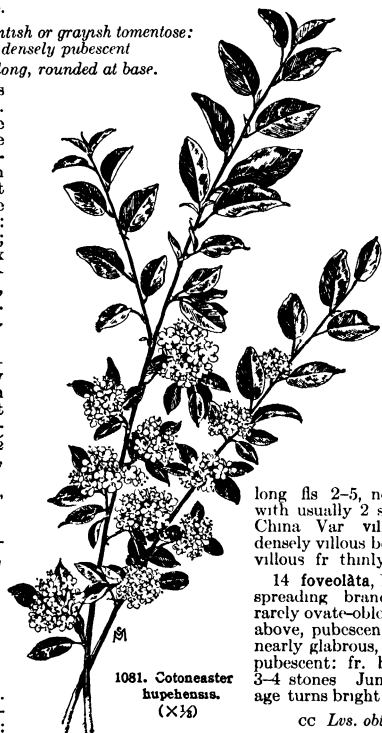
7. integérrima, Medikus (*C. vulgáris,* Lindl.). Shrub, to 4 ft.: lvs ovate or oval, acute or obtuse and mucronulate, glabrous and dark green above, whitish and at length greenish tomentose beneath, ¾–2 in. long: cymes nodding, 2–4-fld; fls pale pinkish; calyx glabrous outside fr. globular, bright red May, June; fr Aug. Eu., W. Asia, Siberia. H.W. 3, p. 73, figs. *a–i.*

8 tomentòsa, Lindl. Shrub, to 6 ft · lvs broadly oval, obtuse, dull green above and pubescent when young, whitish tomentose beneath, 1-2½ in long. fls 3–12, white, calyx tomentose outside fr. bright brick-red June, fr. Sept., Oct. Eu., W. Asia H.W. 3, p. 73, figs *k–o* G.O.H. 105.—Sometimes cult as *C. speciosa,* Hort.

DD. *Lvs about 1 in. or less long, slightly pubescent above*

E. *Apex of lvs mostly obtuse, base rounded*

9 Zábelii, Schneid. Shrub, to 6 ft. with slender spreading branches: lvs. oval to ovate, dull green and loosely pubescent above, grayish or yellowish tomentose below, on young plants sometimes more glabrescent and acutish, ¾–1¼ in. long. fls 5–9 in loose corymbs, pinkish; calyx villous outside, with obtuse teeth: fr ovoid, red, about ⅓in long, with 2 stones. May; fr. in Sept., Oct. Cent. China.



1081. Cotoneaster hupehensis. (×⅓)

EE. *Apex of lvs mostly acute, base often cuneate.*

10. Dielsiàna, Pritz (*C. applanàta,* Duthie) Shrub, to 6 ft with slender spreading and arching branches: lvs. deciduous, firm, ovate or elliptic, acutish, rounded or broadly cuneate at base, yellowish gray tomentose beneath, ½–1 in long: fls. few, short-stalked; calyx pubescent· fr 1–3, subglobose, ¼in across, red, with 3–4 stones. June; fr Sept., Oct. Cent. China. Var. **májor,** Rehd & Wilson. Lvs larger and broader· fr. larger Var **élegans,** Rehd & Wilson. Lvs. smaller, sub-persistent, finally nearly glabrous and somewhat shining above: fr. pendulous, coral-red. W. China

11. Fránchetii, Bois Upright densely branched shrub with spreading branches lvs thickish, elliptic or ovate, acute or acuminate, usually cuneate at base, yellowish white tomentose beneath, ¾–1½ in. long: fls 6–15, in short and dense corymbs, pinkish, small; calyx pubescent outside, with acute teeth: fr orange-red, ovoid, over ½in. long, with usually 3 stones. June; fr Sept., Oct. W. China. R.H. 1902, p. 379; 1907.256. V.F. 118.

BB. *Fr. black or nearly black.*

C. *Lvs. acute or acuminate, pubescent or nearly glabrous beneath.*

D. *Upper surface of lvs glabrous and somewhat lustrous· calyx slightly pubescent or glabrous*

12 lúcida, Schlecht (*C. acutifòlia,* Lindl. *C. sinénsis,* Hort.) Upright, rather dense shrub, to 12 ft · lvs. elliptic or elliptic-ovate, acute, usually cuneate at the base, slightly pubescent beneath, 1–1½ in. long. fls 3–6, in nodding corymbs fr. purplish black, subglobose, with 3–4 stones. May, June, fr. Sept Altai Mts G.W. 5, p. 247 (as *C. acutifolia*) — Foliage dark green, remaining green until very late in autumn.

DD *Upper surface of lvs pubescent, at least when young, dull green· calyx pubescent*

13 acutifòlia, Turcz (*C. pekinénsis,* Zabel *C. acutifòlia* var *pekinénsis,* Koehne) Shrub, to 12 ft., with spreading slender branches lvs elliptic-ovate to oblong-ovate, acute or acuminate, usually rounded at base, slightly appressed-pilose beneath, becoming nearly glabrous, 1½–2 in long fls 2–5, nodding fr ovoid, black, to ½in long, with usually 2 stones May, June, fr Sept., Oct N China Var **villósula,** Rehd & Wilson Lvs more densely villous beneath, somewhat larger calyx densely villous fr thinly pubescent Cent and W China.

14 foveolàta, Rehd & Wilson Shrub, to 10 ft with spreading branches lvs elliptic to elliptic-ovate, rarely ovate-oblong, acute or acuminate, soon glabrous above, pubescent beneath, chiefly on the veins, finally nearly glabrous, 2–3 in long fls 3–6, pinkish, calyx pubescent: fr. black, subglobose, ⅓in across, with 3–4 stones June; fr Sept Cent China —The foliage turns bright scarlet and orange in autumn

CC *Lvs. obtuse or acutish, tomentose beneath.*

15. melanocárpa, Lodd. (*C. nìgra,* Wahlb.) Shrub with spreading branches, to 6 ft. lvs oval or ovate, usually rounded at base, dark green and sparingly pubescent above, grayish white tomentose beneath, 1–3 in long. fls 3–8, calyx glabrous fr black, globose, with 2–3 stones May, June fr Aug. N. and E. Eu to Siberia L.B.C. 16 1531 Var **laxiflòra,** Koehne (*C. laxiflòra,* Jacq.). Corymbs 12- to many-fld., elongated, pendulous B.R. 14·1305 Var **commíxta,** Schneid. (*C. laxiflòra,* Hook.) Lvs acutish, 2 in long corymbs 8–15-fld. B.M. 3519.

AA. *Petals spreading, white, roundish: fr. red.* (*Chænopetalum*)

B. *Fls. in many-fld. corymbs· upright shrubs.*

C. *Lvs. broadly ovate or oval, obtuse or acute, ½–1½ in. long, deciduous*

D. *The lvs. glabrous beneath at maturity.*

16. multiflòra, Bunge (*C. reflexa,* Carr.) Shrub, to 6 ft., with usually slender, arching branches· lvs broad-ovate, usually acute, slightly tomentose at first beneath, soon becoming glabrous: cymes very numerous, 6–20-fld; calyx and peduncles glabrous. fr. red, ⅓in. across May Spain, W. Asia to Himalayas

and China R H. 1892, p. 327; 1893, p 29. G W. 6, p. 62 M D. G. 1914: 7.—Very decorative in bloom, and hardy, but less free fruiting. Var. **calocárpa,** Rehd. & Wilson. Lvs. larger and narrower, slightly hairy below: fr. larger, nearly ½in. across, freely produced. W. China.

DD. *The lvs. tomentose beneath.*

17 **hupehénsis,** Rehd. & Wilson. Fig. 1081. Shrub, to 5 ft., with slender spreading branches, villous while young. lvs ovate to elliptic, obtuse or acutish, mucronulate, rarely emarginate, above finally glabrous, thinly grayish tomentose beneath, ½–1 in long. corymbs very numerous, with 6–12 or more white fls.; peduncle and calyx villous; anthers yellow: fr. red, subglobose, about ⅓in. across, with 2 stones May Cent and W. China. M D G. 1914·6 (as *C. acutifolia* var) —One of the handsomest species in bloom; hardy as far north as Mass

18 **racemiflòra,** Koch (*C. nummulària,* Fisch & Mey. *C Fontanèsii,* Spach). Shrub, to 4 ft , with erect or spreading branches, rarely prostrate· lvs roundish or broad-ovate, obtuse or acute, whitish or grayish tomentose beneath, glabrous above. cymes very short-peduncled, 3–12-fld , peduncle and calyx tomentose: fr red May, June. From N Afr and W. Asia to Himalayas and Turkestan. R H. 1867 31 —Very decorative and hardy Var **soongàrica,** Schneid. Lvs oval, usually obtusish, less pubescent Var. **microcárpa,** Rehd & Wilson Similar to the preceding, but fr. ovoid, smaller Var **orbiculàris,** Wenz. (*C. Wheèleri,* Hort) Low and divaricate: lvs. roundish or obovate, ½–¾in long: cymes 3–6-fld.

CC *Lvs elliptic to oblong, acute at both ends, subcoriaceous.*

D *Length of lvs ½–1½ in : corymbs 1 in. across or less.*

19 **pannòsa,** Franch Half-evergreen shrub, to 6 ft : lvs elliptic- to ovate-oblong, mucronate at the apex, glabrous above, densely grayish white-tomentose beneath calyx tomentose· fr red, globose-ovoid, ⅓in long with 2 stones S W China R H 1907.256. G 25 408 Gn 67, p 118 J. 12 120 —Very handsome, but tender

DD *Length of lvs 1½–4 in : corymbs 1–2 in. across*

20 **salicifòlia,** Franch Half-evergreen shrub, to 15 ft young branchlets floccose-tomentose. lvs elliptic-oblong to ovate-lanceolate, acute or acuminate, rugose and glabrous above, floccose-tomentose beneath, 1½–3 in long fls white in dense corymbs 1–2 in across. fr subglobose, bright red, ¼in. across, with 2–3 stones. June, fr Oct , Nov W China. Var **rugòsa,** Rehd. & Wilson (*C rugòsa,* Pritz) Lvs broader and shorter, elliptic-oblong, dull green above, more woolly-tomentose beneath fr larger, usually with 2 stones. Cent. China Var **floccòsa,** Rehd & Wilson Lvs. oblong to oblong-lanceolate, floccose-tomentose beneath while young, later becoming partly glabrous and glaucous, bright green and lustrous above. fr larger, usually with 3 stones W China —This species is very handsome, particularly in autumn when studded with its clusters of bright red berries. The var. *floccosa* which has been advertised as var. *glaciosa* (misspelled for *floccosa*) seems to be the hardiest and most desirable.

21. **frígida,** Wall Large half-evergreen shrub, to 20 ft lvs oblong, acute at both ends, glabrous above, tomentose beneath when young, 2–4 in. long: cymes long-peduncled, very many-fld , pubescent· fr. scarlet. April, May. Himalayas. B.R 15·1229. L B.C. 16: 1512.—One of the most beautiful in fl. and fr., but not hardy N.

BB. *Fls. 1–3: low prostrate or trailing shrubs: lvs. persistent.*

C. *Lvs green beneath.*

22. **Dámmeri,** Schneid. (*C. humfùsa,* Duthie). Prostrate shrub with trailing often rooting branches: lvs. elliptic, usually cuneate at the base, obtusish and usually mucronulate, glabrous or nearly so, about 1 in. long fls. usually solitary, calyx sparingly pubescent or nearly glabrous: fr bright red. May, June; fr. Oct , Nov. Cent. China. Var. **radicans,** Schneid Lvs. often obovate, slender-petioled: fls. 1–2, on peduncles about ½in. long.

CC. *Lvs. glaucous or whitish tomentose beneath.*

23. **rotundifòlia,** Wall (*C. microphýlla Uva-úrsi,* Lindl. *C. prostràta,* Baker) Low or prostrate shrub: lvs nearly orbicular or broadly oval, dark green above and somewhat pubescent, loosely pubescent beneath or glabrescent and glaucous, ⅛–½in long: fls 1–3, about ½in across· fr bright red, subglobose, more than ½in across Himalayas May, June, fr Sept B R 14: 1187 Var **lanàta,** Schneid (*C buxifòlia,* Baker, not Wall *C Wheèleri,* Hort) Lvs elliptic to elliptic-oblong, tomentose beneath· fr ⅓in across Refug Bot 1:52 (fls. in bud). Gn 55 186 R H 1889, 348, fig 4

24 **microphýlla,** Wall Low, prostrate shrub, densely branched lvs cuneate-oblong or obovate, acute, shining above, densely pubescent beneath, ⅛in. long fls. usually solitary; calyx pubescent fr bright red May, June Himalayas. B R 13 1114 L B C 14:1374. R H. 1889:348, fig 3 G C I 12 333, 18 681 Gn. 4, p. 165 Var **thymifòlia,** Koehne (*C thymifòlia,* Baker). Very dwarf lvs linear-oblong, smaller fls. and fr. smaller R H 1889.348, fig 2 G C I. 12:333; 18·681. Refug Bot 1 50 Var. **glacìalis,** Hook. (*C. congèsta,* Baker) Lvs glabrous beneath, oval: fls. smaller, often pinkish. Refug Bot. 1:51

C affinis, Lindl Allied to C frigida Lvs broad-elliptic fr. dark brown, globose Himalayas L B C 16 1522 —*C ambigua,* Rehd & Wilson Related to C acutifolia Shrub, to 6 ft lvs elliptic-ovate to rhombic-ovate, villous beneath fls 5–10, calyx slightly pubescent or nearly glabrous fr ovoid, black W China —*C amœna,* Wilson Related to C Franchetii Dense shrub, to 5 ft · lvs ovate or elliptic, usually ½in long corymbs 6–10-fld , sepals acuminate fr globose, orange-red Yunnan G C III. 51 2 —*C angustifolia,* Franch =Pyracantha angustifolia —*C apiculata,* Rehd & Wilson Related to C Simonsii Shrub, to 6 ft lvs orbicular to roundish ovate, apiculate, bright green and lustrous, nearly glabrous, ¼–½ in long fr nearly sessile, globose, bright red W China —*C arborèscens,* Zabel=C Lindleyi —*C bacillàris,* Wall Related to C frigida Lvs smaller, usually glabrous beneath at length fr dark brown Himalayas —*C. buxifòlia,* Wall Related to C rotundifolia Lvs elliptic, slightly pubescent above at first, grayish tomentose beneath fls 2–4, ⅓in. across fr red India Wight, Icon 3 992 Tender —*C distichа,* Lange Related to C Simonsii Half-evergreen, upright shrub, to 4 ft lvs suborbicular to broadly obovate, apiculate, sparingly pubescent above, nearly glabrous beneath, ½in or less long fls. 1–2, calyx glabrous or nearly so fr scarlet Himalayas —*C. Harroviana,* Wilson Related to C salicifolia Shrub, to 6 ft · lvs elliptic-oblong, sometimes oval, 1–2 in long, densely villous beneath corymbs 1½ in across S W China —*C Henryàna,* Rehd & Wilson (C rugosa var Henryana, Schneid) Related to C salicifolia Shrub, to 12 ft lvs thinner, elliptic-oblong to oblong-lanceolate, 2–3½ in long, and about 1 in broad, pubescent and only slightly pubescent above, densely grayish pubescent beneath corymbs many-fld , about 2 in across, calyx pubescent fr red, ovoid, ¼in across, with 2–3 stones Cent. China. G C III 46 339 (not good) M D G 1914 15 —*C ignàta,* Wolf Related to C melanocarpa Shrub, to 5 ft lvs ovate or oval, greenish white beneath, pubescent, 1–2 in long fls 8-13, pinkish, calyx pubescent at the base fr dark reddish brown, nearly black. E Turkestan Yearb For Inst , Petersburg, 15 240 —*C Lindleyi,* Steud *C arborescens,* Zabel) Similar to C racemiflora but fr. black Himalayas —*C mauponènsis,* Franch Related to C foveolata Shrub, to 15 ft lvs elliptic to ovate-oblong, thicker, rugose above, pubescent beneath, at least on the veins, 2–5 in long. corymbs many-fld , fls white or pinkish, calyx sparingly pubescent fr black, with 4–5 stones W China —*C nitens,* Rehd & Wilson Related to C divaricata Lvs broadly oval or roundish ovate, glabrous and lustrous above, ½–¾in long fr ovoid, purplish black, stalked, pendulous W China —*C obscura,* Rehd & Wilson. Related to C acuminata Shrub, to 10 ft lvs elliptic-ovate, finally glabrous above, yellowish gray-tomentose beneath, 1–2 in long fr dull brownish red, ovoid, ⅓in long, usually with 3 stones. W China —*C Pyracántha,* Spach=Pyracantha coccinea —*C. rósea,* Edgew Related to C integerrima Shrub, with slender upright branches lvs elliptic to ovate-oblong, nearly glabrous, grayish green beneath, 1–1½ in long fls 4–9, pinkish with slightly spreading petals fr subglobose, dull red Himalayas —*C Silvéstrii,* Pampanini Allied to C integerrima Lvs elliptic-ovate, densely hairy and cream-colored beneath, 1–2 in. long calyx pubescent outside fr orange-colored Cent China —*C uniflòra,* Bunge Allied to P vulgaris Lvs oval to oval-oblong, glabrous when older. fls solitary. fr red Altai Mts.

ALFRED REHDER.

COTTON belongs to the genus Gossypium (name used by Pliny), of the *Malvàceæ*. The species are now much confused, but it is generally agreed that the sea island cotton is of the species *G. barbadense*, Linn. The upland cotton is probably derived chiefly or wholly from *G. hirsutum*, Linn. The former is native in the West Indies. The nativity of the latter is in dispute, but it is probably Asian The cotton flower is mallow-like, with a subtending involucre of three large heart-shaped bracts The carpels or cells of the pod are three to five These carpels break open, and the cotton covering of the seeds makes a globular mass,—the cotton boll (Fig. 1082) Cotton is not a horticultural



1082. A cotton boll.

crop, and is therefore not considered in this work. The reader will find "The Cotton Plant" (published by the Dept of Agric., Bull. 33), a useful monograph. Consult Cyclo. Amer. Agric., Vol. II, p 247.

COTTONWOOD: species of *Populus*.

CÓTULA (Greek, *small cup*, the bases of the clasping leaves forming a hollow or basin) *Compósitæ*. Small diffuse or much-branched strong-smelling annual or perennial yellow-flowered herbs, a few of the perennials sometimes used as carpeters in rock-gardens

Leaves alternate, toothed, lobed or pinnatisect: heads pedunculate, hemispherical or bell-shaped, many-fld. and discoid; outer or marginal florets nearly or quite apetalous, usually pistillate and fertile; disk-florets 4-toothed, fertile or male; torus naked; pappus not evident. achene glabrous, compressed.—About 50 or 60 species, largely in the southern hemisphere.

dioìca, Hook. f (*Leptinélla dioìca*, Hook. f). Sts. glabrous or slightly hairy, 1 ft or less long, creeping: lvs solitary or tufted, not thick or stiff, stalked, 2 in. or less long, linear-obovate to spatulate, obtuse, serrate to pinnatifid or even pinnate: heads on axillary naked peduncles that are longer or shorter than the lvs., unisexual, the males ¼in. or less diam., and the females a little larger achene obovoid, curved New Zeal —Very variable. A compact dwarf carpeter.

Muèlleri, Kirk (*C potentillàna*, Hort? *Leptinélla potentillìna*, Muell) Sts. long and rather stout, creeping and rooting, the branches ascending and somewhat villous towards the tips· lvs 2–5 in. long, stalk and all, linear-obovate, deeply pinnatifid, glandular-dotted: heads on peduncles that usually are shorter than the lvs., bisexual, about ½in. diam.: achene club-shaped and 4-angled. New Zeal.

C. lanàta, Hook. f. (Leptinella lanata, Hook f) Stout and woolly: lvs rather fleshy, pinnate or pinnatifid florets glandular New Zeal —*C lobàta*, Linn.=Lidbeckia —*C plumòsa*, Hook. f. (Leptinella plumosa, Hook. f) Stout, soft-woolly lvs. 3–4 times pinnatisect. florets not glandular New Zeal —*C Squàlida*, Hook. f. (Leptinella squalida, Hook f.)—Allied to C. dioica, with lvs. deeply pinnatifid and segms. incised New Zeal.

L. H. B.

COTYLÈDON (a name used by Pliny, meaning *a cavity*, having reference to the concaved or cup-like leaves of some kinds). *Crassulàceæ* Succulent herbs or shrubs, rarely annual, grown mostly for their oddity, but some of them making good winter bloomers in pots and some used for summer bedding because of the stiff thick foliage, some are half-hardy North.

Habit very various, rosulate or erect, sometimes of a scandent tendency: branches and lvs. thick and fleshy: lvs. opposite or alternate, petiolate or sessile. calyx 5-parted, as long as or shorter than the corolla-tube; corolla tubular, cylindrical or urn-shaped, sometimes 5-angled, the parts or petals 5, erect or spreading, connate to the middle, longer than the usually 10 stamens; ovary of 5 free carpels, each with a narrow scale at base; fls. erect or pendent, sometimes showy, in terminal racemes or cymes Differs from Sedum in the connate petals —Species about 100, in Calif to Texas, and Mex., Afr, Asia and Eu See I H 10 76 for an account of many of the species. Some of the species make dense rosettes of stiff lvs on the ground and send up a small bracted scape; they remind one of the house-leek (*Sempervìvum tectorum* and related species).

As above defined, Cotyledon comprises the broad group habitually known under that name. Recently, however, Britton and Rose have revised the group, excluding Cotyledon from America, reinstating Echeveria and Pachyphytum for some of the American species and making new genera for others, as Dudleya, Oliveranthus, Urbinia, Stylophyllum For the convenience of the gardener, the cult species are here brought together under Cotyledon, and they are also listed at other places under their new generic names

Cotyledons are little known in this country except among fanciers and for carpet-bedding Culturally, there are two groups,—the greenhouse kinds and the bedding kinds The greenhouse kinds are well represented by *C. gibbiflora* It is attractive both in foliage and flower. It may be expected to begin bloom in January or February Its period of bloom is short, after which it may be propagated. The top of the main shoot (or of strong side shoots) may be cut off with 2 or 3 inches of stem, and stood in pots so that the cut end will rest on moss in the bottom and the leaves on the rim of the pot, using no earth; fine roots will soon form and the young plant may then be repotted into dryish soil. The old stems of this and similar tall kinds may be placed rather close together in shallow boxes, when it is desired to propagate them, and kept in a warm dry place, where they will form small growths along the stems; these, when large enough, may be put into boxes of dry sand, and potted in thumb- or 3-inch pots when they have made a sufficient quantity of roots This species should be kept in a warmhouse in winter, where it is rather dry and not exposed to drip *C fulgens* is a good greenhouse species, producing showy waxy red flowers in winter; also *C coccinea*. For this purpose the large plants should be lifted from the beds and carefully potted, as they make a much finer growth in the open ground than when grown in pots —When it is desired to increase the low-growing carpet-bedding kinds on a larger scale, the plants should be lifted before the ground gets too wet and cold They may either be boxed in dry soil and kept in a cool dry house, or placed thickly together in a frame, taking care that no drip is allowed on the plants, and giving no water The most convenient time for propagation by leaves is during the months of November and December, when the fall work of rooting soft-wooded plants is over. Leaves rooted at this time will make plants large enough for planting out the following season They will take from three to four weeks to root, according to the kind The leaves must be taken from the plant as follows Grasp each leaf between the thumb and forefinger, give a gentle twist first to one side then to the other until the leaf comes off, taking care that the dormant bud in the

axil of the leaf accompanies it, otherwise the leaf will root but a plant will not form from it. Make a depression about 2 inches deep in the center and 4 inches wide across the sand-bed, in this lay two rows of leaves with their bases touching each at the bottom of the depression; give no water until the small roots make their appearance, and only slightly afterwards When the little plants are large enough they should be boxed, using sandy loam, and kept in a temperature of not less than 60° F. at night —For summer bedding purposes the following have been employed very successfully, being lower growers: *C. atropurpurea, C fulgens, C coccinea, C fasciculàris, C. gibbiflora* var. *metallica, C. Pachyphytum, C. Peacockii, C. Purpusii, C roseata, C secunda, C. secunda* var. *glauca, C. mexicana.* (G. W Oliver)

Other species of Cotyledon occur in collections of succulent plants, but the following probably represent those of commerce in this country.

INDEX.

agavoides, 12
Aizoon, 1
atropurpurea, 14
Barbeyi, 2
bracteosum, 13
californica, 25
chrysantha, 4
coccinea, 20
edulis, 10
elata, 8
farinosa, 22
fasciculàris, 6
fulgens, 18
gibbiflora, 19
glauca, 16
hispanica, 9
lanceolata, 24
metallica, 19
mexicana, 11
oblonga, 8
orbiculata, 8
Pachyphytum, 13
Peacockii, 17
pendulinus, 5
pulverulenta, 22.
Purpusii, 23.
ramosa, 8
reticulata, 3
rosea, 21
roseata, 21
rotundifolia, 8
sanguinea, 14
Scheeri, 17
secunda, 16
Sempervivum, 7.
Umbilicus, 5

A. *Plants of the Old World, of various habit corolla-tube elongated, usually much longer than the calyx. (Cotyledon and Umbilicus)*

B *Lvs crowded in a rosette (rosulate) at the base of the st plant low, more or less stemless species of the houseleek or hen-and-chickens type, used in rock-gardens and for carpet-bedding.*

c *Fls yellow or milk-white*

1 **Aizoon,** Schoenl (*Umbilicus Aizoon*, Fenzl). Plant small, minutely pubescent, the st very short: lvs densely rosulate, lingulate, obtuse, ciliate, those on the st oblong-obtuse fls golden yellow, on very short pedicels, calyx spreading, corolla-parts lanceolate-acuminate and keeled Asia Minor.

cc *Fls red or greenish*

2 **Bàrbeyi,** Schweinf. Whole plant hoary-white, tall and branching lvs thick, fleshy, shovel-shaped: fls olive-green and red, 1 in long, in a close panicle. Blooms freely in spring and summer Abyssinia Gt. 45, p 465 —An exquisite plant for carpet-bedding

BB *Lvs variously scattered along the st, or sometimes in rosettes or clusters at the ends of the branches mostly branching plants, grown in greenhouses, window-gardens, and sometimes used in summer bedding-out but not in carpet-bedding designs*

c. *Fls white or ochroleucus.*

3 **reticulàta,** Thunb Sts much branched, fleshy: lvs few at the ends of the branches erect, fleshy, soft, smooth, ½in. or less long· fls. ½in. or less long, whitish, in an erect, dichotomous panicle. Cape. G C III 21·282 — The wiry fl.-stalks remain on the plant and give it the appearance of being inclosed in a network. Odd.

4 **chrysântha,** Hort. (*Umbilicus chrysánthus*, Boiss.). Plant pubescent, glandular above, the st short:, lvs. rosulate, short, oblong-spatulate, obtuse, those on the st elliptic and somewhat acute. fls large, ochroleucous (milk-white or yellowish), red-striped on the back of the oblong-lanceolate keeled lobes or parts of the corolla. Perennial. Asia Minor.

cc. *Fls. yellow or greenish.*

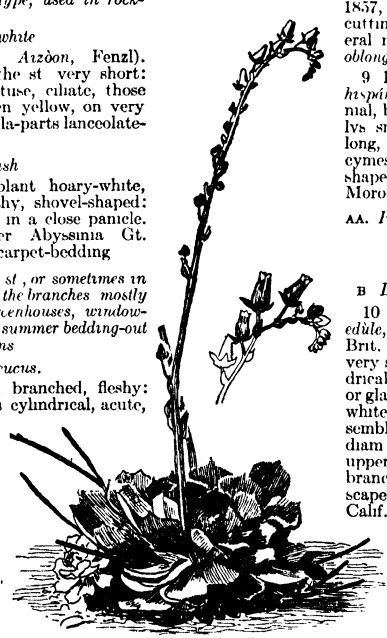
5 **Umbilicus,** Linn. (*Umbilicus pendulinus*, DC). Pennywort. Navelwort Perennial, 6–12 in high in flower, simple or slightly branched, leafy at base: radical and lower lvs fleshy, orbicular, crenate, more or less peltate: fls yellowish green, pendulous, in a raceme, calyx very small, corolla cylindrical, ¼in. long but somewhat enlarging, with 5 short teeth —On rocks and walls, W. Eu. Adaptable in rock-gardens.

ccc *Fls. red or purple.*

6 **fasciculàris,** Soland Smooth, 1–2 ft. high, thick-stemmed, branched. lvs pale greenish white with a yellowish margin, glaucous, few, sessile, cuneate-obovate, thick, flattened, slightly concave, cuspidate: panicle branches long, scorpioid, fls. large, 1 in. long, pendent, calyx-lobes short, broadly ovate-acute; corolla-tube much longer than the calyx, with a greenish tube and reddish revolute limb. S. Afr. B M. 5602. J H III 29 443

7 **Sempervìvum,** Bieb (*Umbilicus Sempervivum*, DC) Houseleek Cotyledon Plant green, glandular radical lvs. spatulate, obtuse, attenuate-cuneate at base, the margin denticulate, st.-lvs oblong. fls purplish and papillose on the outside, on secund branches in a corymbose panicle, corolla thrice longer than calyx, parted to the middle, the parts lanceolate-acuminate and somewhat recurved Perennial —Not to be confounded with *Sempervivum tectorum.*

8 **orbiculàta,** Linn Erect, 2–4 ft high lvs opposite, flat, obovate-spatulate, obtuse, mucronate, glaucous and mealy, with red margins· fls. large, reddish, panicled. Fls. June–Sept S Afr B M 321 R H. 1857, p 347 —Grows well from cuttings Variable, and has several named forms as var *elata, oblonga, ramosa, rotundifolia*



1083. Cotyledon secunda (Detail ×½)

9 **hispánica,** Linn (*Pistorinia hispánica*, DC) Annual or biennial, branched, 6 in high, erect: lvs small, nearly cylindrical, oblong, few, sessile fls erect, in cymes, reddish, corolla trumpet-shaped, lobes spreading Spain, Morocco R H 1895, p. 472

AA. *Plants of the New World. corolla-tube usually short, perhaps always shorter than the calyx*

B *Lvs turete. (Stylophyllum)*

10 **edùlis,** Brewer (*Sèdum edule*, Nutt. *Stylophyllum edule*, Brit. & Rose) Sts cespitose, very short and thick lvs cylindrical, 3–4 in long, erect, whitish or glaucous green, not mealy· fls white, tinged with green, resembling those of Sedum, ½in diam., short-pedicelled, along the upper sides of the flexuous branches of the cymose panicle, scape 1 ft. high. San Diego, Calif. —Young lvs. eaten by Indians.

BB. *Lvs linear or nearly so.*

11. **mexicàna,** Hemsl. Plant glabrous, 3–4 in. high, erect, the branches woody· lvs. few, alternate,

crowded on sterile shoots, somewhat fleshy, linear or linear-spatulate, obtuse, ¼–½in. long: fls. few short-pedicelled, cymose; sepals free, linear, obtuse; petals plane and strongly coherent, forming a tube, ½in.; or less long, the lobes ovate, acute, erect. S Mex —One of the dozen known species of Altamiranoa (see p 237, Vol. I), in that genus becoming *A. mexicana*, Rose.

BBB. *Lvs. broader, flat, often very fleshy.*

C. *Calyx minute.* (*Urbinia*)

12 **agavoìdes,** Baker (*Echevèria agavoìdes*, Lem. *Urbinia agavoìdes*, Brit & Rose) Small and compact: lvs densely rosulate, stiff, acuminate and very sharp-pointed, pale gray-green on both sides, papillose fls 4–6, orange, on long pedicels, sepals several times shorter than the corolla. Mex —Useful for carpet-beddings.

CC. *Calyx evident or prominent.*

D. *Petals always appendaged at insertion of stamens.* (*Pachyphytum*)

13 **Pachyphỳtum,** Baker (*Pachyphỳtum bracteòsum*, Klotzsch) SILVER-BRACT Somewhat shrubby, very succulent, pale glaucous blue throughout. lvs. clothing upper part of st., more or less rosulate, large and thick, spreading, obovate, obtuse or obtuse-pointed, the scars from the fallen lvs orbicular. fls in spikes 4–6 in long on lateral peduncles, corolla red, immersed in the large calyx which is about 1 in. long, stamens 5 large and 5 small Mex B M 4951 —A singular plant, blooming in summer 1 ft.

DD *Petals not appendaged*

E. *Corolla strongly 5-angled* (*Echeveria.*)

F *Color of plant* (*or of lvs*) *dark purple*

14. **atropurpûrea,** Baker (*Echevèria sanquínea*, Morr.). St short and stout lvs in rosette at top of st., dark purple and glaucous, obovate-spatulate fls bright red, in a long raceme terminating the erect st., corolla 5-angled, white toward base Mex. See p. 1086.

FF. *Color green, or ordinarily glaucous* (*except var. of No. 19*)

G. *St wanting or nearly so* (*acaulescent species*).

15 **Peàcockii,** Baker (*Echevèria Peàcockii*, Crouch). Acaulescent lvs about 50 in a dense rosette 6 in across and standing 4 in. high, obovate-spatulate, mucronate, reddish toward tip, glaucous. st. 12–24 in., with small lf.-like bracts: fls. bright red, in a scapoid spike, calyx-lobes linear, unequal, corolla about ½in long, the parts lanceolate-acute. Mex (?)—Interesting for its glaucous coloring and waxy coating of the lvs. Named for Mr Peacock, of Hammersmith, England, in whose collection it flowered See p. 1086

16. **secúnda,** Baker (*Echevèria secúnda*, Booth) Fig 1083 Stemless: lvs in a rosette, crowded, cuneiform, mucronate, glaucous, curving upward fls in a 1-sided, recurved spike, reddish yellow; peduncle long, 6–12 in high. June–Aug. Mex B R 26 57 —Probably the most common species in gardens Distinguished by its pale green red-tipped rosettes, several forms Half-hardy **E. glaûca,** Baker (*E. secúnda* var *glaùca*, Otto), has glaucous-green foliage See pp. 1086–7.

GG *St evident, often tall* (*caulescent species*).

17 **Schèerii,** Baker (*Echevèria Schèerii*, Lindl.). Caulescent, branching lvs large, glaucous, oval, acute, narrowed into a long plane petiole-like part. fls dingy red with yellow tips, broadest at base, in drooping racemes; sepals linear, acute, green, spreading, shorter than the corolla Mex B.R 31 27 P. 1087

18 **fúlgens,** Baker (*Echevèria fúlgens*, Lem.). St. 4–8 in tall, but bearing long leafy fl.-branches: lvs. obovate-spatulate, pale glaucous green, clustered: fls. bright red with yellow base, in nodding racemes. Mex.

19 **gibbiflòra,** Moc & Sessé (*Echevèria gibbiflòra*, DC) Sts 1–2 ft high: lvs. flat, wedge-shaped, acutely mucronate, crowded at the ends of the branches: fls short-petioled; panicle branches 1-sided, spreading; corolla gibbous at the base between the calyx-lobes, the tube white, the tips touched with crimson Mex. B R 1247. Var **metállica,** Baker (*Echevèria metállica*, Hort.). Lvs large, obovate-spatulate, 6 in. wide by 7 in long, a beautiful glaucous purple with metallic reflections: fls yellowish with red tips. Mex.—An excellent plant for summer bedding P. 1087.

20 **coccínea,** Cav (*Echevèria coccínea*, DC) Plant soft-pubescent, 1–2 ft.. lvs. lance-spatulate: fls scarlet and yellow or paler within, in axillary long leafy, 15–25-fld., loose spikes. Mex. B M 2572. P. 1086.

EE. *Corolla not strongly angled.*

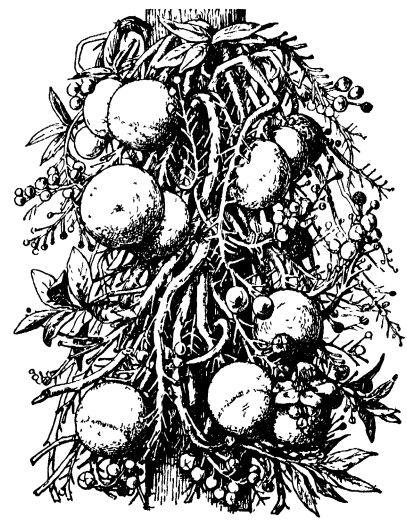
F *Fls. in a dense spike* (*Courantia*)

21 **roseàta,** Baker (*Echevèriaròsea*, Lindl *Courántia ròsea*, Lem) Sts branching, 1 ft: lvs oval, erect, acute, mostly in terminal rosettes on the sterile shoots: fls yellow, in dense rose-bracted spikes, sepals linear-acute, rose-colored; corolla bell-shaped, 5-parted. Mex. B.R. 28 22.

FF. *Fls. in cymes or panicles* (*Dudleya*)

22 **pulverulénta,** Baker (*Echevèria pulverulénta*, Nutt. *E. farinòsa*, Hort *Dudlèya pulverulenta*, Brit & Rose) Lvs in a rosette, silvery green, very mealy, spatulate, acute, the tips reflexed, the cauline lvs gradually diminishing into broadly cordate, clasping bracts: panicles dichotomously branched, pedicels slightly longer than the pale scarlet or coral fls Plants 1 ft diam. S Calif F S 19 1927–8 —A fine plant for carpet-bedding

23 **Púrpusii,** Nichols (*Echevèria Púrpusii*, Schum., not Brit *Dudlèya Purpusii*, Brit & Rose) Cespitose, with powdered snow-white foliage lvs densely rosulate, broadly spatulate, acuminate fls in a branching upright cluster, corolla conico-tubular, much exceeding calyx, segms scarlet with golden yellow tips S Calif. B.M. 7713 G C III 20 698 Gt 45, p 609.



1084. Couroupita guianensis, the cannon-ball tree, showing the trunk and the hanging flowers and fruits.

24 **lanceolàta,** Benth & Hook (*Echevèria lanceolàta,* Nutt. *Dudlèya lanceolàta,* Brit. & Rose) Green or slightly glaucous, acaulescent. lvs. in a rosette, lanceolate, acuminate, slightly mealy; st.-lvs or bracts small, cordate, clasping, distant· panicle narrow, dichotomous: fls red and yellow, calyx-lobes broad-ovate, ⅛in. long, corolla ½in or more long. S. Calif.

25 **califórnica,** Baker (*D. Cotylèdon,* Brit. & Rose. *Sèdum Cotylèdon,* Jacq. *Echevèria califórnica,* Baker). Plant acaulescent, tinged red: lvs. in a rosette, concave, ligulate, lanceolate, acute, glaucous, mealy, slightly yellowish, 8 in long fls pale yellow, on weak lateral flowering sts 1-2 ft long, with short, ovate, clasping lvs or bracts and bi- or trifid racemes Calif.

Many garden names occur in Cotyledon, some of which are unidentifiable and some of which probably represent hybrids *C. devènsis,* Hort —Hybrid between probably *C. glauca* and *C. gibbiflora* fl-sts 5-7 ft long B M 8104 —*C. elegans,* N E Br = Olveranthus —*C. extensa,* Hort =(?) —*C. globòsa,* Hort , see page 1087 —*C. globulariæfòlia,* Baker Rosulate, 8 in lvs 30-40, obovate-spatulate, 2½ in or less long fls white tinged red, 20-40 in a dense thyrse-like cluster Syria —*C. imbricata,* Hort , described on p 1087 —*C. insignis,* N E Br About 2 ft , wholly glabrous, erect, light green lvs opposite, broad, to 5 in long fls light red with lobes greenish yellow inside, 1½ in long, in terminal and axillary cymes Cent Afr B M 8036 —*C. maràbilis,* Hort , hybrid —*C. mucronata,* Baker =Echeveria, p 1086 —*C. nana,* Marl Very dwarf, 1½ in or less high, densely branched and forming a tuft lvs yellowish green, not apiculate S Afr —*C. Petalòzzi,* Mast Lvs distributed, the radical ones spatulate-obtuse and margins slightly denticulate, the cauline oblong-oblong fls pale rose, somewhat secund in a glandular-hairy panicle Cilicia —*C. pulvinàta,* Hook f —Echeveria, p 1086 —*C. sedoìdes,* DC Annual, creeping, smooth lvs sedum-like, oblong and obtuse, convex fls few, pink, in summer. Pyrenees Distinguished from Sedum by the gamopetalous corolla. —*C. spondèus,* Linn Small and quaint, Aptera-like, with a rosette of flat spoon-shaped spine-tipped lvs , 12 in or more tall fls yellow, in early summer Siberia to China and Japan, but not hardy — *C. superba,* Hort , is an annual with yellow fls —*C. tertifòlia,* Thunb St somewhat woody, 6-8 in high, simple or branched lvs 4-5 in long, opposite, nearly terete, acute or cuspidate, hirsute or subglabrous fls many, corymbed, the peduncle to 18 in , yellow, corolla-tube a little shorter then calyx S Afr

L H B †

COUCH GRASS: *Agropyron repens*

COURÁNTIA (personal name) *Crassulàceæ.* Caulescent lvs alternate, closely set, broad fls in a dense bracteate spike, calyx-lobes nearly equal, linear, brightly colored, corolla not angled, yellow, stamens 10, filaments united into a tube for half their length Only one species First brought into cult about 1842 For cult , see *Cotyledon* **C. rôsea,** Lem (*Cotyledon roscàta,* Baker) See No 21, p 870 J. N ROSE

COUROUPÌTA (from a vernacular name in Guiana) *Lecythidàceæ* Trees of Trop Amer (about 9 species) sometimes planted as oddities or for shade, particularly for the curiosity of the great ball-like frs borne on the trunk Lvs alternate, oblong, reticulate, entire or crenate-serrate fls showy and odd, borne in racemes, often from the trunk and larger branches, calyx-tube top-shaped, the limb 6-lobed or -divided; petals 6, somewhat unequal, spreading and more or less incurved, borne on a disk, stamens many, in 2 sets,—one series forming a ring or cup in the center of the fl and about the single 5-7-celled ovary, the other longer and rising from one side like a fringed palm or ladle over the pistil fr a large nearly or quite globular ball, coriaceous or woody, indehiscent, with many seeds imbedded in the pulp **C. guianénsis,** Aubl CANNON-BALL TREE. Figs 1084, 1085 Tall soft-wooded tree in Guiana, where it is native. lvs oblong-obovate, elliptic or broad-lanceolate, acute, entire or very obscurely toothed· fls. with concave petals about 2 in long, yellow- and red-tinged on the exterior and crimson-lilac within, very showy, in racemes 2-3 ft long fr nearly or quite globular, 6-8 in diam , reddish, hard on the exterior, pulpy inside, with very disagreeable odor when ripe. B M 3158-9 —Sometimes planted in the tropics, in botanic gardens and elsewhere Shell of the fr used for utensils, and the pulp said to be eaten by negroes and to be used for the making of beverages. L. H. B.

COUSSAPÒA (Caribbean name). *Moràceæ.* Fifteen to 20 milky-juiced trees or shrubs of Trop. S. Amer., 1 or 2 sometimes grown under glass, but apparently not in the American trade They are sometimes scandent and epiphytic, like other Ficus-like things, sending down branches and completely enveloping the supporting tree and strangling it Lvs alternate, stalked, thick, penninerved or 3-nerved, entire. fls dicœcious, in globose heads, the peduncles solitary or in pairs and axillary, the male clusters few-fld and often paniculate, the females on shorter peduncles fr oblong, becoming succulent and with the including thickened perianth forming a mulberry-like multiple fruiting body. *C. dealbàta,* André (*Ficus dealbàta,* Hort), is described as a very beautiful greenhouse subject, with coriaceous elliptic lvs 1 ft long and half as broad, white-silky beneath and deep green above. I H 17:4.

L. H. B.

COVER-CROPS. Green temporary crops, grown for the purpose of improving the soil, either as protection or to be turned down as green manure; word used chiefly in speaking of fruit-growing operations



1085. Flower of Couroupita guianensis One of the petals has fallen (×¼)

The use of cover-crops has become an essential part of orchard management The name is derived from the fact that the seed is sown in the fall or late summer, and sufficient growth results so that the ground is covered and protected during the winter. The crops are grown for their effect upon the orchard, not for the direct value of the crop The term was first used in this connection by Bailey, Bulletin No 61, of the New York Station at Cornell, p 333, December, 1893

Cover-crops make use of the available plant-food at a time when the trees are beginning to use it less and less In this way, food that otherwise might be lost is stored up until it becomes available to the trees the following spring through the rotting of the cover-crops. The presence of the cover-crop, with its mat of roots, also prevents soil-washing and erosion with its accompanying loss of plant-food The legumes, through the action of the bacteria found in their root-nodules, are able to add to the total amount of nitrogen present in the soil This is the only way in which cover-crops increase the total supply of the plant-food elements, but the decay of the cover-crops increases the humus in the soil and, by the activities thus set up, the locked-up plant-food is released in a soluble form and thus the total available plant-food is increased The ability of a soil to absorb and retain water is greatly increased in proportion to the humus that the soil contains For this reason, soils rich in humus are less likely to be injured by erosion from the rapid run-off of the rainfall and less liable to suffer from drought In soils plentifully supplied with moisture and plant-food, the trees are likely to continue growth so long that the wood does not mature and harden before winter, thus rendering them liable to injury during a severe winter Such trees usually bear fruit that is poor in quality and in color. To produce mature, well-colored apples, it is essential that excessive growth after midsummer be prevented The best means of doing this is to grow a crop in the orchard that will compete with the trees for the food and water Soil protected by a cover-crop does not freeze so quickly or so deeply as when uncovered, and therefore the tree roots under a cover-crop are less likely to be injured by freezing and by heaving Many

of our best fruit soils contain a large proportion of clay. When the humus-content of such soils becomes low, they are stiff and difficult to work and they dry out and bake quickly. Plowing under cover-crops restores the needed humus. This is important from the farm-management point of view The period of time during which a clay field may successfully be plowed may frequently be doubled by thus increasing the humus supply As the physical condition of the soil is bettered, the rootlets of the tree can more easily penetrate it in their search for food, and this larger feeding area means a greater supply of food. Orchards that are to be cultivated should be plowed as early as the land can be worked, in order to prevent excessive loss of moisture through evaporation and the demands of any growing cover-crop This is especially true when rye, clover, or vetch are grown Fall plowing is seldom advisable, as much of the benefit of the cover-crop is then lost The time of seeding depends upon the needs of the fruit and the supply of moisture available In seasons of plentiful rainfall the cover-crop should be put in early, but in a period of drought the trees need all the moisture there is in the soil and the seeding should be late. In the North Atlantic States, the cover-crops are planted from the latter part of July to the middle of August.

Kinds of cover-crops.

In general, cover-crops may be divided into the leguminous or nitrogen-gathering, and the non-leguminous crops.

1. Leguminous cover-crops —Red and mammoth clover, Canada field peas, and winter vetch are used in the northern states, soybean, cowpea, crimson clover, and vetch in the central and southern states.

2. Non-leguminous cover-crops —Rye, oats, wheat, and barley; rape and turnips; buckwheat and nearly all weeds.

Average quantity of seed per acre.

Barley	2	to	2½ bushels.
Buckwheat			1 bushel.
Clover, red	10	to	15 pounds.
Clover, mammoth	10	to	15 pounds
Clover, crimson	15	to	20 pounds
Cowpea	1½	to	2 bushels.
Millet			1½ bushels.
Oats	2	to	3 bushels.
Peas	2	to	3 bushels.
Rape	2	to	5 pounds.
Rye	1½	to	2 bushels.
Soybean	1	to	1½ bushels
Turnip			4 pounds.
Vetch	½	to	1 bushel.
Wheat	2	to	2½ bushels.

3. Combinations of cover-crops —An ideal cover-crop should possess certain characters It should make a vigorous vegetative growth by fall so as to furnish an abundance of humus and to hasten the maturity of the trees. The seed should be of such a nature that it will catch well when planted at a time of year when the soil is very dry Preferably, the cover-crop should winter over. All these characters are seldom found in a single crop and, hence, combinations are desirable. Thus buckwheat, which makes a quick growth, does not live through the winter as does the slower-growing rye, so the two combine well. The following combinations are frequently used:

1.	Clover (red or mammoth)	10	pounds.
	Winter vetch	15	pounds.
	Oats	½	bushel
	Cowhorn turnips	½	pound.
2.	Buckwheat	½	bushel.
	Oats	1	bushel
	Rye	1	bushel.
3.	Oats	1½	bushel.
	Clover	15	pounds.
4.	Buckwheat	¾	bushel.
	Oats	1	bushel
5.	Oats	1½	bushel.
	Rye	1	bushel.

In the peach orchard, where large annual growth is not desirable, or in apple orchards making excessive growth, the leguminous crops should be used sparingly, if at all.

C. S WILSON.

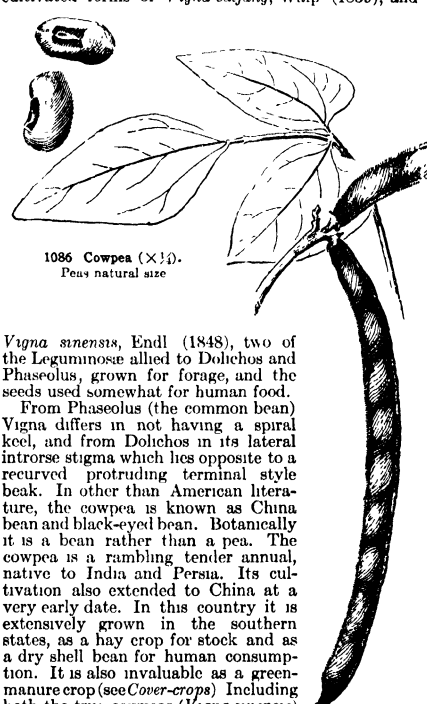
COWÀNIA (after James Cowan, an English merchant, who intro many Peruvian and Mexican plants into England) *Rosàceæ* Some 4 or 5 small shrubs from the S W U S. and from Mex, with small crowded lvs and handsome white or purple fls ; rarely cult in botanical collections Closely related to Fallugia, but differing in the absence of bracts at the base of the calyx Cult and prop like Fallugia, but apparently more tender like that plant well adapted for planting in rockeries. **C. mexicàna,** Don (*C. Stansburiàna,* Torr), has small crowded cuneate 3-7-lobed lvs. and white fls about 1 in across **C. plicàta,** Don (*C. purpùrea,* Zucc.), has incisely serrate lvs and purple fls.

ALFRED REHDER.

COWBERRY· Usually means *Vaccinium Vitis-Idæa.* In parts of Scotland, *Comarum palustre.*

COW-HERB: *Saponaria Vaccaria.*

COWPEA. Fig. 1086. The American name for the cultivated forms of *Vigna catjang,* Walp (1839), and



1086 Cowpea (×⅓).
Peas natural size

Vigna sinensis, Endl (1848), two of the Leguminosæ allied to Dolichos and Phaseolus, grown for forage, and the seeds used somewhat for human food.

From Phaseolus (the common bean) Vigna differs in not having a spiral keel, and from Dolichos in its lateral introrse stigma which lies opposite to a recurved protruding terminal style beak. In other than American literature, the cowpea is known as China bean and black-eyed bean. Botanically it is a bean rather than a pea. The cowpea is a rambling tender annual, native to India and Persia. Its cultivation also extended to China at a very early date. In this country it is extensively grown in the southern states, as a hay crop for stock and as a dry shell bean for human consumption. It is also invaluable as a green-manure crop (see *Cover-crops*) Including both the true cowpeas (*Vigna sinensis*)

and the catjangs (*V. catjang*), Piper lists 270 varieties. As a class the catjangs may be distinguished from the true cowpeas by the smaller size of the seeds and pods and by the latter remaining upright throughout their growth period, never becoming strictly pendulous even after ripening. At the present time the true cowpeas are much more widely grown than the catjangs but the latter may yet come into more prominence on account of the resistance to the weevil of their small hard seeds The cowpea is to the South what clover is to the North and alfalfa is to the West. It is sown broadcast after the manner of field peas. From three to five pecks of seed are used to the acre. See Cowpeas, Farmers' Bulletin No 89, U S Dept. of Agric , by Jared G Smith; Bulletin No 102, pt. VI, and Bulletin No. 229 of the Bureau of Plant Industry, U. S Dept. of Agric ; Cyclo Amer Agric , Vol. II, p. 260. For a botanical discussion of the cowpea and its taxonomic relatives, see *Vigna*. GEO. F. FREEMAN.

COWSLIP. The true English cowslip is *Primula officinalis* The plant wrongly called cowslip in America is the marsh marigold, *Caltha palustris*. The "American cowslip" is a popular name for *Dodecatheon Meadia*. The name "Virginian cowslip" is sometimes used for *Mertensia virginica*

CRAB'S-EYE VINE: *Abrus*.

CRAB-APPLE in its widest sense means a small apple The crab-apples of botanists are particularly fruits of *Pyrus baccata* For more restricted uses of the word crab, see *Pyrus*.

CRAB-GRASS One of several names for *Eleusine indica*, also for certain Panicums, as *P sanguinale* (or *Digitaria sanguinalis*)

CRÁMBE (old Greek substantive). *Cruciferæ*. Herbs or sub-shrubs, one grown in the vegetable-garden, and one or two in the hardy herbary

Annuals, biennials or perennials, with thickened sts , and more or less fleshy lvs , glaucous lvs mostly large, more or less cut, lyrate or pinnatifid fls small, white, fragrant, in paniculed racemes fr 2-jointed, indehiscent, the lower joint st -like and seedless, the upper one globular and 1-seeded —About 20 species in Eu., Asia, and 1 in Patagonia Of easy cult.

cordifólia, Stev Excellent foliage plant, withstanding the winters in the northern states· lvs. very large and heavy, cordate and ovate, toothed, glabrous or nearly so fls small but very numerous, in great branchy panicles 5–7 ft high and nearly as broad, overtopping the mass of root-lvs Caucasus Gn 50, p. 349 Gng 4 291 —For the first 2 years from seed the plant makes only lvs ; but the third year it may be expected to bloom, after which the plant usually becomes weak and dies

maritima, Linn SEA-KALE. Perennial, smooth, stout, to 2 ft · lvs large, heavy and cut, more or less fringed or curled, glaucous green fls many, white, broad, honey-scented, in a tall panicle, in May Coasts of Eu.—Grown as a garden vegetable See *Sea-kale*.

C pinnata, Bieb Biennial small species with white fls. in an attractively slender-branched panicle Iberia —*C Kotschyana*, Boiss Perennial lvs somewhat hairy, the radical ones cordate-ovate with rounded dentate lobes, the st -lvs few, ovate-oblong, lobed. W Asia —*C tatarica*, Jacq Perennial, said to be grown in Hungary as "Tartarian bread" Glaucous, more or less rough-hairy radical lvs decompound, with linear segms Hungary, E L. H B.

CRANBERRY. A name applied to trailing species of the genus Vaccinium (*Ericàceæ*); much grown in North America for the fruit Plate XXIX

Of the true cranberries, there are two species in North America, the small (*Vaccinium Oxycoccus*), and the large (*V. macrocarpon*). The large cranberry, *V. macrocarpon* (Fig. 1087), is now cultivated on thousands of acres in the United States and this cranberry culture is one of the most special and interesting of all pomological pursuits. This cranberry grows wild only in North America, where it is native to acid swamps in the cooler parts of the United States and in Canada Here it trails its slender stems and small oval evergreen leaves over the sphagnum and boggy turf, and the firm red berries which ripen during September and October often persist on the vines till the following spring or even longer. The curve of the slender pedicel in connection with the bud just before the blossom opens, with its resemblance to the head and neck of a crane, is said to have suggested the name craneberry which is now shortened to cranberry



1087 Vaccinium macrocarpon, the common cranberry. (×½)

The low-bush cranberry, or wolfberry (*V Vitis Idæa*), is much used in Nova Scotia and other parts, and is gathered and shipped in large quantities to Boston, but it is not cultivated This berry is also common in Europe, where it is much prized The quantities of this fruit imported into the United States from various sources is considerable

The ideal bog for cranberry-culture should have the following qualifications (1) Capability of being drained of all surface water, so that free water does not stand higher than 1 foot below the surface in the growing season (2) Soil that retains moisture through the summer, for cranberries suffer greatly in drought (3) Sufficient water-supply to enable it to be flooded. (4) A fairly level or even surface, so that the flooding will be of approximately uniform depth over the entire area (5) Not over liability to frosts.

The water of the streams and pools in the acid swamps or bogs, which are the natural habitat of the cranberry, is usually, but not invariably, of a brownish or amber color, and some of the most common associate plants are the swamp huckleberry or blueberry (*Vaccinium corymbosum*), the cassandra or leather-leaf (*Chamædaphne calyculata*), the red maple (*Acer rubrum*) and the swamp cedar (*Chamæcyparis thyoides*)

There are three centers for the production of cranberries in the United States. Massachusetts, where cranberry-culture began and from which come the most berries; New Jersey second; and Wisconsin third. While the culture is in most respects similar in these three centers, each has its own characteristic methods of preparation and care of the bogs There is also an important and growing cranberry industry in Nova Scotia.

The cranberry bog. Figs. 1088–1090.

To insure success in cranberry-culture, a prime requisite is to locate the bog on soil on which wild cranberries or some of their common associate plants flourish This is usually a black peaty formation from a few inches to 7 or 8 feet in depth, overlying sand which in turn is frequently underlaid by a "hardpan" that is nearly impervious to water and the presence of which had much to do with the formation of the peat. Another requisite is to make sure of an ample supply of water, preferably of the brownish color, for winter flooding and for protection from frost in spring and fall Flooding at special times is also the safest and surest weapon against many kinds of insects

Without an ample supply of water, cranberry-culture is so hazardous as hardly to be worth undertaking.

The building of the dams is the first step necessary for the improvement of a bog A foundation for these should be made by digging a trench entirely through the peat, even if it should be 8 feet or more thick, to the clean sand, and this trench should be filled with sand free from all foreign material, above this foundation, embankments are built of clean sand and faced up with sods of live turf to prevent their being washed by the waves of the lake formed. The dams should be sufficiently high to flood the higher parts of the bog a foot deep, which will frequently make the water in the deeper parts 3 to 6 feet or more in depth Gates or flumes must be constructed at the lowest point in these dams to provide for drawing the water off the bog and provision made for surface drainage. The latter is generally accomplished by opening the natural stream, if there should be one, or by digging an open ditch through the natural drainage center of the piece



1088. A Massachusetts cranberry bog —Picking the fruit.

of land being improved. Side ditches should be dug leading into the stream, or main ditch, in sufficient number to drain off all surface water; they may be made from 1 to 3 feet deep, according to the character of the land to be drained A reservoir built above the bog is very desirable in facilitating control of the water. In frosty Wisconsin it is considered almost necessary to have three times the area of the bog in reservoir to insure the crops If a bog is situated on a stream subject to high water, provision must be made for keeping the flood water from the bog, as the crop would be destroyed if it were flooded during blooming time or seriously injured by flooding at any time during the active growing season. Winter flooding of cranberry bogs is to prevent heaving and winter-killing The water is put on about the first of December or after the vines have become thoroughly reddened by cold weather.

Cranberry bogs, being always lower than the surrounding land, are peculiarly liable to damage by frost, serious loss frequently occurring when an ordinary farmer would not dream of danger,and a good supply of water is the only preventive that has been found efficient. The time of starting growth in the spring may be controlled by the time the water is drained off, and the earlier spring frosts may so be avoided while an ample supply of water permits reflooding when a later severe frost threatens. Reflooding about the first of June, provided the water has not been withdrawn earlier than May 5 to 10, will also furnish protection from a number of damaging insects and will not injure the crop, provided care is taken that the water does not stand on any part of the bog more than forty-eight hours. If a bog should become seriously infested with insects later in the season, it is occasionally profitable to sacrifice what remains of the year's crop and clear the bog of insects by flooding This sometimes results in a greatly increased yield the following year Damage from a light frost in the fall, before the berries are picked, may be prevented by raising the water in the ditches and about the roots of the vines Protection from a heavy frost requires covering the plants with water, but this will cause immature berries to rot and should be done with great caution or the damage from water may be greater than it would have been from frost During summer the irrigation of the crop is accomplished by holding the water low or high in the ditches, as the varying season may demand.

Preparation and tillage

Before cranberries are planted, the land must be cleared of all its natural growth, the stumps and roots removed and the ground leveled to a greater or less extent The more nearly level a bog is made, so that proper drainage is provided for, the more economical it is in the use of water and the easier it is to provide the optimum amount of irrigation during the summer The first cost of such perfect leveling, however, may be prohibitive or it may require the removal of all the good peaty soil over a considerable area, leaving nothing but pure sand in which the cranberries will not grow well In many places, the removal of the natural growth may best be accomplished by cutting off the tops of the bushes and trees so that they will not extend above the surface of the water and flooding for two years, thus killing all vegetation. While this flooding entails loss of time, it is much easier and cheaper to clear away the dead roots and stumps than live ones, and when no sand is applied to the surface, as is the rule in New Jersey, it greatly lessens the expense of keeping the bog free from weeds for there are no live roots in the ground to send up suckers In some places, as in most of Wisconsin, this method of drowning out is impracticable, because the surface soil, in which are the roots of all the living plants, will separate from the more perfectly decomposed peat below and rise to the surface of the water in floating islands making death to vegetation by drowning impossible. In such situations the ground must be turfed and all roots and stumps grubbed out In either case the roots and stumps are best disposed of by piling in heaps and burning In Massachusetts, it is the custom to cover the cleared and leveled bog with 3 to 5 inches of sand, which makes it still easier to keep the bogs free from weeds and acts as a moisture-retaining mulch for the

underlying peat. Where sanding is practised, it is the custom to apply a fresh coat of sand an inch or less in depth every two or three years; this keeps the vines short and close.

Cuttings for planting are secured by mowing vigorous vines from an old bog with a scythe These cuttings, preferably not more than 8 or 10 inches long, are thrust diagonally into the surface of the bog from 12 to 14 inches apart. Not more than 3 or 4 inches of the top should be exposed, and if the bog is sanded, care should be taken that the cutting extends well into the muck below. As the vines grow they send out runners in all directions, netting the ground completely over. These sometimes grow as much as 6 feet in length and root in the soil at frequent intervals From the runners grow upright stems which, in time, cover the bog with a solid mat of vegetation The uprights are preferably not more than 6 inches high but under some soil conditions grow to a foot or more when the fruit is likely to be scanty From the time of planting, three to five years must pass before the ground is matted over and a crop may be expected



1089. A cranberry bog flooded in winter.

The character of the growth of cranberry vines precludes any cultivation in the ordinary sense of the word The care of the bogs consists in keeping them free from other plants, which is accomplished almost entirely by hand-pulling, the regulation of the irrigation water, and preventive and curative measures for the many diseases and insect enemies to which they are subject

Fertilizing of cranberries has met with considerable success in increased crops, various brands of commercial fertilizer having been employed The subject is not well understood, however, and is attracting the attention of many thoughtful growers and their scientific helpers in the state experiment stations

The pretty little pinkish white flowers of the cranberry open during June, when the bogs are not flooded, but the holding of the winter water till May throws the fullest bloom into the early part of July.

Diseases and insects.

Spraying with bordeaux mixture is very generally practised to prevent "scald," a fungous disease which has been especially injurious to the growers of New Jersey and which was so named because it was long thought to be caused by the scalding effect of the hot sun shining on berries wet with dew As it is seldom possible to run heavy spraying machinery over the bogs, spraying involves the use of very long lines of hose or the laying of pipe lines, or both, the spraying of each property being a separate engineering problem.



1090 The flume or outlet at the bottom of a cranberry bog.

Insects of many kinds attack the roots, the leaves, the blossoms and the fruit of the cranberry. Knowledge of the life history of each of these is necessary for successful warfare against it, and detailed information is best secured from the various bulletins of the United States Department of Agriculture and the agricultural experiment stations of New Jersey, Wisconsin and Massachusetts More varieties of insects may be successfully combated with water than with any other one thing, as already explained. Arsenical poisons are expensive to apply, of indifferent success in destroying insects on the bogs, and they are suspected of being an actual poison to the vines.

Varieties

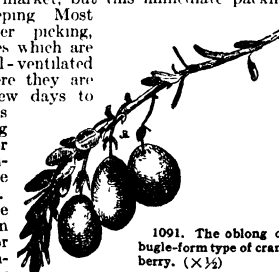
There are now many varieties of cranberries in cultivation, all of them having been selected from wild vines or vines that appeared naturally in cultivated bogs These varieties vary in shape, color, size, productiveness, time of ripening and adaptation to different soils Some of the forms are shown in Figs 1091-1093 The most generally cultivated are the Early Blacks and the Howes, both of which originated in the Cape Cod district and which together make about 50 per cent of the berries marketed from all three of the cranberry states

The Early Blacks are ready to harvest about the first of September both in Massachusetts and New Jersey, and the last of the Howes are seldom picked before the middle of October As the pickers advance over a cranberry bog, they pick clean as they go and do not go back for successive relays of ripening berries as with most other small fruits

Picking and grading

In Massachusetts most of the picking is done by a scoop, by which the berries are raked from the vines When the vines are short, the uprights not tangled, and the picker is experienced, berries can be harvested in this way very rapidly and with very little damage to either fruit or vines The bogs are kept in good condition for "scooping" by pruning every three or four years with a rake the teeth of which are knives placed about 6 inches apart. The scoop (Fig 1094) is also used to a considerable extent in New Jersey and Wisconsin but in these states a great many berries are still picked by hand

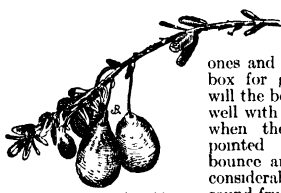
Some of the berries, especially in Massachusetts, are cleaned and packed on the bog as they are picked, and sent directly to market, but this immediate packing tends to poor keeping Most cranberries, after picking, are put in boxes which are packed in well-ventilated storehouses Here they are kept from a few days to several months and the cleaning and packing for market is done immediately before they are shipped.



1091. The oblong or bugle-form type of cranberry. (×½)

The machine which has been the standard for cleaning cranberries for many years is provided with a fan to blow away all grass, pieces of vine, dried-up berries or anything of like nature that may have gotten in the berries while being picked. The berries are then allowed to roll down a series of steps; those that are sound are elastic and will bounce like little rubber balls There are bands of cloth stretched above the steps in such a way that when a berry bounces in the right direc-

tion it is received on the cloth and slides down into the box placed for the good berries without more bouncing The rotten berries having lost their elasticity are not able to bounce over the cloth partition that separates the good from the bad. With berries that are nearly spherical and not too juicy this machine works very well, provided there are no frozen berries to be taken out Berries damaged by frost are even more elastic than sound ones and will all go into the box for good fruit. Neither will the bounce machines work well with long or oval berries; when these strike on their pointed ends they fail to bounce and there is always a considerable percentage of sound fruit found in the refuse box As there may be anywhere from ten to thirty or more steps, it is easily understood that berries going over these machines are not in the best possible condition for long keeping after they are put on the market. Some varieties of berries which are very juicy and tender can not be put through these machines at all as the steps get so sticky with the juice that the berries will not bounce.



1092. The obovoid or bell-shaped form of cranberry (×½)

In 1903, a machine was patented by Joseph J. White, which avoids the defects of the bounce machines This has since been put on the market and its use is spreading among the more careful packers of Massachusetts and New Jersey, but the more complicated machinery and greater cost have prevented its adoption by other growers This machine is provided with a hopper into which the cranberries are emptied through a screen which removes the coarser grass and vines, from the hopper the berries are fed, single file, to screw conveyors on which they are held by trough-like guards These guards do not quite touch the screw, leaving a crack through which the remaining bits of grass, vines and dried berries are dropped into a box placed below to receive them

The screw conveyor passes the berries over a series of selecting plates made of some resilient material, the best found so far being the selected spruce wood prepared for piano sounding-boards These plates are tapped by small hammers placed beneath, the strength of the blow being regulated by a thumb-screw The sound berries respond to this gentle tapping by jumping off the screw conveyor and falling on an endless belt a few inches below, which delivers all the sound fruit at one end of the machine The rotten berries do not respond to the tapping of the selecting plates and are carried to the ends of the screw conveyors where they drop in the same box under the machine that receives the fine grass and the like Frozen berries are removed by this machine nearly as well as rotten ones and the shape of the berries is of no importance, while the berries only drop twice, a few inches each time, and are in much better condition for long keeping than those that go over the bounce machines. After the berries have been cleaned by machine it is customary to place them on tables where women remove any defective berries that may have been missed by the machines.



1093. The globular or cherry-shaped cranberry. (×½)

Marketing; yield.

Most cranberries are marketed in barrels holding about 100 quarts; a few are marketed in crates three of which fill a barrel. Some dealers prefer to buy cranberries "in the chaff," that is, just as they come from the bogs without having been run through any machine. Berries sold in this way are always packed in crates and are cleaned by the dealer, a few crates at a time, as his trade calls for them; they keep better than those that have been cleaned before being shipped

Evaporated cranberries have been on the market for a number of years and are excellent, there being less difference between the sauce made from them and from fresh fruit than is the case with most kinds of fruit

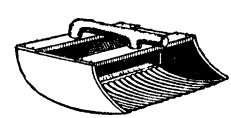
From the cranberry centers, the fruit is shipped in carload lots to the large cities of the United States, and from these distributed to the surrounding towns. There is also a small but steadily growing export trade

A bog in good bearing should yield fifty barrels to the acre, but as many as 200 barrels have been secured

In 1895 cooperative selling of cranberries was inaugurated by some of the New Jersey growers, who organized the Growers' Cranberry Co, with Joseph J White as president and Theodore Budd as vice-president This company was joined by a number of large New England growers and, though handling only 25 per cent of the crop, prospered greatly Later, A U. Chaney organized another cooperative selling company. These two companies consolidated in 1910, forming the American Cranberry Exchange, with George W. Briggs, of Massachusetts, as president. The Exchange controls about 50 per cent of the crop of the country and has been remarkably successful in securing good prices for its members while keeping the retail price as low as during the years of fiercest competition.

History.

Cranberry-culture began about a century ago in Massachusetts on the Cape Cod Peninsula William Kenrick, writing in 1832 in the "Orchardist," says that "Capt Henry Hall, of Barnstable, has cultivated the cranberry twenty years," "Mr F A Hayden, of Lincoln, Massachusetts, is stated to have gathered from his farm in 1830, 400 bushels of cranberries, which brought him in Boston market $600." In the second and subsequent editions, Kenrick makes the figure $400 It is not said whether Hayden's berries were wild or cultivated At the present day, with all the increase in production, prices are higher than those received by Hayden In the third (1841) and subsequent editions, it is said that "an acre of cranberries in full bearing will produce over 200 bushels, and the fruit generally sells, in the markets of Boston, for $1.50 per bushel, and much higher than in former years." It was as late as 1850, however, that cranberry-culture gained much prominence It was in 1856 that the first treatise appeared B Eastwood's "Complete Manual for the Cultivation of the Cranberry." About 1845, cranberry-culture began to establish itself in New Jersey



1094. Cranberry scoop, sometimes used in picking the berries.

The culture of cranberries began in Nova Scotia about thirty years ago The first attempt consisted in improving some of the patches of wild berries found growing around the central district of the Annapolis Valley. Gradually the idea was entertained of planting new areas, and as this proved successful the new industry was soon fairly established Farmers in the vicinity of Auburn soon took up the industry, and in the fall of 1892 the first carload of cranberries was shipped to Montreal Since then, Nova Scotia cranberries have met with a ready sale throughout Canada.

PRODUCTION OF CRANBERRIES IN THE UNITED STATES IN 1899 AND 1909 (13th CENSUS)

State	1899	1909
	Quarts	Quarts
New England—		
Maine	100,192	49,728
New Hampshire	30,304	31,136
Vermont	1,120	
Massachusetts	22,714,496	19,164,992
Rhode Island	34,688	209,888
Connecticut	145,408	221,472
Middle Atlantic—		
New York	327,370	348,064
New Jersey	12,072,288	7,687,072
Pennsylvania	5,728	
East North Central—		
Ohio	4,256	
Indiana	7,552	139,520
Illinois	13,418	1,696
Michigan	125,536	124,288
Wisconsin	2,549,344	3,555,136
West North Central—		
Minnesota	22,112	35,840
Iowa		1,952
Missouri	6,944	..
North Dakota	1,120	32
South Dakota	288	704
Nebraska		640
Kansas		1,152
South Atlantic—		
Virginia	18,112	
North Carolina	1,024	
East South Central—		
Alabama	96	
West South Central—		
Arkansas	288	
Mountain—		
Montana	32	
New Mexico	96	
Pacific—		
Washington	9,728	4,416
Oregon	40,864	22,784
California	10,656	
United States	38,243,060	31,600,512

Literature.

The standard books on the cultivation of cranberries are Webb's "Cape Cod Cranberries," and "Cranberry-Culture," by Joseph J White, these are old books and in many respects out-of-date The best literature on the subject is to be found in the various publications of the United States Department of Agriculture, the bulletins of the agricultural experiment stations of New Jersey, Wisconsin and Massachusetts, the proceedings of the American Cranberry Growers' Association which have been published biennially since 1880, the reports of the Cape Cod Cranberry Growers' Association, and the reports of the Wisconsin State Cranberry Growers' Association.

ELIZABETH C. WHITE.

CRANBERRY TREE: *High-bush cranberry, Viburnum Opulus.*

CRANESBILL. Loosely applied to the whole genus Geranium. In America it usually means *G. maculatum*

CRANIOLÀRIA (from a fancied resemblance of the pod to a skull or cranium). *Martyniàceæ* Coarse but interesting flower-garden annual

Wide-spreading low viscid-hairy rank forking herb lvs large, opposite, long-petioled, broadly cordate, reniform or palmately lobed· fls. white, racemed, calyx 3–5-lobed, more or less inflated, corolla very long-tubed, the tube slender and cylindrical, campanulate at the throat, more or less 2-lipped, the 5 lobes rounded and somewhat undulate, the anterior largest, perfect stamens 4, didynamous, affixed at or near the throat, ovary 1-celled: fr. a 2-valved caps. with a long incurved beak, many-seeded —Two species, Venezuela to Paraguay. Usually confused with Martynia, from which it is distinguished readily by having 4 rather than 2 fertile stamens and by the very long and slender corolla-tube which widens at the throat; the closely related Proboscidea has a much broader tube widening nearly from the base.

ánnua, Linn. (*Martýnia Craniolària,* Glox.). Two feet high: lvs. palmately lobed, the margins dentate· calyx 2-bracted, cut down one side, about one-third the length of the slender straightish corolla-tube; lobes of corolla rounded and not much undulate; style 2-lobed, equaling or slightly exceeding the 2 pairs of stamens N. S Amer —The thick fleshy root is preserved in sugar as a comfit, plant known as "Creole scorzonera" in S Amer There appears to be confusion in the seed sold as *Martynia Craniolaria;* some of it may be *M. louisiana* or other species. L. H. B.

CRÁSSULA (Latin *thickish,* referring to the thick leaves and stems) *Crassulàceæ* Fleshy and leafy greenhouse shrubs or herbs, grown for the grotesque appearance of some of the kinds and also for the bloom.



1095. Crassula quadrifida. (×½)

Variable in habit and foliage, mostly erect; rarely annual· lvs opposite, usually sessile and often connate, fleshy, very entire and the margins sometimes cartilaginous, glabrous or pubescent or scaly. fls. usually small, white, rose or rarely yellow, commonly in cymes but sometimes capitate, usually 5-merous; calyx 5-parted, the lobes erect or spreading, petals 5, free or joined at the base, erect or spreading; stamens 5, shorter than the petals; carpels 5, many-ovuled — Species 150 or more, mostly in S Afr, but a few in Abyssinia and Asia. Many species have been intro. to cult, but only a few are actually grown outside of fanciers' collections. The rocheas sometimes pass as crassulas See *Rochea.*

The genus Crassula gives the name to the order Crassulaceæ, which contains many cultivated succulent plants, and also others of widely different habit The order is closely related to the Saxifragaceæ, but differs in having the carpels of the ovary entirely free and equal in number to the petals, but the forms pass easily into the Saxifragaceæ through Francoa and Tetilla, and back again through Triactina The genera, as usually treated, are ill defined, and certain species of Sedum cross over the lines of Crassula, Cotyledon and Sempervivum, white between Crassula and Tillæa no very clear distinction can be made.

Crassulas are greenhouse plants requiring a dry atmosphere during the resting-period. While making growth, they may be treated like other greenhouse plants in the way of watering, placing them in the lightest and airiest part of the house. The pots must be drained so that any surplus moisture will easily pass through. The soil should consist of sand, loam, broken brick, and a very small quantity of leaf-soil or thoroughly rotted cow-manure Propagation is usually from cuttings Some of the species, such as *C falcata,* do not give much material for this purpose, and they should, therefore, be headed over and the tops put in dry sand in the spring, allowing water only when they show signs of shriveling The cut-over plants should

be encouraged to make side shoots, which may be rooted after they are large enough (G. W. Oliver.)

A. *Floral parts in 4's.*

quadrífida, Baker. Fig. 1095. Perennial. lvs oblong-spatulate, the upper ones rounder, decussate: fls. with their parts in 4's, panicled, white, tinged red. Cape.

AA. *Floral parts in 5's, which is considered to be normal in the genus.*

B. *Lvs petioled.*

cordàta, Soland. Plant slender and shrubby, 1–3 ft., erect or diffused and sometimes rooting at the joints: lvs dotted, stalked, cordate-reniform, obtuse, entire, glabrous cymes panicle-like; fls. reddish, sometimes pure white; petals free, lanceolate, spreading. Cape Winter.—Closely allied to *C. spathulata.*

spathulàta, Thunb. Somewhat shrubby, more slender and trailing than *C. cordata,* decumbent, branching: lvs stalked, roundish, crenate, glabrous, shining above: corymbs panicle-like; fls rosy or flesh-colored: petals acute Cape L B C 4:359 as *C cordata*).—Likely to be cult. as *C. cordata*

BB. *Lvs not petioled (or only tapering to base).*

C. *Foliage glaucous.*

falcàta, Wendl (*Ròchea falcàta,* DC) Height 3–8 ft : lvs. grown together at the base, thick, glaucous, oblong, falcate. fls small, numerous (50 or more), in a crimson, rarely white, dense, terminal corymb; corolla-tube ¼in. long, as long as the limb or shorter. Cape. B M. 2035.

CC. *Foliage not glaucous.*

láctea, Soland. Plant shrubby, branching, tortuous below, 1–2 ft · lvs narrow-obovate, acutish or acuminate, narrowed and grown together at the base, glabrous, spotted along the margin. cymes panicle-like, many-fld , fls. white, small Cape Winter. B M 1771 L.B C. 8·735 —A free-flowering window plant of easy cult. There is a form with variegated lvs. Differs from *C. arborescens* in the narrower acute lvs that are more tapering at base, and in the color of the fls

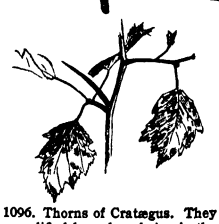
arboréscens, Willd. Fleshy erect shrub, reaching 8–10 ft. lvs. roundish-obovate and obtuse, tapering to base, fleshy, flat and glaucous, dotted above, the edges smooth. fls rather large, rose-colored, in trichotomous panicled cymes Cape B M 384 (as *C Cotyledon*).

C atrosanguínea, Barbey Erect, 12-20 in , rigid st reddish, branched at top lvs aloe-like, straight or recurved, glabrous, narrowed from base to apex, often 8 in long, rosulate and on the st fls dark red, in a dense terminal many-fld cluster Transvaal — *C coccínea* Linn =Rochea coccinea —*C conglóta,* N. E Br Only 3½ in high lvs thick and fleshy, ovate-lanceolate fls numerous, densely crowded in a sessile terminal head, the petals scarcely ½in long, white S Afr —*C conjuncta,* N E Br. Lvs concave fls pure white in a compact narrow cluster S Afr — *C decípiens,* N. E Br Dwarf tufted perennial lvs densely covered with blunt papillæ or nipple-like projections, fleshy, oblong fls very small, white, in terminal 3-branched cymes S Afr (?) —*C jasmínea,* Ker-Gawl—Rochea jasminea — *C sedifólia,* N E Br Only 1–2 in. high when in bloom lvs in small tufts at the base and 3 or 4 pairs on the flsts , bright green, ciliate, with red-brown spots along the margin fls white, 3–9 together in terminal cymes S Afr.— *C variábilis,* N E Br Plant 3–6 in high, branched at base lvs in 4 rows, densely imbricated, ovate, small (½in or less long), ciliate on margin fls white, or red outside, 5–7 in small cymes disposed in a narrow terminal panicle. S. Afr. L. H. B.†

CRÁTÆ-MÉSPILUS: *Cratægus grandiflora.*

CRATÆGO-MÉSPILUS. This name has been bestowed on a graft hybrid between *Cratægus monogyna* and *Mespilus germanica,* discovered in 1894 in the garden of M. Dardar at Bronvaux near Metz, Germany. Like *Laburnum Adamı,* which is probably the best known of the graft hybrids, it produces at the same time branches intermediate in their characters between the parents and branches resembling more or less closely the parent plants Two distinct forms produced on different branches of the parent tree have been prop. and distributed under the names *C Dárdari* and *C. Asnierèsıı.* The first form (*C. Dárdari,* Simon-Louis), has the lvs. and the frs. very similar to those of the medlar, but the branches are spiny, the fls appear in corymbs, are distinctly pedicelled and have 15–20 stamens and the frs. have only 1–3 stones, measure ½–¾in across, and are crowned by persistent upright connivent calyx-lobes M D G. 1912 101. The second form, *C Asnierèsıı,* Schneid. (*C Jules d'Asnières,* Simon-Louis) resembles more *Cratægus monogyna,* but is pubescent; the lvs on the flowering branchlets are usually oval to obovate and often entire, while those of the shoots are ovate or rhombic-ovate and usually with 1 to 3 rounded or rarely acute lobes on either side; the fls are borne in pubescent, 6–12-fld corymbs, have 20 stamens and 1–2 styles; the fr is subglobose and less than ½in. across G C III. 50 183, 185 Gn. 75, p 310. M D G 1912 100.—While *C Dardari* is botanically more interesting, *C Asnieresıı* is more ornamental and forms a handsome small tree with gracefully arching branches studded with numerous fl -clusters. It is prop. by budding or grafting like the horticultural varieties of Cratægus ALFRED REHDER





1096. Thorns of Cratægus. They are modified branches, being in the axils of leaves; sometimes, as in the lower figure, some of the short branches bear leaves.

CRATÆGUS (ancient Greek name, derived from *kratos,* strength, on account of the hardiness of the wood) *Rosàceæ,* subfam. *Pòmeæ* CRATEGUS HAWTHORN Woody plants grown for their handsome foliage, attractive flowers and decorative fruit which, in a few species, is edible, and also for their picturesque habit: very valuable for ornament

Shrubs or small trees, usually spiny. lvs alternate, deciduous, stipulate, serrate, often lobed or pinnatifid: fls white, in some varieties red, in corymbs, rarely solitary, petals and calyx-lobes 5, stamens 5–25, usually 10 or 20; styles 1–5 fr a drupe-like pome, with 1–5 1-seeded bony stones —A large genus, widely distributed in the temperate regions of the northern hemisphere, most abundant in N. Amer., where between 800 and 900 species have been described, while from the Old World only about 60 species are known. There exists no recent monograph of the genus, a systematic enumeration of the arborescent American species will be found in Sargent, "Manual of the Trees of North America," pp 363–504, of the species of the southern states in Small, "Flora of the Southeastern United States," pp 532–569; and of the species of the northeastern states in Gray's Manual, ed 7, p 460 79, and in Britton and Brown, Ill. Flor (ed 2) 2.294–321; for the species cult in European gardens, see Lange, "Revisio Specierum Generis Cratægi" (1897), quoted below as Lange.

The hawthorns are hardy ornamental shrubs and trees, mostly of dense and low growth, with handsome foliage, turning, in most species, to a brilliant coloring in the fall Almost all have attractive white flowers, pink or crimson in some varieties of *C. Oxyacantha* and *C. monogyna* Most of the species have very decorative fruit which in *C. Phænopyrum, C nitida, C. viridis, C*

fecunda, C pruinosa, C Carrierei, C persistens, C Oxyacantha, C. monogyna and others persist on the trees until late into the winter, while some species, as *C Arnoldiana*, ripen their large fruits, which soon drop, in August, also *C dahurica, C sanguinea* and the black-fruited *C nigra* ripen about the same time, and *C. submollis* only a little later, but the earliest of all is the southern *C. æstivalis*, which ripens its fruits in May. This and the blue-fruited *C brachyacantha* are among the most decorative hawthorns for the southern states. The fruit of *C æstivalis*, and that of *C. mexicana* is made into preserves and jellies; also the fruits of the Molles group are suited for jelly-making, and in South Carolina an excellent jelly similar in quality and taste to Guava jelly is made from the fruits of some species of the Flavæ group In Europe, *C monogyna* and *C. Oxyacantha* are counted among the best hedge plants; also many American species like *C Phænopyrum, C. Crus-galli* and possibly *C macracantha, C intricata, C. pastorum, C rotundifolia*, may be used for hedges, but they are stronger growers and cannot be pruned so closely as the European species The hawthorns grow well in exposed positions and as a rule do not like much shade, they are not particular as to the soil, but grow best in limestone soil, also in a rich, loamy, somewhat moist one, and even in strong clay Propagated by seeds, sown in fall or stratified, before stratifying, most of the pulp may be removed by laying the fruits in shallow piles and allowing them to decay Then they are mixed with sand or sifted soil and buried in the ground or kept in boxes in a cool cellar The young plants should not be allowed to remain over one year in the seed-beds, as they form long tap-roots and are then difficult to transplant Varieties and rarer kinds are easily budded or grafted on seedling stock of *C. Oxyacantha*, or other common strong-growing species.

The spines of crategus are modified branches (see Fig 1096) The fruits are pomes (Fig 1097), with structure similar to that of the apple

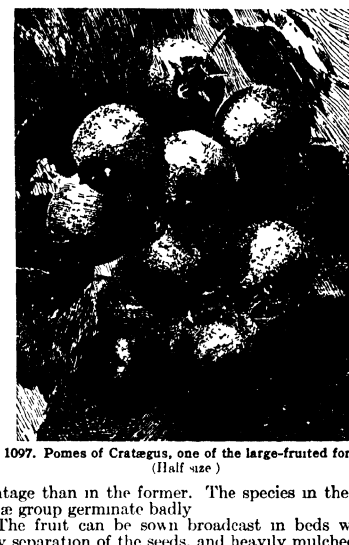
ALFRED REHDER.

The American hawthorns are highly ornamental subjects for the planting of parks and private estates The showy flowers in spring and early summer, the conspicuous red, crimson, and scarlet fruits of nearly all of them, which extend amongst the different species from August to early winter and midwinter,—and some of the species markedly retain their fruits without shrinkage of pulp or loss of color until early winter,—the absolute hardihood, and the bold rugged branching habits characteristic to most of them, make them very interesting objects when their leafless forms are outlined in a winter landscape The landscape gardener cannot make any mistake in planting them in liberal quantities in private estates or public parks

They are easily transplanted They are much benefited by liberal pruning when transplanted from nursery rows or from the woodland The side branches should be pruned in severely, and as the centers of good-sized plants are likely to be full of intricate and congested branches, these should be carefully thinned In a young state they should be grown to one stem whether they are arborescent or shrubby species Under this treatment they make beautiful garden plants

The American hawthorns are almost invariably found growing in heavy limestone clay. They may occasionally overlap into sandy soil. In planting them in sandy soil, it should be liberally enriched with well-rotted manure, and they should be kept well mulched.

The seeds of all of the species of American hawthorns germinate slowly None of the species germinates before the second year after sowing, and many of the seeds in the same "flat" will not germinate before the third year. In many instances, part of the seeds germinate the second year, and the remainder the third The seeds of *Cratægus genesecensis* have been known to be dormant for three years, and all come up thickly at the same time. In some of the groups the seeds of the species germinate more freely than in others The species in the Molles, Flabellatæ and Tomentosæ groups germinate abundantly. The germination of the species in the Pruinosæ group have a much lower per-



1097. Pomes of Cratægus, one of the large-fruited forms. (Half size)

centage than in the former. The species in the Intricatæ group germinate badly

The fruit can be sown broadcast in beds without any separation of the seeds, and heavily mulched until the spring of the second year, when the mulching should be removed This method, however, is not considered good, and has been given up The best way is to soak the fruits in water, and by maceration the seeds or nutlets are separated from the pulp, and the seeds will sink to the bottom of the tub or vessel The seeds are then dried in the sun as they can then be handled easily They are sown in "flats" of convenient size to handle, and piled up in the corner of the shade house and fitted tightly above each other to prevent mice getting at them During this period of rest they must not be allowed to become dry In the spring of the second year they are spread out to allow the seeds to germinate Numbered zinc tags are nailed on the "flats" and the corresponding numbers with the names of the species are recorded.

The American hawthorns can be grafted readily on potted seedling stocks in the greenhouse in winter, any of the species in the Crus-galli group being good to use They are grafted at the crown This, however, is an unnecessary operation. All of the species of American hawthorns (and there are over 900 of them) come absolutely true from seed, and whilst they germinate slowly, they start to grow rapidly into plants of good stocky size from about two years after they germinate.

Some of the species of American hawthorns have highly colored foliage in the fall. The species in the Pruinosæ, Mediximæ and Intricatæ groups have perhaps the most highly colored foliage Notable examples are *Cratægus opulens, C diffusa, C maineana, C. dissona, C. cognata, C conspecta, C promissa, C. exornata, C. perjucunda, C fœtida*, and *C verecunda*.

The different species vary greatly in the time of ripening their fruits and in the period of duration. In many instances the fruit drops soon after ripening and in others hangs on for a long period A selection

of twenty-six species that would give a good fruit display from August until early or mid-winter, would be as follows: *Cratægus matura, C. præcox, C. Arnoldiana, C. Dayana, C Robesoniana, C. pedicellata, C. gloriosa, C. Ellwangeriana, C laula, C. submollis, C. champlainensis, C arkansana, C. Dunbari, C ferentaria, C. opulens, C. compta, C gemmosa, C. livoniana, C geneseensis, C. persimilis, C. maineana, C. Barryana, C. coccinioides, C. leiophylla, C durobrivensis,* and *C. cordata.* (See pp. 887–889 for some of these.)

JOHN DUNBAR

INDEX.

acerifolia, 1, 40
æstivalis, 28
albo-plena, 46
apiifolia, 41, 48
aprica, 32.
arborescens, 17
Arduennæ, 22
arkansana, 2
Arnoldiana, 3
Aronia, 49
aurea, 26, 45
Azarolus, 49.
Barryana, 8
bicolor, 45
Boyntonii, 16
brachyacantha, 42
Brettschneideri, 50
Bruantii, 46
Buckleyi, 15
californica, 50
Calpodendron, 33
Canbyi, 20
carpathica, 43.
Carrierei, 23
Chapmanii, 33
chlorocarpa 38
coccinea, 1, 6, 7, 13, 35, 45
coccinioides, 9.
collina, 27
cordata, 40
crocata, 26
Crus-galli, 19.
dahurica, 39
Douglasii, 35, 37.
Ellwangeriana, 5.
fecunda, 21.
ferox, 46
filicifolia, 46
flava, 31.
florida, 29
glandulosa, 13
Gumpperi, 45.
hypolasia, 25
inermis, 19, 46.
intricata, 14
Koroikowii, 50.
laciniata, 46
Lavallei, 23
leucophlæos, 33.
linearis, 19
lobata, 31
lucida, 19
macracantha, 34, 35
macrosperma, 12.
major, 50
Marshallii, 41.
maura, 49.
media, 45
melanocarpa, 44.
mexicana, 25.
mollis, 1, 4
monogyna, 46.
nana, 19.
nigra, 43
nitida, 18.
odoratissima, 48.
orientalis, 48
ovalifolia, 19.
Oxyacantha, 45, 46.
parvifolia, 29
pastorum, 12.
Paulii, 45
pedicellata, 11.
pendula, 46.
pennsylvanica, 19.
pentagyna, 44
persistens, 24
Phænopyrum, 40.
pinnatifida, 50.
populifolia, 40.
pruinosa, 7.
prunifolia, 36.
ptericifolia, 46.
pubera, 13.
punctata, 26.
punicea, 46
purpurea, 39
pyracanthifolia, 19.
pyramidalis, 46.
pyrifolia, 33
quercifolia, 45.
Robesoniana, 6.
rosea, 46
roseo-pendula, 46.
rotundifolia, 13.
rubro-plena, 46.
salicifolia, 19.
sanguinea, 37, 38, 39, 48
semperflorens, 46.
sinaica, 49.
speciosa, 10.
spissiflora, 6.
splendens, 19.
stricta, 46.
submollis, 4.
succulenta, 34.
tanacetifolia, 47.
tatarica, 50.
tiliifolia, 1.
tomentosa, 29, 33.
Tournefortii, 48.
uniflora, 29.
Vallæ, 30.
variegata, 36.
viridis, 17.
xanthocarpa, 26, 38.

KEY TO THE SPECIES.

A. *Veins of the lvs extending to the points of the lobes or to the teeth only, lvs. usually slightly or not lobed fr. not black or blue, except in No 37*
B. *Stones plain on the inner surfaces.*
C. *Petioles elongated, usually slender.*
D. *The petioles glandular at the apex or sparingly glandular throughout.*
E. *Corymbs many-fld. petioles glandular only at the apex· lvs broad at the base, truncate to broadly cuneate*
F. *Lvs tomentose or pubescent beneath, at least on the veins.*
G. *Stamens 20, anthers pale yellow: lvs thick and leathery*
H. *Fr. ripening in Aug. and Sept · lvs. broadly ovate* . 1. **mollis**
HH. *Fr. ripening at the end of Oct. lvs. oblong-ovate to oval..* . 2. **arkansana**
GG. *Stamens 10 lvs membranous at maturity*
H. *Anthers yellow.*
I *Fr crimson, villous, ripening the middle of Aug · lvs dark green and smooth above* 3. **Arnoldiana**
II. *Fr. orange-red, lustrous, puberulous at the base lvs dark yellowish green, scabrate above* 4. **submollis**
HH *Anthers rose-color. lvs. scabrate above*
I. *Plant a tree. lvs with short lobes corymbs many-fld* . 5 **Ellwangeriana**
II *Plant a shrub· lvs rather deeply lobed· corymbs 4–6-fld.* 6 **Robesoniana**
FF. *Lvs. glabrous beneath or nearly so*
G. *Fr bloomy until nearly fully ripe*
H *Stamens 20 lvs glabrous fr. subglobose, often 5-angled* 7 **pruinosa**
HH. *Stamens 10 lvs. scabrate above, while young fr obovoid* 8 **Barryana**
GG *Fr. not bloomy*
H *Stamens 20, anthers pink lvs truncate at the base*
I. *The lvs dull above, villous beneath when young fr with conspicuous calyx and with red flesh* 9 **coccinioides**
II *The lvs lustrous above, quite glabrous fr with yellow flesh and small calyx* 10 **speciosa**
HH *Stamens 5–10 lvs broadly cuneate*
I *Anthers pink or rose-purple, stamens usually 10*
J *Calyx-lobes coarsely glandular-serrate stones usually 5 lvs distinctly lobed* 11 **pedicellata**
JJ *Calyx-lobes entire or obscurely serrate stones 2–3 lvs slightly lobed* 12 **pastorum**
II. *Anthers yellow, stamens 5–10 lvs orbicular-ovate fr with 2–3 stones* 13 **rotundifolia**
EE. *Corymbs usually few-fld petioles sparingly glandular throughout lvs cuneate at the base· stamens 10*
F. *Calyx-lobes glandular-ciliate corymbs slightly villous anthers yellow* 14 **intricata**
FF. *Calyx-lobes entire or glandular above the middle corymbs glabrous*
G. *Anthers purplish calyx-lobes glandular above the middle* 15 **Buckleyi**
GG. *Anthers yellow calyx-lobes without glands* 16 **Boyntonii**
DD. *The petioles glandless or with a few minute glands lvs cuneate at the base, ovate to lanceolate, not or very slightly lobed, lustrous above, glabrous at maturity stamens 20.*
E. *Fr subglobose, ¼in across or less, bright scarlet or orange lvs oblong-obovate to ovate* 17 **viridis**
EE. *Fr ovoid, about ½in across, dull brick-red, bloomy lvs lanceolate to oblong-obovate* 18 **nitida**
CC. *Petioles short, lvs. cuneate at the base, not or very slightly lobed.*
D. *The petioles glandless*
E. *Corymbs many-fld*
F. *Lvs dark green and shining above.*
G. *Stamens 10· under side of lvs glabrous or nearly so*

HH. *Anthers rose-color or purple*
I. *Fr. glabrous corymbs glabrous.*
J. *Shape of lvs cuneate-obovate to oblanceolate fr. dull red, stones usually 2* 19. **Crus-galli**
JJ. *Shape of lvs oblong to ovate. fr. crimson, lustrous; stones 3–5* 20 **Canbyi**
II. *Fr villous until nearly fully grown lvs oblong-obovate to broadly ovate: corymbs slightly villous.* 21. **fecunda**
HH. *Anthers yellow· lvs obovate fr. dull dark crimson* . . . . . .22. **Arduennæ**
GG. *Stamens 20*
H. *Under side of lvs villous corymbs densely pubescent* 23. **Carrierei**
HH *Under side of lvs glabrous corymbs slightly pubescent* 24. **persistens**
FF. *Lvs dull above stamens 20.*
G *Fr juicy, edible lvs cuneate-oblong or elliptic-lancolate, tomentose beneath* 25. **mexicana**
GG. *Fr dry, mealy lvs obovate or oval*
H. *Length of lvs 2–4 in, pubescent beneath fr. ovoid, ½–1 in long, with large dots* 26. **punctata**
HH. *Length of lvs 1½–2 in, at maturity hairy only on the midrib beneath fr globose, ½–½in across, with small dots* 27. **collina**
EE. *Corymbs few-fld lvs ½–2 in long, pubescent beneath· stamens 20–25*
F. *Fls with or before the lvs · fr. ripening in May, juicy, bright red lvs 1½–2 in. long* 28 **æstivalis**
FF. *Fls after the lvs fr ripening very late, dry, dull red or yellow lvs less than 1½ in long*
G *Lvs obovate, mostly obtuse, crenately serrate· fls usually solitary* 29 **uniflora**
GG *Lvs oval or ovate, acute, serrate and often lobed. fls 2–6* 30 **Vailiæ**
DD. *The petioles, margin of lvs and corymbs densely glandular: corymbs 3–7-fld*
E *Stamens 20, anthers purple: fr. ovoid* . . .31. **flava**
EE *Stamens 10* [lobata
F *Fr pyriform anthers purplish* 31 **flava** var.
FF *Fr globose anthers yellow* 32 **aprica**
BB. *Stones with furrows or irregular cavities on the inner surfaces; fr. lustrous, soft at maturity.*
C. *Lvs. not or only slightly lobed.*
D. *Color of fr scarlet or orange; stones 2–3 lvs with impressed veins.*
E. *Fr small, ovoid or pear-shaped, upright, orange-red lvs thin, dull above, pubescent below* 33. **tomentosa**
EE. *Fr subglobose, larger, nodding, scarlet lvs subcoriaceous, pubescent only on the veins beneath*
F *Anthers rose-color; stamens usually 20* 34 **succulenta**
FF. *Anthers yellow, stamens 10.*
G. *Foliage glabrous below· stones deeply grooved on the inner surface* 35 **macracantha**
GG. *Foliage usually pubescent on the veins below while young stones slightly grooved* 36. **prunifolia**
DD. *Color of fr black, nutlets 5 lvs broadly elliptic to obovate, glabrous (see also No 42 with blue frs)* 37. **Douglasii**
CC. *Lvs more or less distinctly lobed*
D *Length of lvs more than 2 in lvs pubescent fr nearly ½in across* 38 **sanguinea**
DD. *Length of lvs less than 2 in. lvs. quite glabrous fr ⅓in or less across* 39 **dahurica**
AA. *Veins of the lvs extending to the points of the lobes and to the sinuses, lvs. usually distinctly lobed*
B. *Fr. very small, ⅓in long or less, red: calyx deciduous*
C. *Lvs triangular-ovate, with shallow and broad lobes, often 3-lobed fr. subglobose, lustrous, nutlets 3–5.* 40 **Phænopyrum**
CC. *Lvs ovate, deeply 5–7-lobed fr. ovoid, nutlets 1–3* . . 41. **apiifolia**
BB. *Fr larger calyx-teeth persistent.*
C. *Color of fr. black or blue*
D. *The fr blue, bloomy lvs obovate to obovate-oblong, crenate-serrate, usually not lobed* 42. **brachya-**
DD. *The fr. black, stones with cavities on the inner surfaces* [cantha
E. *Lvs with about 5 pairs of lobes fr lustrous, subglobose, juicy* 43 **nigra**
EE. *Lvs with 2–3 pairs of lobes fr ovoid, dull black or purplish black* 44 **pentagyna**
CC. *Color of fr red or yellow*
D. *Stones with cavities on the inner surfaces, 1–2*
E. *Styles 2 lvs 3 5-lobed with short and broad serrulate lobes* 45 **Oxyacantha**
EE. *Style 1 lvs deeply 3–7-lobed, with acute, entire or sparingly toothed lobes* 46 **monogyna**
DD. *Stones plain on the inner surfaces, 2–5*
E. *Branchlets and lvs. pubescent.*
F. *Lvs with glandular toothed lobes, pubescent* 47. **tanacetifolia**
FF. *Lvs not glandular-toothed, lobes often nearly entire*
G. *Upper surface of lvs dull, pubescent, under surface villous* 48 **orientalis**
GG. *Upper surface of lvs glabrescent, lustrous, under surface finely pubescent* 49 **Azarolus**
EE. *Branchlets glabrous lvs deeply lobed, glabrous.* . 50. **pinnatifida**

1. Molles.

1. **mŏllis,** Scheele (*C tŭrifŏlia,* Koch *C. acerifŏlia,* Hort. *C coccínea* var *mŏllis,* Torr & Gray) Tree, to 30 ft, with short, stout thorns: lvs. broadly ovate, sharply and doubly serrate and with 4–5 pairs of short acute lobes, densely pubescent beneath, 3–4 in long corymbs densely villous-pubescent; fls with red disk fr about ½in across, usually pear-shaped, scarlet, more or less pubescent, with thick mealy flesh and 4–5 stones. April, May fr end of Aug, Sept Ohio to S Dak. and Kans S S 13·659 Em 494 (as *C tomentosa*) G F 5 221 —One of the most decorative species, with large, bright green foliage and showy fls and frs, ripening in Sept, but dropping soon after maturity.

2 **arkansāna,** Sarg. Tree, to 20 ft.: branches widespreading, forming an irregular open head, unarmed or

with straight spines ½–½in. long: lvs oval or oblong-ovate, acute, truncate or broadly cuneate at the base, serrate and with 3–4 pairs of short lobes, pubescent on both sides at first, at maturity dull dark green and glabrous above, villous on the veins below, 2–3 in. long; corymbs villous; fls. nearly 1 in. across: fr. ovoid, bright crimson, slightly villous at the ends, ¾–1 in. long, with thick subacid flesh and usually 5 stones.



1098. Cratægus Arnoldiana (×⅔) No 3

May; fr. end of Oct, falling gradually Ark S S. 13·660.—Very handsome in autumn with its abundant brilliant frs. persistent for some time; the lvs. turn clear yellow

3. **Arnoldiàna,** Sarg. Fig. 1098 Tree, to 20 ft., with stout ascending branches forming an open head with zigzag branchlets, armed with stout spines 2–3 in. long lvs broadly ovate to oval, acute, truncate to broadly cuneate at the base, doubly serrate and with many shallow broad lobes, at first hairy above and soft-pubescent below; later smooth, dark green and lustrous above, slightly villous on the veins below, 2–3 in long. corymbs tomentose; fls. ¾in across· fr subglobose, bright crimson, villous toward the ends, ¾in long, with thick subacid flesh and 3–4 stones May; fr. middle of Aug, soon falling. Mass S S 13·668.

4 **submóllis,** Sarg Tree, to 25 ft, with ascending or spreading branches forming a broad handsome head. spines numerous, thin, usually straight, 2–3 in. long: lvs ovate, acute, broadly cuneate at the base, doubly serrate and with 3–4 pairs of acute short lobes, scabrous above, below at first soft-pubescent, later only puberulous on the veins, 2–3 in long· corymbs tomentose; fls 1 in across· fr pear-shaped or ovoid, bright orange-red and lustrous, ¾in long with persistent erect calyx; flesh yellow, mealy; stones usually 5 May; fr. early in Sept, soon falling Que. to Mass and E N. Y S.S. 4:182 (as *C. mollis*).

5 **Ellwangeriàna,** Sarg Tree, sometimes to 20 ft, with stout ascending branches forming a broad symmetrical head, and with zigzag branchlets lvs. oval, acute, rounded or broadly cuneate at the base, coarsely and often doubly serrate with many short acute lobes, at first hairy above and villous below on the veins, later scabrous and light green above, nearly glabrous below, 2½–3½ in. long· corymbs densely villous; pedicels short; fls. 1 in. across: fr. ovoid, bright crimson, very lustrous, slightly villous at the ends, 1 in long, with thin yellow acid flesh and 3–5 nutlets. May, fr at the end of Sept, soon falling. N. Y. and Ont to Mich, south to W. Pa. S S. 13:671. G.C. III. 47:130. A F. 24:325. F E. 33:488.

6. **Robesoniàna,** Sarg. (*C. spissiflòra*, Sarg.) Shrub, with numerous erect sts, to 12 ft., or occasionally small tree, to 20 ft. spines few, stout, 1–1½ in long: lvs oblong-ovate, acute, or acuminate, rounded or broadly cuneate at the base, sharply doubly serrate with many broad acute lobes, pubescent below on the veins while young, glabrous at maturity, scabrate above, 2–3 in. long· corymbs pubescent, 4–6-fld, compact, calyx villous, lobes glabrous outside fr. ovoid, scarlet, ¾in. long, with small calyx; flesh thin, mealy; stones 4–5. May. fr. Sept, soon falling. N. Y. to S Ont —This species was formerly sold by Ellwanger & Barry under the name *C. coccinea.*

2 PRUINOSÆ.

7 **pruinòsa,** Koch (*C coccínea* var. *víridis*, Torr & Gray) Shrub or tree, to 20 ft branches spreading with numerous stout straight spines lvs elliptic or ovate, acute, usually broadly cuneate at the base, irregularly and often doubly serrate, with 3–4 pairs of short acute lobes, red when unfolding, later dark bluish green above, paler below, glabrous, 1–2 in long. corymbs rather few-fld, fls slender-pedicelled, ¾–1 in across; stamens 20, anthers pinkish· fr subglobose, apple-green and glaucous until nearly fully ripe, finely dark purple with yellow sweet flesh and 5 stones calyx prominent with a well-developed tube. May; fr. Oct. Vt to Va, and Ill S S 13.648

8 **Barryàna,** Sarg Shrub, to 15 ft · branches spreading or ascending with slender spines lvs broadly ovate, rounded or abruptly cuneate at the base, sharply doubly serrate and slightly lobed, scabrate above, glabrous and glaucous below, 2–3 in long corymbs glabrous, calyx-lobes entire or sparingly dentate, fls. ¾in across, stamens 7–10, with purple anthers fr obovoid, crimson with small pale dots, pruinose, ¾in. long, with usually 3 nutlets. May; fr. in Oct. W. N Y.

3 DELTOIDES

9 **coccinioides,** Ashe Fig 1099 Tree, sometimes 20 ft branches stout, spreading, forming a broad handsome head spines thick, 1½–2 in long. lvs. broadly ovate, acute, rounded or truncate at the base, doubly serrate, with several pairs of broad acute lobes, at first yellowish green and lustrous above, villous on the veins beneath, later dull dark green above, paler and nearly glabrous beneath, 2–3 in. long fls ¾in. across, in compact 5–7-fld, sometimes slightly villous corymbs: fr subglobose, dark crimson and lustrous, ¾in across, with thick subacid reddish flesh and 4–5 stones May; fr early in Oct and falling gradually Mo, Ind, and Kans S S 13 674 M D G 1901 358, 359 —Very handsome small tree, the foliage tinged red when unfolding and turning scarlet and orange in autumn

10 **speciòsa,** Sarg Shrub, to 15 ft, usually with many sts spines numerous, 1–2 in long lvs ovate, acute or acuminate, rounded or subcordate at the base, doubly serrate and with 4–5 pairs of broad and short acute lobes, tinged red when unfolding and nearly glabrous, at maturity thick, dark green and lustrous

above, paler below and quite glabrous, 2-3 in. long: corymbs glabrous, 5–8-fld, fls 1 in across fr depressed-globose, bright crimson and lustrous, nearly 1 in broad, with thin yellow flesh and 5 stones May; fr the middle of Sept, soon falling Mo. S T S 1 33 —Very handsome with its lustrous lvs., large fls and brilliant fr.

4 Coccineæ.

11 **pedicellàta,** Sarg Tree, to 20 ft, with rather slender spreading or ascending branches forming a symmetrical head: spines straight or slightly curved, 1½–2 in long: lvs broadly ovate, broadly cuneate or truncate at the base, coarsely and often doubly serrate, above the middle with 4–5 pairs of short acute lobes, at maturity membranous, dark green and scabrous above, paler and nearly glabrous below, 2–4 in long fls ½in across in loose slightly villous corymbs; calyx-lobes coarsely glandular-serrate fr pear-shaped or ovoid, bright scarlet, lustrous, with conspicuous persistent calyx, flesh thin, mealy, stones 4–5 May, fr. Sept Pa to Conn, N Y, and Ont. S S 13.677.

5. Tenuifoliæ.

12 **pastòrum,** Sarg (*C macrospérma* var. *pastòrum,* Eggleston) Glabrous shrub, sometimes to 15 ft, with many erect sts, armed with numerous stout or slender spines lvs ovate, acute, usually rounded at the base, doubly serrate, slightly lobed, at maturity thick, dark dull blue-green, glaucescent below, 1½–2 in long: fls. ¾in across in many-fld corymbs, calyx-lobes lanceolate, entire or obscurely serrate fr ovoid, bright scarlet, lustrous, about ½in long, with thick, yellow and mealy flesh and 2-3 stones New England. May; fr Sept S S 4·180 (as *C coccinea*).

6 Rotundifoliæ.

13 **rotundifòlia,** Moench (*C coccínea* var *rotundifòlia,* Sarg *C glandulòsa,* Willd) Shrub or bushy tree, sometimes to 20 ft, with slender, straight or curved spines lvs ovate-orbicular to oval, or obovate, acute, broadly cuneate at the base, rather coarsely serrate and usually with 3–4 pairs of short acute lobes, glabrous, 1–2½ in long corymbs glabrous or slightly villous, fls ¾–1 in across, calyx-lobes and bractlets very glandular fr subglobose, about ½in long, red with yellow sweet flesh and 2–3 stones May, fr Sept Nova Scotia to Sask, Ill and Va G C II 14 557 Gn 22, p 115, 33, p 464 —The most northern species Var **pùbera,** Sarg (*C coccínea,* Linn, in part) Branchlets, petioles and the lvs on the veins more or less pubescent below while young

7 Intricatæ

14 **intricàta,** Lange Shrub, to 10 ft., branches upright or spreading, with rather long curved spines lvs elliptic-ovate, acute, cuneate at the base, doubly serrate with 3–4 pairs of short acute lobes, at first slightly pubescent, later scabrate above, bright green, slightly paler beneath and nearly glabrous, 1–2½ in long corymbs slightly villous, fls about 1 in. across, calyx-lobes serrate: fr subglobose to ovoid, sparingly villous or glabrous, dull reddish brown, with usually 3–4 stones May, fr Oct, Nov Mass and Vt to Pa Lange 1.

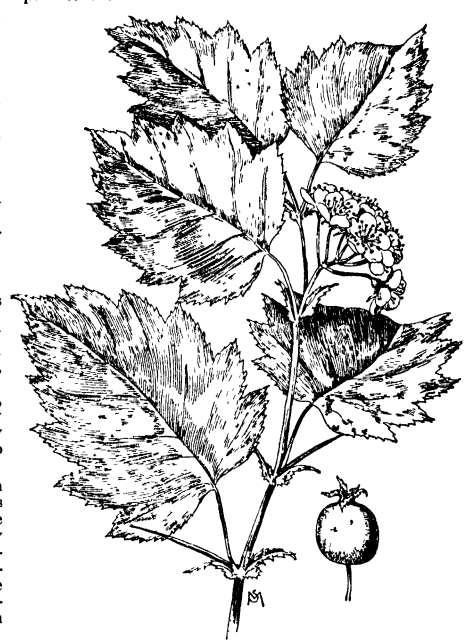
15 **Búckleyi,** Beadle Large shrub or tree, often to 25 ft, with stout spreading or ascending branches and stout straight spines ½in long: lvs broadly ovate or oval, acute, usually rounded at the base, coarsely serrate and incisely lobed with acuminate lobes, glabrous and thick and firm at maturity corymbs 3–7-fld, compact, glabrous, fls. ¾in across; sepals serrate toward the apex and stipitate-glandular fr subglobose, usually angled, about ½in across, yellowish green and flushed red or red, with 3–5 stones May; fr Sept and Oct Va to N. C and Tenn S.M 464

16 **Boyntonii,** Beadle. Tree, occasionally to 20 ft, with stout ascending branches: spines straight, thin, 1½–2 in. long. lvs broadly ovate to oval, acute, sharply serrate with glandular teeth and often with 2–3 pairs of short acute lobes, bronzy red when unfolding and slightly viscid, at maturity yellowish green, thick and firm and glabrous, 1–2½ in long, petioles glandular: fls ¾in across, in 4–10-fld glabrous corymbs, calyx-lobes entire or obscurely glandular-serrate above the middle fr depressed-globose, yellowish green flushed with red, about ½in across, with 3–5 stones. May, fr. Oct. Va. to Ky, Tenn and Ala S S. 13:650.

8 Viridis.

17. **víridis,** Linn. (*C arboréscens,* Ell) Tree, to 35 ft, with spreading branches forming a round, rather compact head. spines slender lvs oblong-ovate to oval, acute or acuminate, serrate above the cuneate base, dark green and lustrous above, paler below, finally glabrous, 1–3 in long corymbs glabrous; pedicels slender; calyx-lobes lanceolate, entire fr globose, bright red, ⅛–¼ in across, with usually 5 stones Md, Va to Ill, Iowa, Texas and Fla May, fr. Oct, persisting through the winter S S 4 187

18 **nítida,** Sarg Tree, to 30 ft, with spreading branches unarmed or with thin straight spines lvs. elliptic to oblong-obovate, acuminate, coarsely serrate except at the cuneate base, often slightly lobed, dark green and lustrous above, paler below, glabrous, 1–3 in long corymbs glabrous, calyx-lobes elongated, entire or sparingly glandular-serrate. fr. ovoid or subglobose, dark dull red, about ½in long with thick mealy flesh and 2–5 stones May, fr Oct, persistent through the winter Ill, Kans. S S 13.703 —Like *C. viridis* very ornamental with its lustrous foliage and persistent frs



1099 Cratægus coccinioides (×⅓). No 9

9. CRUS-GALLI.

19 **Crus-gálli,** Linn COCKSPUR THORN Shrub or tree, to 40 ft · branches wide-spreading, rigid, often pendulous, with numerous slender spines. lvs. obovate or oblanceolate, irregularly and sharply serrate, usually rounded at the apex, quite glabrous, 1–2½ in long, often semi-persistent· corymbs glabrous; calyx-lobes entire or minutely serrate. fr. usually globose, red, with usually 2 stones; flesh thin and dry May, June: fr late in Oct Que, south to N C, west to Mich S S 4 178 Em 492 R B. 1 116 G F 7 295. G C III 28 244, suppl Sept 29.—A very decorative species of distinct habit, handsome in bloom and with showy, bright red fr, remaining on the branches often until spring; the lvs assume a brilliant orange and scarlet color in fall Often used for hedges Var **inérmis,** Lange Spineless form Var **lineàris,** Ser Lvs linear-lanceolate Var **nàna,** Nichols Dwarf form Var **pyracanthifòlia,** Ait Lvs elliptic or obovate, usually acute· fr. smaller, brighter red W N Y and Pa to Fla and Tenn S S 13 637. Var. **salicifòlia,** Ait Lvs. oblanceolate or lanceolate, thinner. Var. **splèndens,** Ait (var *lùcida,* Hort) Lvs elliptic-oblanceolate, very shining. Var **ovalifòlia,** Lindl (*C pennsylvánica,* Hort, not Ashe). Lvs. elliptic or elliptic-obovate, less lustrous. fr ovoid. B R 22:1860. Gn 22, p. 146, 33, p 468 —This is probably not a variety of *C Crus-galli,* but a distinct species identical with one of the recently described species of this group

20 **Cánbyi,** Sarg Shrub or bushy tree, to 20 ft: branches wide-spreading, with thick usually straight spines. lvs oblong-obovate to elliptic, acute or obtuse, coarsely and often doubly serrate above the middle, glabrous, 1½–3 in long: corymbs glabrous; calyx-lobes entire or sparingly serrate· fr subglobose or ovoid, about ½in. long, dark crimson, with juicy flesh and 3–5 stones. May; fr. Oct. E Pa, Del, Md. S S 13:638

21. **fecúnda,** Sarg Small tree, to 25 ft · branches wide-spreading, with slender spines· lvs. oblong-ovate to oval, usually acute, doubly serrate, with strongly marked veins, 1½–3 in long corymbs slightly villous; calyx-lobes glandular-serrate· fr subglobose to ovoid, ½–¾in long, orange-red, with thick flesh and 2–3 stones. May; fr. Oct. Mo, Ill. S.S. 13·641.

22. **Arduénnæ,** Sarg. Shrub or tree, to 20 ft: branches spreading, forming a round-topped head spines slender· lvs. oblong-obovate, acute, acuminate or rounded, crenulate-serrate from below the middle, with obscure veins, 1½–2½ in long. corymbs glabrous, pedicels slender, calyx-lobes entire or slightly serrate:



1100 Cratægus punctata No 26

fr. ovoid, dull dark crimson, about ½in long, with 1–2 stones May; fr the middle of Sept. Pa. to Ill, Mich and Ont S M 373.

23. **Carrièrei,** Vauv. Small tree, to 20 ft, with spreading branches and stout spines· lvs elliptic or oblong-obovate, acute, pubescent below, glabrous above at length and lustrous, irregularly serrate, 3–4 in. long: corymbs rather few-fld, pubescent; fls large, with red disk; calyx-lobes linear, serrulate: fr. bright orange or brick-red, ovoid, about ½in long, with 1–3 stones. May R H 1883 108 G C III 21:118, 119—Probably hybrid between *C Crus-galli* and *C. mexicana,* originated in France Possibly not different is *C. Lavallei,* Hemeq, described with larger subglobose fr.

24. **persístens,** Sarg Low tree, 12 ft. or more. branches wide-spreading, with numerous stout spines to 2 in. long lvs lanceolate to oblong-obovate, acuminate, cuneate at the base, coarsely serrate above the middle, at maturity glabrous, dark green and lustrous above, pale beneath, 2–3 in long corymbs slightly villous, fls over ¾in across; calyx-lobes glandular-serrate above the middle or entire, stamens 20, anthers white, styles surrounded at the base by a broad ring of pale tomentum. fr. ovoid or slightly obovate, crimson, not lustrous, over ½in across, flesh thick and mealy, with 2–3 stones. May fr in Oct S T S 2 190—Of unknown origin, possibly a hybrid of *C Crus-galli* Raised at the Arnold Arboretum. The lvs remain on the branches unchanged until those of all the other hawthorns have fallen and the frs persist until late into the winter One of the most conspicuous of winter fruiting plants.

10. MEXICANÆ.

25 **mexicàna,** Sess & Moc (*C hypolàsia,* Koch). Small tree, to 30 ft. branchlets tomentose, unarmed or with short spines lvs cuneate-oblong or elliptic-lanceolate, obtuse or acute, crenate-serrate and often slightly lobed toward the apex, pubescent above, sometimes nearly glabrous, tomentose below, 1½–3½ in long corymbs white-tomentose, fls ¾in wide, calyx-lobes entire or with a few teeth at the apex, stamens 20, with pink anthers fr ovoid to pyriform, orange or dull orange-red, ¾–1 in thick, edible, with 3–5 nutlets March, fr Oct., Nov. Mex B R 22.1910

11 PUNCTATÆ

26 **punctàta,** Jacq Fig. 1100. Tree, to 25 ft · branches horizontally spreading, with short, stout spines or unarmed· lvs obovate, obtuse or acute, narrowed at the base into a rather long margined petiole, irregularly serrate, on the shoots often slightly lobed, villous below, with impressed veins above, 2–4 in long corymbs villous, fls large, calyx-lobes entire fr pyriform or subglobose, dull red, dotted, about ½in across, with 5 stones. May; fr Oct, falling soon From Que to Ont, Ill and Ga S S 4 184 A F 28 805 Var **aùrea,** Ait (var *xanthocárpa,* Roem *C crocàta,* Ashe). Fr yellow.

27 **collìna,** Chapm Shrub or small tree, occasionally 25 ft. branches wide-spreading, with stout spines, on the trunk with large branched spines lvs obovate or oval, acute, broadly cuneate at the base, irregularly, often doubly serrate, at maturity yellowish green above, paler below and glabrous except on the midrib. corymbs villous, calyx-lobes glandular-ciliate; anthers yellow fr subglobose, dull red, ⅓–½in. long, with yellow mealy flesh and usually 5 stones. May; fr. Oct. Va to Tenn. and Ala. S S. 13.654.

12. ÆSTIVALES.

28. **æstivàlis,** Torr. & Gray. MAY HAW. APPLE HAW Tree, to 30 ft, with a round compact head, unarmed or with stout straight spines 1–1½ in. long: lvs elliptic to oblong-obovate, acute or rounded, gradually narrowed into the ¼–1 in long petiole, sinuate-dentate or crenate-serrate, at maturity dark green and lustrous above, below, particularly on the veins, densely rusty-pubescent, 1½–2½ in long. fls. with the lvs., 1 in across, in 2–5-fld. glabrous corymbs; calyx-lobes entire or minutely glandular-serrate. fr depressed-

globose, fragrant, ½–¾in. across, bright red, crowned by the conspicuous calyx, with juicy subacid flesh and 3–5 stones Feb, March; fr. May. Fla to Ark and Texas. S.S. 4:192.—The fr is made into preserves and jellies.

13. UNIFLORÆ.

29. **uniflòra,** Moench (*C. parvifòlia,* Ait. *C. tomentòsa,* Eggleston, not Linn. *C. flòrida,* Loud.) Dense, low shrub, with numerous slender spines, rarely spineless, 3–8 ft. lvs on short not glandular petioles, cuneate, obovate or oblong-obovate, irregularly or doubly crenate-serrate, pubescent on both sides, at length glabrous above, ½–1½ in long· fls ½in. across, 1–3-fld corymbs, calyx pubescent, with large serrate lobes fr pyriform or globose, yellow, ½ in across, with 3-5 stones May, June Ga and Ala to Fla S S 4 191

30 **Vailiæ,** Brit Shrub, to 12 ft, with slender straight spines. lvs. oval or ovate, acute, cuneate at the base, crenate-serrate and often slightly lobed, at maturity glabrous and lustrous above, pubescent below, ½–1½ in long fls ½in across, in 2–6-fld, pubescent corymbs, calyx-lobes glandular-serrate fr globose, ½in across, dull red, with 3–5 stones May, fr Oct. Va to Ga. and Ala

14 FLAVÆ

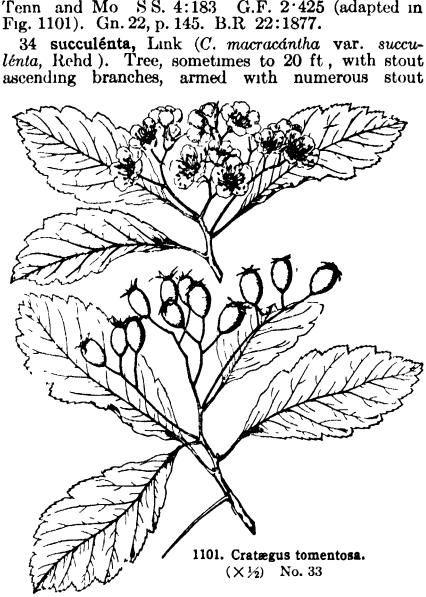
31 **flàva,** Ait Tree, to 20 ft branches wide-spreading, with thin nearly straight spines lvs broadly obovate or elliptic, acute or nearly rounded, cuneate at base, coarsely and doubly serrate, on vigorous shoots usually slightly lobed, the teeth tipped with red glands, at maturity puberulous only on the veins below, about 2 in long, petioles glandular, short corymbs few-fld, slightly villous, calyx-lobes glandular-serrate, fls ¾in across, stamens 20, with purple anthers fr ovoid, dark orange-brown, ½in long, with dry and mealy flesh and 5 stones April, fr in Oct Ga and Fla S S 13 693.—The true *C. flava* is not in cult, the plant now cult as *C. flava* is quite different and is apparently not very closely related to this species, it has so far not been found growing wild in E N Amer, though it was apparently intro from the southern states As it has not yet been determined to which species it belongs, it may be enumerated here as var **lobàta,** Lindl. Shrub or small tree lvs ovate or obovate, cuneate at the base, acute, crenately serrate and often slightly lobed, at maturity pubescent on the veins beneath, 1–2 in long: corymbs pubescent, few-fld, stamens 10 fr pyriform, green or reddish with hard flesh, and 3-5 stones. B R. 23.1932, 1939 G C III 27 404.—Tender

32 **áprica,** Beadle A shrub or small tree, sometimes to 20 ft, with spreading branches and slender zigzag branchlets armed with thin straight spines 1–1½ in long· lvs broadly obovate or oval, acute or rounded at the apex, narrowed into the short petiole, serrate usually only above the middle and often slightly lobed, with gland-tipped teeth, pubescent on both sides while young, at maturity glabrous, dark yellow-green and thickish, ¾–1½ in long fls ¾in across, in 3–6-fld compact pubescent corymbs, calyx-lobes glandular-serrate. fr globose, ½in across, dull orange-red, with 3–5 stones. May; fr Oct Va to Ga and Tenn S S. 13·698.—This species has proved hardy at the Arnold Arboretum.

15 TOMENTOSÆ

33. **tomentòsa,** Linn. (*C. Calpodéndron,* Medikus. *C. pyrifòlia,* Ait. *C. leucophlœos,* Moench. *C. Chápmanii,* Ashe). Fig 1101. Shrub or small tree, to 20 ft, with spreading branches unarmed or with short spines lvs cuneate, obovate-oblong or elliptic, acute, serrate and often slightly lobed, dull green and usually finely glabrous above, below pubescent, 2–5 in. long· corymbs pubescent, compound and many-fld; fls. ½in across, calyx-lobes serrate fr usually oval, dull yellow or yellowish red, ¼–⅓in. across, sweet and succulent, in upright corymbs, stones 2–3, with 2 furrows on the inner side June; fr. Oct Ont to Minn, south to Tenn and Mo S S. 4:183 G.F. 2·425 (adapted in Fig. 1101). Gn. 22, p. 145. B.R 22:1877.

34 **succulénta,** Link (*C. macracántha* var. *succulénta,* Rehd.). Tree, sometimes to 20 ft, with stout ascending branches, armed with numerous stout



1101. Cratægus tomentosa.
(×½) No. 33

slightly curved spines lvs elliptic, acute or acuminate, gradually narrowed into the stout winged petiole, coarsely and usually doubly serrate and with many short acute lobes, at maturity dark green, thickish and somewhat lustrous above, pale green and usually puberulous on the veins below, 2-3 in long fls ⅔in across, in many-fld villous corymbs; stamens usually 20, sometimes 15· fr globose, bright scarlet, ½–⅔in across, with juicy sweet flesh and 2–3 stones May, fr Sept, Oct Que and Ont to Mass and Ill S S 4 181 (as *C. coccinea* var *macracantha*)

35 **macracántha,** Lodd (*C. coccínea* var *macracántha,* Dudley) Fig 1102. Shrub or small tree, to 20 ft, of dense growth, with numerous long and slender spines lvs rather slender-petioled, broadly elliptic or ovate, doubly serrate, glabrous, at maturity thickish, shining and dark green above, almost glabrous beneath, 1–2½ in long corymbs slightly villous; fls ¾in across, stamens 10, calyx-teeth glandular-serrate· fr subglobose, ½in diam, dark cherry-red, shining, with usually 2–3 stones May, June. W N Y and Vt to Pa. S S 13 689. B.R. 22:1912. L B C 11 1012 (as *C. glandulosa*). A G. 11·509. M D.G. 1906 561 G W 5·245.—Sometimes cult. under the name of *C. Douglasii* See page 3567.

36 **prunifòlia,** Pers Shrub or tree, to 30 ft · branches spreading or somewhat ascending, spiny· lvs obovate, or roundish obovate, doubly serrate, glabrous or pubescent on the veins beneath when young, 2–3 in. long corymbs pubescent, stamens 10; anthers pink fr red, stones with 2 furrows on the inner side, sometimes nearly plain May, June —Origin unknown, by some thought to be a hybrid between *C. Crus-galli* and *C. macracantha* or *C. succulenta* B.R 22·1868 G.W. 8.114 Var **variegàta,** Hort. Lvs. variegated with yellowish white F.W 1877 65.

16 DOUGLASIANÆ (page 3567).

37. **Douglasii,** Lindl. (*C. sanguínea* var. *Douglasii,* Torr & Gray). Tree, to 40 ft., with slender, often pendulous branches, unarmed or with short spines: lvs. short-petioled, broadly ovate or oblong-ovate, acute, gradually narrowed at the base, serrate and slightly lobed, nearly glabrous, pubescent on the midrib above, chartaceous, 1–4 in long· corymbs glabrous; fls. ⅓–½ in across; stamens 20; calyx-lobes triangular-ovate, usually glandular-serrate above the middle. fr ovoid, ½in. long, black and lustrous, with sweet, light yellow flesh and 3–5 nutlets. May; fr. Aug, Sept. Brit Col. and N. Calif. to Wyo. S S. 4:175. B.R. 21:1810.

17. SANGUINEÆ.

38. **sanguínea,** Pall. Shrub or small tree, to 20 ft., with upright, spreading branches and short spines· lvs ovate or broadly ovate, narrowed into the petiole, irregularly serrate and slightly lobed, more deeply lobed on vigorous shoots, at first hairy above and often also below, at maturity glabrous or nearly glabrous, 1½–3 in. long· corymbs pubescent or glabrous; fls. large; stamens 20, with purple anthers. fr. ½ in. diam. May; fr. in Aug., Sept. E. Siberia. Var. **chlorocárpa,** Schneid. (var. *xanthocárpa,* Regel). Fr. yellow, smaller: anthers whitish.



1102. **Cratægus macracantha** (×⅓). No 35

39. **dahúrica,** Koehne (*C. purpúrea,* Bosc. *C. sanguínea* var. *altáica.* Loud.). Shrub or small tree· spines to 1½ in. long: lvs. ovate or broadly elliptic-ovate, acute, broadly cuneate at the base, sharply serrate, those of the flowering branches very slightly or scarcely lobed, those of the shoots distinctly and acutely lobed, glabrous, ¾–2 in. long: corymbs glabrous, fls. ½in across: fr. subglobose, ½in. across, orange-red. April, May; fr. Aug. E. Siberia.—The earliest leafing species of all hawthorns; very graceful; hardy.

18. CORDATÆ.

40. **Phænopýrum,** Medikus (*C. cordáta,* Ait. *C. acerifólia,* Moench. *C. populifólia,* Walt.). WASHINGTON THORN. Tree, to 30 ft., with slender spines: lvs. slender, petioled, triangular or broadly ovate, usually truncate at the base, 3–5-lobed, sharply serrate, 1½–2½ in. long: corymbs many-fld., glabrous; styles 5: fr. depressed-globose, ¼in. across, shining, bright coral-red; calyx deciduous, leaving a circular scar; stones 3–5. May, June; fr Sept, Oct. Va to Ala. and Mo. S S. 4:186. B.R. 14:1151. F.E. 28, p 103 (habit) — A very desirable species, with beautiful fall-coloring and large clusters of bright red fr remaining a long time on the branches. Formerly much used for hedges.

19. APIIFOLIÆ.

41. **apiifólia,** Michx (*C. Márshallii,* Eggleston). Shrub or small tree, rarely 20 ft., with stout spines and the branchlets pubescent when young. lvs. slender-petioled, broadly ovate, pinnately 5–7-cleft, serrate, glabrous or pubescent, ¾–1½ in long· corymbs few-fld, villous; styles 1–3: fr ovoid, ¼in. high, scarlet, with 1–3 stones; calyx often deciduous April, May, fr. Oct. Va. to Fla., Ark. and Texas. S S. 4:188.—A handsome species with graceful foliage and an abundance of white fls. in spring and small but bright-colored frs. in fall.

20. BRACHYACANTHÆ

42. **brachyacántha.** Sarg & Engelm Tree, to 50 ft, with stout spreading branches, armed with numerous short usually curved spines, ½–⅔in long lvs obovate-oblong, oblong-lanceolate or elliptic, acute or sometimes obtuse, cuneate at the base, crenulate-serrate, rarely slightly lobed, glabrous at maturity, lustrous above, ¾–2 in long corymbs many-fld, glabrous, fls ½in across, turning orange in fading, stamens 15–20 fr subglobose, ⅓–½in across, bright blue and bloomy, with 3–5 stones. April, May; fr. Aug. La. and Texas S S 4:177.—The only species with blue fr.; hardy only S.

21 PENTAGYNÆ.

43. **nigra,** Kit (*C carpáthica,* Lodd) Shrub or small tree. branches pubescent or tomentose, with short spines: lvs. short-petioled, ovate or ovate-elliptic, deeply pinnately 5–9-lobed with serrate lobes, slightly pubescent above, densely pubescent beneath, 2–3 in long corymbs dense, 10–15-fld, tomentose; pedicels short, fls white, becoming slightly red, anthers yellowish fr. subglobose, ½in. across, black, lustrous, juicy, with 5 stones May; fr in Aug S E Eu L B C 11: 1021 L I 30.

44 **pentágyna,** Waldst & Kit. (*C melanocárpa,* Bieb). Shrub or small tree, to 15 ft.: young branchlets pubescent, with short spines· lvs ovate to obovate, irregularly and usually sparingly serrate, pinnately 3-7-lobed, hairy above while young, finally nearly glabrous above, pubescent below, 1–2 in long corymbs villous; fls. ½in. across, anthers red fr ovoid or obovoid, purplish black, ½in. long, with 4–5 stones. May; fr. Sept, Oct. S E. Eu., Caucasus. B R 22: 1874; 23:1933 (as *C. Oxyacantha Oliveriana*). R.H. 1901, p. 310.

22. OXYACANTHÆ.

45. **Oxyacántha,** Linn. HAWTHORN or MAY of English literature. Shrub or small tree, to 15 ft, with spreading glabrous branches and stout spines· lvs. short-petioled, cuneate or truncate at the base, roundish or broadly ovate, 3–5-lobed, with broad, serrulate lobes, 1–2 in long: corymbs 5–10-fld., glabrous: fr. globular or roundish oval, ⅓–½in. high, scarlet; stones 2, with 2 furrows on the inner side. May. Eu., N. Afr. B R 13.1128 (as *C. oxyacanthoides*) Var. **bicolor,** Rehd (*C Oxyacántha* var. *Gimpperi bicolor,* Hort *C. Oxyacántha rúbra,* Schneid) Fls. white in the center, edged red. F S 16:1651. Var **Paúlii,** Rehd (var *coccínea,* Hort. Var. Paul's New Double Scarlet. *C. Oxyacántha* var. *spléndens,* Schneid.). Fig 1103. With

double, bright scarlet fls ; one of the most showy I H 14 536 F. 1867.117 Var **aûrea,** Loud (*C Oxyacántha* var *xanthocárpa,* Lange) With yellow fr Var. **quercifôlia,** Loud Lvs with broad, rounded and crenate lobes —Most of the garden forms usually listed as varieties of *C Oxyacantha* belong to the following species Even the varieties enumerated above are by some botanists not considered true *C Oxyacantha,* but referred to *C media,* Bechst , a hybrid between this and the following species, the existence of hybrid forms makes the distinction between the two species still more difficult.

46 **monógyna,** Jacq (*C Oxyacántha,* Hort) Shrub or tree, to 20 ft , with stout spines. lvs on rather slender petioles, ovate, 3–7-lobed, lobes with few teeth at the apex, 1–2 in long corymbs many-fld , with usually hairy pedicels fr oval, with usually 1 stone, ¼–½in high May, June Eu and N Afr to Himalayas Gn 33, p 165, 37, p 467, 40, p 500, 52, p 266, 55, p 452 R H 1900, p 72 (all as *C Oxyacantha*) —Many garden forms are cult , some of the most distinct are the following Var **punícea,** Rehd Fls deep red, single. F S 15 1509, fig 1. L B C 14 1363 Var **rósea,** Hort Fls pink, petals with white claw Var **álbo-plèna,** Schneid With white double fls F S 15 1509, fig 2. Var **rùbro-plèna,** Schneid With double red fls F S. 15 1509, fig 3 Varieties differing in lvs and habit: Var **laciniàta,** Loud Lvs deeply pinnatifid with incised serrate lobes Var **pteridifôlia,** Rehd (*C. Oxyacántha* var *pteridifólia,* Loud Var *filicifólia,* Hort) Similar, but lvs longer, with narrower and more incised lobes F S 20 2076 Var **férox,** Schneid (*C Oxyacantha* var *ferox* Carr *C. Oxyacántha* var *hórrida,* Carr) Branches with fascicles of numerous stout spines F S 14 1468 G C III 24 13 Var **inérmis,** Rehd (*C Oxyacántha inermis,* Dauthenay) A spineless form R H 1900, pp 72, 73 Var **péndula,** Loud With pendulous branches Gn 68, p 288 G M 44·827 M D G 1902 25, 26 Var **róseo-péndula,** Rehd (*C Oxyacántha* var *péndula rósea,* Hort) A pendulous form, with pink fls. Var **stricta,** Loud (var *pyramidàlis,* Hort) Of fastigiate, upright habit. G C III 41 184 M D G 1906 390 Var **semperflórens,** Rehd (var *Bruantii,* Carr) Low, graceful shrub, flowering until fall R H 1883, p 140 Gn 29, p 431, 33, p 465 There are also some varieties with variegated lvs

23 ORIENTALES

47. **tanacetifôlia,** Pers Shrub or small tree branches with short spines or unarmed, branchlets tomentose lvs cuneate, obovate, pinnately 5–7-cleft, with the lobes glandular-serrate, villous-pubescent, 1 2 in long. corymb dense, 5–7-fld , calyx-lobes large, deeply glandular-serrate, fls large· fr pubescent, yellow, 1 in or more across, with laciniate bracts at the base May, June Asia Minor B R. 22 1884 Gt 43, p 215.

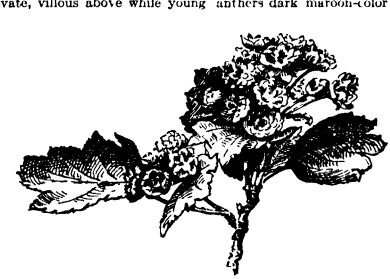
48 **orientàlis,** Pall (*C odoratissima,* Lindl *C apiifólia,* Hort). Shrub or small tree, with spreading, almost unarmed branches and tomentose branchlets: lvs short-petioled, cuneate, obovate or oblong, pinnately 3–5-cleft, with the lobes incisely serrate at the apex, tomentose pubescent, 1–2 in long corymb dense, tomentose; calyx-lobes entire· fr depressed globose, brick- or orange-red, ¾–1 in across, with 4–5 stones. June. S E Eu , Asia Minor B M 2314 B R 22. 1885 (as *C odoratissima*) Gn 28 632 (as *C tanacetifolia*), and p 635 G M 40 824. Var **sanguínea,** Rehd (*C. sanguínea,* Schrad , not Pall *C Tournefórtii,* Griseb). Lvs more glabrescent fr. dark red, with 2–4 stones B R 22 1852.

49. **Azárolus,** Linn (*C Aròna,* Ser. *C maùra,* Linn. f.). Shrub or tree, to 25 ft , with pubescent branchlets: lvs short-petioled, cuneate-obovate, deeply 3–5-lobed, with the lobes nearly entire or incised at the apex, grayish green, pubescent, 1½–2½ in long corymbs few-fld., densely tomentose fr orange-red or yellow, globular or ovoid, ¾–1 in across May N Afr , Asia Minor B R 22 1897 (as *C Aronia*) R H. 1856.441 Var **sinàica,** Boiss Lvs glabrous· fr smaller, reddish yellow B R 22.1855 (as *C. maroccana*). Gn. 22, p 146; 28, p 634.

24. PINNATIFIDÆ.

50. **pinnatífida,** Bunge Fig 1104 Shrub or small tree, to 20 ft · lvs slender-petioled, cuneate, elliptic-ovate, pinnately 5–9-cleft, incisely serrate corymbs many-fld , usually pubescent fr globular or pyriform, dark red, punctate ½–¾in high, stones 3–5 June. N China, E Siberia to Korea R H 1901·308 Gt. 1862 366 Var **màjor,** N E Br (*C Korolkòwii,* Schneid , not Henry *C Brettschneideri,* Schneid *C. californica,* Hort *C. tatárica,* Hort) Lvs larger, less deeply lobed· fr pyriform, 1 in long. G C II 26:620. R H 1901 308

C altàica, Lange = C Wattiana —*C amblgua,* C A Mey. Related to C monogyna Lvs deeply 4–7-lobed, sparingly hairy on both sides, 1–2 in long corymbs slightly hairy fr ovoid, usually with 2 stones S Russia —*C Bàtteri,* Sarg = C fœtida —*C. beata,* Sarg Allied to C pruinosa Shrub, to 15 ft lvs oblong-ovate, villous above while young anthers dark maroon-color fr.



1103. Paul's thorn—Cratægus Oxyacantha var Paulii. (×⅓)

crimson, pruinose, ripens end of Sept N Y —*C Béckwithæ,* Sarg. Allied to C pastorum Shrub or tree, to 18 ft lvs ovate, usually truncate at the base, at maturity thin calyx-lobes glandular-serrate fr subglobose, crimson, with 5 stones N Y —*C billula,* Sarg Related to C pruinosa Shrub, to 12 ft , glabrous lvs ovate, bluish green and lustrous above, 2–3 in long stamens 8–10 fr dull crimson, bloomy, ¾in across, with usually 4 stones Mich S T S 1 50 —*C berberifólia,* Torr & Gray Related to C Crus-galli Lvs obovate or obovate-oblong, obtuse, pubescent below, lustrous and nearly glabrous above, 1½–2 in long corymbs pubescent, anthers yellow fr orange with red cheek La S S 4 179 —*C Celsiana,* Bosc Shrub lvs punctately lobed, slightly pubescent beneath corymbs many-fld fr ovoid, red Origin unknown, probably hybrid of C pentagyna —*C champlainénsis,* Sarg Allied to C mollis Tree, to 20 ft , spiny lvs ovate, usually truncate at the base, lobed, glabrous above, pubescent on the veins below, 2–2½ in long corymbs villous, usually 4–5-fld , stamens 10. fr obovoid or ovoid, scarlet, ½in long, in Sept Que and Ont to Vt and N Y S S 13 60.9 —*C chlorosárca,* Maxim Allied to C. sanguinea Lvs pinnately lobed, truncate at the base, with short lobes, glabrous at length corymbs many-fld , nearly glabrous fr. black, with green flesh Japan —*C cognàta,* Sarg Closely related to C pruinosa Shrub, to 10 ft , spiny lvs ovate, acute or acuminate, slightly lobed, dull bluish green, glabrous corymbs 5–7-fld ; anthers yellow fr ovoid or pyriform, pruinose, dull crimson at maturity, over ½in long, in Oct Mass —*C cómpta,* Sarg (*C silvicola* var *compta,* Eggleston) Allied to C pruinosa Shrub, spiny, glabrous lvs oblong-ovate, usually rounded at the base, slightly lobed, glabrous corymbs many-fld , stamens 7–10, anthers dark rose fr obovoid, light cherry-red, ½in long, in Oct W N Y. —*C conspécta,* Sarg Allied to C pruinosa Tree, to 20 ft , spiny: lvs broadly ovate, rounded or subcordate at the base, lobed, yellow-green, pubescent on the midrib below corymbs 5–6-fld , slightly hairy, compact, anthers white fr subglobose, crimson, over ½in. across, in Oct Ont —*C crenulàta,* Roxbg = Pyracantha crenulata. —*C cuneàta,* Sieb & Zucc Belongs to group Cuneatæ Shrub: young branchlets villous lvs short-petioled, cuneate-obovate or cuneate-oblong, crenate-serrate, glabrous and lustrous above, sparingly hairy below corymbs villous, 3–7-fld., stamens 20, anthers red fr red, with 5 stones, plain inside China and Japan L I 5 — *C cupulifera,* Sarg Allied to C rotundifolia Shrub, to 20 ft lvs. obovate or rhombic, slightly lobed, lustrous and scabrate above: corymbs slightly villous, fls cup-shaped, stamens 10, anthers pink. fr. scarlet, with 3–4 stones N Y —*C Daydna,* Sarg. Allied to C.

pedicellata Tree, to 15 ft , spiny lvs broadly ovate, acuminate, rounded or cuneate at the base, dark yellow-green, slightly hairy on the veins below white young corymbs 10-14-fld., fls ¾in. across, stamens 20 fr obovoid, crimson, in Sept , soon falling. W N Y —*C. diffusa*, Sarg Allied to C pruinosa Intricately branched spiny shrub, to 15 ft , glabrous lvs ovate, acuminate, rounded or cuneate at the base, dark bluish green and slightly scabrate above corymbs 6-12-fld , stamens 10 fr subglobose, scarlet, less than ½in across, in Oct W N Y —*C. Dippeliana*, Lange (C tanacetifolia var Leeana, Hort C tanacetifolia × C punctata?). Small tree, spiny lvs rhombic-elliptic, lobed, sparingly pubescent above, densely beneath corymbs densely villous, stamens 20 fr. subglobose, reddish yellow or dull red Origin unknown Gn 33, p 408.—*C dissona*, Sarg (C pruinosa var dissona, Eggleston). Allied to C pruinosa Slender spiny shrub, to 10 ft , glabrous lvs ovate to rhombic, cuneate at the base, dark bluish green corymbs 5–7-fld , stamens 10, anthers purple fr subglobose, crimson, in Oct. Mass.—*C. dsungarica*, Zabel Allied to C. sanguinea. Tree



1104. Cratægus pinnatifida (×⅓). No. 50

lvs. deeply lobed, sparingly pubescent or nearly glabrous· corymbs slightly pubescent fr black, stones without or with slight furrows. Of unknown origin —*C. Oxyacantha*, Sarg Shrub, to 12 ft., spiny lvs ovate to suborbicular, usually rounded at the base, slightly lobed, glabrous or slightly rough above corymbs 10–14-fld . fr. subglobose, crimson, ½in across, in Oct W N Y. Belongs to group Anomalæ, allied to Tenuifoliæ —*C. durobrivensis*, Sarg. Allied to C coccinioides Shrub, to 20 ft , spiny lvs ovate, with 3–4 pairs of short lobes, glabrous corymbs glabrous, stamens 20; fr. bright red, in Oct. N Y S T S 1 2 —*C. elliptica*, Ait (C. glandulosa, Moench C flava var pubescens, Gray) Allied to C flava. Lvs broader, of firmer texture, more pubescent and glandular: fr. subglobose, red or yellow. Southern states. B R 22. 1890 (as C spathulata) —*C elliptica*, Beadle, is C senta, Beadle, a species allied to C flava S S 13 697 —*C elliptica*, Mohr, is C. signata, Beadle, a species allied to C Crus-galli S S 13 644 — *C. exornata*, Sarg Allied to C pruinosa Shrub, to 10 ft , spiny: lvs ovate, usually rounded at the base, slightly lobed, dark yellow-green and rough above corymbs 5–6-fld , stamens 7–10; anthers pink fr subglobose, scarlet, less than ½in. across, in Sept. Ont.—*C. Fdzonii*, Sarg. Allied to C. rotundifolia. Shrub, to 10 ft , spiny· lvs broadly ovate, with 4–5 pairs of short lobes, nearly glabrous at maturity corymbs villous, stamens 5–10 fr. dark crimson, in Sept N H S T S 1 60 —*C ferentaria*, Sarg. Allied to C macracantha Intricately branched shrub, to 12 ft , with stout spines lvs rhombic or obovate, puberulous below on the veins corymbs slightly villous, stamens 7–10, anthers white fr subglobose or ovoid, ½in long, scarlet, with usually 2 stones, ripening in Oct W N Y —*C flabellata*, Spach (C Grayana, Eggleston). Allied to C pedicellata Shrub, to 20 ft lvs ovate, with short acute lobes, at first sparingly hairy above and villous at the veins beneath corymbs slightly villous, calyx-lobes sparingly glandular-serrate, stamens 20 fr ovoid, crimson, with 3–5 stones, in Sept Que.—*C florentina*, Zuccagni=Pyrus cratægifolia —*C fabula*, Ashe (C Baxteri, Sarg). Allied to C intricata Intricately branched, spiny shrub, to 12 ft , glabrous lvs ovate or oval corymbs usually 5–6-fld , calyx-lobes serrate fr subglobose, orange-red or red-brown, about ½in thick, with 3–4 stones, in Oct Mass to Ont and Va —*C Fontanesiana*, Steud Allied to C Crus-galli Lvs elliptic or elliptic-lanceolate, almost glabrous, shining above corymbs many-fld , pubescent fr red Probably hybrid of C Crus-galli —*C Förbesæ*, Sarg Allied to C pastorum Shrub, to 15 ft lvs ovate or oval, cuneate or rounded at the base, slightly lobed stamens 20, anthers dark rose-color fr globose or ovoid, scarlet, with thin and juicy flesh Mass —*C formosa*, Sarg Allied to C pruinosa Shrub, to 15 ft lvs oblong-ovate, rounded or cuneate at the base, slightly lobed, slightly hairy above while young corymbs many-fld fr ovoid or obovoid, scarlet, pruinose, with 4–5 stones N Y —*C gemmosa*, Sarg Allied to C succulenta Tree, to 30 ft , spiny lvs broadly obovate to broadly elliptic, doubly serrate and often slightly lobed, at maturity pubescent on the midrib beneath corymbs villous fr. scarlet, lustrous, in Oct N Y to Mich and Ont. S S 13 686 —*C generosensis*, Sarg Allied to C Crus-galli Small tree, to 12 ft , spiny, glabrous lvs obovate-oblong, pointed at the rounded or acute apex, with prominent veins corymbs many-fld , lax, anthers pink fr ovoid, scarlet, ½in long, with 1–3 nutlets, in Oct W N Y G C III 53 115 — *C glandulosa*, Moench=C elliptica —*C gloriosa*, Sarg Allied to C pedicellata Tree, to 25 ft , with few spines lvs ovate, cuneate or rounded at the base, slightly pubescent on the veins below, sometimes finally glabrous corymbs 10–15-fld , stamens 7–10 fr ovoid, often unsymmetrical, deep crimson, in Sept W N Y —*C grandiflora*, Koch (C lobata, Bosc Cratæ-mespilus grandiflora, Camus) Small tree lvs elliptic, serrate, often slightly lobed toward the apex, pubescent fls 1–3, large fr brown, globose, large Supposed to be a hybrid between Mespilus germanica and a Crataegus G F 10 35 R H 1869, p 80 —*C Grayana*, Eggleston=C flabellata —*C Hardsonii*, Beadle Belongs to group Bracteatæ allied to Intricatæ Tree, to 25 ft lvs oval or broadly obovate, coarsely serrate, petioles glandular corymbs many-fld , with conspicuous glandular bracts fr red or bright red, in Oct S S 13 691 —*C heterophylla*, Fluegge Allied to C monogyna Lvs larger, usually trifid. fr larger, bright red corymbs many-fld B R 14 1161, 22 1847 — *C hiemalis*, Lange Possibly C Crus-galli × C pentagyna Lvs. elliptic to ovate, densely serrate or slightly lobed, lustrous above, pubescent on the veins beneath corymbs villous, stamens 15, with purple anthers fr purplish black Origin unknown — *C Holmesiana*, Sarg Allied to C pedicellata Tree, to 30 ft lvs oval to ovate, slightly lobed, at maturity yellowish green, glabrous fls ½–¾in across, stamens usually 5, anthers purple fr ovoid, crimson, with usually 3 stones Montreal to Pa , W N Y and Ont S S 13 676 — *C. integriloba*, Sarg Allied to C tomentosa Tree, to 10 ft , spiny lvs broadly obovate or oval, broadly cuneate at the base, slightly lobed, glabrous corymbs villous, calyx-lobes entire fr subglobose, ⅝–½in across, scarlet, lustrous Que G C III 47 60 —*C irrasa*, Sarg Allied to C pedicellata Shrub, to 12 ft lvs ovate, cuneate or rounded at the base, slightly lobed, lustrous and glabrous above stamens 20, anthers yellow fr ovoid, dark red, lustrous Que —*C. Korolkowii*, Henry=C. Wattiana See also No 50 — *C lauta*, Sarg Allied to C Ellwangeriana Arborescent shrub, spiny lvs ovate, acuminate, scabrate above, sparingly pubescent on the veins below corymbs 8–12-fld , compact fr ovoid, bright orange-red, ¾in long, with 5 nutlets, in Sept Origin unknown, much planted in Boston parks —*C leiophylla*, Sarg Allied to C pruinosa Slender intricate, spiny shrub, to 15 ft , glabrous lvs broadly ovate, usually rounded or truncate at the base, dark dull blue-green above corymbs 5–7-fld , compact, anthers yellow fr obovoid, bright red, ½in long, with usually 4 stones, in Nov W N Y —*C luionana*, Sarg Allied to C Crus-galli Tree, to 20 ft , spiny, glabrous lvs oblong-obovate, acute or rounded at the apex, finely and often doubly serrate corymbs lax, 10–18-fld , calyx-lobes glandular-serrate fr subglobose to ovoid, dark crimson, ½in long, with 2–4 stones, in Oct. N Y S T S 2 129 —*C. lobata*, Bosc=C grandiflora —*C lucorum*, Sarg Allied to C pastorum Tree to 25 ft , spiny lvs broadly ovate to obovate, slightly lobed, glabrous corymbs villous, few-fld , stamens 20, with purple anthers. fr ovoid, crimson, in Sept Ill. S S 13 679 —*C maineana*, Sarg (C. leiophylla var maineana, Eggleston) Allied to C. pruinosa Tree-like shrub, to 15 ft , spiny, glabrous lvs ovate to deltoid, acuminate, hairy while young. corymbs many-fld , stamens 10, anthers dark purple fr globose, scarlet, scarcely pruinose, about ½in tnick, in Oct W N Y.— *C. matura*, Sarg. Allied to C pastorum Shrub, to 10 ft , with few spines, glabrous lvs oval to ovate-oblong, usually cuneate at the base, dark green above, yellow-green below corymbs many-fld ; stamens 5–10, anthers red fr ovoid, dark purplish crimson, ¾in. long, in Aug Vt , Mass , N Y —*C Maximowiczii*, Schneid (C. sanguinea var. villosa, Maxim) Allied to C sanguinea Small tree, to 20 ft lvs. ovate, slightly lobed, pilose below corymbs densely pilose fr. pilose when young, finally glabrous Amurland, Manchuria —*C microcarpa*, Lindl =C spathulata —*C opulens*, Sarg. Allied to C pruinosa Shrub, to 15 ft , spiny, glabrous lvs oblong-ovate to oval, acuminate, hairy above while young corymbs 5–8-

fld , compact fr. subglobose, obscurely angled, crimson, slightly pruinose, ½in long, in Oct W N Y —*C Palmeri*, Sarg Allied to C Crus-galli Tree, to 25 ft lvs broadly ovate to oblong, rounded or acute at the apex, coarsely serrate, glabrous corymbs glabrous, stamens 10, with yellow anthers fr dull green, tinged with red, in Oct S M 381 —*C peregrina*, Sarg Allied to C mollis Tree lvs ovate, broadly cuneate, with 5–6 pairs of narrow lobes, glabrous above, villous beneath corymbs many-fld , villous fr ovate-globose, dark dull purple, pubescent at the base and apex, ½in across. Origin unknown, probably S W Asia S T S 2 191 —*C perjucunda*, Sarg Allied to C pruinosa Spiny shrub, glabrous lvs, ovate, acuminate, dark green above corymbs 8–10-fld , anthers white fr ovoid, orange-red, finally crimson, slender-stalked, less than ½in long, in Oct Ont , N Y —*C persimilis*, Sarg Allied to C Crus-galli Shrub, to 8 ft lvs oblong-obovate to oval, usually acute, veins prominent, slightly hairy while young corymbs slightly villous, stamens 10-20 fr subglobose or ovoid, crimson, lustrous, with 1–2 stones N Y —*C præcox*, Sarg (C præcoqua, Sarg.) Allied to C rotundifolia Shrub, to 10 ft , spiny lvs rhomboidal to oval, slightly hairy while young, glabrous at maturity and scabrous above corymbs slightly villous, many-fld , stamens 10 fr subglobose, dark crimson, ⅔in thick, in Aug Vt., Que —*C promissa*, Sarg Allied to C pruinosa Shrub, to 12 ft , spiny glabrous lvs oblong-ovate, acuminate, deeply lobed. corymbs lax, many-fld , stamens 5–7, anthers pink fr ovoid, crimson, not pruinose, less than ½in long, in Sept W N Y —*C Pyracantha*, Pers =Pyracantha coccinea —*C riparia*, Nutt Allied to C Douglasii Shrub lvs ovate-lanceolate, serrate, glabrous at length Wyo to Colo and Utah S S 4 176 —*C Sargentii*, Beadle Allied to C intricata Tree, to 20 ft lvs elliptic to oblong-ovate, slightly lobed, glabrous at maturity corymbs slightly villous or glabrous, stamens 20, with purple anthers fr. yellow or orange-yellow, tinged with red, in Sept Ga to Tenn and Ala —*C songarica*, Regel—C Wattiana —*C spathulata*, Michx. Shrub or tree, to 20 ft lvs cuneate, oblanceolate, crenately serrate or 3-lobed at the apex corymbs many-fld fr scarlet, globular, ½in across Southern states S S 4 185 B R 22 1846 (as C intricata) The only species of the group Microcarpæ allied to the Apiifoliæ *C triflora*, Chapm Shrub or small tree, to 20 ft lvs ovate or elliptic, serrate, often slightly lobed, pubescent, 1–2½ in long corymbs 3-fld , hirsute, fls 1in across, stamens 20, anthers yellow fr globose, red Ga , Ala Belongs to the group Trifloræ, allied to Intricatæ —Very distinct and handsome, has proved hardy at the Arnold Arboretum —*C rerecunda*, Sarg Allied to C intricata Shrub, about 3 ft , spiny, glabrous lvs oblong-obovate or oval, acute or acuminate, light bluish green corymbs 6–10-fld , stamens 7, anthers white fr ovoid or obovoid, less than ½in long, with 2–3 stones, in Sept or Oct W N Y —*C Watsiana*, Hemsl & Lace (C altaica, Lange C songarica, Regel) Allied to C sanguinea Lvs smaller, truncate at the base, glabrous corymbs glabrous fr yellow or reddish yellow, smaller Cent Asia Var. *incisa*, Schneid (C Korolkowii, Henry C sanguinea var incisa, Regel) Lvs more deeply and acutely lobed R H 1901 301 —*C Wilsonii*, Sarg Allied to C tomentosa Shrub, to 20 ft lvs ovate or obovate, acute or obtuse, lustrous above, sparingly villous beneath fr ovoid, red, nearly ½in long, with 1–3 stones Cent. China

ALFRED REHDER

CRATÆVA (after Cratevas, an obscure writer on medicinal plants, not, as sometimes stated, at the time of Hippocrates, but at the beginning of the first century B C , since he named a plant after Mithridates) *Capparidàceæ* Tropical trees and shrubs, sometimes planted in the warm parts of the country

Leaves 3-foliolate· fls in corymbs, usually polygamous, with the odor of garlic; sepals and petals 4; stamens 8–20, torus elongated berries ovate-globose, with a slender stripe —Ten species, around the globe. The bark of the garlic pear, *C gynandra*, blisters like cantharides *C religiosa*, from Malabar and the Society Isls is a sacred tree, and is planted in native graveyards The bitter, aromatic lvs and bark are used by them in stomach troubles. The above and some other species are cult. in Eu. as ornamental greenhouse shrubs.

religiòsa, Forst f. (*C Nurvàla*, Buch -Ham). A spreading unarmed deciduous tree of graceful proportions. lvs. long-petioled, the lfts. 2½–3 times as long as broad. fls. 2–3 in across, showy, yellow, or purplish yellow, the petals long-clawed.—Once cult by Franceschi, Santa Barbara, Calif , but reported by him as no longer in cult. there. Excellent greenhouse plant N.

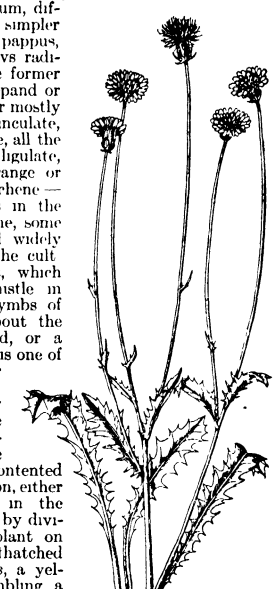
N. TAYLOR †

CRATEROSTÍGMA (Greek, referring to character of stigma). *Scrophulariàceæ*. Torenia-like perennial low nearly stemless herbs of E. and S. Afr , sometimes grown under glass. Lvs. radical, plantago-like, many-nerved, entire: fls lilac and purple, spicate, racemose or even solitary; calyx tubular, 5-ribbed and narrowly 5-toothed, corolla tubular, 5-ribbed and 5-toothed, the tube enlarged toward the top, the limb 2-lipped, the dorsal lip concave and entire or emarginate, the other large and spreading and 3-lobed, stamens 4 and perfect, in unequal pairs, style filiform, 2-lobed and dilated at apex. fr. an oblong caps included in the calyx Differs from Torenia in technical floral characters and in being nearly or quite stemless and with only radical lvs —About 4 species **C. pùmilum,** Hochst (*Torènia auriculafòlia*, Dombr) has fls. on slender pedicels ½–1¼ in long, the corolla-lobes pale lilac blotched with purple and veined with white: lvs sessile, ovate, in a basal rosette, pubescent beneath and nearly glabrous above. E. Africa. F.M. 10:534.—A stemless perennial.

L H. B.

CRÈPIS (Greek for *Sándal;* application obscure). *Compósitæ*. A large group of annual, biennial and perennial herbs, a few of which are now and then grown in outdoor gardens for the showy flowers.

Much like Hieracium, differing mostly in the simpler involucre, white soft pappus, and beaked achene lvs radical and cauline, the former mostly runcinate, repand or pinnatisect, the latter mostly clasping heads pedunculate, solitary or paniculate, all the florets perfect and ligulate, the rays yellow, orange or red fr. a smooth achene —Perhaps 250 species in the north temperate zone, some of them weedy and widely dispersed. Among the cult kinds is *C sibirica*, which resembles a sow-thistle in habit, and has corymbs of reddish blue fls about the size of a hawkweed, or a small dandelion It is one of the coarser border plants, and rare Rather light, sandy soil, and full exposure to the sun are essentials to the welfare of this plant It is contented in a rather dry position, either in the rockery, or in the border It is prop by division A common plant on the moss of English thatched cottages is *C virens*, a yellow-fld plant resembling a dandelion. *C. rubra* appears to be the commonest annual species cult abroad.



1105. Crepis rubra. (×⅓)

sibírica, Linn Perennial, 2–3 ft high, and at least as wide when in bloom plant covered with short rough hairs· root large, fleshy lvs rough, wrinkled, the lower coarsely dentate, the upper often somewhat cordate, 12 in long, including a petiole half as long fls bright yellow in a strictly terminal corymb; involucre loose, hairy. July Eu , Asia Minor, Himalayas Gn 53, p. 493 —The tallest and largest-fld of the genus. Its white plumy masses of seeds are also attractive.

aùrea, Reichb Black-hairy· height 1 ft or less: fls. orange, mostly solitary. lower lvs. spatulate-oblong, toothed, shining June. Alps.—One of the commonest perennial species of the genus abroad Repays rich soil.

rùbra, Linn. Fig 1105. Annual· height ½–1½ ft : fls. red, usually solitary, the involucre being hispid. An attractive little flower-garden plant Var **álba,** Hort., has flesh-colored or whitish fls. Italy, Greece.

C barbàta, Linn =Tolpis —*C montàna*, Reich 12-18 in. lvs unequally dentate fls yellow in a large head High mts, Switzerland, etc Mentioned as grown in this country, but apparently not in the trade L H B †

CRESCÉNTIA (after Crescenzi, thirteenth century Italian agricultural writer) *Bignoniàceæ* This genus is chiefly interesting for the calabash tree, which has



1106. Crescentia Cujete —The calabash. (×⅛)

no near allies of horticultural importance; yields the calabash fruit.

Tropical trees, glabrous: lvs alternate, solitary or clustered at nodes. fls. large, tubular, with a fluted 5-cut limb, yellowish, with red or purple veins; calyx 2-parted or deeply 5-cut —About 5 species, in Mex. and Cent. Amer The calabash tree is a native of Trop. Amer, is especially familiar in the W Indies, and can be grown outdoors in extreme S Fla. and S Calif The outer skin of the fr is removed and the seeds and pulp from within, and the hard woody shell is used for watergourds and for all sorts of domestic vessels, according to size and shape. The growing fr. can be made to assume various forms by skilful tying It is a tree 20–40 ft high, and readily distinguished from all others by its peculiar habit of growth, as it bears large, horizontal, scarcely divided branches, which bear clusters of lvs. at intervals The tree is becoming important in the manufacture of tobacco-pipes.

Cujète, Linn. Fig. 1106 A handsome tree when growing in the open, with wide-spreading well-foliated branches. lvs. 4–6 in long, broadly lanceolate, tapering at the base, dark glossy green fls. solitary, pendulous; calyx 2-parted; corolla constricted below the middle, and then swollen above, malodorous when decaying; stamens 4, sometimes 5: fr frequently 18–20 in. through The growing tree has somewhat the habit of a Burbank plum tree. B M. 3430. N. Taylor.†

CRESS. A name applied to the pungent herbage of several species of the Cruciferæ, used as salad.

The leaves of the ordinary garden cress (*Lepidium sativum*), sometimes called peppergrass, have a pleasant pungency, somewhat like that of the water-cress, which makes the plant well adapted to be used as a popular condiment, served with salads, especially lettuce, and also for garnishing purposes The quick sprouting habit of the seed is proverbial Often the plants show above ground the third day after seed is sown But if cress is wanted in its prime continuously, new sowings must be made every few days. Sow seed rather thickly in rows a foot apart, selecting any good garden loam. The reason that this useful plant is seldom seen in the average home garden is probably its liability to be attacked by hordes of flea-beetles which seem to have a particular fondness for cress pungency. But it is easily grown under glass, in flower pots, flats, or on a bench, in any light and fairly warm place and in any good soil Grown thus it is usually free from flea-beetle injury, and goes well with forced lettuce. Seed is easily grown, either in the open or under glass The plants are allowed to mature their seeds, are then pulled and the seed rubbed or thrashed out and cleaned. There are slight variations in the form of the leaves, some of which are more or less curled, others more of the broad-leaved type

Water-cress (*Nasturtium officinale* of the older books, but known as *Radicula Nasturtium-aquaticum* and *Rorippa Nasturtium* in recent books), Fig 1107, is a hardy perennial, and finds a congenial place in small, running streams, shallow pools or ditches, wintering well when covered with water. It is usually found freely, bunched, in most of our markets and at green grocers'. It grows readily from seed as well as from freshly cut pieces of branches, and soon spreads over a large area. The best product comes from clear running water

Similar to water-cress in pungency is the upland cress (*Barbarea præcox*), a hardy biennial It also grows easily from seed sown in the open or under glass in ordinary soils and situations The root-leaves are used for garnishing and seasoning, but they are not of the highest quality. See p 454, Vol I.

Other plants sometimes grown under the name of cress are *Cardamine pratensis* (p 661) and *Splanthes oleracea* (which see) The very pungent root-leaves of the former are said to be eaten, but apparently the plant is not cultivated for this purpose

T. Greiner.

CRÌNUM (Greek name for a lily) *Amaryllidàceæ*. Large and showy flowering bulbs, mostly tender, closely allied to Amaryllis and distinguished by the longer perianth-tube; flowers usually white or in shades of red, largely summer bloomers, but differing widely in this respect

Stems arising from a tunicated bulb with a more or less elongated neck· lvs mostly persistent, usually broad, sometimes several feet long fls few or many in a 2-bracted umbel, often very fragrant and with 3 types of coloring, pure white, banded red or purplish down the center, or flushed with the same colors, perianth salver-form or funnel-shaped, the tube straight or curved, long-cylindrical, segms linear, lanceolate or oblong, nearly or quite equal, stamens 6, attached on the throat of the corolla, with long filiform filaments and very narrow versatile anthers; ovary 3-celled, the ovules few in each cell, the style long and filiform, somewhat bent



1107 Water-cress—Radicula Nasturtium-aquaticum.

downward, the stigma not lobed: fr a roundish or irregular caps, at length dehiscing; seeds large, green, thick —Probably 100 species in warm and tropical regions around the world, in moist or wet places. The crinums are amaryllis-like plants of great beauty. They are widely grown, often under the name of "lilies," some of them as warmhouse plants, some as

coolhouse subjects, and a few as hardy border plants. The bulbs are often very large, sometimes as much as 2 or 3 feet long, neck and all, the leek-like neck gradually tapering from the bulb proper. In some species the bulb is short and onion-like Fig. 1108 shows forms of crinum bulbs In some species the flowers are 1 foot long and half as broad, and sometimes the leaves reach the length of 6 feet and a width of 5 or 6 inches. The flower-stalk is solid, leafless, usually arising from the side of the bulb-neck. The genus might be roughly divided into the evergreen kinds, mostly with leek-like bulbs and symmetrical star-like straight-tubed usually erect flowers, and the deciduous-leaved kinds, mostly with roundish bulbs and nodding bell-shaped more or less irregular flowers

The crinums require so much room that they are not often seen in commercial collections in this country They are particularly adapted to mild and warm climates, and therefore full notes on such handling of them are given here They are not much grown in American greenhouses The species cross freely, and many fine hybrids are known, some of them under Latin species-names

Hardy crinums

The species of Crinum require widely different culture, and their geographical distribution furnishes an important clue as to the degree of warmth required. There are two species hardy in the northern states, *C. longifolium* and *C. Moorei*, the latter being less reliable than the former but with finer flowers These two species differ from others in blooming all summer instead of during a short period, and in the more lasting qualities of their flowers An interesting hybrid between the two, *C. Powellii*, is hardier than *C. Moorei*, and the flower, though better than *C. longifolium*, is not quite so showy as that of *C. Moorei* The hybrid has three well-marked colors, white, rosy and purplish. A single bulb of the white variety has given fifty flowering bulbs in four years It is excellent for placing in conspicuous positions on terraces or lawns, or in corners where flowers are wanted to combine with architecture or statuary for summer effect. The Agapanthus is frequently grown also for such purposes. Of course large specimens are needed for this use, but they are easily secured and they last from year to year. The bulbs of crinums are mostly grown in Holland and in Florida The only native species, *C. americanum*, the "swamp lily of Florida," makes a brilliant and striking spectacle when seen in places far from cultivation, as in the Everglades

The most reliable of the hardy crinums in the North is probably *C. Powellii* If the bulbs are planted 2½ to 3 feet deep (to the bottom of the bulb) in well-drained soil, the plant stands without protection in the neighborhood of New York City Let them stand 2 to 3 feet apart This crinum makes a very ornamental summer plant, even the strong foliage producing a tropical effect It produces offsets very freely, but they are deep in the ground It seems not to produce seed in the North *C. longifolium* is also hardy, but is better with a covering in winter; and it is inferior to *C. Powellii* in leaf and flower *C. Moorei* is equally hardy except that the bulbs grow near the surface and are therefore so much exposed as often to be ruined by frost. It is a very desirable summer species It often seeds in the latitude of New York City, and these fleshy seeds germinate readily if placed on the surface of moist soil. It produces offsets freely, which are used in propagation It has very strong fleshy roots; and when grown in pots or tubs (which is a desirable practice) it should be given plenty of room This species has a long columnar neck with a spreading cap or crown of leaves, and large white or pink flowers. *C. variabile* (*C. capense*) is hardy south of the Ohio There are a number of half-hardy species; and most of the greenhouse kinds make very desirable lawn or porch plants when well established in large pots or tubs.

Tender crinums.

There are more than fifty species of greenhouse crinums, all of them worth growing because of their handsome flowers; some of them have very ornamental foliage. Most of the species are seldom seen in this country, possibly because they occupy too much space and give a comparatively small number of flowers to recompense the grower for their upkeep. It is not necessary to keep the evergreen species growing all the time after the flowers have been produced. The plants may be put out-of-doors under a lath-house for four or five months The soil should be of a lasting nature with good drainage so that frequent repotting will not be necessary. When the plants are in a growing state, frequent applications of manure water will be found to be beneficial. In the warmer parts of the country,



1108 Crinum bulbs as named in the trade Left to right, C Moorei, C. giganteum, C. Kirkii, C. Powellii.

many of the tropical species should be plunged or planted out in the open border, where they often give a satisfactory quantity of flowers. In winter, the plants may be carried over under the bench of a temperate house They should be given water occasionally during April and the first half of May to encourage new root-growth When planted out in rich soil, nearly all of them will produce their gorgeous flowers out-of-doors, and during winter they are best treated as dormant bulbs with a little more heat than given such plants as cannas and richardias, planting them out as soon as the weather is favorable. A few of the tropical crinums are grown for their foliage principally, and are often seen in public conservatories and palm-houses where they suffer but little from dense shade The flowers of most species are exceedingly handsome but only for a comparatively short time; during the remainder of the year when out of bloom there are hosts of things that are much more ornamental. Tropical crinums should be grown in this country nearly altogether for outdoor work; we then get the best out of them because our hot summers are favorable to their growth and for the production of bloom. Those species not amenable to this treatment do not give results at all in keeping with the space and time devoted to them. (G. W Oliver.)

Crinums in Florida and the South.

The various species of Crinum belong to the most important, the most beautiful and the most popular of Florida garden plants. No plants grow so easily, with so little attention, and no plants are so floriferous and so deliciously fragrant. Some of the species, as *C. zeylanicum*, *C. erubescens* and *C. Sanderianum*, are so common in gardens, that they are little appreciated by people in general. Planted together in masses or in borders and in front of shrubbery, they look extremely beautiful They grow best in rich, somewhat moist soil, but they are also perfectly at home in the high pineland ridges when well fertilized and cultivated. There is great confusion in the nomenclature of these plants, scarcely half a dozen being correctly named in the various catalogues The following notes are based on many years' experience with crinums in Florida, and the names represent plants that the author considers to be proper representatives of the species.

C. abyssinicum has white flowers and is attractive, but it does not grow well in the sandy soils of Florida.

C. amabile. Very much like *C augustum* in growth and the flowers also much the same, but it is considerably smaller and multiplies rapidly by offsets Every three or four years it must be replanted in fresh rich ground, and the offsets must then be removed. It is a very beautiful plant, and much more floriferus than the *C. augustum*, flowering in every month of the year The perfume of the masses of flowers in spring and summer is so strong that it pervades the entire garden It does not bear seeds in Florida. but the pollen is fertile and can be used in cross-breeding

C americanum Common along muddy banks of lakes and rivers A very beautiful pure white, intensely fragrant species and very valuable in hybridizing work. Flower-stem usually 3 feet high, bearing mostly four flowers. Grows well in gardens, particularly in rich moist soil

C amœnum A rather small-growing Asiatic species with long slender bulbs and white flowers tinged red on the outside. Rare

C asiaticum The columnar stem-like bulb, about 12 to 15 inches long, grows mostly above the ground. In planting it should never be set deep in the ground, a few inches is sufficient The leaves are arranged in a rosette They are about 3 feet long, very broad near the bulb, gradually narrowing to a sharp point at the end. The color is light bluish green Flowers almost all the year round, even in winter when the weather is warm, usually 20 flowers in an umbel being borne always a little above the foliage on a strong stem The flowers are pure white, with linear narrow segments, filaments and stigma purplish red, yellowish white in the lower third Strangely and deliciously fragrant A real gem among our garden flowers Hardy all over the Gulf Coast region, where it forms in time large and impressive clumps of tropical foliage Bears large pea-green fleshy seeds abundantly Excellent for raising hybrids.

C. augustum "Great Mogul" of Barbados. The largest-growing of all our crinums, specimens 4 feet high and 6 to 8 feet in diameter being not uncommon It needs rich moist soil and a fair amount of good fertilizer Leaves are very broad, 4 to 5 feet long, narrowing gradually to a sharp point, deeply channeled It blooms continually for months Flower-stem an inch in diameter, purplish-red, 4 feet high, bearing a large umbel of glossy purplish crimson flower-buds which are pink inside after opening Nearly twenty flowers to each umbel, giving a large mass of very beautiful and deliciously fragrant blossoms This umbel is so large and heavy that it soon bends over and finally lies on the ground For this reason, it is necessary to tie it to a strong bamboo stake It is difficult to propagate, as offsets are formed slowly A plant five years old has formed only two side-shoots Although it affords good pollen for hybridizing purposes, it does not seed Hardy in New Orleans

C. campanulatum (*C. cafrum*) Very distinct, with beautiful glaucous green leaves and umbels of six to eight rosy red campanulate flowers The flowers are much recurved at their edges It blooms several times each year. One plant, although eighteen years old, never made a side-shoot. It grows wild in ponds in southern Africa and very likely needs moist soil

C. Careyanum (offered in the trade as *C virgineum* which is really a white-flowering species from Brazil) It also goes under the name of *C. grandum* This is a doubtful plant, being perhaps an old English hybrid. It is very distinct from all other crinums, very beautiful and deliciously fragrant and a night-bloomer Flower-stem 3 feet high, with an umbel of six to eight pure white flowers with a faint red band in the center. The buds are reddish and the stem is purplish grayish green. Bears no seed.

C. carsbæum. Reminds one of *C americanum*, but flower-stem grayish purple on a green ground. Flowers pure white, very fragrant. Rare.

C. crassipes. Bulbs conical, very large, 8 to 10 inches in diameter. Forms offsets tardily, if at all Flower-stem short. Flowers fifteen to twenty in an umbel, white, bell-shaped, faintly keeled with pink

C. erubescens (usually advertised as *C fimbriatum*). One of the most common species in Florida gardens. Increases rapidly by offsets Leaves long, thin and narrow, 2 to 3 feet long· flower-stem 2 to 3 feet tall, purplish green, carrying usually four to six very beautiful fragrant flowers, pure white with a faint pink keel, outside purplish red. Does not bear seeds, and pollen, and is useless for cross-breeding. Found everywhere in gardens

C. fimbriatulum. Extremely rare, and not in the trade. Flowers pure white, with a soft red band in the center of each petal. One plant formed only five offsets in the course of eight years.

C. giganteum Perhaps the most beautiful species, the leaves being as ornamental as an aspidistra or a dracena Evergreen like *C pedunculatum*, *C. amabile*, *C. augustum*, and *C. asiaticum*. The leaves are about 3 feet long, rich deep green with a slight bluish tint. It forms large clumps in the course of a few years. Flowers six to eight in an umbel, bell-shaped, creamy white in the bud, pure white when fully expanded, exhaling a very strong vanilla-like perfume They appear six or eight times during the year, even in winter when the weather is warm Needs rich moist soil and does not thrive satisfactorily on high dry land. An excellent species for hybridization.

C imbricatum Allied to *C. giganteum*, but bulbs much larger and leaves rather glaucous green, strongly nerved, with serrated edges Flowers similar, but creamy white Flowers usually two or three times during the year This is as beautiful as *C. giganteum*, but it does not form such large clumps in the course of a few years. Seeds freely.

C. Kunthianum. A large-growing species, with a fine rosette of bright green spreading leaves and large umbels of pure white flowers Its variety *nicaraguense* is a still larger-growing plant. The flower-stem is quite short, about a foot high, bearing five or six very large white flowers with a faint pink band in the center, purplish on the outside. The flowers of both are strongly fragrant.

C. longifolium. An excellent plant for hybridizing The leaves are glaucous green, flowers eight to twelve in an umbel, pink, flushed with deeper red on the outside A fine foliage plant, though flowers not very showy The white variety, *C. longifolium album*, with very beautiful pure white bell-shaped flowers, is a very showy plant and much superior to the type

C Macowanii Forms very large bulbs with long slender necks. A beautiful species with pink flowers, but very difficult to grow in light soils It does not flower regularly each year

C. Moorei Bulb very large, 6 to 8 inches in diameter, with a very long slender, stem-like neck about 10 to 12 inches long The leaves are very beautiful, long and thin and very wavy It usually flowers in March in central Florida Flowers four to ten in an umbel, bell-shaped, rosy or pinkish red and deliciously fragrant There is a beautiful white form of this extremely beautiful species Var. *Schmidtii*, which usually flowers also in March or April Both kinds bear seeds if hand-pollinated with their own pollen or crossed with different other species. This crinum will not thrive well in the light soils It requires a heavier soil with some clay in it, and it grows well only in a lath-house.

C. pedunculatum. Very rare in Florida gardens Reminds one of *C asiaticum*, but the bulb is shorter, more massive and the leaves thinner and of a brighter green Flowers twenty to twenty-five in an umbel, pure white and strongly fragrant This plant needs rich mucky soil to do its best It does not thrive on dry ground It is a much shyer bloomer than *C asiaticum*, with which it is often confounded

C. podophyllum This is another evergreen species, almost a miniature *C imbricatum* Leaves glaucuous green, strongly nerved, with serrated edges Bulb only a few inches in diameter and very short Flower-stem about 10 inches high bearing only a few pure white strongly fragrant flowers. Flowers only once during the summer

C pratense. Bulb 5 to 6 inches in diameter Flowers white. Requires moist rich soil Rare

C. purpurascens This small species, with linear undulated leaves about a foot long, forms large clumps in rich moist soil, thriving with caladiums, marantas, ferns, and other shade-loving plants Flowers five to six in an umbel, slightly red in bud and pink when expanded Flower-stem purplish, only about 6 to 8 inches high

C Sanderianum (Milk-and-Wine Lily) Common in Florida gardens. Flowers white, keeled with bright red, deeper red on the outside Flower-stems 3 feet high, carrying five or six flowers in the umbel Bears no seed

C scabrum One of the showiest Flowers large, amaryllis-like, pure white, banded crimson, reminding one of *Hippeastrum vittatum*. Very fragrant, but flowers of short duration Flowers three or four times during spring and summer Bears seed abundantly and can be easily cross-fertilized with other species. Grows well on high dry pine land, but, like all crinums, requires rich soil.

C variabile When in bloom, this is the showiest of all the species Bulbs very large, conical Flower-umbels consist of fifteen to twenty large pure white bell-shaped flowers, being borne well above the foliage, standing upright. The flowers are faintly striped with pink Three or four stems are usually pushed up at the same time from one large bulb, and beds consisting of twenty-five or fifty bulbs are a magnificent sight, as almost all the buds open at the same time. This crinum is strictly a night-bloomer, the flowers beginning to open in the dusk of evening, remaining in perfect condition until sunrise A clump or a bed of this species in full bloom during a moonlight night has a wonderful effect It looks particularly beautiful under palms This species is hardy as far north as southern Missouri and Kentucky, with a little protection in the form of stable manure or dry leaves It has been received under the names *C. Kirkii*, *C. ornatum* and *C. latifolium*. Does not bear seeds

C. yemense. Flowers pure white, bell-shaped and somewhat fragrant Bears seeds. Excellent for cross-breeding purposes

C. zeylanicum (often sold as *C. Kirkii*) Perhaps the most common of all the crinums, being found in almost every garden, even in the backwoods. The flowers which are intensely fragrant are borne on tall purplish stems. They are deep crimson in the bud

state, white with a red stripe, when fully expanded They usually flower in June and July after the rainy season has set in. Bears large grayish green fleshy seeds abundantly and is a fine plant to be used in hybridizing.

H. NEHRLING

INDEX.

abyssinicum, 31.
album, 12, 14, 15.
amabile, 4, 8
americanum, 5.
amœnum, 7
anomalum, 1
aquaticum, 26.
asiaticum, 1
augustum, 4, 8.
australe, 2.
caffrum, 20
campanulatum, 26.
canaliculatum, 2
capense, 12
cappedum, 1
Careyanum, 24.
caribæum, 3.
Colensoi, 14
crassifolium, 18.
crassipes, 21.
declinatum, 1.
eboraci, 1
elegans, 6.
erubescens, 9, 10.
exaltatum, 2.
fimbriatulum, 25.
floridanum, 3.
giganteum, 29.
grandiflorum, 12.
Herbertii, 23.
hybridum, 1
imbricatum, 33
intermedium, 15.
jemenicum, 19.
jemense, 19
Johnstonii, 20.
Kirkii, 16.
Kunthianum, 10, 23
latifolium, 19
lineare, 27
Lxnnæi, 19
longifolium, 12.
Mackenii, 14
Macowanii, 13.
Makoyanum, 14.
Mearnsii, 7
Moorei, 14
natalense, 14
nicaraguense, 10.
nobile, 29.
ornatum, 19, 22, 24.
pedunculatum, 1, 2.
platypetalum, 14.
podophyllum, 28.
Powellii, 15.
pratense, 6
procerum, 1
purpurascens, 11.
Rattrayii, 30
riparium, 12
Sanderianum, 22.
scabro-carpense, 23.
scabrum, 23
Schmidtii, 14.
simico-scabrum, 1.
sinicum, 1.
toxicarium, 1.
variabile, 18.
venustum, 6.
virgineum, 32.
viginicum, 23.
yemense, 19.
zeylanicum, 17.

A. *Perianth erect, salver-shaped, with linear segms.; stamens spreading. (Stenaster.)*

B. *Color of perianth white; tube greenish.*

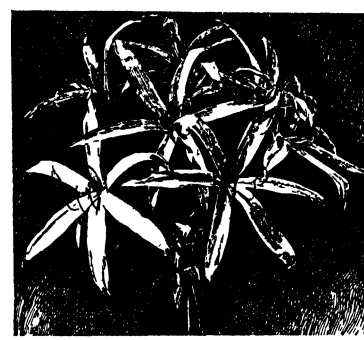
1. **asiáticum,** Linn (*C toxicárium,* Roxbg.). Bulb 4–5 in thick, neck 6–9 in. long. lvs 20–30 to a bulb, 3–4 ft long, 3–4 in broad. peduncle 1½–2 ft long, 1 in. thick; fls 20–50 in an umbel; spathe-valves 2–4 in. long, pedicels ½–1 in long; perianth white; tube erect, tinged with green, 3–4 in long, segms. 2½–3 in long; filaments tinged red, 2 in long· ovule 1 in a cell. Trop. Asia. B M. 1073. G F 4:283. Baker gives 5 botanical varieties, of which the most important in the American trade is probably var. **sínicum,** Baker (*C. sínicum,* Roxbg. *C. pedunculátum,* Hort, not R. Br.). ST JOHN'S LILY. Bulb 6 in. thick, 18 in. long: lvs 5 in broad, with undulated edges, forming a massive crown 4–5 ft high· peduncle 2–3 ft. long; fls. 20 or more, the tube and segms longer than in the type; perianth white China The bulb usually divides into 2 of equal size; small offsets are rarely produced. Seedlings flower in 5 years Var. **declinátum,** Baker (*C declinátum,* Herb.), has a declined instead of erect bud; perianth-segms tinged red at tip B M 2231 Var. **pròcerum,** Baker (*C pròcerum,* Carey), is larger than the type with lvs 5 ft. long, 6 in. wide. perianth-tube and limb 5 in long, the latter tinged red outside. Rangoon. B M 2684 Var **anómalum,** Baker, is freakish-looking, its lvs being expanded into a broad, membranous, striated and plaited wing B M 2908 (as *C. plicatum*). **C. ebòraci,** Herb. (*C. hýbridum Todòræ,* Hort). Similar to the variety next mentioned, but half the size. Garden hybrid between a small form of *C. asiaticum* and *C longifolium.* **C. ebòraci** var **cáppedum,** Reasoner (*C. cáppedum,* Reasoner). Habit much like *C. asiaticum,* but lvs tapering to a slender point, semi-erect, 4 ft. high: fls. about 20, segms. 4 in. long, ½in. broad, spreading, white, sometimes changing to pink. Garden hybrid between *C. asiaticum* var. *sinicum* and *C. longifolium.* Increases both by offsets and splitting of the bulb into two. **C. sínico-scàbrum,** Hort, hybrid of *C. asiaticum* var. crossed with *C. scabrum,* and intermediate in aspect and fl.—*C asiaticum* is the largest of the cult. species, good specimens standing 5 ft. high and having a greater spread. The evergreen reticulated lvs. are ornamental. It blooms several times each year in good warmhouse or greenhouse conditions.

2. **pedunculàtum,** R Br. (*C. austràle,* and *C. exaltàtum,* Herb. *C. canaliculàtum,* Roxbg.). Bulb 4 in. thick; neck 6 in. long. lvs. 25–30 to a bulb: fls. 20–30 in an umbel; spathe-valves 3–4 in. long; pedicels 1–1½ in.; perianth greenish white, not tinged with red outside, the segms. linear and spreading and shorter than the tube; filaments short, bright red; style shorter than the filaments: ovules 3 in a cell. Austral. B.R 52.—The bulb grows above ground on a large rootstock; summer; coolhouse.

3 **caribæum,** Baker (*C. floridánum,* Griseb., not Fraser). Lvs. lorate-oblong, 1 ft. or less, 3–4 in. broad, narrowed to the base: umbels 3–4-fld.; perianth-tube 3–4 in. long, nearly straight; segms. white, linear, spreading, nearly as long as tube. W. Indies.

BB. *Color of perianth purplish red outside; tube purplish red.*

4. **amábile,** Donn. Bulb small; neck 1 ft. or more long: lvs. 25–30 to a bulb, 3–4 ft. long, strap-shaped, tapering to the point, the margin entire peduncle 2–3 ft. long; fls 20–30 in an umbel, very fragrant; spathe-valves 4–5 in. long; pedicels ½–1 in long; perianth with a crimson center band, tinged outside bright purplish red; tube bright red; segms. 4–5 in long; stamens an inch shorter than the segms. Sumatra B.M.1605. R H. 1856.241.—Summer; warmhouse Supposed by Herbert to be a spontaneous hybrid between *C. asiaticum*



1109. Crinum americanum. (×⅓)

var *procerum* and *C. zeylanicum·* fls sterile; bulb increases by small offsets; has been sold under the name of *C augustum* (Hort, not Roxbg), which is a similar but smaller natural hybrid presumably between *C. bracteatum* and *C. zeylanicum,* and has more obtuse lvs. than *C. amabile.*

AA. *Perianth erect, salver-shaped, with lanceolate segms.: stamens spreading. (Platyaster.)*

B. *Lvs. few, 6–12 to a bulb.*

5. **americànum,** Linn. Fig. 1109. FLORIDA SWAMP LILY. Bulb stoloniferous, ovoid, 3–4 in. thick, neck short. lvs. 1½–2 in. broad and 2–4 ft long, curved, denticulate: fls. 3–6, usually 4 on an erect scape 20–30 in. high; pedicels 0 or very short; perianth creamy white, the lobes linear or lance-linear; tube greenish, equaling or exceeding the lobes. Native in river swamps Ga and Fla. and westward. B.M. 1034 —Blooms in spring and summer, but some fls. may occur in winter far S.

6. **praténse,** Herb. Bulb ovoid, 4–5 in. thick; neck short: lvs. 6–8, linear, suberect, 1½–2 ft. long, 1½–2 in. wide, channeled, narrowed to point, margin entire: fls 6–12 on a lateral compressed peduncle 1 ft or more high; perianth white, the tube greenish and 3–4 in. long, the segms. nearly or quite as long, ½in. broad, lanceolate; filaments shorter than segms, bright red. Low grounds, India. Summer. Var. **élegans,** Carey, has a longer-necked bulb, decumbent, peduncle, and tube an

inch shorter than the segms B M 2592 Var. **venûstum,** Carey, has about 30 fls in an umbel India.

7 **amœnum,** Roxbg Bulb globose, 2–3 in. diam, with a very short neck· lvs 10–12, suberect, linear, 2 ft or less long, rough-edged, tapering to the apex. fls 6–12, the peduncle standing 1–2 ft high; perianth-tube greenish, 3–4 in long; segms. white tinged red outside, 2–3 in. long, lanceolate, filaments bright red, shorter than segms. India Summer; warmhouse. Var **Mèarsii,** Bedd (*C. Mèarsii,* Bedd.). Very small: lvs 1 ft. or more long, 1 in. wide, very smooth peduncle 3-5 in long, 6–10-fld, fls white, the tube slender and 5 in long; segms lanceolate, 2½ in. long and ½in broad. Upper Burma. G C. III 42 62 —Whole plant not more than 2 or 3 in high when not in bloom; blooms well in a 3-in. pot



1110.
A young plant of Crinum Moorei.

BB *Lvs numerous, 20 or more to a bulb.*

8. **augûstum,** Roxbg (*C amábile* var. *augústum,* Gawl) Bulb conical, 6 in thick, neck long lvs 20–30, strap-shaped, 2–3 ft long, 3–4 in broad: fls. 12-30, on a lateral much-compressed peduncle 2–3 ft. high, pedicels sometimes an inch long, color strong purplish red outside, banded within; tube purplish; segms. lanceolate, 4–5 in. long, filaments half length of segms., red. Mauritius, Seychelles. B.M. 2397. B R. 679 —Warmhouse; effective

9 **erubéscens,** Ait Bulb ovoid, 3–4 in thick, the neck short. lvs many, curved, strap-shaped, thin, 2–3 ft long and 2–3 in broad, slightly rough on edges. fls 4–12, on peduncle 2 ft or more high, the pedicels 0 or very short, color reddish outside, white within; tube bright red, 5–6 in. long; segms. half as long as tube, lanceolate, reflexing Trop. Amer. B M 1232. L B.C 1 31.—Summer; warmhouse.

10 **Kunthiànum,** Roem. (*C erubéscens,* HBK., not Ait) Bulb ovoid, 3 in diam, with a short neck· lvs about 20, strap-shaped, spreading, 2–3 in broad, undulate but entire fls 4–5 in an umbel, the peduncle 1 ft high, the pedicels 0 or very short, pure white, tube 7–8 in long; segms lanceolate, 2½ in long; filaments less than 2 in long, bright red. Colombia. Var. **nicaraguénse,** Baker, is purple outside, the segms. a little longer and lvs. longer and narrower.

11 **purpuráscens,** Herb Bulb ovoid, short-necked, 2 in. diam, stoloniferous lvs 20 or more, linear, thin, 3 ft or less, prominently undulate fls. 5–9, on a peduncle 1 ft or less long, tube very slender, 5–6 in. long, segms lanceolate, half as long as tube, pink or purplish; filaments bright red Upper and Lower Guinea, in streams and lakes, the lvs often floating B M 6525. G.C. III. 47:114 —Amphibious. Summer; warmhouse.

AAA *Perianth funnel-shaped, tube permanently curved, segms oblong ascending, stamens and style contiguous and declined* (*Codonocrinum.*)

B. *Bulbs long-necked* (*No. 30 omitted*).

C. *Margin of lvs. not ciliate, but often scabrous*

12. **longifôlium,** Thunb. (*Amarýllis longifólia,* Linn *C. rìpàrium,* Herb. *C capénse,* Herb) Bulb ovoid, 3–4 in. diam: lvs. 12 or more, strap-shaped, 2–3 ft. long, 2–3 in wide, margins rough fls 6–12, pedicels 1–2 in. long; perianth tinged red on the back, and sometimes on the face, with a white variety, tube cylindrical, 3–4 in. long, about equaling the limb; segms. oblong, acute, 1 in. or less broad; stamens nearly as long as segms.; filaments red. Cape. Natal. B M. 661. Var. **álbum,** Hort. Gn. 52, p 123.—Probably the hardiest pure species of crinum, enduring the winter of the Middle States, if protected with litter during cold weather. Prop. by offsets or seed, which latter is produced abundantly **C. grandifôrum,** Hort, is a hybrid with *C Careyanum,* said to partake of the hardiness of *C longifolium.* Sometimes described as having a short-necked bulb.

13. **Macôwanii,** Baker. Bulb globular, 9–10 in. diam, with neck 6–9 in long. lvs. 12–15, strap-shaped, thin, 2–3 ft long, 4 in or less broad: fls. 10–15, on a stout green peduncle 2–3 ft high; tube curved, green, 3–4 in. long; segms about equaling the tube, pink, oblong, acute, 1–1½ in broad. Natal.—Late autumn, greenhouse, or half-hardy.

14. **Moôrei,** Hook. f. (*C Makoyànum,* Carr *C. Colénson, C Máckeni* and *C natalénse,* Hort). Fig. 1110 Bulb ovoid, neck 12–18 in long lvs 12–15, strap-shaped, 2–3 ft long, 3–4 in wide, margin entire, veins rather distant, distinct fls 6–12, on peduncle 2–3 ft high, the pedicels 1½–3 in long; tube greenish, about 3 in. long and with a funnel-shaped pinkish limb of equal length, the segms oblong, nearly acute, connivent, filaments pink, an inch shorter than segms. Natal and Kaffraria B M 6113 G C III 2 499, 48·59. R H 1887 300 and p 417 R B 22 p 196, 23.61 Var **álbum,** Hort Gt 31·1072. Gn 52, p 122, and var **platypétalum,** Hort, are cult *C Colensoi* has a longer tube, smaller fl, with a paler and narrower limb *C. Schmidtii,* Regel, is probably a pure white-fld. form of this species.

15 **Pôwellii,** Hort Fig 1111 Bulb about 3 in. diam, with a long slender neck lvs about 20, spreading, ensiform, acuminate, 3–4 ft long, 3–4 in broad near the base, margin smooth fls about 8, perianth dark rose-color, pedicels 1–1½ in long – Garden hybrid of *C longifolium* and *C. Moorei* —A valuable outdoor crinum Var **álbum,** Hort, white Var. **intermèdium,** Hort, light rose-color

CC *Margin of lvs ciliated*

16 **Kirkii,** Baker Bulb globose, 6–8 in thick, neck 6 in long· lvs 12 or more, 3½–4 ft long, 4–4½ in wide and long-tapering to a point, margin rough, veins close fls 12-15 on a stout compressed peduncle 1–1½ ft. high, pedicels 0 or very short, color white, with a very distinct bright red band down the center of each oblong acute segm, tube greenish, 4 in, about equaled by the segms E Afr B M 6512 —Probably not in commerce. See No 17. Sept; warmhouse

BB *Bulbs short-necked (not considering No 30)*

C *Fls numerous, usually more than 8 in an umbel.*

17 **zeylánicum,** Linn Bulb globose, 5-6 in thick. lvs. 6–10, thin, sword-shaped, 2–3 ft long, 3–4 in wide, wavy, margin roughish, peduncle long and not very stout, often tinged red, fls. 10–20 on very short pedicels; tube 3–4 in long, curved, segms oblong, acute, 3–4 in long, 1 in broad, white with a broad red keel, stamens an inch shorter than segms Spring to midsummer, warmhouse Trop Asia and Afr B M 1171 (as *Amaryllis ornata*) —A warmhouse species Usually sold as *C Kirkii,* which is an allied species from E Afr., probably not known outside of botanic gardens

18 **variábile,** Herb. (*C crassifólium,* Herb) Bulb ovoid, 3–4 in. thick, without distinct neck lvs 10–12, linear, glabrous and entire, the outer ones 2 ft. and more long, 2 in. wide, weak. fls 10–12, on a compressed erect peduncle 1–1½ ft high, the pedicels ½–1 in. long; tube greenish, 1½ in. long, segms white with red tinge down the keel, oblong, acute, 2½–3½ in. long, filaments red, an inch shorter than segms Cape region Spring

19 **latifôlium,** Linn (*C. ornàtum* var *latifólium,* Herb *C. Línnæi,* Roem *C. jemênse, C jemênacum* and *C yemênse,* Hort) Bulb nearly globose, 6–8 in. diam., with a short neck· lvs. many, strap-shaped, thin,

2–3 ft. long and 3–4 in broad, slightly scabrous on the margins· fls. 10–20, on a peduncle 2 ft. or less high; tube curved, 3–4 in long, greenish; segms. about as long as the tube, oblong-lanceolate and acute, 1 in broad at middle, whitish tinged red. Trop Asia.—An excellent species; summer; warmhouse.

20 **Jōhnstonii,** Baker Bulb globose, 3–4 in diam., without neck· lvs about 20, long-pointed, the outer ones 5–6 ft long and sword-shaped, the inner linear· fls about 20 on a peduncle 2 ft high; tube slightly curved, tinged green, 4 in , limb shorter than tube, the segms. ovate or oblong, acute, white and tinged pink on the back, stamens nearly as long as limb Mts. British Cent. Afr. B M 7812. G.C. III. 50.170—Closely allied to *C. longifolium*. Fls. fragrant, 8 in. long

21 **crāssipes,** Baker. Bulb very large, conical, without neck: lvs sword-shaped, 3–4 ft long, 4 in. broad and long-tapering to the apex, entire. fls 15–20, in a stout compressed peduncle less than 1 ft long, the pedicels 1–1½ in long, tube about 3 in long, slightly curved, green, segms oblanceolate, ½in broad, equaling the tube, ascending, white tinged red on the back; filaments purple, nearly equaling the segms. Probably Trop. Afr.

CC *Fls. fewer, usually less than 8 in an umbel*

D. *Segms. of perianth red, striped or tinted with red.*

E. *Tube of perianth usually 3 in. or more long.*

22. **Sanderiànum,** Baker (*C. ornàtum*, Bury). Bulb globose, 2 in thick, neck short, 2–3 in long. lvs. 10–12, thin, 1½–2 ft long, 1½ in broad. margin denticulate, tapering to a long point fls 3–6, nearly sessile, white, keeled with red; tube 5–6 in long, curved; segms oblong, acute, ascending, 3–4 in long and 1 in. or less broad; stamens much shorter than segms Upper Guinea Gn 52 122 —Closely allied to *C. scabrum*. Intermediate house, blooms at intervals.

23 **scàbrum,** Herb Bulb globose, 5–6 in diam , with short neck lvs 12 or more, 2–3 ft long, 1½–2 in. wide, closely veined, margin scabrous. fls 4–8, the peduncle 1–2 ft high; pedicels 0 or very short, tube greenish, 4–5 in long, segms white with distinct red keel, oblong, acute, 3 in or less long, filaments rather shorter than segms Apr May Trop Afr B M 2180 F S 21 2216 A very showy and easily cult species, spring or early summer, warmhouse **C. Hérbertii,** Sweet (*C scàbro-capense*, Hort. *C Kunthiànum*, Hort , not Roem) Fls similar to *C scabrum*, but color lighter, the plant taller and larger Garden hybrid between *C scabrum* and *C longifolium* This is a doubtful name *C Herbertianum*, Wall =*C. zeylanicum* *C Herbertianum*, Roem & Schulte= *C strictum* **C. virgínicum,** garden hybrid, resembles *C. Herbertii*, but the plant is smaller and the fls larger and brighter in color See also No. 32.

24 **Careyànum,** Herb (*C ornàtum* var *Careyànum*, Herb.). Regarded by Baker as "scarcely more than a variety of *C latifolium*," confused in cult ·fls only 4–6 in the umbel, on a subterete green peduncle about 1 ft high bulb globose, 3–4 in. diam., short-necked, with brown coverings lvs 8–10, strap-shaped, undulate, thin, 2 ft. or less long, 2–3 in. broad, the margin entire· perianth-tube curved, greenish, 3–4 in. long; segms. (or limb) about as long as the tube, oblong-acute, 1 in. broad, lightly red-tinged at center, stamens a little shorter than segms Mauritius and Seychelles. B M 2466 —Autumn; greenhouse.

25. **fimbriātulum,** Baker. Lvs. linear, 4–5 ft. long, 2 in. broad toward base but long-pointed, glaucous green, margins ciliated with small membranous scales: fls 3–7, nearly sessile, on peduncle 2 ft. high; tube curved, 4–5 in long; segms. white with distinct red keel, oblong, acute, ascending, 3 in long and 1 in. broad; stamens an inch shorter than segms. Lower Guinea. Gn. 55. 92 Allied to *C scabrum* —A different plant is passing in the trade under this name.

EE. *Tube short,—3 in. or less.*

26. **campanulātum,** Herb. (*C aquàticum*, Herb. *C. càffrum*, Herb). Bulb small and ovoid: lvs linear, deeply channeled, 3–4 ft. fls 6–8, on a slender peduncle 1 ft. or more long, the pedicels ½–1 in long; tube slender, 3 in or less long, about as long as the campanulate limb; segms bright rose-red, oblong, obtuse, much exceeding the filaments Cape region B M. 2352 —A very distinct species; warmhouse.

27. **lineàre,** Linn f Bulb small, ovoid: lvs linear, 1½–2 ft long, ½in broad, glaucous, channeled on the face, the margin entire fls 5–6, the peduncle slender and about 1 ft long, the pedicels ¾in or less long, tube slender, 2½ in or less long; segms 2–3 in. long, white tinged with red in center, oblong or oblanceolate, acute; stamens much shorter than segms. Cape region. B M. 915 (as *Amaryllis revoluta*). B R. 623 (as *A. revoluta* var. *gracilior*).

DD. *Segms. of perianth pure white (exception in one form of No 29)*

E. *Pedicels very short or 0.*

28 **podophýllum,** Baker. Bulb subglobose, 2 in. or less diam , without evident neck lvs. 5 or 6, 1 ft. long, 2 in or less wide, oblanceolate, acute, thin, narrowed to base fls 2, sessile, the slender compressed peduncle 1 ft. long, tube 5–6 in long, slender and curved, limb somewhat erect, the segms oblong-spatulate, pure white; filaments nearly as long as limb Upper Guinea B M. 6483 —Perhaps a form of *C. giganteum* late autumn; warmhouse.

29 **gigantēum,** Andr. Bulb globose, 5–6 in. thick, the neck short:



1111. Crinum Powellii.

lvs 12 or more, lanceolate, narrowed both ways, 2–3 ft. long, 3–4 in. broad, veins distant, with distinct cross veinlets. fls. 4–6, rarely 8–12 on a stout compressed peduncle 2–3 ft long; tube 5–7 in. long; segms pure white, much imbricated, oblong; filaments pure white, an inch shorter than segms. Trop Afr. B M. 5205. F S. 23.2443. G F. 4:223. I.H. 33.617. —A very fragrant species. Var. **nóbile,** Baker (*C. nóbile,* Bull), has the peduncle and fl. suffused with tinge of red —*C giganteum* is large or gigantic only in its fls., summer; warmhouse

30 **Ráttrayii,** Hort Excellent stove plant, 20 in.: lvs. ascending, strap-shaped, acute, entire, dark green: fls pure white, with a spread of 6 in , in few-fld. umbels; segms ovate-elliptic, acute or sometimes erose; stamens strongly declined, nearly equaling the segms. Uganda G C III 38 11 and suppl

31 **abyssínicum,** Hochst. Bulb ovoid, 3 in. thick, the neck short· lvs. about 6, linear, 1–1½ ft. long, ½–1 in wide, veins close, margin rough, narrowed to a point fls 4–6, on a peduncle 1–2 ft high, the pedicels very short or 0, perianth white, the tube slender, 2 in. or less long, the segms oblong, acute, 2–3 in. long and ¾in or less broad, filaments less than 1 in. long. Mts. of Abyssinia. Greenhouse.

32 **virgíneum,** Mart Bulb large and brown: foliage as in *C giganteum,* the lvs 2–3 ft long and 3–4 in. broad at the middle, narrowed both ways, pointed. fls. about 6, sessile or very nearly so, tube 3–4 in long, segms. pure white, connivent, acute, as long as the tube, filaments much shorter than the segms S Brazil. See also *C virginicum* under No. 23.

EE *Peduncls 1 in long.*

33. **imbricâtum,** Baker Bulb very large, globose lvs strap-shaped, very thin, 3 ft long, 3 in broad at middle and narrower toward base, distinctly veined fls 5–6, on a stout peduncle 1 ft or more long; tube slender and curved, 3 in long, the campanulate limb of equal length; segms. imbricated, oblong-obtuse, filaments 1 in. shorter than segms S Afr —Allied to *C. giganteum*

Crinums hybridize so freely, and the progeny is so likely to be interesting, that many mongrel forms have been recorded under Latin names It is not feasible to account for all such names here. Many of the forms are soon lost —*C Lugárdæ,* N E Br Bulb small lvs long and narrow, rough-edged fls 2–6, the peduncle 1 ft or less high, tube nearly or quite 4 in long, segms lanceolate, about or nearly as long as tube, white with light pink median stripe Trop Afr —*C nátans,* Baker Allied to C purpurascens, but aquatic, the 20 or so strap-shaped undulate lvs submerged bulb small, narrow-ovoid, with many long fibrous roots fls few, white, the narrow segms recurved Upper Guinea B M 7862 —*C. rhodánthum,* Baker Lvs lorate, exceeding 1 ft , thick, ciliate-edged fls many, tube 3 in long, segms red, lanceolate, 2½ in long, erect-spreading and curved in upper part, stamens as long as segms , the filaments red Cent Afr G C III 33 315. —*C Sámuelii,* Worsley Bulb 3 in diam and 2½ in long lvs. sometimes 4 ft long, rough-edged fls 2, sessile, on peduncle 1 ft high, white slightly flushed with pink, not fragrant, 4½ in across Cent Afr —*C Vásseı,* Boiss Bulb ovoid, 4 in across, without distinct neck lvs linear-lorate, 2 ft or less long, 2 in broad, rough-edged fls about 15, on peduncle 1 ft or less high, white with red median stripes, perianth funnel-shaped, 8 in long, the tube curved and red, the segms linear-lanceolate, and a little shorter than tube Mozambique R H 1908 132 — *C Wimbushii,* Worsley Differs from C Samuelii in lvs not rough-edged, fls on short pedicels, faintly fragrant, less lasting and with longer style Cent Afr —*C zanzibarense,* Hort =(?).

L H. B.†

CRÍTHMUM (Greek for barley, from some resemblance in the seed) *Umbellíferæ.* Samphire. A single species, **C. marítimum,** Linn , on shores in Great Britain, W. Continental Eu , and the Medit. region, rarely planted in wild gardens or borders It is a fleshy glabrous perennial herb, seldom more than 1 ft. high, somewhat woody at the base: lvs. 2–3-ternate, the segms. thick and linear: umbels compound, of 15–20 rays, involucrate, the umbellules with involucels; petals very minute, entire, fugacious: fr. ovoid, not compressed, about ¼in. long. Thrives well in a sunny situation, and will grow at considerable distance from the sea. Prop. by division, and by seeds sown as soon as ripe.

CROCÓSMIA (Greek, *odor of saffron,* which is perceivable when the dried flowers are placed in warm water) *Iridàceæ.* Gladiolus-like garden plant.

This genus has but one species, and is not clearly distinguished from the closely allied Tritonia, but it differs in the stamens being separated at equal distances instead of grouped at one side, the form of the limb, the tube not swollen at the top, and the fr. 3-seeded, sometimes 5-seeded, instead of many-seeded



1112. Crocosmia aurea var. imperialis. (×½)

The name of this genus is spelled Crocosma by Baker, but it was first spelled Crocosmia The fls with coppery tips shading into orange-yellow are very distinct and attractive Pax, in Engler & Prantl, combines the genus with Tritonia.

Crocosmia aurea is a showy bulbous autumn-blooming plant, which is hardy south of Washington, D C, with slight protection, and in the North is treated like gladioli, the bulbs being set out in the spring, after danger of frost, and lifted in the fall for winter storage It is of easy culture, and is propagated by offsets or by seeds which should be sown in pots, under glass, as soon as ripe Corms should be stored in peat or sphagnum to prevent them from becoming too dry.

aûrea, Planch (*Tritònia aùrea,* Pappe) Height 2 ft . corm globose, emitting offsets from clefts in the side scape 1½–2 ft high, leafy below, naked or only bracted above, compressed, 2-winged. lvs. distichous, shorter than the scape, linear, ensiform, striated, but with a distinct midrib· fls sessile in the panicle, perhaps 25 scattered over a long season, with buds, fls and seeds at the same time; perianth bright orange-yellow toward center; tube slender, curved, 1 in. long; segms longer than the tube caps 3-celled. Trop and S. Afr July–Oct F S. 7.702. B M. 4335. B.R 33.61 (Tritonia). Also interesting as one parent of a bigeneric cross resulting in *Tritonia* (*Montbretia*) *crocosmæflora* Var. **imperiàlis,** Hort , Fig 1112, grows about 4 ft. high. Var. **maculàta,** Baker, has dark blotches above the base of the 3 inner segms. J.H. III 33:567.

J. N. Gerard.
Wilhelm Miller.

CRÒCUS (Greek name of saffron). *Iridàceæ.* Low spring-flowering and autumn-flowering garden bulbs, showy, and well known.

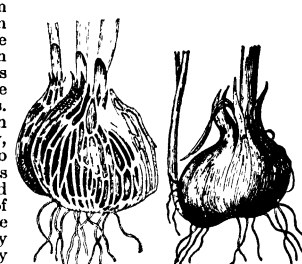
Stemless plants (the grass-like lvs. rising from the

ground or corm), with solid bulbs or corms: fls showy, in many colors, funnel-shaped and erect, with a very long tube and 6 nearly or quite equal segms ; stamens 3, attached in the throat of the perianth and shorter than the segms ; style 3-cleft, the branches entire or forked or much fimbriated, ovary 3-loculed seeds many, nearly globular: fr. an oblong 3-valved caps — Probably 75 species, many of them variable, in the Medit region and extending into S. W Asia The fls open in sunshine They come in fall or spring, but the best-known species are spring-flowering, which are amongst the earliest and brightest of spring bloom. Crocuses force easily (see *Bulb*). A half-dozen corms may be planted in a 4-in pot for this purpose Crocuses are scarcely known in the American trade under their species names Inasmuch as the flowers of the common crocus close when taken out of the sun, they are not popular as window-garden or house subjects. Crocuses have been much hybridized and varied There are many color-forms The common crocuses of the trade have descended from *C. vernus* chiefly, but *C. susianus, C. mæsiacus, C stellaris, C. biflorus* and *C sativus* are frequent. The Dutch bulb-growers cult many species, and these are offered for sale in their American lists, the species are therefore included in the following synopsis In this account, the treatment by Baker is followed (Handbook of the Irideæ).

Botanically, the genus divides itself into three groups on the characters of the style-branches the branches entire, once-forked or fimbriated at the apex, or cut into several capillary divisions Horticulturally, the species fall into two groups,—the spring-flowering and the autumn-flowering. These groups are not so definitely separated as it would seem, however Some of the species bloom in winter in regions in which the ground does not freeze hard, others begin to bloom in July or August, some may continue to bloom till winter closes in Yet these two flowering periods mark very important differences in the utilization of the plants and the primary division in the following treatment is made on this basis The colors are now much varied by cultivation and hybridizing, but they are well marked in the specific types as a rule They run largely in yellow, white and purple

The covering or tunic of the bulbs may be uniformly membranaceous, or it may be composed of strongly reticulated or parallel fibers Fig 1113 The flowers appear usually just in advance of the grass-like foliage-leaves The floral leaves are small and more or less dry or scarious and arise directly from the corm and may be seen as a spathe-like structure inside the leaf-tuft, this is usually known as the basal spathe. The real spathe subtends the bloom, and it is always one-flowered; this floral spathe may be one-leaved or two-leaved

Culture —Many forms of crocus are well known, where they are justly valued as among the showiest and brightest of winter and spring flowers They thrive in any ordinary soil About two-thirds of the species are classed as vernal and the remainder as autumnal flowering, but the various members of the tribe would furnish nearly continuous bloom from August to May were the season open While there are numerous species interesting to a botanist or a collector, practically the best for general cultivation are *Crocus Imperati, C. susianus* (Cloth of Gold crocus) and the Dutch hybrids, mostly of *C. mæsiacus* These bloom in about the order named The rosy flowers of *C. Imperati* may be expected with the earliest snowdrops. The named species, having shorter flower-tubes than the Dutch hybrids, are not so liable to injury by the severe weather of the early year. The autumnal species are not satisfactory garden plants, the flowers mostly appearing before the leaves, and being easily injured *C speciosus* and *C. sativus* are probably the most satisfactory. The latter species has been cultivated from time immemorial, the stamens having a medicinal reputation, and being a source of color (saffron). The cultivation of this species is a small industry in France, Spain and Italy.—The corms of crocuses should be planted about 3 or 4 inches deep, in a well-worked and perfectly drained soil which is free from clay or the decaying humus of manure They should be set only 2 or 3 inches apart if mass effects are desired They may be planted in September or October for bloom in the spring or the following autumn; or the autumn kinds may be planted early in spring. The corms should be carefully examined and all bruised and imperfect ones rejected, as they are very susceptible to attacks of fungi, which, gaining a footing on decrepit corms, will spread to others —The careful gardener will examine all exotic small bulbs annually, or at least biennally, until they show by the perfection of their new bulbs that they have become naturalized, or are suited to their new environment In this case they may be allowed to remain until crowding requires their division This examination should take place after the leaves are matured and dried up. Inasmuch as new corms form on top of the old ones, the plants tend to get out of the ground; it is well therefore to replant the strongest ones every two or three years Increase may be had from new corms which are produced more or less freely in different species on top or on the sides of old corms. —Seeds are often produced freely, but are likely to be overlooked, as they are formed at the surface of the soil These germinate readily and most freely at the growing time of the plant. They should preferably be germinated in seed-pans, which should be exposed to freezing before the natural germinating time Seedlings usually flower the third season —The dutch hybrid crocus is often useful for naturalizing in the lawn, although the grass may run out the plants in a few years, if the bulbs are not replaced by strong ones, they will not last more than a year or two if the foliage is mown off, but if the foliage is allowed to remain until ripe and if the lawn is fertile, the plants may remain in fair condition three or four years or more. (J N. Gerard)



1113 Reticulated and membranaceous tunics Crocus susianus (left) and C sativus (right).

INDEX.

Adamii, 7.
ærius, 8
Aitchisonii, 39.
albidus, 2
albus, 39
Alexandri, 7.
ancyrensis, 5.
argenteus, 7
asturicus, 36.
aureus, 4
banaticus, 10.
biflorus, 7
Boryi, 33
byzantinus, 37.
candidus, 21.
caspius, 26
chrysanthus, 2, 18.
dyticus, 6
etruscus, 15
Fleischeri, 20
Fleischerianus, 20.
Fontenayi, 32.
Foxii, 22
fragrans, 9
graveolens, 19
hadriaticus, 24
hyemalis, 22
Imperati, 17.
iridiflorus, 37.
Kotschyi, 21
Korolkowii, 6.
lacteus, 4
laevigatus, 32.
lineatus, 7.
longiflorus, 28.
luteus, 21
Malyi, 16
marathonicus, 33.
medius, 34
melitensis, 24.
mœsiacus, 4.
niveus, 31.
nubigenus, 7.
nudiflorus, 35.
Olivieri, 18
Orphanidis, 33.
Pestalozzæ, 7
præcox, 7
pulchellus, 38.
purpureus, 12.
pusillus, 7
Reinwardtii, 9
reticulatus, 13.
Salzmannii, 30.
sativus, 23
Scharojani, 27
serotinus, 29
Sieberi, 12
Sibthorpianus, 8.
smyrnensis, 20.
speciosus, 39.
stauricus, 8.
stellaris, 3
sulphureus, 4.
susianus, 1
Suteranus, 18
syriacus, 19
tingitanus, 30.
Tommasinianus, 14.
Tourneforti, 33.
vernus, 14
versicolor, 9, 12.
vitellinus, 19.
Weldeni, 7
Wilhelmi, 24.
zonatus, 25.

A. *Blooming in spring (sometimes in midwinter and continuing toward spring).*

B. *Style-branches entire or merely toothed.*

C. *Fls. yellow, at least inside (varying to whitish forms): basal spathe absent.*

D. *Outer segms. striped or feathered outside.*

1. susiànus, Ker CLOTH-OF-GOLD CROCUS. Fig. 1114. Corm ¾in. diam.: lvs 6–8 in a tuft, reaching to the fl., narrow-linear, with revolute edges and a central band of white. upper spathe 2-lvd.: perianth-segms. 1½ in. or less long, orange-yellow, becoming reflexed, the outer ones brownish or striped on the outside; anthers orange, longer than the filaments; style-branches long and spreading Crimea B M 652 (adapted in Fig. 1114).—Blooms very early, Feb., Mar.

2 **chrysánthus,** Herb (not B R. 33:4, fig. 1, which=*C. Olivieri* var *Suterianus*) Corm small: lvs as high as the fl, very narrow· upper spathe 2-lvd, nearly as long as perianth-tube. perianth-tube 2–3 times as long as the segms, the latter 1¼ in or less long, and plain orange-yellow (varying tinted or striped on the outside, or even nearly white); throat glabrous; anthers orange, twice as long as the roughened filaments; style-branches red-orange. Macedonia and Asia Minor. Gn 74, p. 140. Var **álbidus,** Hort. Fls whitish. Gn.W. 25·229



1114 Crocus susianus. (×½)

3. **stellàris,** Haw. Supposed to be a hybrid between *C. mœsiacus* and *C. susianus,* and known only in cult.: blooms with *C. mœsiacus:* lvs. only 4–6, narrow-linear, reflexed edges, white-banded. upper spathe 2-lvd.: perianth-tube short, the segms. 1–1½ in long, bright orange, the outer ones striped and feathered with brown on the back; anthers pale orange, a little longer than the filaments; style-branches somewhat overtopping the anthers. Mar.

DD *Outer segms. not striped (at least not in the specific types).*

4. **mœsiacus,** Ker (*C. aùreus,* Sibth. & Smith). DUTCH CROCUS Later: corm larger: lvs. 6–8 in a tuft, overtopping the fl, narrow-linear, with reflexed edges and white central band: upper spathe 2-lvd, inner valve very narrow or obsolete; segms very obtuse, bright yellow, 1½ in long, one-half to a third the length of the tube· anthers pale yellow, hastate at the base, somewhat longer than the filaments; style-branches overtopped by the anthers. Transylvania to Asia Minor. B M. 2986 —Variable. A sulfur-yellow form is *C. sulphùreus,* Ker. B M. 1384. There is a striped form. B.M. 938. A cream-white form is *C. lácteus,* Sabine.

5. **ancyrénsis,** Maw. Corm ¾in. diam.: lvs. 3–4, as tall as the fl., very narrow: upper spathe 2-lvd.: perianth-tube exserted; segms. bright orange-yellow, 1 in. or less long, not striped nor colored outside; anthers orange-yellow, much longer than the filaments; style-branches red-orange. Asia Minor.—Blooms early.

6. **Korolkôwii,** Maw & Regel. Corm globose, 1 in. diam. with matted fibers: lvs. 8–12, very narrow, with reflexed edges and a central white band: upper spathe of 1 or 2 membranous valves: perianth-tube shortly exserted; segms about 1 in long, bright orange-yellow and not striped, the outer ones grayish brown on the outside; anthers orange-yellow; style-branches entire and orange-yellow. Turkestan, etc. Var. **dytíscus,** Bowles, has the outer segms deep brown outside and with narrower margins of yellow.

CC. *Fls. lilac, purple or white.*

D. *Basal spathe (rising directly from the corm inside the lvs.) absent.*

7. biflòrus, Mill. SCOTCH CROCUS. Corm ¾in. or less in diam.· lvs. 4–6, overtopping the fls., very narrow, with deflexed edges and a white central band: upper spathe 2-lvd.: perianth-tube exserted, the segms 1½ in. long, purple-tinged, the outer ones 3-striped down the back, the throat bearded and yellowish; anthers orange, exceeding the filaments; style-branches orange-red. S and S. W. Eu B M 845 —Runs into many forms, some of them almost white Some of the named botanical forms are: Var **argénteus,** Baker (*C. argénteus,* Sabine. *C. pàrcus,* Haw. *C. lineàtus,* Jan) Less robust and with only 3 or 4 lvs to a tuft and smaller fls. more tinged with purple and the outer segms dark-striped outside. Italy B M 2991 (as *C. minimus* Var **pusílius,** Baker (*C. pusillus,* Tenore) Fls smaller than in var *argenteus,* paler, the 3 outer segms striped with dark purple Italy B.R. 1987 (var *estratus,* with petals pale purple and not striped). Var. **Wéldenii,** Baker (*C. Wéldenii,* Hoppe), with uniform slaty purple limb. Dalmatia B M 6211 Var. **Ádamii,** Baker (*C. Ádamii,* Gay) Limb pale purple, the outer segms 1-colored or with 3 pale purple stripes. Caucasus. B M. 3868 (as *C. annulatus* var *Adamicus*). Var. **nubígenus,** Herb. Segms very small and nearly white, the outer ones with a broad band of purple on the back Asia Minor Var. **Pestalózzæ** (*C Pestalózzæ,* Boiss) Small-fld, with 1-colored whitish segms Asia Minor Var **Alexándri,** Hort (*C Alexándri,* Velen Fls larger than in *C bàlorus* type, outer segms flushed all over the back with bright lilac and with a narrow margin of white, or often with only feather-like stripes on white grounds. B M 7740

8 **èrius,** Herb (*C. Sibthorpiànus* var *stàuricus,* Herb.). Corm globose, ¾in or less diam, the tunic bristle-ringed at top lvs 3–6 in the tuft, as high as the fl, very narrow, with reflexed margins and a white band: upper spathe 2-lvd · perianth-tube little exserted; segms. 1 in. or less long, unstriped, pale or dark lilac, the throat yellow and glabrous, anthers orange, twice the length of the slightly papillose filaments Armenia, Kurdistan. B M. 6852B. Gn 74, p 212 Early.

DD *Basal spathe present*

E. *Throat of perianth glabrous.*

9. versícolor, Ker (*C fràgrans,* Haw *C Reinwardtii,* Reichb) Corm ¾in or less in diam, with tunics of matted parallel fibers: lvs 4–5, as high as the fls, otherwise like the last upper spathe 1- or 2-lvd. perianth-tube exserted; segms 1½ in. long, pale or dark purple, often striped and feathered with dark purple; throats glabrous, whitish or yellowish; anthers yellow, twice as long as the filament; style-branches, orange-yellow, equaling or overtopping the anthers. S. France. B M. 1110.

10 **banáticus,** Heuff. Corm globular, ½in. diam.: lvs. usually 2, thin and flattish, and becoming ¼in. broad, glaucous beneath: upper spathe 1-lvd · perianth-tube scarcely exserted; segms 1½ in or less long, bright purple, and never striped, but often dark-blotched toward the tip; throat glabrous; anthers orange, a little longer than the white filaments; style-branches short, orange-yellow, somewhat fringed at the tip Hungary

11. **Tommasinianus,** Herb Corm globular, ½in diam.: lvs. appearing with the fls, narrow (⅛in. broad): upper spathe 1-lvd perianth-tube little exserted; segms 1½ in. or less long, pale red-bluish, sometimes dark-blotched at the tip; throat glabrous, anthers pale orange, a little longer than the white glandular filaments; style-branches short, orange-yellow Dalmatia and Servia.—Distinguished from *C. vernus* by its glabrous throat.



1115 Crocus vernus. (×⅓)

12. **Sieberi,** Gay. Corm globular, ¾in. diam.: lvs. 4–6, as high as the fl., glaucous beneath, ⅙in. broad. upper spathe 2-lvd : perianth-tube short-exserted; segms. 1–1½ in. long, color of *C. vernus;* throat yellow and glabrous; anthers orange, twice as long as filaments; style-branches nearly entire, orange-red Greece, Crete Gn W. 22 287 G M. 49 54 Var **purpùreus,** Hort Fls darker purple than the type Var **versícolor,** Hort. Outer perianth-segms white feathered with purple or dark violet, inner segms white, yellow at base inside Gn. 73, p. 201

13 **reticulàtus,** Bieb Corm ¾in. diam, covered with honeycombed fibers: lvs. 3–5, as high as the fl, very narrow, with reflexed edge and a white band; upper spathe 2-lvd perianth-tube much exserted; segms 1–1½ in long, white to purple, the 3 outer ones striped, throat glabrous; anthers orange, twice the length of the orange filaments; style-branches scarlet, overtopping the anthers. S E. Eu —Varies to white.

BB. *Throat of perianth pubescent or bearded*

14 **vérnus,** All Fig. 1115. Corm 1 in or less diam. lvs 2–4, as high as the fl., often ½in broad, glaucous beneath, but green above, with reflexed edges, and a central white band: upper spathe 1-lvd, about as long as perianth-tube: perianth-segms 1–1½ in. long, lilac, white or purple-striped; throat pubescent, never yellow, anthers lemon-yellow, exceeding the filaments, style-branches orange-yellow S Eu B M 860, 2240 R H 1869, p 331 Gn 54, p 79 —The commonest garden crocus.

15 **etrúscus,** Parl Corm 1 in or less in diam lvs. about 3, very narrow, as tall as the fl upper spathe 1-lvd · perianth-tube short exserted; segms 1–1½in. long, lilac, or the outer ones cream-colored and sometimes purple-feathered outside; throat yellow, slightly pubescent; anthers orange, twice as long as the glabrous filaments, style-branches nearly entire, orange. Italy

16 **Màlyi,** Vis Corm depressed-globose, 1 in or less diam, with fine parallel fibers in the tunic which is slightly reticulated upward: lvs. narrow-linear, not so tall as the fl, with reflexed margins and white central band upper spathe 2-lvd, foliaceous: perianth-tube yellow, scarcely exserted; segms white, 1¾in. long; throat orange-yellow and bearded; anthers orange, twice as long as the filaments; style-branches orange, slightly divided at tip. Dalmatia. G.C. III. 37:163. G. M. 51:455.

BB *Style-branches fimbriate at the top, or once-forked.*

17 **Imperàti,** Tenore. Fig. 1116. Corm nearly or quite 1 in diam., basal spathe present · lvs 4–6, exceeding the fls, very narrow. upper spathe 1- or 2-lvd : perianth-tube little exserted; segms. 1–1½ in long, lilac or even white, the outer ones buff and 3-striped on the outside; anthers yellow, exceeding the filaments, style-branches fimbriate Italy. B.R. 1993. Gn. 54, p. 79. Very early.

18. **Olivieri,** Gay. Corm nearly globose, ⅓–¾in. diam. · basal spathe absent: lvs. 4–5, as tall as the fl, becoming ¼in broad · upper spathe 2-lvd . perianth-tube little exserted, segms bright orange-yellow and never striped, 1½ in. or less long; throat glabrous; anthers orange, twice the length of the roughish filaments; style-branches orange, slender-forked. Var. **Suterianus,** Baker (*C chrysánthus,* Bot Reg.) has narrower and more rolled lvs. Greece to Asia Minor. No. 2.

BBB. *Style-branches cut into capillary divisions: basal spathe absent · upper spathe 2-lvd*

19. **vitellinus,** Wahl (*C. syriacus,* Boiss & Gaill). Corm ¾in. or less diam : lvs 4–6, as high as the fls, narrow-linear: perianth-tube short, exserted, segms 1 in. or less long, orange-yellow, the outer brown-tinged outside; style-branches divided into many capillary parts Asia Minor B M 6416 —Rare in cult. Var **gravèolens,** Baker (*C gravèolens,* Boiss & Reut. *C. syriacus,* Baker) Lvs narrower outer segms. flushed with black or bearing 3 distinct stripes of black down the back.

20 **Fleischeri,** Gay (*C. Fleischerianus,* Herb. *C. smyrnénsis,* Poech) Corm ¾in or less diam, the tunics a dense mass of regularly interlacing fibers. lvs. about 6 to a tuft, as high as the fls, very narrow and having reflexed edges and a white band perianth-tube not exserted; segms 1–1¼ in long, white, acute, the outer with 3 slender lilac lines on the back; throat yellow and glabrous; anthers small, orange, about as long as the filaments; style-branches brick-red. Asia Minor, on limestone hills

21. **cándidus,** Clarke (*C Kúkii,* Maw) Corm globose, ¾in diam.; tunics of matted parallel fibers. lvs as high as the fl, becoming ¼in broad, the margin ciliated and the keel very narrow: perianth-tube little exserted; segms 1–1¼ in long, white tinged yellow towards throat (which is glabrous), the outer ones tinged or feathered with purple on back; anthers orange, about as long as the filaments; style-branches cream-white. Asia Minor. G. 31:17. Var. **lùteus,** Hort Fls yellow, more deeply colored at the base, 3 outer segms veined and mottled with purple

22 **hyemàlis,** Boiss. & Blanche. Corm globose, ¼in or less diam, the tunic membranous: lvs about 4 to the tuft, as high as the fl, with reflexed margins and a white band perianth-tube little exserted, segms 1–1½ in. long, white, with a long central purple line and three shorter lines, throat yellow, glabrous; anthers orange, twice as long as filaments; style-branches red. Palestine Var. **Fóxii,** Maw, has nearly black anthers. Gn. 74, p. 188.



1116. Crocus Imperati. (×½)

AA. *Blooming in autumn (sometimes in late summer and continuing toward autumn).*

B *Style-branches entire or very nearly so.*

C. *Fls. white or lilac · basal spathe present (except in No. 26); upper spathe 2-lvd.*

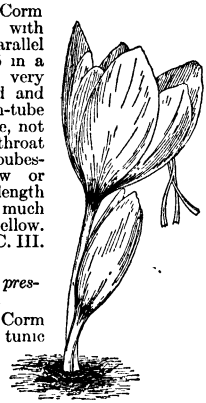
23. **sativus,** Linn. SAFFRON CROCUS. Fig. 1117. Corm 1 in

or more diam : lvs 6–10, as tall as the fl , very narrow, ciliate-edged: perianth-tube little exserted; segms. oblong and obtuse, bright lilac or even white; throat pubescent; anthers yellow, longer than filaments; style-branches 1 in or more long, bright red (the source of saffron). Asia Minor. R.H. 1895, p. 573.—The commonest fall-blooming species.

24. **hadriáticus,** Herb. Much like *C sativus:* usually smaller-fld., pure white, the segms. pubescent at base: anthers bright orange, more than twice longer than the white or purple filaments Greece, etc —Runs into several forms. Var. **meliténsis,** Hort. Fls. feathered with purple and brown Malta. Var. **Wilhelmii,** Hort. Fls. pale, with purple markings outside near the throat.

25 **zonátus,** Gay. Corm somewhat flattened or deflexed, ½–¾in. diam.: lvs. appearing after the fls., narrow-linear. perianth-tube exserted, 2–3 in.; segms. 1–2 in. long, rose-lilac, purple-veined and orange-spotted within, throat yellow, pubescent; anthers white, 2–3 times longer than the yellow filaments; style-branches short and yellow Cilicia. G.C. III. 23:85.

26. **cáspius,** Fisch & Mey. Corm ovoid, ¾in. or less diam., with rigid tunic that has matted parallel fibers toward base lvs 4–5 in a tuft, not reaching the fl , very narrow, with a white band and reflexed margins perianth-tube much exserted; segms white, not striped, 1–1¼ in. long; throat yellow, glabrous or slightly pubescent; anthers pale yellow or cream-colored, twice the length of filament, style-branches much exceeding anthers, slender, yellow. Near Caspian Sea. Oct. G.C. III. 34:443.



1117 Crocus sativus (×⅔)

cc. *Fls. yellow: basal spathe present; upper spathe 1-lvd.*

27. **Scharojànii,** Rupr. Corm globose and very small, the tunic membranous lvs developed in spring and remaining till the fl. appears; perianth-tube much exserted; segms. bright yellow, 1-colored, 1½–1¾ in long; throat yellowish white; anthers pale yellow; style-branches nearly entire, orange-red, shorter than the stamens. Caucasus, Armenia, blooming end of July and in Aug. G C III. 32:321.

bb. *Style-branches fimbriated or forked at the top: basal spathe present, upper spathe 1-lvd.*

28 **longiflòrus,** Raf. Corm ½in. diam.: lvs. 3–4, very short at flowering time, very narrow: perianth-tube much exserted, segms oblong and bright lilac, 1½ in., never striped, throat slightly pubescent, yellow; anthers orange, more than twice as long as the filaments; style-branches scarlet, slightly compound. S. Eu. B.R. 30:3.—Not frequent.

29 **serótinus,** Salisb. Corm 1 in. or less: lvs. 4–6, as high as the fl., very narrow. perianth-tube little exserted; segms. oblong, 1½ in , lilac or purple, indistinctly or not at all striped; throat glabrous; anthers yellow, much exceeding the filaments; style-branches orange-yellow, fimbriated. Spain. B M 1267.—Not frequent.

30. **Sálzmannii,** Gay (*C tingitànus,* Herb). Corm somewhat depressed, 1 in. diam.: lvs. about 6, not prominent at flowering time, very narrow: perianth-tube much exserted; segms. 1½ in. long, plain lilac; throat pubescent, yellowish; anthers orange, longer than the filaments; style-branches slender, orange. Morocco. B.M. 6000.

bbb. *Style-branches capillary-divided.*

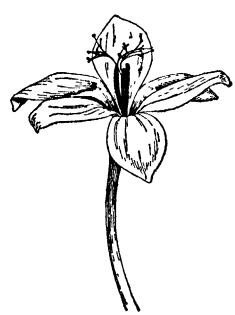
c. *Fls. white.*

d. *Basal spathe present.*

31. **níveus,** Bowles. Very robust and vigorous: corm globose, ¾–1 in. diam., the tunic of fine reticulated fibers; lvs. 6 in the tuft, equaling the fls.: basal spathe 2½ in. long; spathe 2-lvd., 4 in. long, leafy at top: perianth-tube 5½ in long, the segms. white but with an orange glabrous throat; anthers yellow, 3 times as long as the filament. Probably Greece — Differs from *C. Boryi,* to which it is closely related, by the basal spathe being present, yellow anthers, naked filaments, and reticulated tunic.

dd. *Basal spathe absent.*

32. **lævigàtus,** Bory & Chaub Corm ovoid, ¾in. or less diam , with rigid tunic broken into many small imbricated parts: lvs. 3–4 in a tuft, as high as the fl., very narrow, with reflexed margins and a white band: upper spathe 2-lvd , very short· perianth much exserted; segms about 1 in long, white and 1-colored or with 3–5 stripes of lilac on the back of outer segms ; throat yellow, glabrous; anthers white, about as long as the papillose filaments; style-branches bright yellow, exceeding the anthers Greece Var. **Fontenàyi,** Bowles, is very late-blooming, and the fl has a buff tint, outside finely feathered with purple, and clear lilac inside Gn. 74, p 176.



1118. Crocus speciosus var. Aitchisonii. (×½)

33. **Bòryi,** Gay Corm globular, ¾in or less diam : lvs 3–6, narrow-linear, as high as the fls : upper spathe 2-lvd peri-anth-tube short-exserted; segms. 1–1½ in. long, white, sometimes lilac-lined at the base outside; throat yellow, glabrous; anthers white, somewhat longer than the orange filaments; style-branches scarlet, divided into many capillary segms and exceeding the anthers. Greece. Var **Tournefórtii,** Baker (*C Orphanidis,* Hook. f. B.M. 5776), has lilac fls. Var **marathoníseus,** Baker (*C. marathoníseus,* Heldr), has style-branches less divided than in the type, shorter and not overtopping the anthers. G.C. III. 40:335. Gn. 70, p. 273. G M. 49:767.

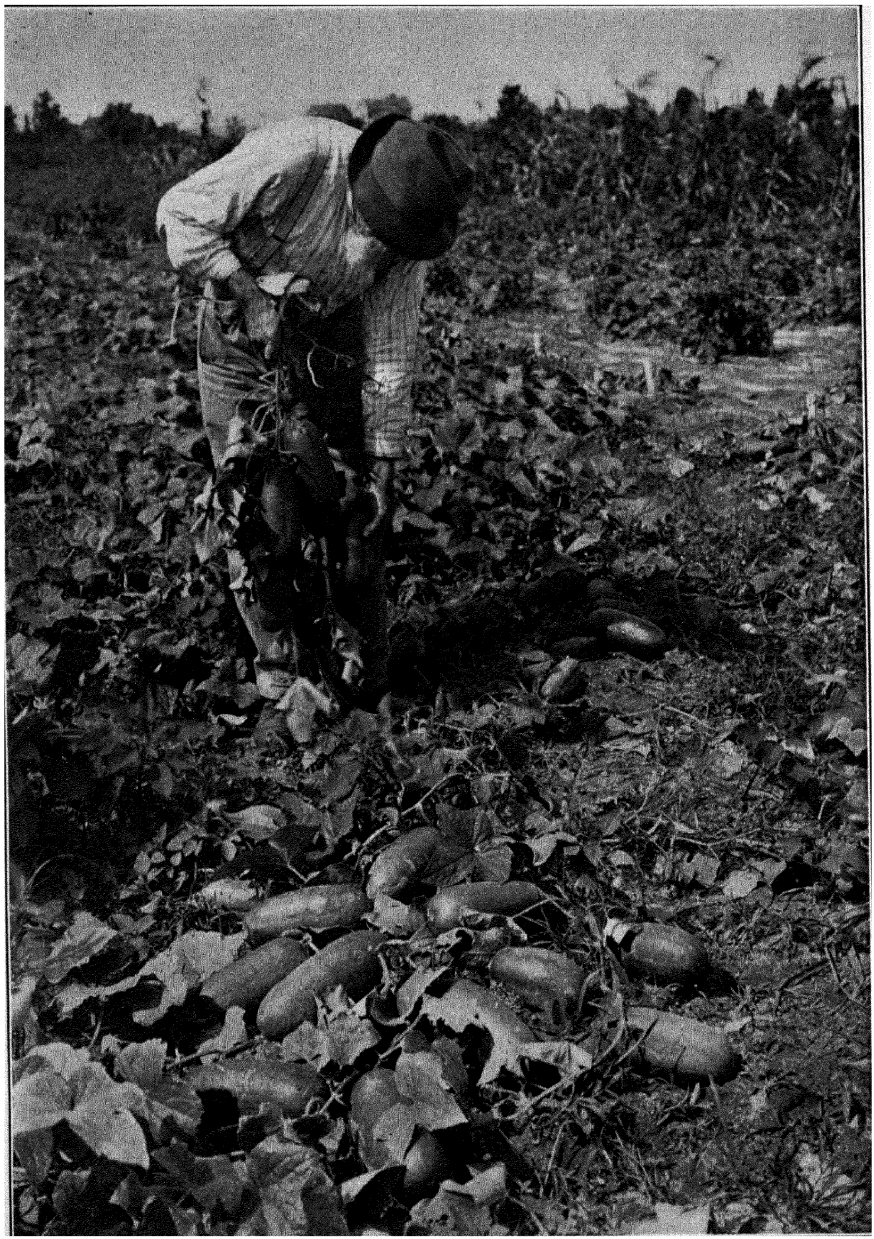
cc. *Fls. lilac (varying to white in No. 39).*

d. *Basal spathe present; upper spathe 1-lvd.*

34. **mèdius,** Balb. Corm globular, 1 in. or less diam.: lvs. 2–3, appearing in spring, narrow, becoming a foot or more high: perianth-tube much exserted; segms 1½–2 in. long, bright lilac; throat glabrous, whitish; anthers pale orange, twice the length of the yellow filaments; style-branches scarlet, with many capillary divisions. S. France, Italy.

35. **nudiflòrus,** Smith. Corm very small, stoloniferous: lvs 3–4, appearing after the fls., very narrow: perianth-tube much exserted, segms. 1½–2 in., lilac; throat glabrous; anthers large and yellow, twice as long as the filaments. Mts. S. France and Spain.—Long known in cult , but not common.

36. **astùricus,** Herb. Corm globular, ¾in. or less in diam.: lvs. about 3, appearing in fall but not maturing till spring: perianth-tube short-protruded; segms. 1½ in long, lilac; throat pubescent; anthers bright yellow, longer than the white filaments; style-branches orange, with many capillary divisions. Spain.



XXXI. The White Spine cucumber.

37. **byzantînus,** Ker (*C. iridiflòrus,* Heuff.). Corm ½in diam.: lvs 2–4, developing after the fls.: perianth-tube much exserted; segms 2 in. or less long, the outer ones dark lilac and acute, the inner ones shorter and pale lilac or white, anthers orange, longer than the filaments S E Eu B M. 6141. B R 33 4.—An old garden plant, but rarely seen in this country.

DD *Basal spathe absent, upper spathe 2-lvd.*

38. **pulchéllus,** Herb Corm small, somewhat depressed: lvs produced after flowering, maturing in spring perianth-tube much exserted, segms 1–1½ in long, bright lilac, more or less indistinctly striped, throat glabrous, bright yellow, anthers white, longer than the pubescent yellow filaments, style-branches orange, with many capillary branches. Greece to Asia Minor B R 30 3

39 **speciòsus,** Bieb Corm not stoloniferous, 1 in. or less lvs usually 3, developing after the fls, thin, very narrow, becoming 1 ft long perianth-tube much exserted; segms 1½–2 in, lilac and feathered with darker color, anthers very large, bright orange, much exceeding the filaments S E Eu and Asia B M 3861 Gn 62, p 265, 71, p 613 B R 25 40 —Handsome and variable Var **álbus,** Hort Fls white Var **Aitchsonii,** Foster (*C Aitchsonii,* Hort) Fig. 1118 More graceful than the type and larger, fls paler in color, the segms more pointed, divisions of stigma more numerous and more spreading or even drooping fls very pale blush lilac. Asia G. 28·415 Gn M 8 228.

L H B

CROP. The product secured from an area of cultivated plants; as, a crop of wheat, a crop of mushrooms, a crop of violets The word is used generically for classes of products, as grain crop, root crop, forest or timber crop, fiber crop, flower crop, seed crop, salad crop It is employed also as a verb,—the cropping of the land, to crop to fruit

Other limitations of the word refer to duration and inter-relations *catch-crop,* a secondary crop grown between the succession of other crops, as in the time between a crop of radishes and a crop of cabbages, or between the rows or stands of other plants, *companion-crop,* a catch-crop grown between other growing plants, as lettuce between rows or hills of beans; *succession-crop,* a catch-crop succeeding another crop as late celery following early potatoes, *cover-crop,* a catch-crop grown usually late in the season, or in winter, to protect the land and to afford green-manure. Rotation-cropping is a form of succession-cropping Double-cropping may be either companion-cropping or succession-cropping, or both

L H. B.

CROSSÁNDRA (Greek, *fringed anthers*). *Acanthàceæ.* Warmhouse evergreen shrubs of minor importance.

Upright, with entire or somewhat toothed, often verticillate lvs, glabrous, or the infl. hairy· fls. in dense sessile spikes, red or yellow, with prominent bracts, corolla cylindrical, more or less curved, somewhat enlarged at the throat, with a flat or spreading oblique limb, stamens 4, in pairs —Perhaps 20–25 species from India, Trop Afr, and Madagascar. The one commonly in the trade has handsome 4-sided spikes of scarlet-orange fls., perianth has 5 segms, the 2 upper ones being smaller, stamens 4, of 2 lengths· caps. oblong, acute, 4-seeded. It is cult. S. outdoors to a slight extent, and also rarely in northern greenhouses. Should be grown in rich loam, peat or leaf-mold, and sand Prop. by cuttings in sand over bottom heat, preferably under a bell-jar.

undulæfòlia, Salisb. (*C. infundibulifórmis,* Nees). Height 1 ft., rarely 3 ft.: lvs. opposite, ovate-acuminate, stalked: fls. scarlet-orange, overlapping one another in dense closely bracted, æchmea-like spikes, 3–5 in. long India. B.M. 2186. R H 1891:156. B R. 69.

C flàva, Hook. Unbranched shrub, 6–8 in high· st green, glabrous lvs. opposite, close together, large for the size of the plant, 6 in long, obovate-lanceolate, dark green above, paler beneath, wavy, more obtuse than in the above, lower lvs stalked, upper ones sessile spike 4-sided, spiny, fls yellow, tube much exserted, jointed Trop W Afr B M 4710 —*C guineénsis,* Nees. Height 2–6 in st light red, rusty pubescent lvs 2–4 pairs, 3–5 in long, elliptic, green above, with golden netted nerves, reddish beneath: spike solitary, terminal, slender, 3–5 in high, fls numerous, small, pale lilac, with 2 darker spots on the 2 smallest segms and a white eye Guinea B M 6346 —A handsome foliage plant

N. Taylor †

CROSSOSÒMA (Greek, referring to a fringe-like body on the seeds) *Ranunculàceæ,* by Bentham & Hooker referred to *Dillenìàceæ,* and by Engler made the type of the family *Crossosomatàceæ* Four much-branched woody plants of Mex, Ariz and S Calif: very glabrous, with grayish bark and whitish wood· lvs. oblong or narrower, entire, alternate, nearly or quite sessile, some of them fascicled fls mostly white, solitary and short-stalked at the ends of the branchlets *C. califórnicum,* Nutt, has been mentioned in gardening literature abroad· 3–15 ft high lvs 1–3 in long, not much fascicled fls large, with nearly orbicular white petals more than ½in long, the anthers long-oblong. follicles ¾in or more long, many-seeded. Isl of Santa Catalina *C Bigelovii,* Wats, is lower, the lvs mostly fascicled and fls only half as large, the petals white or purplish. Ariz to S E. Calif.

CROTALÀRIA (Greek, *rattle, castanet;* from the rattling of the seeds in the pod) *Leguminòsæ.* Rattle-Box Annual outside herbs, and shrubs grown in greenhouses or in the open far South

Herbs or shrubs of various habit: lvs. simple (actually unifoliolate) or compound fls. in terminal racemes or rarely the racemes opposite the lvs., calyx-tube short, the teeth narrow, as long as or a little shorter than the pea-like corolla —A cosmopolitan genus of perhaps 250 species, in tropics and subtropics mostly For best results, the seed should be started early indoors, after being soaked in warm water. The name is sometimes misspelled Crotolaria Greenhouse kinds are subject to red spider *C. juncea* yields the Sunn hemp of India Our common rattle-box, *C. sagittalis,* is often a troublesome weed.

A *Lvs apparently simple*

retùsa, Linn. Annual, 1½ ft. high branches few, short. lvs entire, very various in shape, but typically obovate with a short mucro, clothed beneath with short appressed hairs fls about 12 in a raceme, yellow, streaked or blotched with purple, standard roundish, notched Cosmopolitan June–Aug —Intro. 1896, as a novelty and called "dwarf golden yellow-flowering pea," "golden yellow sweet pea," etc The fls are much less fragrant than the true sweet pea

verrucòsa, Linn Annual, erect and nearly glabrous, the branches and fl-stalks 4-angled. lvs. ovate, shortly petioled, blunt· fls racemose, numerous, their variegated blue corollas making a magnificent show in early spring Cosmopolitan in the tropics. B.M. 3034. B.R. 1137. P.M 13.223

AA *Lvs foliolate (compound).*

B *Fls. striped with brown or red.*

longirostràta, Hook & Arn Greenhouse plant, herbaceous or somewhat shrubby, much branched, 3 ft. high. branches long, slender, glabrous. petioles 1½ in. long; lfts 3, oblong, with a minute mucro, glabrous above, hoary beneath, with very short, appressed, silky hairs racemes erect; calyx with 2 upper lobes ovate, the 3 lower ones lanceolate; fls. as many as 25 in a raceme, yellow with reddish or reddish brown stripe along the back of the unopened fls; standard wider than long, reflexed, notched. W Mex, Guatemala B M 7306. F R 1:809.—Flowering from Dec. to March. Intro. into Kew through the U. S. Dept. Agric. in 1891.

BB. *Fls not striped, pure yellow.*

incàna, Linn. A woody perennial, 2–4 ft., with stout round branches, the whole plant silky-hairy lfts 1½–2 in. long, obtuse, cuneate below, membranous fls. 12–20 in a raceme, yellow, at least ½in long: pod nearly sessile, loosely hairy. Common throughout the tropics. B R. 377.

capénsis, Jacq Stout, much-branched shrub, 4–5 ft high: branches terete, appressedly silky, stipules when present petiolulate, obovate and lf-like, obsolete or wanting on many petioles: lfts broadly obovate, obtuse or mucronulate, glabrous or minutely pubescent on one or both sides racemes terminal or opposite the lvs, loose, many-fld., the fls usually more than 1 in long; calyx and pod pubescent; wings transversely wrinkled and pitted. S. Afr.—Cult in S Fla

C. Trèpæ, Mattei. An erect or prostrate annual racemes lateral, often 20-fld. or more, fls. small, yellowish Italian Somaliland.

WILHELM MILLER.
N. TAYLOR.†

CRÒTON (Greek name, probably of the castor bean) *Euphorbiàceæ.* Herbs, shrubs or trees of no special horticultural value, some cultivated for economic products which they yield

Pubescence stellate or scaly. lvs. usually alternate. fls mostly in terminal spikes or racemes, usually monœcious, sometimes dioecious; sepals usually 5–10, small, petals present at least in the staminate fls; stamens 5 to many, incurved in the bud; ovary 3-celled, 1 ovule in each cell.—Five hundred or more species in the warmer parts of the world, chiefly in Amer. Several herbaceous species native in S. and W. U. S.



1119. Croton alabamensis.

For *Croton tinctorius,* see *Chrozophora;* for *C. sebiferus,* see *Sapium* See also *Codæum* for the commonly cultivated crotons of florists.

Tíglium, Linn. CROTON-OIL PLANT. PHYSIC-NUT. PURGING CROTON. Small tree: lvs. ovate, acuminate, serrate, petiolate, varying from metallic green to bronze and orange: pistillate fls. apetalous. S E. Asia. Blanco. Fl Fil. 383.—The powerful purgative, croton oil, is obtained from the seeds. Offered in S. Calif. as an ornamental and curious plant.

Elutèria, Benn CASCARILLA. SEASIDE BALSAM. SWEETWOOD. Petals in both staminate and pistillate fls: lvs ovate-lanceolate, acuminate subcordate. Bahamas B M. 7515 — This species and *C. Cascarilla,* Benn., Bahamas and Fla., yield the cascarilla bark

alabaménsis, E. A. Smith Fig 1119. Shrub, 6–9 ft. high lvs evergreen, nearly entire, oblong-lanceolate, upper side nearly smooth, lower side densely silvery scaly both staminate and pistillate fls with petals. Local in Ala., rarely cult G F. 2.594 (see Fig. 1119).

J. B. S. NORTON.

CROWFOOT: *Ranunculus.*

CROWN IMPERIAL: *Fritillaria Imperialis.*

CRUCIANÉLLA (Latin, *a little cross,* from the arrangement of the leaves) *Rubiàceæ* CROSSWORT. Hardy rock plants of minor importance

Herbs, often woody at the base. branches usually long, slender, 4-cornered upper lvs opposite, without stipules, lower lvs or all in whorls of 3 or more, linear or lanceolate, rarely ovate or obovate fls small, white, rosy or blue —About 30 species, natives of the Medit region and W. Asia The genus is closely related to Asperula, and is distinguished by the fls having bracts, not an involucre, and the style-branches distinctly unequal instead of nearly equal The first species below has lately been referred to Asperula It is of easy cult, preferring light, moderate loam and partial shade A delicate plant for the front of borders, and capital for the rockery. Prop. chiefly by division, and also by seeds.

stylòsa, Trin (*Asperula cilìata,* Rochel) Annual, prostrate, 6–9 in high lvs in whorls of 8 or 9, lanceolate, hispid. fls small, crimson-pink, in round terminal heads ½in diam, floral parts in 5's, style club-shaped, long exserted, very shortly twice cut at the top June–Aug. Persia Grown, and often acting in England, as a perennial

angustifòlia, Linn Annual lower lvs 6 to a whorl, linear, on an erect or sometimes branching, smooth st fls white, in spike-like clusters, small, the petals sometimes short mucronate. Medit region July

C chlorostachys, Fisch & Mey Annual, rough and spreading, but the whole plant only 4–6 in high fls small, in spike-like clusters —*C glomeràta,* Bieb (Asperula glomerata, Griseb.), has yellowish green fls in many interrupted spikes Palestine to Persia Properly an Asperula.

N. TAYLOR †

CRYPTÁNTHE (Greek, for *hidden flower*) *Boraginàceæ* NIEVITAS This genus includes many species referred by some writers to Eritrichium and Krynitzkia, but probably none of them is in cult They are mostly annuals, with white fls, which are usually sessile calyx 5-parted to the base, as long as the corolla-tube; segms more or less hispid or with hooked bristles, in fr. closely embracing the nutlets, eventually deciduous: nutlets 4, sometimes 3, 2 or 1, smooth, papillate, or muriculate, never rugose —Over 60 species, in Pacific N. Amer., southward, into N Mex and Chile. **C. glomeràta,** Lehm. (*Krynitzkia glomeràta,* Gray), is a coarse biennial, 1–3 ft high lvs spatulate or linear-spatulate Plains, along eastern base of Rocky Mts. **C. barbígera,** Greene (*K barbigera,* Gray *Eritrichium barbigerum,* Gray) Nine to 12 in high lvs. linear S Calif

CRYPTÁNTHUS (Greek, for *hidden flower*) *Bromeliàceæ* Brazilian epiphytal bromeliads, differing from Æchmea and Billbergia (which see for culture) in the tubular calyx and the dense heads of flowers nearly sessile amongst the leaves.

Leaves crowded in a rosette, recurved-spreading, spinulose-serrate: fls in a terminal head, nearly buried beneath the bracts; petals oblong, joined at the base; stamens attached to corolla-tube —Monogr. by Mez (who recognizes 8 species) in DC. Monogr. Phaner. 9 (1896); by some, all are considered to be forms of one species.

A. *Lvs. not narrowed or petiolate above the sheath.*

acaûlis, Beer (*Tillándsia acaúlis,* Lindl *C undulàtus,* Otto & Dietr.). A few inches high, suckering freely. lvs sea-green, long-pointed and spreading, weak-spiny: fls. white, nestling deep in the foliage. B R. 1157.—A very variable plant, of which Mez recognizes the following leading types:

Var. **genuînus,** Mez. Stemless or very nearly so: lvs. sub-elliptic-lanceolate, strongly undulate, gray-scurfy beneath, scurfy above.

Var. **díscolor,** Mez (*C. díscolor,* Otto & Dietr.). Stemless or nearly so. lvs. elongated, scarcely undulate, silvery-scurfy below, glabrous or nearly so above.

Var. **rûber,** Mez (*C rùber,* Beer) Produces a branching st. or trunk. lvs short, strongly undulate, reddish.

Var. **bromelioìdes,** Mez (*C. bromelioìdes,* Otto & Dietr.) St tall· lvs much elongated, scarcely undulate, remotely spinulose.

Var. **diversifòlius,** Mez (*C. dwersifòlius,* Beer). St.-bearing lvs elongate-lingulate, deep green above, silvery-scurfy beneath

zonàtus, Beer Fig. 1120 Lvs oblong-lanceolate, the margin undulate and densely serrate-spinulose, marked with transverse bands of white: fls. white.

bivittàtus, Regel (*Billbérgia bivittàta,* Hook. *B. mttàta,* Hort) Nearly or quite stemless· lvs long-oblong, curving, long-pointed, somewhat undulate, spiny, dull brown beneath, green above and with 2 narrow buff or reddish bars extending the length of the lf.. fls. white. B M 5270.

AA *Lvs narrowed or petiolate above the sheath.*

Beûckeri, Morr. Lvs 10–20, oblong, pointed, canaliculate at base, very finely spiny, brownish green or rosy and spotted or striped with light green fls white.

C nitidus, Bull A recent importation from Brazil, described as a stemless species with sessile dark olive-green lvs , marked with a band of cream-color each side of the midrib

L. H B

GEORGE V. NASH †

CRYPTOCORŸNE (Greek-made name, referring to the spadix being inclosed or hidden in the spathe). Syn *Myrioblástus Aràceæ* Aquatic or paludose herbs of 20–30 species in Trop Asia and the Malayan Archipelago, rarely seen in choice collections but apparently not in the trade They have creeping and stoloniferous rhizomes, strongly ribbed oblong or linear or ovate lvs , monœcious fls without perianth, the upper ones on the spadix staminate and the lower pistillate spathe closed, the infl wholly included The species require the treatment given tender arums. *C. cilìàta,* Fisch , 1 ft lvs narrow, stalked. fls fragrant in a long tubular peduncled spathe which is fringed at the top. *C. retrospiràlis,* Fisch , plant slender with very narrow almost grass-like lvs , and small spathe terminating in a spiral or twist. *C. Griffithii,* Schott, with lvs ovate or orbicular-oblong marked with fine red lines; spathe purple B M. 7719

CRYPTOGAMS are flowerless plants, producing not seeds but spore· The whole vegetable kingdom was formerly thrown into two classes, the flowering plants or phanerogams and the flowerless or cryptogams. Cryptogam means "concealed nuptials," and phanerogam "visible nuptials." These names were given when it was thought that the sexual parts of the flowerless plants were very obscure or even wanting. The word is now falling into disfavor with botanists. Cryptogams are of less horticultural interest than the flowering plants, although they include the ferns, and some interesting smaller groups, as selaginellas, lycopods or club mosses. The word cryptogam is now mostly given up by botanists as representing a taxonomic group, as the name is founded on imperfect or false analogies The plants covered by this name are now distributed in the great divisions of thallophytes, bryophytes and pteridophytes; and the phenogams or phanerogams are spoken of as spermatophytes (see the categories on p. 2, Vol I.).

CRYPTOGRÁMMA (Greek, *a concealed line,* alluding to the sub-marginal sori). *Polypodiàceæ.* Hardy subalpine ferns of both hemispheres of interest mainly to the collector



1120. Cryptanthus zonatus.

Leaves of 2 sorts, the fertile lvs contracted and the sori covered by the infolded margin of the segms , forming pod-like bodies Besides our native species, a third one, *C. crispa,* is found in Eu , and a fourth in the Himalayas Name often incorrectly written Cryptogramme. Cult. simple.

acrostichoìdes, R. Br ROCK-BRAKE. Height about 8 in.: lvs. numerous, 4–6 in long, on tufted straw-colored stalks, tri-quadripinnatifid, with toothed or incised segms , the sporophylls with longer stalks, less divided and with pod-like segms. Canada to Colo., Calif., and northward.

Stélleri, Prantl (*Pellæa gràcilis,* Hook. *P. Stélleri,* Baker) SLENDER ROCK-BRAKE. Lvs 4–10 in. long, very delicate in texture, withering by Aug., few to a plant, about 2 pinnate —Grown best in loose well-drained leaf-mold. A rather rare rock fern of the eastern states, offered by some dealers in hardy ferns. Grows in crevices of cliffs, or in moss

R. C. BENEDICT †

CRYPTÓLEPIS (Greek, *hidden scale*) *Asclepiadàceæ* Shrubs, erect or twining, of Trop Asia and Afr. Lvs opposite. fls. in a loosely forking, few-fld. cyme; calyx deeply 5-parted, with 5 scales at base, corolla with spreading limb, the tube short-cylindrical or campanulate, the lobes 5 and linear, spreading or deflexed and twisted; corona of 5 scales attached at or near the middle of the tube. follicles terete and smooth, spreading —Species 20. Cult only in S. Calif. and S Fla. **C. Buchánanii,** Roem & Schult. A twining shrub with yellow fls , resembling those of an echites: lvs 3–6 in. long, leathery, shining above· cymes very short-stalked, paniculate. India **C. longiflòra,** Regel. Dwarf and compact growing, with long lvs tinted with red; tubular white fls , as in *Bowardia jasminiflora.* Native country unknown.

CRYPTOMÈRIA (Greek, *kryptos,* hidden, *meros,* part; meaning doubtful) *Pinàceæ* Ornamental evergreen cultivated for its handsome habit and foliage.

Large pyramidal tree, with a straight slender trunk, covered with reddish brown bark and with verticillate spreading branches, ascending at the extremities: lvs spirally arranged, linear-subulate, acute, slightly curved, decurrent at the base. fls. monœcious; stami-

nate oblong yellow, forming short racemes at the end of the branches, pistillate globular, solitary, at the end of short branchlets. cone globular, with thick, wedge-shaped scales, furnished with a recurved point on the back and with pointed lobes at the apex, each scale with 3–5 narrow-winged, erect seeds.—One species in China and Japan, extensively planted for avenues, and as timber trees in the latter country, where the light and easily worked but durable wood is much used.

It is hardy as far north as New York, and thrives in sheltered positions even in New England. It seems, however, in cultivation, not to assume the beauty it possesses in its native country. With us, it looks best as a young plant, when it much resembles the *Araucaria excelsa* It is therefore sometimes grown in pots. It thrives best in a rich, loamy and moist soil and sheltered position Propagated by seeds or by cuttings of growing wood, especially var. *elegans*, which grows very readily The horticultural varieties are also sometimes increased by grafting.

japónica, Don. Tree, attaining 125 ft.: lvs. linear-subulate, compressed and slightly 4- or 3-angled, bluish green, ½–1 in. long: cone brownish red, ¾–1 in. across. S Z. 124 H I. 7·668. R H 1887, p. 392. Gng. 4:197. F.E. 10·510 G.F. 6:446 —Of the garden forms, the most desirable is var. **élegans,** Beissn (*C. élegans*, Veitch) Low, dense tree, with horizontal branches and pendulous branchlets: lvs. linear, flattened, soft, spreading, longer than in the type, bright green, changing to bronzy red in fall and winter Very handsome when young, but short-lived. Var. **araucaroides,** Carr. Of regular pyramidal habit, with short, thick falcate lvs., resembling *Araucaria excelsa*. Var. **compácta,** Beissn Of very compact habit, with bluish green foliage. Var. **pyramidàlis,** Carr. Of narrow pyramidal compact habit, dark bluish green, not changing to reddish brown during winter Var. **Lóbbii,** Carr. Of compact habit, with shorter and more appressed bright and deep green lvs. Var **nàna,** Knight. Dwarf and procumbent, densely branched form; adapted for rockeries Var. **spiràlis,** Veitch Slender shrub, with strongly falcate lvs., twisted spirally around the branchlets. S Z. 124, fig. 4. ALFRED REHDER.

CRYPTOPHORÁNTHUS (Greek, meaning to *bear hidden flowers*). *Orchidàceæ*. A few Trop American orchids closely allied to Masdevallia and Pleurothallis, remarkable for the almost closed fl within which is hidden the lip: sepals united at the base into a short tube and joined also at the apex, the petals being inside; there are openings or "windows" on either side where the sepals spread apart at their middles. The species require the cult. given Pleurothallis. Apparently none is in the American trade. *C. maculàtus*, Rolfe (*Pleurothállis maculàta*, Rolfe), is a little plant with numerous yellow densely crimson-spotted fls. *C. Dayànus*, Rolfe (*Masdevállia Dayànus*, Reichb. f.). and *C. atropurpùreus*, Rodr. (*Pleurothállis* and *Masdevállia fenestràta*, Hort.), may be expected; the former has upper sepal yellowish white and purple-spotted keels, and inferior sepals (joined) orange with brown spots; the latter has dark purple solitary fls. *C. Moòrei*, Rolfe, has small dull red-purple fls. with darker lines, the lateral openings about ½in. long: lvs. broadly elliptic, purple beneath, about 1½ in. long.

CRYPTOPÝRUM: *Triticum.*

CRYPTOSTÈGIA (Greek, *krupto*, conceal, and *stego*, cover; referring to the 5-scaled crown in the corolla-tube, which is not exposed to view). *Asclepiadàceæ*. Tropical climbers.

Leaves opposite: fls. large and showy in a terminal trichotomous cyme; corolla funnel-shaped, the tube short.—Only 2 species, 1 from Trop Afr, and 1 from Madagascar. The juice of *C grandiflora*, when exposed to the sunshine, produces caoutchouc. See Dict Economic Products India 2·625. The plant is cult in India for this purpose. It is rarely cult. in Old World greenhouses for ornament. It is said to be of easy cult. in a warmhouse and prop. by cuttings.

grandiflòra, R. Br. (*Nèrium grandiflòrum*, Roxbg.). St. erect, woody: branches twining: lvs. opposite, short-stalked, oblong, entire, 3 in long, 1½ in. wide. fls. in a short spreading cyme, reddish purple, becoming lilac or pale pink, about 2 in across, twisted in the bud fr a follicle Old World, probably Indian origin, but established in the African Isls of the Indian Ocean, especially Reunion Hooker, however, thinks that it was originally a Trop African plant. B R. 435 — Once cult at Oneco, Fla., by Reasoner, and not uncommon in botanic gardens under glass Called pulay or palay in India where it is widely cult as an ornamental Not important as a rubber plant

madagascariénsis, Hemsl A climbing glabrous shrub: lvs. short-petioled, leathery, variable in outline, 2–4 in long. fls 2½–3 in across, pink or whitish, not lilac as in many specimens of *C grandiflora*, corolla-lobes longer than the tube. Madagascar —A very showy greenhouse climber with cymose infl

N TAYLOR †

CRYPTOSTÉMMA (Greek, *hidden crown*) *Compósitæ*. Two or 3 hoary herbs, by some united with Arctotis, apparently not in the trade, but sometimes mentioned in gardening literature: diffuse or creeping, with basal or alternate lvs. that are dentate or lyrate-pinnatisect, villous above and white-tomentose or woolly beneath. heads radiate, yellow or more or less purplish, rather large, pedunoled, or solitary on leafless scapes, the rays sterile: achene densely villous, 5-ribbed, the pappus paleaceous and in 1 series *C. calendulàceum*, R Br (*C lusitánicum*, Hort.), is a free-blooming annual with pale yellow rays and a dark brown disk, the heads on 1-fld peduncles lvs pinnatifid, 3-nerved Cape and Austral B M 2252 G C. III. 28.390, desc. *C Forbesiànum*, Harv., and *C niveum*, Nichols (*Macrostèphium níveum*, Less.), of S Afr, may be more or less in cult. Both have yellow rays, in the latter the heads being solitary and the plant decumbent or creeping and the lvs. ovate, cordate or orbicular; in the former the lvs. are mostly pinnatisect, the margins revolute.

CRYPTÓSTYLIS (*hidden style*, Greek) Syn. *Zosteróstylis. Orchidàceæ*. Eight or 10 terrestrial orchids of the E. Indies, Malaya and Austral, allied to Pogonia Lvs. solitary or few, narrow and membranaceous, on stiff petioles: fls rather large, racemose or spicate on simple sheathed scapes, the sepals and petals very slender or even awl-like and nearly or quite equal; lip large, sessile, the broad base inclosing the column and then expanding into a broad blade *C. arachnìtes*, Blume Rootstock fleshy: lvs. erect, green, lanceolate: fls. on a scape 18 in. or less high, many and spider-like, the sepals and petals green and the fleshy lip purple and mottled, pubescent and grooved India (Ceylon, Khasia). B.M. 5381. A curious indoor orchid.

CTENÁNTHE (Greek, *comb-flower*). *Marantàceæ*. About a dozen Brazilian plants closely allied to Calathea and Maranta, differing from the former in belonging to the 1-seeded section of the family and from the latter in having a shorter corolla-tube and different shaped fls. Sepals 3, free and equal, somewhat parchment-like; corolla-tube short but wide, the lobes 3 and nearly equal and hooded at the apex; staminal tube very short, 2 exterior staminodia petal-like, short, obovate and hooded, with lateral deflexed lobes The ctenanthes are perennial herbs with basal and cauline lvs. that are more or less petiolate, and crowded fls. in terminal spikes or racemes. They are glasshouse plants requir-

ing the treatment of calathea; apparently little known in American collections The species fall into two groups, those with variegated and those with green lvs Of the former group are **C. Kummeriàna,** Eichl , and **C. Oppenheimiàna,** Schum , the former being 20 in. or less tall and with villous ovary and raceme, the latter robust and 3 ft. or more tall and ovary glabrous. Of the plain-lvd kinds, **C. Luschnathiàna,** Eichl (*C. compréssa* var *Luschnathiàna,* Schum), and **C. setôsa,** Eichl , may be found in choice collections, both species grow about 3 ft high, the former having ovate-acute bracts and the latter long-acuminate brown-villous bracts.

CUCKOO FLOWER: *Cardamine pratensis.*

CUCKOO-PINT: *Arum*

CUCUMBER. Plate XXXI The common cucumbers are derived from an Asian species, *Cucumis sativus* (see *Cucumis*), which has long been known in cultivation. The so-called West India gherkin, which is commonly classed with the cucumbers, is *Cucumis Anguria.* The snake, or serpent cucumber is more properly a muskmelon, and should be designated botanically as *Cucumis Melo* var *flexuosus* (cf. A G. 14 206) The "musk cucumber" is *Cucumis moschata,* Hort., which is probably identical with concombre musqué, referred to *Sicana odorifera* by Le Potager d'un Curieux, known in this country as cassabanana. The Mandéra cucumber is *Cucumis Sacleuxii,* Paill. et Bois. (Pot. d'un Curieux), but it is not in cultivation in this country None of these is of any particular importance except the common types of *Cucumis sativus* These are extensively cultivated in all civilized countries as field and as garden crops. They come into commerce as pickles packed in bottles and barrels, and are very extensively used in this form. Of late, the forcing of cucumbers under glass has come to be an important industry in the eastern states.

Field culture.

The common cucumber is an important field and garden crop and may be classed as one of the standard crops of the vegetable-garden. The fruit is used as a table salad, eaten raw, with the usual salad seasonings, and is pickled in large quantities. The cucumber is pickled in both large and small sizes, both by the housewife and commercially on a large scale. The small fruit, of not more than a day or two's growth and measuring from 1 to 2 inches in length, makes the most desirable and delicate of pickles These are packed in bottles for the commercial trade and bring fancy prices. Larger sizes are pickled and sold by the keg or barrel.

The cucumber is a native of the tropics and tender of frost. It should be planted in a warm location, after danger from frost is past. For the early crop—and earliness is of prime importance to the commercial vegetable-grower—a sandy soil is preferable, supplied with an abundance of well-rotted stable manure. The seed may be sown in hills 3 feet apart with rows 6 feet apart, or may be planted by machine (the common seed-drill) in drills 6 feet apart. In either case, an abundance of seed should be used, for severe injury by insect pests often occurs in the early stages of the cucumber's life. Plants may be started under glass to hasten maturity. The seed is sometimes sown in pots or baskets or in inverted sods and these protected and so managed that the cucumber plant receives those conditions most suitable to its rapid and healthy growth. These conditions are: a temperature between 60° and 65° at night, which may be allowed to rise to 100° in bright sunshine; an ample supply of moisture; sufficient ventilation, without draft, to prevent a soft brittle growth. It is almost impossible to transplant cucumber seedlings and secure satisfactory results if the roots are disturbed. A glass-covered frame may be used over seed planted in the field, and yields good returns on labor and equipment. Any method whereby marketable cucumbers may be obtained a few days earlier, if not extravagant of time and labor, will pay handsomely.

The cucumber, in the field, should yield marketable fruits in seven to eight weeks from seed and continue in profitable bearing until frost. It is customary among commercial growers to allow two or three plants to the hill, and when grown in drills, one plant is left every 18 to 24 inches.

During the height of the growing season, which is usually in August when the days are hot and nights moist and warm, the cucumbers need to be picked every day. The fruit is ready to harvest when it is well filled out, nearly cylindrical in shape When immature it is somewhat furrowed. When allowed to remain too long, it becomes swollen in its middle portion and cannot be sold as first quality Cucumbers are marketed by the dozen, the field crop often bringing as much as 60 cents a dozen at the first and selling as low as 5 cents a dozen at the glut of the market.

The cucumber plant is affected by serious insect pests and fungous diseases. Of the insect pests, the striped cucumber beetle is the most serious and difficult to combat. It feeds on the leaves, usually on the

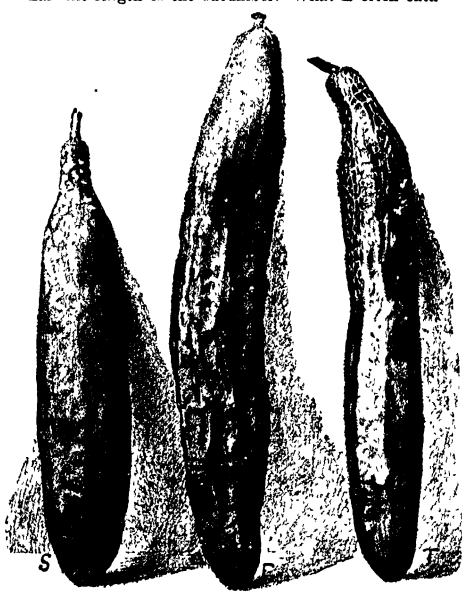


1121 House of English cucumbers.

under sides, and appears soon after the cucumber seedlings break ground. This cucumber beetle seems to be little affected by the common remedies for chewing insects. This is probably largely due to its activity, the beetle moving to unpoisoned parts of the plant, and also to the fact that rarely, in commercial practice, is the under side of the leaves thoroughly poisoned. Arsenate of lead applied in more than ordinary strength is the most satisfactory remedy. Hammond's Slug Shot, dusted lightly over the plants, will drive the bugs away, while a teaspoonful of paris green mixed with two pounds of flour makes also an excellent mixture with which to fight the bugs Or cover the young plants with small wire or hoop frames, over which fine netting is stretched. If the plants are kept quite free from attack till these protectors are outgrown, they will usually suffer little damage Plants started in hotbeds or greenhouses may usually be kept free at first, and this is the chief advantage of such practices The cucumber beetles are kept away somewhat at times by strewing tobacco stems thickly under the plants; and kerosene emulsion will sometimes discommode the young squash bugs without killing the vines, but usually not. What is known as the cucumber blight (*Pseudoperonospora cubensis*) has done much to discourage the growth of cucumbers. This fungus may be repulsed by thorough spraying with bordeaux and the plants should

be kept covered with bordeaux throughout their growth This will require at least three or four sprayings. The growth of the vines, which usually completely covers the ground, prevents late sprayings, which are often necessary to maintain healthy growth and insure maximum returns.

The common field varieties most popular in the United States grown for a slicing cucumber are of the White Spine type. Many of the so-called White Spine varieties now on the market are not typical of the original White Spine cucumber, which is a fruit averaging about 6 inches in length, rather blunt on both ends, with white prickles appearing at frequent intervals over the surface The seed end is light-colored, in mature specimens almost white with whitish stripes extending toward the stem end from one-third to one-half the length of the cucumber. What is often cata-



1122. Three prominent varieties of English or Forcing cucumber. S. Sion House; E. Duke of Edinburgh, T. Telegraph. (×⅛)

logued as the Improved White Spine has become more popular among growers within recent years. This type possesses some of the characteristics of the popular English type of cucumber known as the Telegraph. The improved type has been obtained by crossing the White Spine with the Telegraph or some closely related variety. This cross has resulted in an increased length and darker green color, with a fewer number of spines and seeds and a more common tapering of the ends. All of these changes have apparently been beneficial and have been well fixed by careful selection. This is well illustrated by the cucumber of the White Spine type sold as Woodruff Hybrid.

The English type of cucumbers is raised on a small scale in this country but infrequently for market purposes.

Forcing of cucumbers.

The commercial production of cucumbers under glass has assumed large proportions. This crop ranks second in commercial importance among greenhouse-grown vegetable crops, lettuce only exceeding it in importance The cucumber crop is ordinarily grown in the spring of the year after two or three crops of lettuce have been removed, and it continues to occupy the ground until the vines cease bearing, due either to poor management, pests or some similar trouble. The cucumber should come into bearing six to eight weeks after setting in the houses. It is the customary plan to plant the seed in 4- to 6-inch clay pots about two weeks before the house to be used is ready for setting. These pots are often placed over manure heat and should always be in a warm house separate from the lettuce Two weeks should be sufficient to allow the plant a good start, two or three pairs of leaves being all the development desired before setting in the permanent location Careful management is essential to a healthy growth, for many pests prove more serious in the glasshouse than in the field. A night temperature not below 60° F. is very essential, while the day temperature may go to 90° F without danger in bright sunshine The appearance of the plants will immediately indicate, to the experienced observer, the conditions under which the crop has been grown. A short stocky growth between joints with dark green foliage is desirable. There are localities in which growers make cucumbers the all-the-year-round crop in the glasshouse, usually growing crops from two seedings during the entire season It requires more skill to produce good cucumbers during the fall and winter months than from February on, and the yield is much lighter in the late fall and early winter than for the spring crop All cucumbers require an abundance of moisture and food. It has become a common practice in certain sections to mulch the cucumber vines in the greenhouse with good quality strawy manure to the depth of 3 or 4 inches and apply the water directly on the manure This practice eliminates the packing and puddling of the soil often caused by direct heavy watering, increases the supply of readily available plant-food and gives the roots a good opportunity to grow near the surface where air is available and still be protected from the drying out which occurs when the soil is directly exposed to the sun

The pruning and training of the cucumbers in the greenhouse is of much importance A number of methods are in common use, one of the most common and practical of which is: Stretch a wire tightly the length of the house at the base of the plants which may be set in rows 3 feet apart and 18 inches to 2 feet apart in the rows, fasten at the base of each plant a soft but strong twine known in tobacco-growing sections as tobacco twine, securing this single twine to an overhead wire running parallel and directly over the ground wire, but not stretching the string tight As the cucumber plant grows, it is twined about this string to which it clings by tendrils When the plant reaches the upper wire it is either allowed to grow at will over wires provided for an overhead support and from which the cucumbers usually hang down where they can be easily picked, or it is pruned and the encouragement of fruiting along the upright stem continued In the meantime more or less fruit has been harvested and at each joint a lateral branch has appeared It is necessary to cut these off. Some growers prefer to take them off back to the main stem, while others, if a cucumber is obtainable on the first joint of the lateral, nip the lateral just beyond this point

"In the greenhouse, cucumbers are liable to damage from mite, aphis, root-gall and mildew For the mite, syringe the plant and pick off the infested lvs ; for aphis, use tobacco fumigation and pick infested lvs ; for root-gall, use soil which has been thoroughly frozen; for mildew, improve the sanitary conditions, and then use sulfur "—Bailey, "Forcing-Book "

Yields of twenty-five to one hundred and twenty-five cucumbers have been secured from single plants. The expert growers, under normally good circumstances,

may expect to obtain a yield of six to seven dozen marketable cucumbers from a plant.

Varieties of cucumber.

There are a great many varieties of cucumbers in cultivation This means that the group is variable, the varieties comparatively unstable, and varietal distinctions somewhat uncertain Nevertheless, there are certain dominant types which may be separated, and around which most of the varieties may be conveniently classified The principal types are the following:

Common cucumber, *Cucumis sativus*

I. English forcing type (var *anglicus*) Fig 1122 Large-lvd, strong-growing, slow-maturing plants, not suited to outdoor cult fr large, long, smooth, usually green, with few or early-deciduous black spines Telegraph, Sion House, Tadby Hybrid, Kenyon, Lorne, Edinburgh, Blue Gown

II. Field varieties (hill or ridge cucumbers)

a Black Spine varieties

1 Netted Russian type Small, short-jointed vines, bearing more or less in clusters, small, ellipsoidal fr. covered with many small, black, deciduous spines fr green, ripening to dark reddish yellow, on a cracking, chartaceous skin Early-maturing and prolific Netted Russian, Everbearing, New Siberian, Parisian Prolific Pickle

2 Early Cluster type Small or medium vines fr small, usually less than twice as long as thick, indistinctly ribbed, green, ripening yellow, with scattered, large, black spines Early Cluster, Early Frame

3. Medium Green type Intermediate in size of vine and fr between the last and next fr about twice as long as thick, green, ripening yellow, with scattering, large black spines Nichols Medium Green, Chicago Pickle

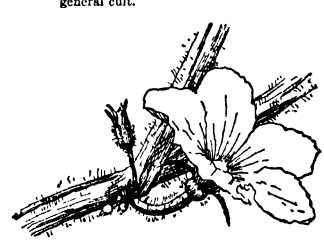
4. Long Green type One of the best fixed types, representing, perhaps, one of the more primitive stages in the evolution of the group Vines large, long and free-growing fr large and long, green, ripening yellow, with scattered, large, black spines Long Green, Japanese Climbing

b. White Spine varieties

5. White Spine type A strong and important type plants medium large, vigorous fr medium large about three as long as thick, green, ripening white, with scattering, large, white spines There are many selected strains of White Spine Cool and Crisp, Davis Perfect and Lordbook Famous belong here

6. Giant Pera type Mostly poorly fixed varieties having large rather unthrifty vines bearing large fr tardily and sparsely, which are white or whitish, smooth or with scattering, deciduous, usually white spines Chicago Giant, Goliath, Giant Pera, White Wonder, Long Green China

Sikkim cucumber, *Cucumis sativus* var *sikkimensis* Plant small and stocky, much like the common cucumber fr large, reddish brown marked with yellow (The Egyptian hair cucumber, of Haage & Schmidt, as we have grown it, is apparently an odd form of *Cucumis sativus*, and may belong here It has a medium-sized white fr, densely covered with soft, white hair The plant resembles the Sikkim cucumber) Not in general cult.



1123. Staminate flower of Cucumis Melo. (Nat. size)

Snake or Serpent cucumber, *Cucumis Melo* var *flexuosus* Vines resembling those of muskmelon fr very long, twisted, ribbed-cylindrical, green, tardily yellowing, covered with dense, woolly hairs

West India gherkin, *Cucumis Anguria* Figs 1127, 1128 Vines small and slender, somewhat resembling a slender watermelon plant: fr very abundant, small, ellipsoid, covered with warts and spines, green, tardily whitening Good for pickles

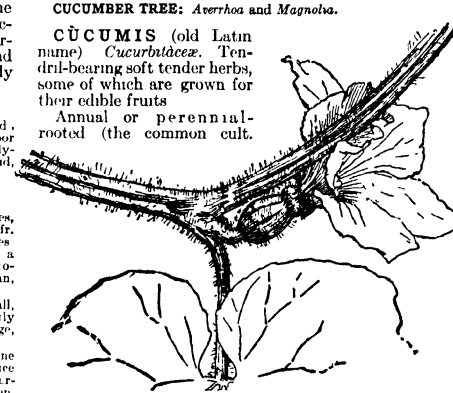
These varieties are mostly all good for one purpose or another The small sorts are naturally preferred for pickling, the medium sorts for slicing, and the large, late varieties for ripe fruits The White Spine varieties are great favorites for slicing, and only less so for pickling

F. A. Waugh.
H. F. Tompson.

CUCUMBER TREE: *Averrhoa* and *Magnolia.*

CŪCUMIS (old Latin name) *Cucurbitàceæ.* Tendril-bearing soft tender herbs, some of which are grown for their edible fruits

Annual or perennial-rooted (the common cult.

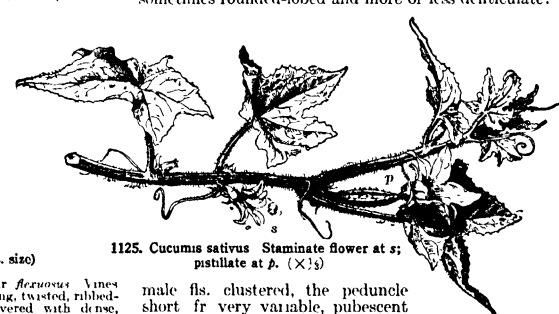


1124. Pistillate flower of Cucumis Melo (Natural size)

species annual), with large alternate entire or palmately lobed or dissected lvs monœcious (rarely dioecious), sterile fls in clusters, not long-stalked, the fertile ones solitary and mostly short-stalked in the axils, corolla of 5 deep acute lobes, stamens not united, stigmas 3, obtuse tendrils simple fr a pepo, mostly 3-celled, usually indehiscent, fleshy or thick, globular, oblong or cylindrical, sometimes echinate, many-seeded — About 30 species of villous or spinescent climbers and trailers with annual sts, in warm parts of the globe, most abundant in Afr Monogr by Cogniaux, DC Monogr Phaner 3 See, also, Naudin, Ann Sci Nat (Bot) IV 11 9, 12 108

A *The melon group fr smooth at maturity or only pubescent (not spiny or tuberculate)*

Mèlo, Linn Melon Muskmelon. Figs 1123, 1124 Long-running, hairy or villous annual lvs large, soft-hairy, round-heart-shaped or reniform, sometimes rounded-lobed and more or less denticulate:

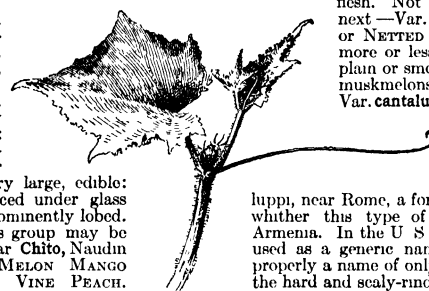


1125. Cucumis sativus Staminate flower at *s*; pistillate at *p*. (×⅓)

male fls. clustered, the peduncle short fr very variable, pubescent or becoming glabrous S Asia and Trop Afr —Very variable, and widely cult.

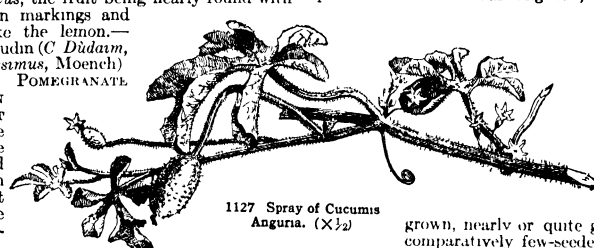
1 Subspecies or var **agréstis,** Naudin The wild or run-wild or spontaneous plant: slender fls small, short-peduncled, often in 2's or 3's fr oblong or turbinate, size of a plum, not edible —To this subspecies

Cogniaux refers such names as *C. Chate*, Linn, *C. pubescens*, Willd., *C. maculatus*, Willd., *C. campechianus* Kunth, *C Gurmia* and *C. Chaeta*, Wall., *C maderaspatanus*, Roxbg, *C. eriocarpus*, Boiss, *C picrocarpus* and *C. jucundus*, Muell, *C. trigonus*, Benth (not Roxbg), *C. Pancherianus*, Naudin, and the varietal names *maculatus*, *Cossonianus*, *texanus*, *cantonianus*, *saharunporensis*, *anatolicus*, *æthiopicus* of Naudin



1126. Branch of Cucumis sativus.

2. Subspecies or var. **cúlta,** Kurz. The many forms of the cult. melon: plant very robust: fls. longer-pedunculate, 3–5 together and large. fr. large to very large, edible: widely variable; when forced under glass the lvs tend to be more prominently lobed. See *Melon* Forms of this group may be distinguished as follows. Var **Chito,** Naudin (*C Chito*, Morr) Orange Melon Mango Melon. Melon Apple. Vine Peach. Garden Lemon Vegetable Orange Vine less robust than that of the muskmelon, and lvs smaller· fr size, shape and color of an orange or lemon, without markings, with a white or pale yellow cucumber-like flesh, with no muskmelon odor Not edible in its natural state, but useful for the making of preserves (or "mangoes") and pickles. Name pronounced *keeto*. Cf Bull 15, Cornell Exp Sta; A G 14 206.—The "Lemon cucumber" offered by dealers is apparently a form of *C. sativus*, the fruit being nearly round with yellow and green markings and smooth skin, like the lemon.—Var **Dûdaim,** Naudin (*C Dûdaim*, Linn *C odoratissimus*, Moench) Dudaim Melon. Pomegranate Melon. Queen Anne's Pocket Melon Vine small, as in the last· fr size and shape of an orange, somewhat flattened at the ends, very regular and smooth, marbled with longitudinal markings of cinnamon-brown overlying yellow, exceedingly fragrant A most handsome gourd-like fr and highly and deliciously perfumed Not eaten A nearly odorless and scarlet-rinded form is separated by Naudin as var *erythræus*.—Var. **acídulus,** Naudin Cucumber Melon Frs oblong or cylindrical, mottled or unicolored, the flesh white and cucumber-flavored No varieties in the American trade are of this group, but they are occasionally seen in botanical gardens and experimental grounds that import seeds of oriental plants.—Var. **flexuôsus,** Naudin (*C flexuôsus*, Linn.). Snake Melon Snake Cucumber. Fr. many times longer than broad, greenish at maturity, variously curved and furrowed A G. 14: 203 Fr often 2–3 ft long, and 1–3 in diam. Grown mostly as an oddity, but it is useful for the making of conserves. The hard-shelled snake gourd is a Lagenaria (which see).—Var **inodôrus,** Naudin Winter Melon. Lvs. lighter colored, less hairy, narrower. frs possessing little or none of the common muskmelon odor, and keeping long. The winter muskmelons are little known in this country, although they are worthy of popularity. Much cult. in parts of the Medit. region.—Var **saccharînus,** Naudin. Pineapple Melon. Comprising varieties of oblong shape and very sweet flesh. Not sufficiently distinct from the next.—Var. **reticulâtus,** Naudin Nutmeg or Netted Melons Frs softer rinded, more or less netted, or sometimes almost plain or smooth. Comprises the common muskmelons, aside from cantaloupes.—Var. **cantalupénsis,** Naudin Cantaloupe. Rock Melons Frs mostly hard-rinded, more or less warty, scaly or rough, often deeply furrowed or grooved. Name derived from Cantaluppi, near Rome, a former country seat of the Pope, whither this type of melons was brought from Armenia. In the U S the word cantaloupe is often used as a generic name for muskmelon, but it is properly a name of only one group of muskmelons—the hard and scaly-rinded (see Waugh, G F. 8 183).

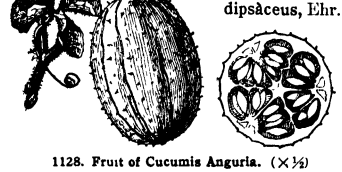


1127 Spray of Cucumis Anguria. (×½)

aa. *The cucumber group: fr. spiny or tuberculate (nearly unarmed in C. Sacleuxii)*

sativus, Linn. Cucumber Figs 1125, 1126 Long-running, prickly lvs usually 3-lobed (or strongly angled), the middle lobe most prominent and often pointed· fr prickly or muricate, at least when young, but in some varieties becoming smooth, mostly oblong, the flesh white S Asia See *Cucumber* Runs into many fr-forms in cult, but not so widely polymorphous as *C. Melo*.—Var **anglicus,** Bailey Figs 1121, 1122 English or Forcing Cucumber A product of cult and selection, distinguished from the common or field cucumbers as follows frs (and ovaries) very long and slender, little if any furrowed, spineless or nearly so when grown, nearly or quite green at maturity, comparatively few-seeded fls. very large: lvs very broad in proportion to their length, with shallower sinuses vines very vigorous, with long and thick tendrils.—Var **sikkimensis,** Hook f, cult in the Himalayan Mts, but not known to be in this country, has large 7–9-lobed lvs and cylindrical-club-shaped fr. B M 6206

Angûria, Linn. (*C. echinàtus*, Moench *C. anguriòides*, Roem *C grossulariæfórmis*, Hort). Bur Cucumber. West Indian Gherkin Gooseberry Gourd. Figs. 1127, 1128 Sts slender, hispid lvs deeply cut into 3–5 narrow obovate or spatulate divisions, watermelon-like fls small, the pistillate long-stalked. fr 1–3 in. long, cucumber-like but more spiny Supposed to be native to the American tropics B M 5817.—Cult. both for the oddity of its frs. and for the making of pickles The gherkins of mixed pickles, however, are young cucumbers.

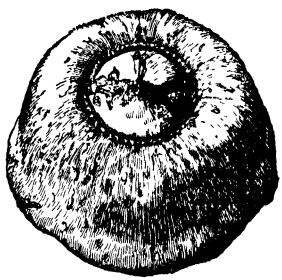


1128. Fruit of Cucumis Anguria. (×½)

dipsàceus, Ehr. (*C. bcrdàna* and *C. ambígua*, Fenzl. *C crinàceus*, Hort). Dipsaceous Gourd Ostrich-Egg Gourd Hedgehog Gourd. Plant and foliage like that of *C. Melo:* fls. long-stalked: fr 1–2 in long, oblong or nearly spherical, becoming hard and dry, densely beset with long scales or hairs, and looking like a bur. Arabia,

Afr. R.H. 1860, p. 210.—Cult. as an ornamental gourd.

Saclelùxii, Paill. & Bois. MANDERA CUCUMBER. Slender, hairy, whitish: lvs. rou dish-reniform, obscurely lobed and irregularly dentate, scabrous on both surfaces and grayish green. fls solitary, males on long-filiform peduncles, the females on shorter but slender peduncles and with hairy ovary. fr. ovoid, 3–4 in. long and half as thick at the middle, somewhat scabrous, with longitudinal stripes of lighter green, seeds brown, ⅛ in long. Zanzibar.—Said to be ornamental and the fruits useful for pickles.



1129. Young Turban squash, on which the remains of the corolla still persist. The central part of the fruit is the ovary.

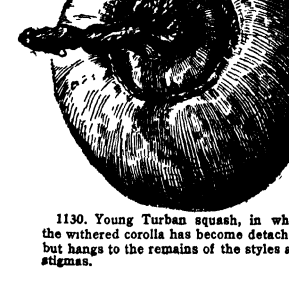
C. acutángulus, Hort.=Luffa.—*C. Citrullus,* Ser.=Citrullus vulgaris.—*C. Colocynthis,* Linn.=Citrullus Colocynthis.—*C. meteŕifera,* Mey. Hispid annual, with palmately somewhat 3-lobed cordate petiolate lvs., and oblong-obtuse spany fr., about 4 in. long. S. Afr.—*C. perénnis,* Jaub. & Spach=Cucurbita.—*C. prophetarum,* Linn. Slender perennial with ashy scabrous long-stalked mostly 3–5-lobed lvs., and longitudinally white-striped softly spinose fr. 1-1¾ in. long. Afr.—*C. Wilmórinii,* Hort. A plant of unrecorded origin, with cut lvs. and abundance of canary-yellow soft-spined frs.

L. H. B.

CUCURBIT. A plant of the genus *Cucurbita.* Sometimes shortened to *Cucurb.*

CUCÚRBITA (classical name). *Cucurbitàceæ.* GOURD. PUMPKIN. SQUASH. Vine-like tender herbs, tendril-bearing, grown for their edible and ornamental fruits.

Annual, or the root perennial-rhizomatous, rough-hairy and scabrous, with large often palmately lobed lvs., the tendrils bifid or multifid. fls. monœcious, large, yellow, solitary in the axils, the staminate long-stalked, the pistillate short-stalked, corolla 5-lobed; stamens 3, arising from the bottom of the fl., and united in a column; stigmas 3, but 2-lobed; ovary inferior, inclosed in a hollow receptacle; tendrils 2–3-forked.—About 10 species in warm parts of Asia, Afr., Amer. The morphology of the pepo or gourd-fruit may be illustrated by the Turban squash. Figs. 1129–31. In this fr., there is a "squash inside a squash." The inner part bears the corolla and the styles. It is the ovary. The corolla is attached about the edge of the inner squash, as the withered remains in Fig. 1129 show. Sometimes the withered corolla becomes detached, but hangs to the withered remains of the stigmas, as in Fig. 1130. The longitudinal section of the flower (Fig. 1131) explains the structure. The corolla is shown at *c, d.* The top of the ovary is at *o.* The stigmas are on the ovary. The part encircling the ovary (outside of *o*) is the hollowed receptacle. Ordinarily the receptacle is closed at the top, completely confining the ovary, but in the Turban squashes the receptacle does not extend over the top of the ovary, and the ovary therefore protrudes. The older morphologists held this outer part of the squash to be adnate calyx, rather than receptacle. The cucurbits are monographed by Cogniaux, DC. Monogr. Phaner. 3. Also by Naudin, Ann. Sci. Nat. (Bot.) IV, vol. 6. See *Pumpkin* and *Squash.*

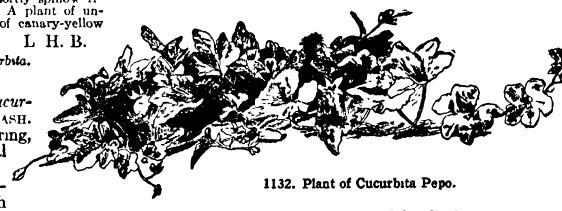


1130. Young Turban squash, in which the withered corolla has become detached, but hangs to the remains of the styles and stigmas.



1131. Section of flower of Turban squash. Showing the ovary inside the hollowed receptacle.

The terms squash and pumpkin are much confused. In Europe, the large varieties of *Curcubita maxima* are known as pumpkins, but in this country the fruits of this species are known usually as squashes. In America, the words pumpkin and squash are used almost indiscriminately, some varieties in all species being known by those names. The field or common pie pumpkins are *C. Pepo,* so are vegetable marrows; also the summer squashes, as the Scallop, Pattypan and Crookneck varieties. The Hubbard, Marblehead, Sibley and



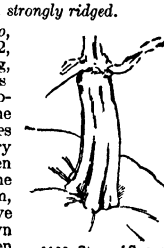
1132. Plant of Cucurbita Pepo.

Turban kinds are *C. maxima.* The Cushaws, Canada Crookneck, Japanese Crookneck, Dunkard, and Sweet Potato pumpkins (or squashes) are *C. moschata.* The fruit stem (as shown in Figs. 1133, 1136, 1141) is a distinguishing characteristic of the ripe fruits. *C. Pepo* and *C. maxima,* and *C. maxima* and *C. moschata* apparently do not intercross. *C. Pepo* and *C. moschata* have been crossed, but it is doubtful if they intermix when left to themselves. In Europe, the word gourd (or its equivalent in various languages) is used generically for cucurbitas; but in this country it is restricted mostly to the small, hard-shelled forms of *C. Pepo* (var. *ovifera*) grown for ornament, and to *Lagenaria vulgaris.*

A. *Plant annual.*

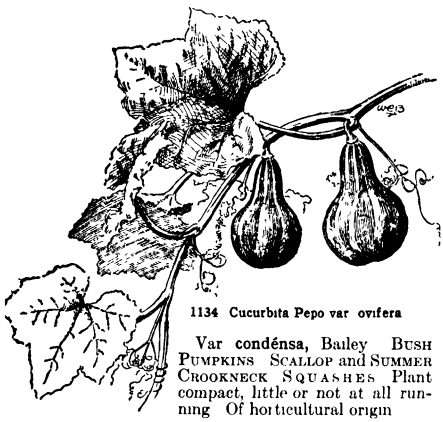
B. *Lvs. lobed. stalks of frs. strongly ridged.*

Pèpo, Linn. (*C. Melopèpo,* Linn.). PUMPKIN. Figs. 1132, 1133. Annual. long-running, prickly on sts. and petioles: lvs. 3–5-lobed, dark dull green: corolla-tube widening upwards, the pointed lobes erect; calyx-lobes narrow, not lf.-like; peduncle very hard and deeply furrowed when mature, not enlarging next the fr.: the fr. very various in form, color, season, size. Probably native to Trop. Amer., but unknown wild.—Cult. by the Indians when Amer. was discovered, in fields of maize. For studies in the nativity



1133. Stem of Cucurbita Pepo.—Early Sugar pumpkin.

of the pumpkins and squashes, see De Candolle, Origin of Cultivated Plants; Gray and Trumbull, Amer Journ Sci 25.372, Sturtevant, Amer. Nat 1890.727; Wittmack, Ber der Deutschen Bot. Gesell. 6.378 (1888).

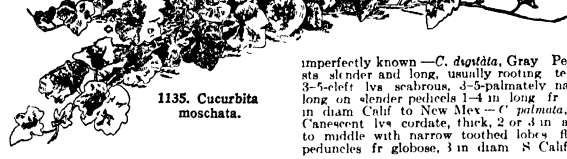


1134 Cucurbita Pepo var ovifera

Var **condénsa,** Bailey BUSH PUMPKINS SCALLOP and SUMMER CROOKNECK SQUASHES Plant compact, little or not at all running Of horticultural origin

Var. **ovífera,** Bailey (*C ovífera,* Linn) GOURD Fig 1134 Plant slender, running lvs smaller than in *C. Pepo,* usually very prominently lobed. fr small, hard and inedible, egg-shaped, globular, pear-shaped, oblate, often striped R H 1894.429 —Sold in many vars by seedsmen, under the names of *C. Pepo* vars. *pyriformis, depressa, annulata,* etc See *Gourd.*

moschàta, Duchesne (*C melonæfórmis,* Carr) CUSHAW. CHINA, CANADA CROOKNECK and WINTER CROOKNECK SQUASHES Figs 1135–37 Annual: long-running, less prickly and sometimes soft-hairy: lvs more rounded than those of *C. Pepo,* but lobed, often grayish fl. with a widening tube, and large, erect lobes; calyx-lobes large, often lf -like, peduncle becoming deeply ridged and much enlarged next the fr. Possibly of E. Asian origin



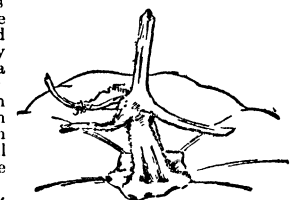
1135. Cucurbita moschata.

BB *Lvs not lobed (except sometimes on young shoots): stalks of frs. not prominently ridged*

máxima, Duchesne SQUASH Figs 1138–41 Annual: long-running, the sts nearly cylindrical, little prickly and often hairy lvs. orbicular or kidney-shaped, commonly not lobed, the basal sinus wide or narrow, the margin shallowly apiculate-sinuate corolla-tube nearly the same diam. at top and bottom (Figs 1139, 1140), the corolla-lobes large and soft, and wide-spreading or drooping peduncle at maturity soft and spongy, not ridged nor prominently enlarged next the fr fr very various, but not light yellow nor warty nor crookneck-shaped, usually late-ripening, the flesh orange and not stringy. Nativity undetermined. Var. **sylvéstris,** Naudin A form found wild in the Himalayan region, with fr. as large as a man's head.

AA. *Plant with perennial root.*

fœtidíssima, Kunth (*C perénnis,* Gray *Cucumis perénnis,* James). CALABAZILLA. Fig 1142 Perennial long-running, scarcely prickly: lvs. large, cordate-triangular, grayish pubescent, the margin shallowly apiculate-crenate. fl nearly as large as in *C Pepo* and similar in shape, the pistillate on a peduncle 2 3 in long. fr size and shape of an orange, smooth, green and yellow splashed, not edible. Sandy arid wastes, Neb and Colo to Texas and Mex. and westward to Calif R H 1855 61; 1857, p. 54.—In its native haunts, the root is tuberous, 4–7 in. diam and penetrating the earth 4–6 ft Roots at the joints The plant has a fetid odor Sold by seedsmen as a gourd, but the fr does not often ripen in the northern states Useful on arbors and small trees, when coarse vines are wanted

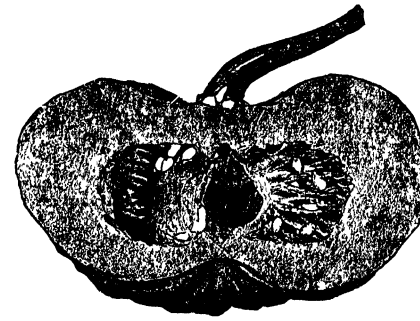


1136 Stem of Cucurbita moschata Large Cheese pumpkin

ficifòlia, Bouché (*C melanospérma,* A Br) St very long, stout, becoming somewhat woody lvs pale green, often marbled, in outline ovate or suborbicular, cordate at base, roundly 5-lobed and the sinus rounded: calyx-tube short and campanulate fl large (often 1 ft long), fleshy, round-ovoid, white-striped, the flesh white, seeds ovate, black E Asia, but widely cult in warm countries for its ornamental watermelon-like frs A var *mexicàna,* Hort (*C mexicàna,* Spreng), is mentioned, with seeds twice the size of those of the type, and said to grow wild in the neighborhood of Mazatlan, Mex

C Andreana, Naudin Allied to C moschata sts long and rooting at the nodes lvs large, marbled with white fls of the form of those of C maxima but much smaller fr obovoid, 8 in long, marked with white and yellow Uruguay R H 1896, pp 542 3 — *C californica,* Torr Canescent lvs thick, 2 in across, 5-lobed the lobes triangular and mucronate tendrils parted to the base fls 1 in or more long on pedicels ½–1 in long Calif , imperfectly known —*C. digitàta,* Gray Perennial, the root fleshy sts slender and long, usually rooting tendrils short and weak, 3–5-cleft lvs scabrous, 3–5-palmately narrow-lobed fls 2–3 in long on slender pedicels 1–4 in long fr subglobose, yellow, 2–4 in diam Calif to New Mex — *C palmata,* Watts . MOCK ORANGE Canescent lvs cordate, thick, 2 or 3 in across, palmately 5-cleft to middle with narrow toothed lobes fls 3 in long on stout peduncles fr globose, 3 in diam S Calif L H B

CUDRÀNIA (derivation unknown) *Moràceæ* Woody subjects cultivated for their foliage and as hedge plants Deciduous trees or shrubs, often thorny, with alter-



1137 Fruit of Cucurbita moschata—Tonasu, a Japanese variety.

nate, petioled and stipulate lvs.: fls. dioecious, in axillary globular heads; staminate with 4 sepals and 4 stamens and 2–4 bracts at the base; pistillate with 4 sepals inclosing the 1-ovuled ovary, growing into a fleshy subglobose fr. with a crustaceous rind.—About 3 species, in S. and E Asia and Trop. Austral., of which only one is sometimes cult. It requires protection in the N and is usually prop. by greenwood cuttings in summer under glass

tricuspidàta, Bureau (*Maclùra tricuspidàta,* Carr. *C triloba,* Hance). Shrub, or small tree, to 20, rarely to 60 ft., with slender, thorny branches: lvs elliptic-ovate, acuminate, entire, sometimes 3-lobed at the apex and on young plants even tricuspidate, nearly glabrous, 1½-3 in. long: fl.-heads axillary, solitary or in 2's, on short peduncles: fr. globose, about 1 in. across. China. R H 1864, p 390; 1872, p 56, 1905, p 363 (habit) H I 18·1792.—Recently recommended as an excellent hedge-plant for the S. In China the lvs are used as a substitute for mulberry lvs and it is called silkworm thorn, the fr. is edible. Between this species and *Maclura pomifera,* a hybrid has been raised, described as *Macludrânia hybrida,* Andrć R H. 1905.362. ALFRED REHDER.



1138. Cucurbita maxima.

CULINARY HERBS are those herbs used for flavoring in cookery, but the term has a wide application, including species used for garnishing and sometimes as potherbs. The culinary herbs are of very minor importance in American gardens, and yet a few of them, as anise, caraway and coriander, are well and favorably known. The species are mostly aromatic. They are largely of the Umbelliferæ and Labiatæ. No special



1139. Staminate flower of Cucurbita maxima—Hubbard squash. (×⅓)



1140. Pistillate flower of Cucurbita maxima—Hubbard squash. (×⅓)

difficulty attaches to their cultivation, and little more may be said here than to present an alphabetical list with statements as to uses, duration of plant, and means of propagation. They all thrive in mellow fertile garden land. Usually they are grown at the side of the main garden plantation, and they may add a certain charm to the garden as well as to supply an agreeable aroma to the kitchen products. See the little book on "Culinary Herbs" by M. G. Kains, 1912.

Angelica (*Archangelica officinalis*) *Umbelliferæ.* Biennial or perennial. *Uses* Stems and leaf-stalks as salad, or roasted like potatoes, garnish, as "candied angelica," stems blanched and used as vegetable, leaves as spinach, seeds for flavoring, oil of angelica obtained from seeds for flavoring. Propagated by seeds in late summer or early autumn.

Anise (*Pimpinella Anisum*) *Umbelliferæ* Annual. *Uses* Leaves as garnish, flavoring, and potherb, seeds and oil for flavoring and perfumery. Propagated by seeds in early spring.

Balm (*Melissa officinalis*) *Labiatæ* Perennial. *Uses* Foliage for flavoring and salad, oil for perfumery and flavoring beverages. Propagated by divisions, layers, cuttings and seeds.

Basil (*Ocymum basilicum*). *Labiatæ* Annual. *Uses* As flavor in highly seasoned dishes, oil as perfumery. Propagated by seeds.

Borage (*Borago officinalis*) *Boraginaceæ* Annual. *Uses* Herbage as potherb and salad, garnish, flavor in beverages. Propagated by seeds in spring.

Caraway (*Carum Carvi*) *Umbelliferæ* Biennial or annual. *Uses* Herbage eaten cooked or as salad, roots as vegetable, seeds for flavoring, oil in manufacture of perfumery and soaps. Propagated by seeds in May or early June.

Catnip or **catmint** (*Nepeta Cataria*) *Labiatæ* Perennial. *Uses* As bee forage, leaves as condiment, formerly a medicinal remedy. Propagated by seeds in autumn or spring.

Chervil (*Anthriscus Cerefolium*) *Umbelliferæ* Annual. *Uses* Leaves for seasoning and for mixed salads. Propagated by seeds.

Chives (*Allium Schœnoprasum*) *Liliaceæ* Perennial. *Uses.* Leaves for flavoring. Propagated by individual bulbs or division of clumps in early spring.

Clary (*Salvia Sclarea*) *Labiatæ* Perennial. *Uses* Leaves in cookery, wine made from plant when in flower. Propagated by seeds in spring.

Coriander (*Coriandrum sativum*) *Umbelliferæ* Annual. *Uses* Seed in confectionary and as ingredient in condiments, flavor in beverages. Propagated by seeds in spring or autumn.

Cumin (*Cuminum odorum*) *Umbelliferæ.* Annual. *Uses* Seeds as ingredient in curry powder, for flavoring pickles, pastry and soups. Propagated by seeds in spring.

Dill (*Anethum graveolens*) *Umbelliferæ* Annual. *Uses* Seed as seasoning, extensively for commercial pickles, oil for perfuming soap, young leaves as seasoning and salads, dill vinegar as condiment. Propagated by seeds in spring.

Fennel (*Fœniculum vulgare*) *Umbelliferæ* Biennial or perennial. *Uses* Herbage as garnishes and flavors, as salads, seeds for flavoring beverages, and for confectionary, oil as perfumery. Propagated by seeds, and grown as an annual.

Finocchio or **Florence fennel** (*Fœniculum dulce*). *Umbelliferæ* Annual. *Uses* As a vegetable. Propagated by seeds.

Fennel Flower (*Nigella sativa*) *Ranunculaceæ* Annual. *Uses* Whole plant or seed used in cookery. Propagated by seeds in spring.

Hoarhound, or **horehound** (*Marrubium vulgare*). *Labiatæ.* Perennial. *Uses* Formerly in cookery and medicine; now for candy only. Propagated by seeds in spring.

Hyssop (*Hyssopus officinalis*) *Labiatæ* Perennial. *Uses* Herbage in salads; oil in preparation of soaps, etc. Propagated by divisions, cuttings and seeds in spring.

Lavender (*Lavandula angustifolia, L Spica*) *Labiatæ* Perennial. *Uses* Flowers and oil in perfumery, sometimes as condiment and in salads. Propagated by divisions or cuttings, or rarely seeds.

Lovage (*Levisticum officinale*) *Umbelliferæ* Perennial. *Uses* Young stems in confectionary. Propagated by division or seeds in late summer.

Marigold (*Calendula officinalis*) *Compositæ* Annual. *Uses* Flower-heads as seasoning, fresh flowers to color butter. Propagated by seeds in spring.



1141. Stem of Cucurbita maxima –Hubbard squash.

Marjoram (*Origanum vulgare* and *O. Marjorana*) *Labiatæ* Perennial (*O. Marjorana* treated as annual). *Uses* Herbage for seasoning, oil in perfuming soaps, etc. Propagated by cuttings, division or layers and seeds in spring.

Mint (*Mentha spicata*) *Labiatæ.* Perennial. *Uses* Herbage as seasoning, leaves in jelly. Propagated by cuttings, offsets and divisions in spring.

Parsley (*Petroselinum hortense*) *Umbelliferæ* Biennial. *Uses* Roots as vegetable, top as potherb, leaves for seasoning and garnish. Propagated by seeds in spring.

Pennyroyal (*Mentha Pulegium*) *Labiatæ* Perennial. *Uses* Leaves as seasoning, pennyroyal oil. Propagated by division, or rarely cuttings.

Peppermint (*Mentha piperita*) *Labiatæ* Perennial. *Uses* Oil as flavoring, perfume in soaps, etc. Propagated by division or running rootstocks.

Rosemary (*Rosmarinus officinalis*). *Labiatæ*. Perennial. *Uses:* Herbage as seasoning, oil for perfuming soaps and in perfumery. Propagated by cuttings, root division, layers in early spring, and seeds.

Rue (*Ruta graveolens*). *Rutaceæ* Perennial *Uses* Leaves as seasoning and flavor in beverages, oil for aromatic vinegar and toilet preparations. Propagated by seeds, cuttings, layers or division of tufts.

Sage (*Salvia officinalis*). *Labiatæ* Perennial *Uses* Leaves for seasoning dressings, sausages, cheese, etc , oil in perfumery. Propagated by division, layers and cuttings, also seeds

Samphire (*Crithmum maritimum*) *Umbelliferæ* Perennial *Uses.* Leaves pickled in vinegar, sometimes with other vegetables. Propagated by seeds in autumn.

Savory, Summer (*Satureia hortensis*). *Labiatæ* Annual. *Uses:* Seasoning Propagated by seeds in spring

Savory, Winter (*Satureia montana*) *Labiatæ* Perennial *Uses·* Seasoning Propagated by seeds, cuttings, layers and division.

Southernwood (*Artemisia Abrotanum*) *Compositæ* Perennial *Uses* Young shoots for flavoring cakes, etc. Propagated by seed, also cuttings in early summer

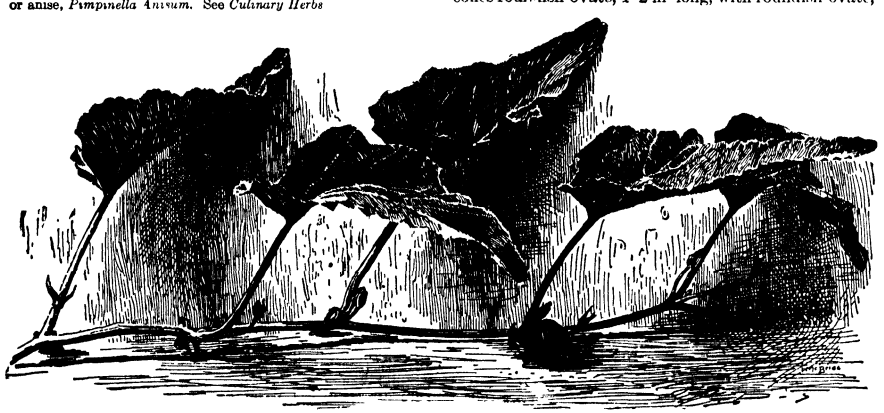
Tansy (*Tanacetum vulgare*) *Compositæ* Perennial. *Uses:* Seasoning Propagated by division of clumps, or seeds

Tarragon (*Artemisia Dracunculus*) *Compositæ* Perennial. *Uses·* Herbage in salads and with meats, seasoning, as a decoction in vinegar, oil to perfume soaps, etc. Propagated by cuttings, layers and division

Thyme (*Thymus vulgaris*) *Labiatæ* Perennial *Uses* Herbage as seasoning, oil as perfumery, oil-crystals as disinfectant Propagated by seeds in spring, also cuttings, layers and divisions

L. H. B.

CUMIN, or CUMMIN: The seeds of *Cuminum odorum* (or less properly *C. Cyminum*), black cumin, *Nigella sativa*, sweet cumin, or anise, *Pimpinella Anisum*. See *Culinary Herbs*



1142. Cucurbita fœtidissima.

CUMMÍNGIA (for Lady Gordon Cumming) of gardeners (name bestowed by D. Don in 1828), sometimes spelled **Cumingia** (Kunth, 1843), is now referred to **Conanthèra.** *Amaryllidàceæ*. The conantheras are of about four species in Chile, one of which is rarely in cult. as a tender summer-blooming bulb. They are said to be difficult to keep long in cult. They are cormous plants, with basal linear or linear-lanceolate lvs , erect sts paniculate-branching above, fls. blue on bractless pedicels. perianth funnelform, the tube short; lobes longer than tube, oblong, nearly equal, spreading or becoming reflexed, stamens 6, attached in the throat, shorter than the perianth-lobes, all perfect, the filaments very short; ovary 3-celled, the style subulate. **Conanthèra campanulàta,** Lindl. (*C. Simsii*, Sweet. *C. bifòlia*, Sims, not Ruiz & Pav. *Cummingia campanulàta*, D. Don) is 1–1½ ft. high, with linear lvs. shorter than the st. or peduncle and blue paniculate pretty fls. B.M. 2496.

CUNÌLA (origin unknown). *Labiàtæ*. A low-growing tufted hardy native perennial of this genus is rarely cultivated in borders for its profusion of bloom.

Flowers small, white or purplish, 2-lipped, borne in corymbed cymes or clusters. The genus contains not more than 16 species, 2 N. American, 2 Mexican, and the others S. American. They are somewhat woody, and usually have small lvs.: the whorls of fls. are sometimes loosely corymbose, sometimes axillary, few-fld., much shorter than the lvs , sometimes many-fld , in dense spikes or terminal heads, calyx 10–13-nerved, 5-toothed; perfect stamens 2.

mariàna, Linn. (*C. origanoides*, Brit). Maryland Dittany. Stone-Mint Height 1 ft : lvs smooth, ovate, serrate, rounded or heart-shaped at the base, nearly sessile, dotted, 1 in. long: fls. purple-pink in a loose cymose cluster which is terminal. Dry hills, S. N. Y. to Ohio., south to Fla. J.H. III. 35 321. Mn. 7:201. See also *Dittany.*

CUNNINGHÁMIA (after J Cunningham, botanical collector, who discovered this conifer in China in 1702) *Pinàceæ*. Evergreen trees cultivated for their handsome foliage.

Trunk stout. branches verticillate, spreading, pendulous at the extremities· lvs. linear-lanceolate, rigid, densely spirally arranged and 2-rowed in direction. fls monœcious; staminate oblong, pistillate globose, both sexes in small clusters at the end of the branches cones roundish-ovate, 1–2 in long, with roundish-ovate, serrate and pointed, coriaceous scales, each with 3 narrow-winged seeds at the base —Two species, in S W. China and in Formosa. The species in cult is a very decorative conifer for warmer temperate regions, much resembling the *Araucaria brasiliensis*. It prefers a half-shaded position and sandy and loamy humid soil. Prop. by seeds or cuttings of half-hardy wood in late summer under glass; short sprouts from the old wood of the trunk or larger branches are the best; cuttings from lateral branches grow into weak and one-sided plants.

lanceolàta, Hook. (*C. sinénsis*, R. Br.). Tree, attaining 80 ft.: lvs. linear-lanceolate, with broad, decurrent base, sharply pointed, finely serrulate, light green and shining above and with 2 broad, whitish bands beneath, 1½–2½ in. long: cones 1–2 in. high. China, cult in Japan. B.M. 2743. S Z 104, 105. R H. 1903, pp. 549–551. G W. 13, p 330; 14, p. 13. J.H. III. 49:447. F. 1854, p. 169.—The second species, *C. Konishii*, Hayata, from Formosa, is not in cult ; it has narrower and much smaller lvs , glaucescent on both sides, and smaller cones; it is very different and forms a transition to Taiwania.

Alfred Rehder.

CUNÒNIA (named for John Christian Cuno, who catalogued his garden in Amsterdam at the middle of the 18th century) *Cunoniàceæ*, formerly included in the *Saxifragàceæ* A half dozen trees or shrubs of the southern hemisphere, one of which is sometimes grown under glass Lvs opposite, petiolate, thick and leathery, 3-foliolate or odd-pinnate: fls white, in dense spike-like racemes; calyx-tube short, the limb 5-parted; petals 5; stamens 10. fr a coriaceous beaked caps. **C. capénsis,** Linn , in moist woody places in Cape Colony, is a large glabrous shrub or tree to 50 ft · lfts 2–3 pairs, oblong-lanceolate, sharply serrate: fls small, very numerous, in opposite racemes, the stamens much exserted Said to be of easy cult in a sandy-peaty soil, prop by cuttings of half-ripened wood. L. H. B.



1143 Cuphea hyssopifolia (×½)

CUPÀNIA *Blighia*

CÙPHEA (Greek, *curved*, referring to the prominent protuberance at the base of the calyx-tube). *Lythràceæ* Mostly small greenhouse and conservatory plants

Plants often clammy lvs opposite, rarely whorled or alternate, ovate, lanceolate, or linear, entire· the fls are often borne in 1-sided racemes, and some of the species have a very odd look from the bold angle made by the slender ascending pedicel and the descending calyx-tube, with an odd projection at the base —An exceedingly interesting genus of 200 species of tropical and subtropical American herbs and shrubby plants, with remarkable variations in the petals In *C ignea*, perhaps the most attractive of the group, the petals are entirely absent, and the showy part is the brilliantly colored calyx-tube At the other extreme is *C. hyssopifolia* with 6 petals (the normal number in the genus), and all of equal size Between these two extremes (shown in Figs 1143 and 1145) are at least two well-marked intermediate types One of these (exemplified in *C. procumbens*) has 2 large and 4 small petals the other (*C Llavea*) has 2 conspicuous petals and the other 4 are completely abortive. These two types are unique among garden plants The series of intergradient forms is completed by *C cyanea*, in which there are only 2 petals, and these minute, and *C. micropetala* in which there are 12 barely visible petals, alternating with and shorter than the calyx-teeth In addition to the species described below, *C. Hookeriana*, Walp , is cult. as *C. Roezlii*, Carr It has lanceolate lvs., with vermilion and orange calyx R H. 1877: 470 According to many American botanists, the correct name for these plants is Parsonsia, Cuphea applying only to another widely separated genus.

Nearly all cupheas are grown from seed and treated as tender annuals, but *C. ignea* is chiefly propagated by cuttings They are of easy culture, and the whole series is worth growing

INDEX

alba, 8
compacta, 8.
cyanea, 6
eminens, 1
Galleottiana, 6
hyssopifolia, 5
ignea, 9
lanceolata, 2.
Llavea, 7
micropetala, 1
miniata, 8
pinetorum, 4
platycentra, 9
procumbens, 3.
purpurea, 3
strigulosa, 6.
Zimpanii, 2

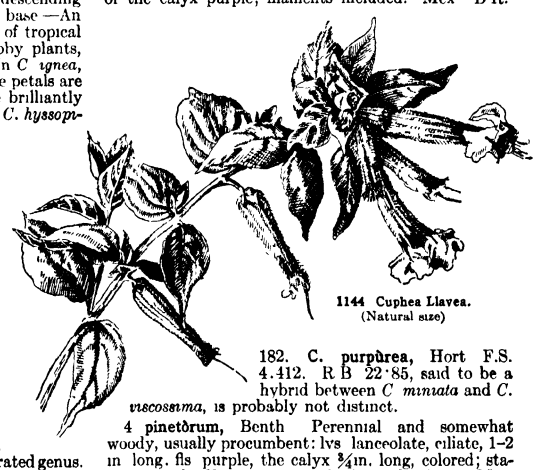
A. *Petals 6, but very minute and inconspicuous.*

1. **micropétala,** HBK (*C éminens*, Planch & Lind.). St shrubby, more or less branched, 1–2 ft. high: branches and calyx scabrous· lvs oblong-lanceolate, acute at both ends, but without a distinct petiole, rigid, scabrous· fls borne singly in succession at a point above the axils, which distinguishes this species from all others here described, petals 6, minute, borne between the calyx-teeth, and shorter than them, calyx 12-toothed, scarlet at the base, yellow towards the top, greenish at the mouth, stamens and filaments red; ovary 2-celled, many-seeded Mex HBK. Nov. Gen. Sp 6, p 209, t 551 R H 1857, p 151. F S. 10 994. —The picture first cited shows a 1-sided raceme, the second a panicle and the third a common raceme In this species the calyx-tube is the attractive portion, while the petals are inconspicuous. The tube is not 2-lipped, but almost regular. See page 3567

AA. *Petals 6, all conspicuous, but 2 of them much larger than the others*

2 **lanceolàta,** Hook (*C Zimpànii*, Roezl). An erect sticky annual, 3–4 ft high, the branches stout, purplish green· lvs petiolate, opposite and alternate, ¾–3 in long, entire fls axillary, solitary, purple or reddish purple, often deflexed, stamens hardly longer than the petals Sept , Oct B M. 6412 —A good, showy herbaceous border plant

3 **procúmbens,** Cav Annual, herbaceous, 1 ft high, procumbent, sticky-pubescent, with characteristic purplish hairs lvs ovate-lanceolate, with white hairs, 1½–3 in long, gradually decreasing in size until they become bract-like; petiole short fls numerous, peduncles longer than the petioles, 2 or 3 times shorter than the calyx, calyx 6-toothed, purplish at the base, green at the tip, with 12 raised streaks, and a pubescence like that of the st , petals 6, the 2 larger ones on the upper lip of the calyx purple, filaments included. Mex B R.



1144 Cuphea Llavea. (Natural size)

182. **C. purpùrea,** Hort F.S. 4.412. R B 22·85, said to be a hybrid between *C miniata* and *C. viscosissima*, is probably not distinct.

4 **pinetòrum,** Benth Perennial and somewhat woody, usually procumbent: lvs lanceolate, ciliate, 1–2 in long. fls purple, the calyx ¾in. long, colored; stamens 11, the filaments unequal In sandy plains. Mex. —A useful plant S.

AAA. *Petals 6, all of the same size.*

5. **hyssopifòlia,** HBK Fig. 1143. St shrubby: branches numerous, strigose lvs lanceolate, rather acute, obtuse at the base, glabrous above, strigose-pilose along the midrib and veins, as may be seen with a hand-lens. fls. with their slender pedicels scarcely longer than the lvs.; calyx glabrous; petals 6, somewhat

unequal, dilute violet; stamens 11, included, filaments villous; ovary 5–6-seeded. Mex.—This is the least attractive of the species here described, and is no longer advertised, but it probably still lingers in conservatories. It is readily distinguished from its showier relatives by its much smaller lvs. (less than ½in long) and much-branched and woody appearance.



1145. Cuphea ignea. (×½)

AAAA. *Petals normally 2, the other 4 abortive.*

B *Size of petals very small, less than half as long as the calyx.*

6 **cyánea,** Moç & Sessé (*C. strigulósa,* Hort, not HBK *C. Galleottiàna,* Hort) St herbaceous, erect: branchlets hispid. lvs. opposite, stalked, ovate, cordate, acuminate, villous on both sides: peduncles alternate, racemose; calyx slightly hispid, scarlet at the base, yellow at the top, petals 2, clawed, spatulate; anthers and petals violet-blue Mex. B.R. 32:14 (as *C strigillosa,* Lindl) F S. 1.15 and P.M. 11.241 as *C strigulosa,* but neither of these plates is the *C strigulosa,* HBK, which is a different species, with a shrubby st.: branches and calyx clammy-hispid. lvs. ovate-oblong, acute at both ends, clammy, glabrous above, strigose-scabrous below: petals nearly equal; ovary about 8-ovuled.

BB. *Size of petals larger, half as long as the calyx or longer.*

C. *Calyx 6-toothed.*

7 **Llàvea,** Lindl RED-WHITE-AND-BLUE FLOWER. Fig 1144 Sts. numerous, herbaceous, hispid: branches ascending: lvs almost sessile, especially near the top, ovate-lanceolate, strigose: racemes short, few-fld.; calyx green on the ventral side, purple on the back and at the oblique-6-toothed mouth; petals 2, large, scarlet, obovate, the other 4 abortive, stamens 11. Guatemala B R 1386 J H III 31 305.—It is doubtful whether the plant described by Lindley is the same as the Mexican plant originally described by Lexarza, which was said to have petals of "dilute scarlet" Lindley's plant had a green calyx, but the plant in the trade is colored Used for baskets and bedding Often misspelled *Llavæ.*

CC *Calyx 12-toothed*

8 **miniàta,** Brongn St shrubby, erect: branches few, hispid: lvs. opposite, the upper ones not quite opposite, with a very short petiole, ovate, acute, entire, with white, silky hairs which are denser beneath fls. solitary, subsessile, axillary, the peduncle adnate to the branch in such a way as to appear between and below the petioles, raceme few-fld, 1-sided F S 2 73. P M. 14·101 R.H 1845. 225. R.B 22.85 Var **álba,** Hort A white-fld. variety. Var. **compácta,** Hort S H 2 43 Gt. 46, p 637 —This is referred to *C Llavea* of Lexarza, by Index Kewensis. The above description is from the original in F S. 2:73. Van Houtte describes several hybrid varieties in F S. 5, p. 487, which differ chiefly in size, color, and marking of petals. Calyx 1 in long, hispid, green at the base, purple above, 12-toothed at the tip; petals 2, scarlet, wavy. The specific name *miniata* means cinnabar-red, and refers to the petals.

AAAAA. *Petals 0.*

9 **ígnea,** DC. (*C. platycéntra,* Hort, not Benth.). Fig 1145. Branches somewhat angled: lvs. petioled, ovate-lanceolate, acuminate, narrowed at the base, lightly scabrous: fl.-stalks 2–4 times longer than the lf.-stalks. calyx glabrous, shortly 6-toothed, bright red except at the tip, which has a dark ring and a white mouth, petals 0, stamens 11 or 12, glabrous Mex F S 2.180. P M 13·267 —This is still sold as *C. platycentra,* although De Candolle corrected the error in 1849 (F S 5.500 *c*) This is a remarkable instance of the persistence of erroneous trade names.

WILHELM MILLER.
N. TAYLOR.†

CUPRÉSSUS (ancient Latin name from Greek, *Kuparissos*) CYPRESS. *Pinàceæ.* Evergreens, cultivated for their graceful habit and the dark green or glaucous foliage, some are timber trees.

Trees, rarely shrubs, with aromatic evergreen foliage: branchlets quadrangular or nearly so: lvs. opposite, small, scale-like, appressed, minutely denticulate-ciliate, on young seedling plants linear-subulate and spreading: fls monœcious, minute, solitary on short branchlets; staminate ovate or oblong, yellow; pistillate subglobose: cones globular or nearly so, consisting of 3–7 pairs of ligneous, peltate scales, with a mucro or boss on the flattened apex, each bearing many or numerous seeds, but the lower scales usually sterile and smaller; they ripen the second year —About 12 species in Cent Amer, north to Calif and Ariz, and from S Eu to S E Asia Monogr by M. T Masters in Journ of Linn Soc 31 312–51 (1895) By some botanists, the allied genus Chamæcyparis is included

The cypresses are highly ornamental evergreen trees, greatly varying in habit, hardy only in California and the Gulf states The hardiest seems to be *C Macnabiana* and *C arizonica,* which will stand many degrees of frost in a sheltered position, also *C macrocarpa, C sempervirens, C. funebris* and *C torulosa* are of greater hardiness than the others They stand pruning well, and some species are valuable for hedges, *C macrocarpa* being especially extensively planted for this purpose in California *C. arizonica* yields excellent timber The cypresses seem not to be very particular in regard



1146 Cupressus sempervirens. Verona.

to soil and situation, but prefer a deep, sandy-loamy soil. For propagation, see *Chamæcyparis*. The young plants should be removed several times in the nursery to secure a firm root-ball; otherwise they will not bear transplanting well.

INDEX.

arizonica, 7
Bedfordiana, 1
Benthamii, 6, 7.
californica, 5
cashmeriana, 11.
cereiformis, 1
compacta, 5
Corneyana, 8.
cornuta, 5
Crippsii, 2
elegans, 6
excelsa, 6
fastigiata, 1, 2.
funebris, 10
glandulosa, 4
glauca, 5, 9
Goveniana, 5
guadalupensis, 3.
Hartwegii, 2
horizontalis, 1
indica, 1
Karwinskyana, 6
Knightiana, 6
Lambertiana, 2
Lindleyi, 6
lusitanica, 9
lutea, 2.
Macnabiana, 4.
macrocarpa, 2, 3.
majestica, 8
nepalensis, 8
pendula, 9, 10, 11.
Royleı, 1
sempervirens, 1.
smensis, 9
stricta, 1
thurifera, 6
torulosa, 8, 11.
viridis, 5
Whitleyana, 1

A *Branches and branchlets erect or spreading, branchlets short and usually rather stout*

B. *Cones 1–1½ in across, with 6–14 scales.*

C *Lvs obtuse bark scaly*

1 **sempérvirens,** Linn Fig 1146 Tree, to 80 ft, with erect or horizontal branches and dark green foliage lvs closely appressed, ovate, obtuse, glandular. cones oblong or nearly globose, scales 8–14, with a short boss on the back, bract free at the apex F S 7, p 192. (as *C torulosa*) S Eu, W. Asia Var **stricta,** Ait (*C fastigiata*, DC *C Bedfordiana*, Hort) ITALIAN CYPRESS With erect branches, forming a narrow, columnar head The classical cypress of the Greek and Roman writers, much planted in S Eu G W 9, p 127 Gn 33, p 3 (as *C stricta*) Var **cereifórmis,** Rehd (*C fastigiata cereifórmis*, Carr) A form with very short branches, forming a narrow and slender columnar head Var **índica,** Parl (*C Royleı*, Carr *C Whitleyana*, Hort) Similar to var *fastigiata* in habit cones globose, with 10 scales, bract acutely mucronate at the apex Var **horizontàlis,** Gord (*C horizontàlis*, Mill) Branches horizontally spreading, forming a broad, pyramidal head The famous avenue of *C sempervirens* in the Villa Giusti, Verona, Italy, is shown in Fig 1146 (G F. 2 464)

2 **macrocárpa,** Hartw (*C Hártwegii*, Carr) MONTEREY CYPRESS Tree, to 40 ft, occasionally to 70 ft, with horizontal branches, forming a broad, spreading head branchlets stout lvs rhombic-ovate, obtuse, closely appressed, not or obscurely glandular, dark or bright green cones globular or oblong, scales 8–12, with a short, obtuse boss on the back Calif, Bay of Monterey S S 10 525 G 22 30 G M 52 952 G W 2, p 497 G C III 18 63, 22 53 Gn 29, p 36; 30, p 189, 38, p 363, 53, p 219; 68, p 237 G F 7 245 Var **Crippsii,** Mast Lvs spreading, light glaucous A juvenile form Var **fastigiàta,** Knight Of narrow, pyramidal, fastigiate habit Var **Lambertiàna,** Mast (*C Lambertiàna*, Carr) Dark green form with spreading branches R H 1870, p 191, 1907, p 565 Var. **lùtea,** Hort, has yellow foliage. Gn 68, p 237. J H.S 1902, p 426, fig 111.

CC *Lvs acute bark exfoliating, cherry-like*

3 **guadalupénsis,** Wats (*C macrocárpa* var *guadalupénsis*, Mast) Wide-spreading tree, 40 ft high or more bark grayish brown, exfoliating, brownish red below branchlets drooping, slender· lvs bluish green, scentless, acute or acutish, obscurely glandular cones globose, 1 in across or more, with 6–8 very thick strongly bossed scales Guadalupe Isl. G C III. 18.62.

BB *Cones ½–1 in across, with 6–8 scales.*

C *Lvs distinctly glandular*

4 **Macnabiàna,** Murray (*C glandulòsa*, Hook) Fig 1147 Shrub with several sts, or small tree, to 20 ft, forming a dense, pyramidal head lvs ovate, obtuse, thickened at the apex, glandular, dark green or glaucous cones oblong, ¾–1 in high; scales usually 6, with prominent conical and curved bosses on the back Calif S S. 10 528 R H 1870, p. 155. G.C. III. 9:403. F. 1874, p 88

CC *Lvs inconspicuously glandular.*

D. *The branchlets slender lvs. green or sometimes glaucous.*

5 **Goveniàna,** Gord (*C. californica*, Carr). Tree, to 50 ft, with slender, erect or spreading branches, forming a broad, open or pyramidal head branchlets slender. lvs ovate, acute, closely appressed, inconspicuously glandular abundant staminate fls in spring cones subglobose or oblong, scales 6–8, with short, blunt bosses Calif S S 10. 527 R H 1875, p 108. F 1876, p 197 Var **compácta,** André Of compact, pyramidal habit R H. 1896, p 9 Var **glaùca,** Carr, with glaucous, and var **víridis,** Carr, with bright green foliage Var. **cornùta,** Carr A form with strongly developed bosses R H 1866, p 251.



1147. Cupressus Macnabiana.
(From a cultivated tree)

6 **Bénthamii,** Endl. (*C. excélsa*, Scott *C Karwinskyàna*, Regel *C thurifera*, Schlecht, not HBK.). Tree, to 70 ft, with horizontal branches, forming a pyramidal head branchlets slender. lvs ovate, obtuse or acute, keeled and somewhat thickened at the apex, inconspicuously glandular, bright green. cones globular, ½–¾in across, scales 6–8, with short-pointed bosses Mex Var **Lindleyi,** Mast (*C. Lindleyi*, Klotzsch) Branchlets regularly arranged, of nearly equal length cones small, with small-pointed bosses Var **Knightiàna,** Mast (*C elegans*, Hort) Branchlets very regularly arranged, fernlike, drooping, glaucous cones with stout, conical-pointed bosses. G C III 16 669 *C Benthamii* has been found in prehistoric asphalt beds at Los Angeles

DD *The branchlets stout· lvs glaucous.*

7 **arizónica,** Greene (*C Bénthamii* var *arizónica*, Mast) Tree, to 40, rarely to 70 ft, with horizontal branches, forming a narrow, pyramidal or broad, open head· branchlets stout· lvs ovate, obtuse, thickened at the apex, usually without glands, very glaucous cones subglobose, ¾–1 in across, scales 6–8, with stout, pointed, often curved bosses Ariz, Calif. S S 10:526. G C III 18 63 I T 4 145 M D 1904:50

AA *Branchlets slender, more or less pendulous lvs. usually acute and keeled, not thickened at the apex cones about ½in or less across (see No 6).*

B *The branchlets not or only slightly compressed.*

8 **torulòsa,** Don (*C. nepalénsis*, Loud) Tall, pyramidal tree, to 150 ft, with short, horizontal branches, ascending at the extremities branchlets slender, drooping lvs rhombic-ovate, acutish or obtusish, appressed or slightly spreading at the apex, bright or bluish green· cones globular, nearly sessile, ½–¾in across; scales 8–10 with a short, obtuse, inconspicuous boss Himalayas Gn 27, p 39 Var **Corneyàna,** Mast (*C Corneyàna*, Knight) With distinctly pendulous branches cones oblong, larger Var **ma-**

jéstica, Gord. (*C. majéstica,* Knight). Of more vigorous growth, with drooping branchlets, grayish green.

9 **lusitánica,** Mill. (*C. glaùca,* Lam *C. péndula,* L'Her. *C sinénsis,* Hort.). Tree, to 50 ft, with spreading branches and more or less pendulous branchlets: lvs. ovate, acutish, glaucous. cones peduncled, about ½in across, covered with glaucous bloom, scales 6–8, with an elongated, pointed and usually hooked boss Habitat unknown; cult in Portugal and naturalized; possibly intro. from India

BB. *The branchlets distinctly flattened.*

10. **fùnebris,** Endl (*C péndula,* Lambert). Tree, to 60 ft, with wide-spreading, pendulous branches and branchlets, branchlets flattened· lvs deltoid-ovate, acute, light green, often slightly spreading at the apex. cones short-peduncled, globose, ⅓–½in across, scales 8, with a short-pointed boss China G C 1850·439. Gn. 28, p. 62 F S 6, p 91

11. **cashmeriàna,** Royle (*C toruldsa* var *kashmiriàna,* Kent. *C péndula* var *glaùca,* Nichols) Tree· branchlets very slender, pendulous, flattened lvs rhombic-ovate, spreading at the acute tips, glaucous. cones ⅓in. across. Intro. from Kashmir

C formosénsis, Henry=Chamæcyparis formosensis.—*C Lawsoniàna,* Murr =Chamæcyparis Lawsoniana —*C nootkatènsis,* Lambert = Chamæcyparis nootkatensis —*C obtùsa,* Koch= Chamæcyparis obtusa —*C pisífera,* Koch=Chamæcyparis pisifera —*C pygmæa,* Sarg (C Govenıana var pygmæa, Lemin) Tree, to 30 ft, often fruiting when only 1 or 2 ft tall branchlets rather stout lvs dark green, without glands cones ovoid, ⅛–¾in long, with 6–10 scales, seeds black Calif, Mendocino Co S S 14 740 —*C thurifera,* HBK Tree with spreading branches lvs oblong-lanceolate, upright-spreading, not closely appressed cones globose, about 1 in across, with slightly mucronate scales —*C thyoides,* Linn =Chamæcyparis thyoides. ALFRED REHDER

CURATÉLLA (name refers to the plants being used or *worked* used for polishing weapons and metal) *Dillenàceæ.* Three or 4 S American and W. Indian small trees or scandent shrubs, of which one is sometimes mentioned in horticultural literature They are warmhouse evergreens, with white fls in dense panicles. Sepals and petals 4–5, stamens many, carpels 2 (rarely 1), more or less cohering, follicular. *C americana,* Linn., of W. Indies and S. Amer., grows to 10 ft., erect, tortuous. lvs. oval, rough on the upper side, toothed fls malodorous, in lateral compound racemes: bark wrinkled and cracked.



1148. Curculigo latifolia.

CURCÙLIGO (Latin, *curculio,* weevil; referring to the beak of the ovary) *Amaryllidàceæ* Warmhouse and conservatory foliage plants with the habit of a young palm and an odd flower-cluster.

Stemless herbs, with short rhizomes, radical long narrow usually plicate lvs., and small fls. in spikes or clusters on short scapes that may be nearly concealed at the base of the plant perianth 6-parted, the segms. spreading and about equal, stamens 6, attached at the base of the segms, ovary 3-celled —The genus is closely related to Hypoxis, but differs in its succulent indehiscent fr, and because in many species the ovary has a long beak which looks like a perianth-tube, but this beak is always solid, and bears on its summit the style which is in the center of the perianth —Twelve species in eastern and western tropics of which *C recurvata* is grown S and N, being used by florists for vases, jardinieres, and general decorative work, and also used outdoors in summer It is of easy cult, but requires perfect drainage It is a question to be determined whether the plants mostly in cult are *C. recurvata* or *C latifolia,* the recurved dense ovoid head of fls. quickly distinguishes the former species

The curculigos are very ornamental plants for large greenhouses, where a high temperature is maintained. To have them looking their best they should, if possible, be planted out in a bed, where they will attain a height of 5 feet Their gracefully arching leaves are so constructed that they move continually from side to side with the slightest movement of the air The variety *variegata* is one of the best variegated-leaved plants While not so robust as the green form, it is more adapted to pot culture The soil should be two parts loam and another of rotted cow-manure and sand Drainage must be carefully arranged, as the plants need an abundance of water The green-leaved kind stands the summers well in the neighborhood of Washington, D C, if protected from the sun and afforded an abundant supply of water As house-plants they are likely to suffer for lack of moisture.

Propagation is by division The pieces, before potting, will make new roots rapidly if placed in the sand-bed of a warm propagating-house for a few days.

recurvàta, Dry Height 2½ ft or more. root tuberous lvs from the root, 1–3 ft long, 2–6 in wide, with a channeled stalk one-third or one-fourth the length, the blade lanceolate, recurved, plaited scapes very rarely as long as the lf-stalks, covered with long, soft brown hairs, recurved at the end, bearing a head of drooping yellow fls, each ¾in across; the scape is frequently only 1–3 in long, the fls appearing almost on the ground; bracts 1 to each fl and about as long. Trop Asia, Austral. B.R. 770. (with scape abnormally long). Var. **striàta,** Hort, has a central band of white Var **variegàta,** Hort, has longitudinal bars of white.

latifòlia, Dry Fig 1148. Height 2–3 ft · differs from *C recurvata* in having a very short-stalked erect infl, the bright yellow fls. in a dense cluster near the base of the plant: lvs. lanceolate, 1–2 ft long and 1–5 in. wide, the petiole 12 in. or less· fr 1 in long, club-shaped or pyriform, hairy, with black seeds· the plant produces numerous suckers which, when removed, are easily grown, and bloom in about a year; said to be a beautiful and hardy house-plant, more satisfactory than palms for one without a conservatory. India, Malaysia B M. 2034. B R 754. L B C. 5·443 (as *C. sumatrana*).—Variable in foliage.

G W OLIVER
WILHELM MILLER.



XXXII. The Fay currant, one of the large red varieties.

CÚRCUMA (Arabic name). *Zingiberàceæ.* Curious and showy warmhouse herbaceous plants with great spikes of large concave or hooded bracts, from which the flowers scarcely protrude.

Erect herbs, the st. rising to 10 ft from a thick tuberiferous rootstock lvs. usually large: fls. in a dense cone-



1149 Curcuma petiolata leaves (×⅛)

like thyrse, borne behind concave or hooded imbricated obtuse often colored bracts, calyx and corolla tubular, the former 2–3-toothed, the latter dilated above and with 5 ovate or oblong lobes, staminodium petal-like, 3-parted, the middle lobe anther-bearing fr inclosed by the bracts The latest monograph, 1904 (by Schumann in Engler's Pflanzenreich, hft 20), recognizes 42 species, mostly in Trop Asia and some in Trop Afr The fleshy bracts are perhaps the showiest feature of the plant, the topmost ones being colored with gorgeous tropical hues Rhizomes of some of the species yield East India arrowroot, while others furnish turmeric The rhizome of *C zedoaria* of India is very pungent and has properties similar to ginger The genus is allied to Alpinia and Amomum

In spring the tubers should be deprived of last year's mold and repotted in a fresh mixture of light loam, leafmold and turfy peat, the pots being well drained, and placed in a warm pit or frame in bottom heat Water should be given sparingly until after the plant has made some growth The young roots are soft and succulent, and are likely to rot if the soil remains wet for a long time After flowering, the leaves soon show signs of decay, and water should be gradually withdrawn During the resting period the soil should not be allowed to get dust-dry, or the tubers are likely to shrivel The plants are propagated by dividing the tubers in spring

cordàta, Wall Lvs 1 ft long, sheathing, ovate, acuminate, the same color on both sides, obliquely penninerved. bracts in a cylindrical spike, the upper part forming a sterile part called a coma, which is a rich violet, with a large, blood-colored spot fls yellow, with a pink hood Burma B M 4435 —This is now referred to *C petiolata,* Roxbg, but it seems at least horticulturally distinct, with its rose-pink bracts.

petiolàta, Roxbg QUEEN LILY. Figs. 1149, 1150 Lvs 6–8 in long, peculiar in this genus as being more or less rounded or cordate at the base, the stalk 4–5 in. long fls. spicate, the spikes 5–6 in long, bracts 20–30, connate at their bases, and wholly including the pale yellow fls. India. B M. 5821 —The most beautiful and showiest of the curcumas

lónga, Linn. Lvs. 2–2½ ft., the blade about 1 ft and narrowed at the base· fls spicate, autumnal. the spikes 4–6 in. long; bracts pale green, not wholly inclosing the pale yellow fls. India. B.R. 886.—The dried rhizomes of this furnish the well-known turmeric of India, used as a condiment and as a dye. Intro. by the Royal Palm Nurseries

C albiflòra, Thwaites, differs from some others here described in having its spikes sunk below the lvs, instead of standing high above the lvs, and all the bracts have fls, while the others have a sterile portion of the spike which is brightly colored In this species the spike is short and green and the fls are prominent and white Ceylon B M 5909 —*C australasica,* Hook. f., has its upper bracts soft, rosy pink and the fls pale yellow Austral B M 5620 —*C Roscoeana,* Wall, has a long and splendid spike, with bracts gradually changing from green to the vividest scarlet-orange fls pale yellow Burma B M 4667 —*C rubescens,* Roxbg (C rubricaulis, Link) Lvs stalked, oblong, with red sheaths, said to be brown in the center fls red E Indies —*C zedoaria,* Roscoe, has the upper bracts white, tinged with carmine, and handsomely variegated lvs., which, with the green of the lower bracts and the yellow of the fls, makes a striking picture of exotic splendor Himalayas B M. 1546

WILHELM MILLER.
N TAYLOR.†

CURMÈRIA: *Homalomena.*

CURRANT. The currants grown for their fruit in America are derived mainly from two species, namely, the European red currant, *Ribes vulgare* (*R rubrum*) (Fig 1151), and the European black currant, *R nigrum* (Fig 1152) There are two promising American species, of which few, if any, improved varieties have been introduced, the swamp red currant (*R. triste*) and the wild black currant (*R americanum*) Another American species of which at least one named variety has been offered for sale is the Buffalo or Missouri currant (*R aureum*) (Fig 1154), also grown because of its ornamental flowers The currant is not known to have been under cultivation before the middle of the sixteenth century It is not mentioned by any of the ancient writers who wrote about fruit, and was evidently not known to the Romans

Currants are natives of comparatively cold or very cold climates; hence most varieties succeed over a very wide area in America They are among the hardiest of fruits from the standpoint of resistance to cold or changes of temperature, but in hot and dry sections they do not thrive, and, on this account, are unsatisfactory in parts of the southern states

The currant is not so generally used in America as some other fruits, as few persons care for them when eaten raw, and when cooked they are usually made into jelly and consumed by only a comparatively small proportion of the people In the coldest parts where other fruits do not succeed well, the currant is more popular, and is used much more generally It is a wholesome and refreshing fruit and deserves much more attention than it receives at the present time.

The currant does not vary so much when grown from seed as most cultivated fruits, and, being so easily propagated from cuttings, it has not been improved so much as it otherwise would have been Moreover, size in currants was not of great importance until recent years, when competition in marketing has become keener It is only during the past fifty or sixty years

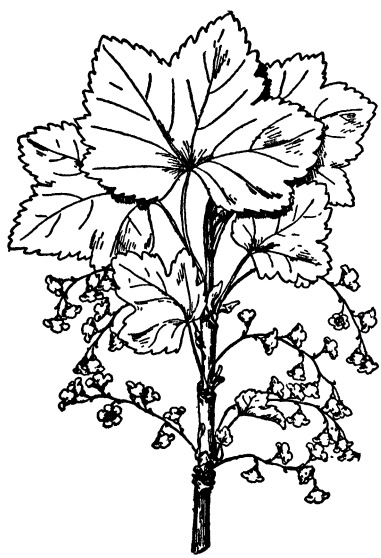


1150. Curcuma petiolata in flower. (×⅛)

that many new varieties have been introduced. At the beginning of the nineteenth century, few named sorts were recognized, the currant being generally known simply under the names black, red and white.

Propagation of currants.

The usual method of propagating currants is by means of cuttings These root very readily and good plants are secured after one season's growth. The best time to make the cuttings is in the autumn, as currants begin to grow very early in the spring, and once the buds have swollen they cannot be rooted successfully Wood of the current season's growth is used. This may be cut early in the autumn as soon as the wood has ripened, from the end of August to the middle of September being the usual time It should be cut in as long pieces as possible to save time in the field, and put in a cool moist cellar or buried in sand If the cuttings can be made at once, it is best to do so. These are made by cutting the wood into pieces, each about 8 to 10 inches long, although an inch or two more or less is not of much consequence. The base of the cutting should be made with a square cut just below the last bud. There should be at least ½ inch of wood left



1151. Common currant—Ribes vulgare, in bloom. (×⅔)

above the top bud of each cutting, as there should be a strong growth from the upper bud, and if the wood is cut too close it is liable to be weakened. A sloping cut is best for the upper cut, as it will shed rain better, but this is not important. When made, the cuttings should be planted at once, which is usually the best plan, or heeled in If heeled in, they should be tied in bundles and buried upside down in warm well-drained soil, with about 3 inches of soil over them The object of burying them upside down is that by this method the bases of the cuttings will be nearer the surface where the soil is warmer and there is more air, and will callus more quickly than if they were further down. The cuttings should callus well in a few weeks, and may then be planted outside, if thought advisable. Cuttings may be kept in good condition over winter by heeling-in or burying in sand in a cool cellar, or after callusing under a few inches of soil outside, they may be left there over winter if covered with about 4 to 5 more inches of soil to prevent their drying out Good results are secured with the least trouble by planting the cuttings in nursery rows as soon as they are made The soil should be well prepared and should be selected where water will not lie Furrows are opened 3 feet apart and deep enough so that the top bud, or at most two buds, will be above ground The cuttings are placed about 6 inches apart on the straight side of the furrows and soil thrown in and tramped well about them When only a smaller number are to be planted a trench may be opened with a spade It is important to have a large proportion of the cutting below ground, as more roots will be made and the plants will be stronger There would also be danger of the cuttings drying up before rooting if too much of the wood is exposed. If the season is favorable the cuttings should callus well and even throw out a few roots by winter Where there is little snow in winter, it is a good practice to cover the tops of the cuttings with about 2 inches of soil, which will be a good protection for them. This soil should be raked off in spring. In the spring, cultivation should be begun early and kept up regularly during the summer to conserve moisture and favor rooting and the development of the bushes By autumn they should be large enough to transplant to the field.

In Great Britain and Europe, currants are often grown in tree form and are prevented from throwing up shoots from below ground by removing all the buds of the cuttings except the top one before planting in the nursery This system is not recommended for most parts of America as it has been found by experience that snow breaks down currants grown in this way, and when borers are troublesome it is not wise to depend on one main stem.

Most of the cultivated varieties of currants have originated as natural seedlings, little artificial crossing having been done with this fruit. Currants grow readily from seeds, and it is easy to get new varieties in this way. The seeds are washed out of the ripe fruit, and after drying, may either be sown at once or mixed with sand and kept over winter in a cool dry place and sown very early in the spring. The best plan is to sow them in the autumn in mellow well-prepared and well-drained soil, since when this is done they will germinate very early in the spring, while if sown in the spring the seed may be all summer without sprouting. The seed should not be sown deep, from ¼ to ½ an inch being quite sufficient. If sown very deep they will not germinate. The young plants may be transplanted from the seed-bed to the open in the autumn of the first year if large enough, but if the plants are very small they may then grow another season, when they should be planted out at least 4 by 5 feet apart, so as to give them room enough to fruit for several seasons, in order that their relative merits may be learned If intended to remain permanently, the plants should be at least 6 by 5 feet apart The bushes should begin to bear fruit the second or third year after planting out. Each bush will be a new variety, as cultivated fruits do not come true from seed. If a seedling is considered promising it may be propagated or increased by cuttings, as already described.

The soil and its preparation.

Currants should be planted in rich soil in order to get the best results. The soil should also be cool, as the currant is a moisture-loving bush The currant roots near the surface; hence if the soil is hot and dry the crop will suffer. A rich, well-drained clay loam is the best for currants, although they do well in most soils If the soil is not good, it should receive a good dressing of manure before planting, which should be well worked into the soil, the latter being thoroughly

pulverized before planting is done. A northern exposure is to be preferred, as in such a situation the currants are not likely to suffer in a dry time.

Planting.

The best time to plant currants is in the autumn. If planted in the spring, they will probably have sprouted somewhat before planting, and on this account their growth the first season will be checked When the soil is in good condition, currants, especially the black varieties make strong growth, and the bushes reach a large size; hence it is best to give them plenty of space, as they will do better and are more easily picked than if crowded Six by 5 feet is a good distance to plant If planted closer, especially in good soil, the bushes become very crowded before it is time to renew the plantation. Strong one-year-old plants are the best, but two-year-old plants are better than poorly rooted yearlings. It is better to err on the side of planting a little deeper than is necessary than to plant too shallow A good rule to follow is to set the plants at least an inch deeper than they were in the nursery. The soil should be well tramped about the young plant so that there will be no danger of its drying out. After planting, the soil should be leveled and the surface loosened to help retain moisture.



1152. Black currant—Ribes nigrum.
(About natural size.)

Cultivation.

As the currant, to do well, must have a good supply of moisture, cultivation should be begun soon after planting, and the surface soil kept loose during the summer While the plants are young the cultivation may be fairly deep between the rows, but when the roots begin to extend across the rows, cultivation should be shallow, as many of the roots are quite near the surface.

Fertilizers

After the first application of manure, no more should be necessary until the plants begin to fruit, unless other crops are grown between, after which an annual top-dressing of well-rotted barnyard manure is desirable. When only a light application of manure is given, the addition of 200 to 300 pounds to the acre of muriate of potash would be very beneficial. Wood-ashes also would make a good fertilizer with barnyard manure. There is little danger of giving the currant plantation too much fertilizer. Unfortunately, it is usually the other way, this fruit being often very much neglected.

Pruning.

The black and red currants bear most of their fruit on wood of different ages, hence the pruning of one is a little different from the other The black currant bears most of its fruit on wood of the previous season's growth, and it is important always to have a plentiful supply of one-year-old healthy wood. The red and white currants produce their fruit on spurs which develop from the wood two or more years of age, and it is important in pruning red and white currants to have a liberal supply of wood two years and older; but, as the fruit on the very old wood is not so good as that on the younger, it is best to depend largely on two- and three-year-old wood to bear the fruit. A little pruning may be necessary at the end of the first season after planting in order to get the bush into shape. From six to eight main stems, or even less, with their side branches, will, when properly distributed, bear a good crop of fruit. Future pruning should be done with the aim of having from six to eight main branches each season and a few others coming on to take their places. By judicious annual pruning, the bush can be kept sufficiently open to admit light and sunshine. A good rule is not to have any of the branches more than three years of age, since when kept down to this limit the wood will be healthier, stronger growth will be made, and the fruit will be better

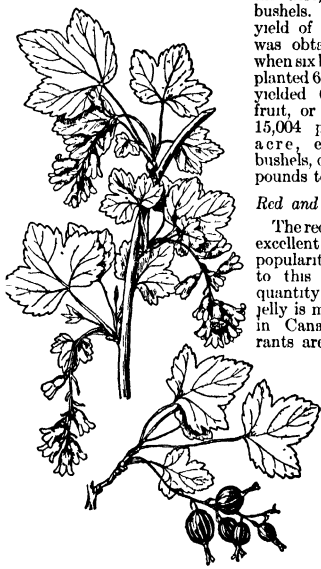
When to renew the plantation.

A currant plantation will bear a great many good crops if well cared for, but if neglected the bushes lose their vigor in a few years. The grower will have to decide by the appearance of the bushes when to renew the plantation; but as a currant plantation can be renewed at comparatively little labor, it is best to have new bushes coming on before the old ones show signs of weakness. At least six good crops may be removed with fair treatment, and ten or more can be obtained if the bushes are in rich soil and well cared for When one has only a few bushes for home use, they may be reinvigorated by cutting them down to the ground in alternate years, and thus securing a fresh supply of vigorous young wood.

Yield of currants.

The red currant is one of the most regular in bearing of all fruits, and as it is naturally productive, the average yield should be large. Bailey, in the "Farm and Garden Rule-Book," puts the average yield at 100 bushels per acre. Card, in his book on "Bush-Fruits," says that it ought to be 100 to 150 bushels, "with good care," and reports 320 bushels At the Central Experimental Farm, Ottawa, Canada, the Red Dutch averaged for four years at the rate of 7,335 pounds to the acre, or over 183 bushels. The largest yield from red currants obtained at the Central Experimental Farm was in 1900, when six bushes of the Red Dutch currant yielded 73 pounds, 15 ounces of fruit. The bushes were 6 by 5 feet apart This means a yield at the rate of 17,892 pounds to the acre, or, at 40 pounds per bushel, 447 bushels 12 pounds to the acre. The same variety in 1905, in a new plantation, yielded 55½ pounds from six bushes, or at the rate of 13,431 pounds to the acre, or 335 bushels 31 pounds. These are very large yields, and while half of this amount may not be expected in ordinary field culture, the fact that such yields can be produced on a small area should be an inspiration to get more on a larger one.

The average yield of black currants has been somewhat less than the red, although individual yields have been large. The Saunders currant yielded for four years at the rate of 6,534 pounds to the acre, or over 163 bushels; the Kerry at the rate of 6,382 pounds to the acre, or over 159 bushels. The highest yield of black currants was obtained in 1905, when six bushes of Kerry planted 6 by 5 feet apart, yielded 62 pounds of fruit, or at the rate of 15,004 pounds to the acre, equal to 375 bushels, estimating at 40 pounds to the bushel.



1153. Native black currant—Ribes floridum. The fruit is immature (×½)

Red and white currants.

The red currant makes excellent jelly, and its popularity is largely due to this fact A large quantity of red currant jelly is made every year in Canada Red currants are used to a less extent for pies and as jam and are also eaten raw with sugar As a fruit for eating out-of-hand, the red currant is not very popular, but there are few fruits so refreshing. The white currants are better liked for eating off the bush than the red, as they are not so acid The Moore Ruby is a red variety, however, which is milder than most others, and for this reason is better adapted for eating raw The red currant does not vary so much in quality as the black.

Red currants will remain in condition on the bushes for some time after ripening, and therefore do not have to be picked so promptly as the black

Varieties Varieties of red currants vary considerably in hardiness, the Cherry, Fay, Comet, Versaillaise, Wilder and others, while bearing very large fruit, are decidedly more tender than some of the others, hence they should not be planted in the coldest parts The Franco-German and Prince Albert currants are later than most other varieties, and when it is desired to lengthen the season, these may be planted.

Varieties of red and white currants recommended: Red—for general culture—Pomona, Victoria, Cumberland Red, Red Dutch, Long Bunched Holland, Red Grape. Where bushes are protected with snow in winter, and for the milder districts—Pomona, Victoria, Cumberland Red, Wilder, Cherry, Fay, and Red Cross. White—White Cherry, Large White, White Grape.

Black currants.

There are not so many black currants grown in America as red, but there is a steady demand for them, and it is thought there will be an increasing demand as they become better appreciated. They make excellent jelly and the merits of black currant jam have long been known.

Black currants vary considerably in season, yield and quality, and therefore it is important to know those that are the best As most varieties of black currants drop badly from the bushes as soon as ripe, it is important to pick them in good time.

Varieties of black currants recommended: Saunders, Collins Prolific, Buddenborg, Victoria, Boskoop Giant. Of those not yet on the market which are considered equal or better than those above, the following are the best: Kerry, Eclipse, Magnus, Clipper, Climax and Eagle, and the Success, for an early variety when yield is not so important as size and quality.

Crandall currant.

This is a variety of the Buffalo or Missouri currant (*Ribes odoratum*) A tall, strong, moderately upright grower; moderately productive Fruit varies in size from small to large, in small, close bunches, bluish black, skin thick, sub-acid with a peculiar flavor. Quality medium Ripens very unevenly Season late July to September. As this variety ripens after the others, the birds concentrate on it and get a large proportion of the fruit

Some of the most injurious insects affecting the currant

Currant aphis (*Myzus ribis*). When the leaves of currant bushes are nearly full grown, many of them bear blister-like elevations of a reddish color, beneath which will be found yellowish plant-lice, some winged and some wingless The blisters are due to the attacks of these insects, and when, as is sometimes the case, they are very abundant, considerable injury is done to the bushes Spraying forcibly with whale-oil soap, or kerosene emulsion will destroy large numbers of these plant-lice at each application, but the liquid must be copiously applied and driven well up beneath the foliage by means of an angled nozzle Two or three applications at short intervals may be necessary

Currant borer (*Sesia tipuliformis*) Early in June a beautiful little bluish black fly-like moth, with three bright yellow bands around the body may be seen darting about, around, or at rest on the leaves of currant bushes of all kinds This is one of the most troublesome enemies of these fruits The moth lays an egg at a bud on the young wood, and the caterpillar, when hatched, eats its way into the cane and destroys the pith It remains in the wood during the winter, and the moth emerges during the following summer Close pruning is the best remedy Burn the wood.

Currant maggot (*Epochra canadensis*). Red, black and white currants are in some places seriously attacked by the maggots of a small fly. These maggots come to full growth just as the berries are about to ripen, causing them to fall from the bushes, when the insects leave them and burrow into the ground to pupate Attacked fruit is rendered useless by the presence of the maggots inside the berries; and frequently it is not until the fruit is cooked that



1154 Buffalo currant. R aureum (×½)



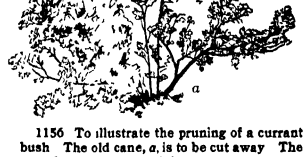
1155. Currant cutting

the white maggots can be detected Gooseberries are sometimes injured but far less frequently than black and red currants The only treatment which has given any results is the laborious one of removing about 3 inches of the soil from beneath bushes which are known to have been infested, and replacing this with fresh soil That which was removed must be treated in some way, so that the contained puparia may be destroyed. This may be done either by throwing it into a pond or by burying it deeply in the earth

Currant worm or *imported currant sawfly* (*Pteronus ribesii*) By far the best known of all the insects that injure currants and gooseberries, is the "currant worm." The black-spotted dark green false caterpillars of this insect may unfortunately be found in almost every plantation of currants or gooseberries, every year in almost all parts of America where these fruits are grown. The white eggs are laid in rows along the ribs of the leaf on the lower side, toward the end of May. From these the young larvæ hatch and soon make their presence known by the small holes they eat through the leaves Unless promptly destroyed, they will soon strip the bushes of their leaves, thus weakening them considerably so as to prevent the fruit from ripening the first year, and also reducing the quality of the crop of the following season There are at least two broods in a season in most places, the first appears just as the leaves are attaining full growth, and the second just as the fruit is ripening The perfect insect is a four-winged fly which may be seen flying about the bushes early in spring The male is blackish, with yellow legs and of about the same size as a house-fly, but with a more slender body The female is larger and has the body as well as the legs yellow For the first brood a weak mixture of paris green, one ounce to ten gallons of water, may be sprayed over the bushes, or a dry mixture, one ounce to six pounds of flour, may be dusted over the foliage after a shower or when the leaves are damp with dew. For the second brood paris green must not be used, but white hellebore, or hellebore may be used for first brood, but it is necessary to kill quickly This is dusted on as a dry powder, or a decoction, one ounce to two gallons of water, may be sprayed over the bushes It is, of course, far better to treat the first brood thoroughly, to reduce the number of females which lay eggs for the second brood.

Oyster-shell scale (*Lepidosaphes ulmi*). Several kinds of scale insects attack currants. These plants seem to be particularly susceptible to the attacks of the well-known oyster-shell scale of the apple, and the San José scale In neglected plantations these injurious insects increase rapidly, and a great deal of injury results to the bushes The remedies for scale insects are direct treatment for the destruction of the infesting insect, and preventive measures, such as the invigoration of the bush by special culture and pruning, to enable it to throw off or outgrow injury Infested plantations should be cultivated and fertilized early in the season, and all unnecessary wood should be pruned out As direct remedies, spraying the bushes at the time the young scale insects first appear in June with kerosene emulsion or whale-oil soap, or spraying in autumn before the hard weather of winter sets in with a simple whitewash made with one pound of lime in each gallon of water, give the best results. Two coats of the whitewash should be applied, the second one immediately after the first is dry. In putting on two thin coats of the wash instead of one thick one, far better results have been secured.

For the San José scale, the lime-and-sulfur wash is necessary, and must be repeated every year.

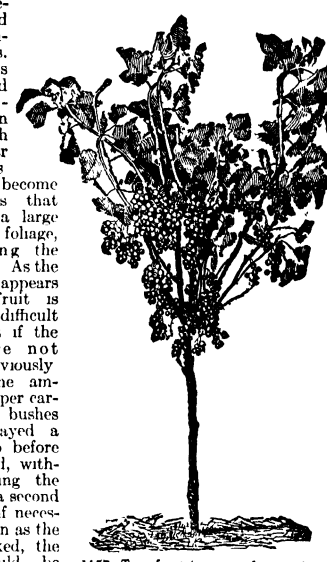


1156 To illustrate the pruning of a currant bush The old cane, *a*, is to be cut away The straight new canes at left are to remain.

Diseases of the currant.

The currant is affected by very few diseases. The only ones that do much injury are the following:

Leaf-spot, rust (*Septoria ribis*) The leaf-spot fungus affects black, red and white currants, causing the leaves to fall prematurely, and thus weakening the bushes. This disease is first noticed about midsummer, when small brownish spots appear on the leaves These often become so numerous that they affect a large part of the foliage, soon causing the leaves to fall As the disease often appears before the fruit is picked, it is difficult to control it if the bushes are not sprayed previously By using the ammoniacal copper carbonate the bushes may be sprayed a week or two before it is expected, without discoloring the fruit, giving a second application, if necessary As soon as the fruit is picked, the bushes should be thoroughly sprayed with bordeaux mixture Experiments have shown that this disease can be controlled by spraying.



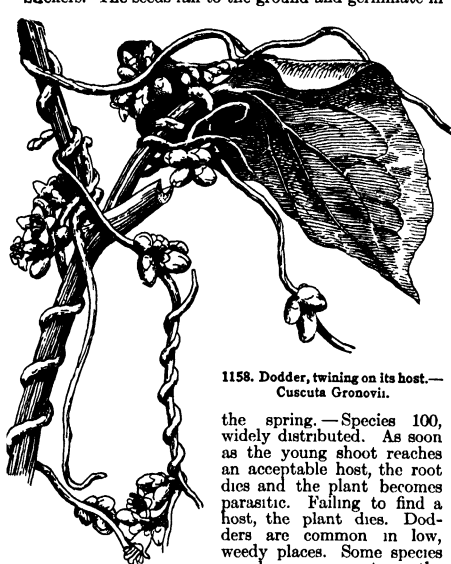
1157 Tree-form training of currant

Currant anthracnose (*Gloeosporium ribis*). This disease, which may be mistaken for the leaf-spot, affects different parts of the bush, including the leaves, leaf-stalks, young branches, fruit and fruit-stalks. On the leaves it is made evident during the month of June by the small brown spots which are usually smaller than those made by the leaf-spot fungus The lower leaves are affected first, and finally the upper ones. They turn yellow and gradually fall to the ground, and when the disease is bad the bushes are defoliated before their time On the petioles or leaf-stalks, the disease causes slightly sunken spots The fruit is affected with roundish black spots which are more easily seen when the fruit is green On the young wood the diseased areas are light in color and are not so noticeable The wood is not nearly so much injured by the disease as the leaves. The spores which spread this disease are formed in pustules, the majority of which are under the upper epidermis of the leaf. Where the spores are to appear, the surface of the leaf is raised and blackened

in spots looking like small pimples. When the spores are ready to come out the skin breaks and they escape and re-infect other parts. When the foliage drops early on account of this disease the fruit is liable to be scalded by the sun. The fruit may also wither before ripening properly, owing to lack of food or of moisture, as, the leaves having fallen, they are unable to keep up the necessary supply. The premature falling of the leaves prevents the buds from maturing properly, hence they are not in so good condition to bear fruit the next year. Spraying with bordeaux mixture is recommended as an aid in controlling this disease. It would be wise, when currant anthracnose is troublesome, to spray the bushes thoroughly before the leaves appear. A second spraying should be made when the leaves are unfolding, and successive sprayings at intervals of ten to fourteen days until the fruit is nearly full grown, and there is danger of its being discolored by the spray when ripe. Paris green should be added to the mixture when the first brood of the currant worm appears. A thorough spraying after the fruit is harvested is desirable.

W. T. MACOUN.

CŬSCUTA (origin of name obscure). *Convolvulaceæ.* DODDER. Degenerate parasitic twiners, bearing clusters of small flowers. They are leafless annuals, with very slender yellow, white, or red stems, which become attached to the host-plant by means of root-like suckers. The seeds fall to the ground and germinate in



1158. Dodder, twining on its host.—Cuscuta Gronovii.

the spring.—Species 100, widely distributed. As soon as the young shoot reaches an acceptable host, the root dies and the plant becomes parasitic. Failing to find a host, the plant dies. Dodders are common in low, weedy places. Some species are also serious pests, as the clover dodder, alfalfa dodder, and flax dodder. One of the common species (*C. Gronovii*, Willd.), of low grounds, is shown in Fig. 1158.

CUSHAW: *Cucurbita moschata.*

CUSTARD APPLE: *Annona.*

CUT-FLOWER INDUSTRY IN NORTH AMERICA. The feature that most distinguishes American floriculture from that of Europe is the great preponderance of the cut-flower trade as compared with the sales of plants. Forty years ago the passion of Americans for cut-flowers was remarked by travelers, but however important the cut-flower trade may then have appeared it has had a marvelous growth since that time. Prior to the Civil War it would have been impossible to purchase any considerable quantity of cut-flowers in the winter season in any of the large cities. The greenhouses were small flue-heated structures in which a great variety of plants was grown, hence it would have been impossible to secure a quantity of any one kind. There were no middlemen to collect even the small quantities produced in a locality, and when large numbers of blooms were required, advance notice was expected and the person wishing the flowers had to do the collecting from the various establishments. After the period mentioned, floricultural establishments rapidly increased in number and size. This growth has continued until today. Instead of being concentrated about large cities, there is scarcely a city of 5,000 or even less that does not have its florist. Not less than $100,000,000 is now invested in the cultivation and sale of cut-flowers in America. Although statistics of the cut-flowers alone are not available, a conservative estimate based on the United States census of 1910 places their annual value at $25,000,000.

From forty to sixty years ago the camellia was the most valued cut-flower, either for personal adornment or for bouquets, and sometimes as much as $1, $2 and even $3 were obtained for single flowers at the height of the holiday season. Then came a period of decline during which they were almost forgotten except in a few private collections, but now they are seen upon the market as pot-plants. The florist of the present generation wonders how they could have been admired to the extent that they should lead as cut-flowers. Perhaps no better idea of the requirements of the former cut-flower trade can be given than to quote the record of a leading New York florist establishment for 1867 which shows a product as follows: Camellias about 45,000, bouvardias 20,000, carnations 70,000, double primroses 100,000, and tuberoses 50,000. Other flowers on the market in those days were daphne, abutilon, callas, sweet alyssum, poinsettia, eupatorium, heliotrope and a few tea roses. The most profitable white cut-flowers, in the opinion of many florists, were *Stevia serrata*, Double White camellia, *Calla æthiopica*, *Lilium candidum*, *Deutzia gracilis*, and Double White Chinese primrose.

It will be noted that roses were not important in the cut-flower trade of this period. It is a fact that very few were grown under glass. A few florists were growing Bon Silene, Lamarque and Safrano roses, occasionally devoting an entire house to them, but more often in houses with other flowers. The rapidly-awakening demand for all kinds of flowers brought good prices for roses and stimulated the florists to give this flower more attention. The time was one of changing ideals and the old formal camellia, show dahlia and Chinese chrysanthemum were passing, while new and less formal flowers were coming into favor. The flower-buying public, however, wanted something larger than the small tea varieties then grown. Every new variety from Europe that had any promise was tried, and from that day to this scarcely a new introduction has escaped a searching test as to its adaptability for culture under glass. The Marechal Niel was grown for the discriminating trade, and it continued the leading variety until it was supplanted by the everblooming, more prolific and more easily cultivated Perle des Jardins. Likewise, the hybrid perpetuals were tried, and some of them, notably General Jacqueminot, were found to force well. This variety, when it could be had for the holidays, brought $1 and $2 a bud.

The roses of this time were produced on plants grown in deep beds or in pots or boxes. The latter method enabled the grower better to time his crops, while the former involved less time and attention. The endeavor to secure the advantages of both naturally resulted in

the shallow raised bench, and this method of growing cut-flowers has been adopted for practically all now grown in large quantities, in fact, this system of culture is perhaps the greatest single feature which distinguishes American floricultural methods from those of Europe Simultaneously it became very generally recognized that to grow roses successfully required separate houses and a different temperature. For a long time it was thought that a special form or construction was necessary, viz , the three-quarter span, but now the even-span house is in general use.

The present cut-flower production

Having made these important advances in cultural methods, it needed but the introduction of the epoch-making rose, Catherine Mermet, to place the rose in the first place among cut-flowers This variety came at once into great popularity with the flower-buying public and was very profitable to the growers, thereby attracting capital to the flower business The competition to produce and market the best quality of flowers elevated the standards in cut-flowers to a higher level Although the introduction of Catherine Mermet did much for the flower business, it is as the parent of Bride and Bridesmaid that the variety is generally remembered These "sports" have been the leading white and pink varieties for twenty years, and have been displaced only during the last five years by White Killarney and Killarney, although many claimants arose to dispute their leadership These roses succeeded because they were profitable with every florist who could grow roses, and it is doubtful whether we shall ever see varieties so generally successful over so wide a territory The market is seeking a greater variety among roses than it did during the years these roses held sway, but all this is advantageous to the rose specialists Next in importance to Bride and Bridesmaid and their successors, White Killarney and Killarney, is the American Beauty (Madame Ferdinand Jamain) This variety can be grown successfully and profitably only by growers who have special conditions As the variety is still without a rival, it continues to be popular with the wealthy flower-buyers

The American carnation may be regarded as the greatest contribution America has yet made to the floriculture of the world The plant is unlike any type grown in Europe and its development is due to American plant-breeders, Dorner, Fisher, Ward and many others During the last fifty years it has been improved in form, size, color and productiveness Hundreds of varieties have been introduced and the progress has been so rapid that the best have lasted but a few years. Within the last ten years the American carnation has become popular in England, and now new varieties are appearing from over the sea The United States census of 1890 shows that roses were first, carnations second, and that the two comprised 65 per cent of all cut-flowers This relative standing has been maintained to the present time

The development in chrysanthemums has been no less marked From the old formal Chinese sorts, the popular fancy turned to the large informal Japanese kinds Now a change to the single and pompon types is being experienced The varieties of greatest commercial importance have been for the last ten or fifteen years of American origin The English, French and, finally, the Australian varieties have led as exhibition flowers, but only an occasional variety has proved meritorious as market cut-flowers (See *Carnation*, *Chrysanthemum*, *Rose*, and other special articles.)

At the present time the important cut-flowers are roses, carnations, violets, chrysanthemums, sweet peas, lilies, narcissi, orchids, lilies-of-the-valley, mignonette, snapdragons, marguerites and gardenias. A modern cut-flower establishment in the region of New York grows for its wholesale trade the following numbers of plants:

Roses		100,000
Chrysanthemums		240,000
Carnations		45,000
Lilies	(75,000 for Easter)	150,000
Lilies-of-the-valley		300,000
Orchids		25,000

These are grown in a range of houses comprising 900,000 square feet of glass requiring 8,000 tons of coal, 300 employees, 25 horses, 4 automobiles, and a 250-acre farm with a dairy of 160 cows to suppy the manure required

The past ten years have witnessed the development of the new winter-flowering types of sweet peas, and now these flowers bid fair to rival the violet and chrysanthemum for position after roses and carnations

Orchids, particularly cattleyas, now are being grown by commercial florists for cut-flowers Although of recent development, during the last ten or twelve years, all large establishments have an orchid department, while many smaller growers are specializing in their culture

Lilies, through the means of cold storage, may now be had by forcing throughout the year The varieties of Japanese longiflorums have largely supplanted the old *Lilium Harrisii* kind. *Lilium speciosum* varieties are now largely grown

The antirrhinum is now being grown by several specialists and doubtless will yield varieties adapted to greenhouse culture

The most important outdoor flowers for cutting are peonies, gladioli and asters The peony is now a most important Memorial Day cut-flower, and many acres are devoted to its culture in regions in which the improved varieties mature their flowers early enough By means of cold storage, flowers of certain varieties may be kept in good condition for as much as four weeks The florists are enabled to have a supply of this flower for commencements, weddings, and the like, throughout the latter part of May, June and early July

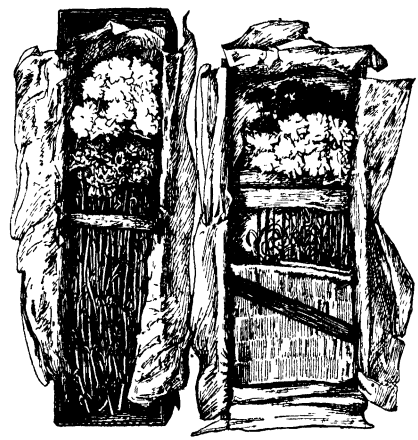
Gladioli are increasing in popularity as summer cut-flowers because of their keeping qualities under ordinary conditions. Not only are the white varieties useful, but the magnificent colored varieties are being used in large numbers for bouquets on dining-tables in hotels and restaurants

The selling.

The marketing of cut-flowers is a business of itself Many an excellent grower fails because he is not expert in selling his blooms The cutting of the blooms must be properly done and at the right stage of development The proper stage in the development when cutting should be done varies with the variety and the season Roses should be cut as the petals begin to unfold, when the tip of the bud is bursting and the outer petals have reached the proper color Carnations are picked when fully developed or when three-quarters developed The latter stage is determined by the pistils having reached an even length with the center petals Most flowers should be cut early in the morning, and as soon as cut should be placed in clean fresh water, after which they are carried to the cooling-room. The vases in which the flowers are placed should be deep enough to allow plunging the stems two-thirds their length in water The temperature of the water should be 10° to 15° higher than that of the cooling-room which is 45° to 50° The temperature is thus gradually lowered to that of the storage-room The flowers remain in the cooling-room until the picking is done, when they are graded

Along with the advance in cultural methods and to meet market requirements, flowers have been graded. Although the kinds of flowers grown and the quality

differ but little in the various flower markets, the grades are not yet uniform However, this ultimately will be brought about through the Florists' Telegraph Delivery Association, an organization which enables a resident of San Francisco, for example, to have an order filled and delivered at an address in Boston, Montreal, Baltimore or elsewhere The American Rose Society adopted the following grades for tea and hybrid tea roses: 9, 12, 15, 18, 24 inches of stem. Of course the flowers must be good to accord with this standard. American Beauty is graded Specials, above 38 inches; fancy, 32 to 36 inches; extras, 24 to 32 inches; firsts, 13 to 23 inches; seconds, 8 to 13 inches; thirds all under 8 inches On the Chicago market this variety is graded into specials, 36-, 30-, 24-, 20-, 18- and 12-inch stems. Carnations on the New York market are usually graded into fancies, extras and firsts. Fancies are all perfect blooms, from 2¾ to 3½ inches in diameter, with straight stems 16 to 24 inches or more in length. Extras are those blooms which fall short in one or the other of the above requirements Firsts comprise all merchantable flowers which do not pass as extras or fancies During the grading, all the leaves from the lower 6 inches are stripped off as well as any side shoots in the axils of the remaining leaves. Chrysanthemums are classed as small, medium, fancy and special. Whatever the grades used in any market, it is important that they be definite, and that the grower use care in grading his own products



1159. Carnations packed for shipment.

The present methods of the growers in disposing of their flowers to the retail florists are as follows: The large wholesale growers maintain wholesale stores of their own, dealing with the retailers direct and conducting a shipping trade The growers at a distance from the city market usually consign to the wholesale commission florist whose field is as broad as that of the wholesale grower These two classes of florists keep in close touch with their customers, even those at a distance, by the ordinary means of communication and in some cases by traveling representatives. The smaller growers living close to a large city adopt any one of five methods, that is, (1) form a cooperative association with an expert salesman to sell the flowers, (2) organize a flower-market and operate a flower-stand; (3) consign the flowers to a commission florist, (4) supply certain retailers regularly, (5) operate their own retail stores. The particular method to be adopted in any individual case depends upon the local conditions and the business ability of the grower. The grower-specialist usually will find it more remunerative to arrange with retailers better able to dispose of his high-class product.

The development of the methods of packing and handling flowers has been a great factor in the business. In the old days flowers were brought to market, or as was more often the case, the retailers went to the growers and carried them into the city in market-baskets. They were delivered to the customers in the same way. When flowers were to be shipped, which was seldom, any convenient box was adapted to the purpose. At present the florists employ wooden and folding paper boxes for different classes of trade. These are in various sizes adapted to the kind of flower to be packed and to the quality shipped. Furthermore, the package is clean, light, strong and entirely in keeping with the goods. The perfection of the railway and express service has facilitated the delivery of flowers to the consignee. Not only has this enabled growers to get their flowers to the city, but has made it possible for florists over the country to secure flowers when they do not have a sufficient supply. The great wholesale flower business of Chicago is built in a large measure upon the demand of florists in towns and cities over the vast territory extending from Winnipeg to the Gulf of Mexico, and from the Alleghanies to the Rockies.

The packages now used to carry the flowers to the wholesale market are either return or gift boxes, the former, are strong wooden boxes with a hinged lid 12 to 16 inches wide and 5 to 6 feet long These packages are returned to the grower Some do not find it profitable or possible to have shipping-boxes or -crates returned and must use gift boxes which may be of wood or heavy paper. The common box used by the wholesalers in shipping flowers to distant customers when the package must be handled many times, is the light wooden box This is made of thin wood, ½-inch ends and ¼-inch tops, bottoms and sides, with two interior cleats to hold the flowers down These boxes are made in sizes 4 to 8 inches deep, 12 to 16 inches wide, and 36 to 50 inches or more long The boxes are first lined with paper, usually four to eight thicknesses of newspapers, according to the season Then a layer of waxed paper is put in Roses, whether on their way into or out of the wholesale market, are seldom bunched. Carnations, when shipped out or when sent in by a wholesale grower to his own store, are usually not bunched, but growers who sell through the commission florist should bunch the flowers as it facilitates handling when the flowers arrive on the market Sweet peas, violets and similar flowers are always bunched. The number of flowers in a bunch will depend upon the requirements of the market. Usually sweet pea bunches contain twenty-five, violets, fifty or one hundred; peonies, thirteen; and carnations, twenty-five flowers The bunches of violets are encircled by a rim of twenty to thirty leaves and the combination must be attractively done if even the best flowers are to bring a good price. Sweet peas are bunched without foliage, while most flowers bear their natural foliage

Long-stem flowers, such as roses and carnations, when not tied in bunches, are packed one by one in rows across the width of the box, beginning at one end. The first row rests upon a pillow made of a roll of paper, and each succeeding row is separated from the preceding row by a strip of wax paper. This continues until five rows have been put in each end of the box. Five or six rows of flowers in each end constitute a layer. The flowers of each layer are covered with a sheet of wax paper, and the packing goes on until the box is filled; but only four to six layers should be put in a box.

Over the stems in the center are placed eight to ten thicknesses of well-saturated newspapers, after which cleats are nailed in place This will prevent the flowers from becoming disarranged in shipping When different grades of roses are to be packed in the same box, the specials are placed in first unless shipment has a long distance to travel, when two or three rows of the cheap, short grades should go next the end of the box because of danger of injury to the flowers. Each grade is separated from the next by sheets of tissue paper and the different grades are filled in until the short lengths complete the box It should be a general rule to pack white flowers in the top of the box. Every box should contain a statement of the contents for the information of the recipient No icing is usually needed in winter, but in warm weather the foliage of roses may be sprinkled with water or chipped ice Carnations are cooled by lumps of ice wrapped in wet newspapers and placed between the cleats of the boxes. Violets are preserved by wrapping the stems in soft tissue paper and dipping this in cool water. Sweet pea stems are wrapped in wet cotton wool, great care is being taken to prevent wetting the blooms.

In the early days of the cut-flower business, the grower retailed his own flowers. He found time to propagate the plants, tend the furnace, grow the crops, cut the blooms, make floral designs and, if necessary, pack and ship his product The rapid growth of the cities, making it impossible for the florist to conduct his business near the centers of trade, led to the retail florist This man, having no glass, could open a flower-stand or store in the most favorable locations, giving it his entire time The present-day flower stores are the achievements of his skill and industry in developing the art side of the florist business.

The changing demands.

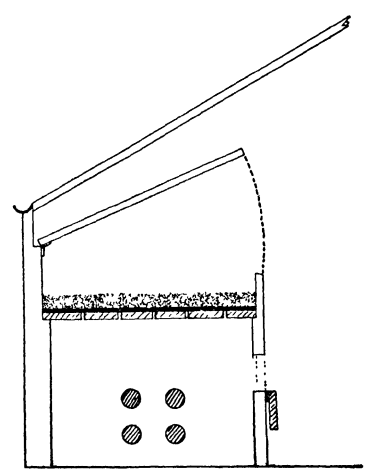
The uses to which cut-flowers are put have changed. Forty years ago the taste was for formal designs. The flowers were picked with short stems, and in the case of carnations only the open buds were cut, while the remaining buds on the stem were allowed to develop These flowers were wired to wooden sticks for basket work or to broom-corn straws for bouquets The details for making the formal pieces of that time will be found in Henderson's "Practical Floriculture." That the florists of that day enjoyed a good trade is seen in the fact that on New Year's Day, 1867, one New York firm sold $6,000 worth of flowers, and it was estimated that the total sales in the city amounted to $50,000. The same authority estimates the annual sales of flowers in New York at $100,000 and in Boston $200,000 Probably the sales of the whole country did not exceed $1,000,000 Often $200 or $300 were spent for flowers for a reception, and the spending of $1,500 for a similar purpose, as well as a $6,000 church decoration, were then the highest achievements of the profession.

The public taste of the present day is for loose, artistic arrangements of long-stemmed flowers The popular funeral emblems are forms of the wreath which are either made of one kind of flowers or of a great variety of material Flat sprays and bunches of flowers, and palm (sago) leaves tied with ribbon are also commonly used. House decorations consist of vases of long-stemmed flowers Roses, carnations, chrysanthemums, peonies and gladioli are suitable for this purpose. Table decorations for dinner are also made of long-stemmed flowers in vases, with some placed on the cloth with ferns or asparagus. Bridal bouquets are arranged often in shower effects by means of narrow ribbon. A remarkable advance has been made in the use of ribbon Instead of the florist going to the nearest drygoods store for the ribbon he needed, the present-day florist carries his own supply of specially prepared ribbon. As soon as a new shade of color appears in roses, a new ribbon is manufactured to match the color. The accessories now required to conduct a successful florist business are numerous, requiring a considerable outlay of money; and the trade in this class of floral supplies is a very large one Every large city now has its supply houses The kinds of flowers used throughout the United States and Canada vary very little and this is confined to varieties rather than species. The growth of the cut-flower business in Canada also has been rapid, and artificial boundaries have not divided the florists of the two countries A good book on cut-flower culture is "How to Grow Cut-Flowers," by M A. Hunt There are no works on the handling of cut-flowers On the use and arrangement of flowers, the best literature is found in the current trade papers Among the foreign works which may prove helpful are "Floral Decoration," by Felton; "The Book of Cut-Flowers," by R P Brotherston; and the German special journal, "Die Bindekunst"

A. C. BEAL.

CUTTINGS, PROPAGATION BY. A cutting is the gardener's name for a piece of stem, root, rootstock or leaf, which, if cut off and planted under suitable conditions, will form new roots and buds, reproducing the parent plant

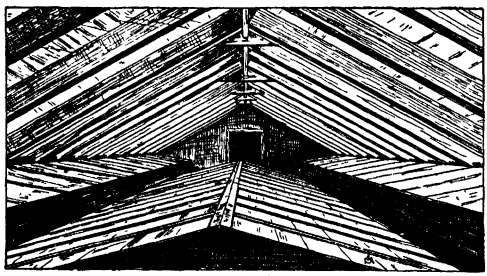
The word cutting, when unrestricted, is given to parts of the stem; a part or the whole of the leaf, when so used, is called a leaf-cutting; a piece of root or root-stock is called a root-cutting. The scales of some bulbous plants, as of the lily, can also be used as cuttings A cion used in grafting might be called a cutting which unites and grows on another plant Plants secured by division or layering are provided with roots before they are detached from the parent plants, and, therefore, are not properly cuttings There are intermediate states between these different categories, however, so that hard-and-fast definitions do not hold.



1160 Section of propagating-bed. Shows four pipes beneath, the door in the side, and the frame cover.

The practice of propagating by means of cuttings, together with the discussion of the reasons, results and bearings, constitutes a department of horticultural knowledge that has been denominated *cuttage*, as the practices, reasons and philosophy of tilling have been called tillage.

Multiplication by cuttings is a form of bud-propagation in contradistinction to sexual reproduction, i.e.,



1161 Permanent propagating-frames in a greenhouse.

propagation by seeds. It is a cheap and convenient way of securing new plants All plants cannot be profitably increased by these means. Why they differ we do not know; the gardener learns by experience what species yield a good percentage of healthy plants, and acts accordingly.

The following table will show the different ways in which cuttings are made:

- Cuttings
  - Stem
    - Growing wood.
      - Soft e g., verbena.
      - Hardened e g , tea roses
    - Ripened wood.
      - Long, in open air e g , grape
      - Short, under glass e g , Japanese cedar
  - Roots or rootstocks
    - Short, under glass e. g , *Anemone japonica*
    - Long, in open air e. g , blackberry
  - Leaf .
    - Entire e. g., echeveria.
    - Divided e g , *Begonia Rex.*
    - Bulb-scales e g , lilies.

There is less variation in cutting-progeny than in seed-progeny, and therefore cuttings (or layers or cions) are used when it is desired to keep a stock particularly true to name. They are used largely for the multiplication of forms that are specially variable from seed (which have not become fixed by seed selection), and of mutations as between the different branches or parts of a plant (bud sports) Thus, the varieties of roses, chrysanthemums, carnations, most begonias, and currants and grapes can be grown from cuttings. Cuttings are also employed when seeds are difficult to secure, as in many greenhouse plants, or when propagation by seeds is difficult and cuttings are easy, as in poplars and willows.

The cutting-bed.

Under glass cuttings are commonly planted in pure sand, such as a mason would use for making mortar. Sphagnum moss is sometimes used and various substances like brick-dust, coal-ashes jadoo fiber have been tried, but without much success Sand and well-rotted leaf-mold mixed half and half, is occasionally employed for geraniums, for lily scales, root-cuttings and some succulent plants.

Sphagnum is useful in rooting *Ficus elastica*, the base of the cutting being wrapped in a ball of moss and plunged in a bed of moss. English ivy, oleander and other plants can be struck in water, but this method is cumbersome Peter Henderson's saucer method is valuable in hot weather. the cuttings are planted in sand, kept saturated and fully exposed to sun.

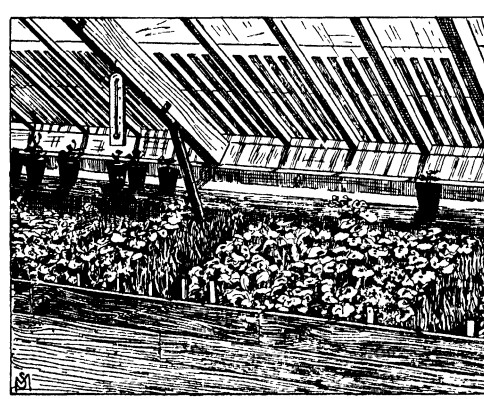
In the open air, a well-protected place, a part of the frame-yard, for example, should be chosen for a cutting-bed. The aspect should be southerly and the soil must be well drained. The soil should also be trenched to the depth of 2½ to 3 feet, all poor material removed and additions of humus, in the form of peat, leaf-mold or well-rotted barnyard manure incorporated. Provision for watering should be easy. If the soil is a heavy clay, add sand.

Structures in which cuttings are started. Figs. 1160–1165

Large establishments have one or more houses set apart for this and similar purposes called "propagating-houses" In smaller places a propagating-bed or -bench can be made at the warmest end of the warmest house It should be placed over the pipes where they leave the boiler, and, in order to secure bottom heat when needed, the space between the bench and the floor should be boarded up, having a trap-door to open on cold nights (Fig 1160). Cutting-frames inside a greenhouse are also shown in Fig 1161 Side partitions should also be provided to box in all the heat from the pipes under that part of the bench Good dimensions for such a bed are, width 3 feet, length 6 feet or any multiple of six thus making it simple to use a hotbed sash when confined air is wanted The depth of the frame should be from 6 to 10 inches in front and about the same behind The bottom of the bed may be either wood, slate or metal and should be well drained. place a layer of potsherds first, then moss, and from 2 to 3 inches of sand on top The sand should be clean, sharp and well compacted· before planting it should be watered if at all dry It is sometimes advisable to have the bed filled with moss (sphagnum), into which pots or boxes containing cuttings are plunged the moss should be moist, neither too wet nor dry, and well packed.

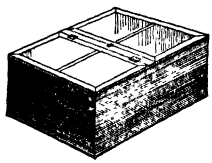
In many cases, when large quantities of one sort of easily struck cuttings are to be planted, the ordinary greenhouse bench covered with sand is sufficient (Fig 1162)

Hand-lights and bell-glasses are sometimes used under glass for small quantities of cuttings instead of frames They may be of every convenient size up to 12 or 15 inches in diameter. The important point is that



1162. Cutting-bench shaded with lath

provision for good ventilation be always provided: if too much water accumulates inside the glass it can be wiped off with a cloth They are somewhat obsolete devices for providing a close atmosphere and intensifying bottom heat. The modern gardener finds that sunlight and shading with apers put directly over the cuttings is quite sufficient for all plants except a few difficult subjects. Figs. 1163–1165 illustrate forms of hand structures.

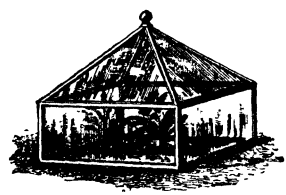


1163. Propagating-box.

Out-of-doors coldframes are employed for striking cuttings in summer. They are made of concrete or plank, and are about 5½ feet wide, 18 inches deep behind and 12 inches in front. They are of any convenient length, which is a multiple of three and are covered with standard hotbed sash Instead of coldframes, light hotbeds are sometimes employed for rooting cuttings in the open air in summer They entail more care and the results do not offset the gain.

Cuttings of growing wood Figs 1166–1171

These cuttings are made either of the soft growing tips, as in coleus (Fig 1166, also Fig 1027, p 827), salvia, verbena (Fig 1167), geranium (Fig 1168) and others, or, of the same wood in more mature condition, but by no means ripe, as in tender roses (Fig. 1169), and *Azalea indica* The cuttings of plants like *Euphorbia pulcherrima*, erica, epacris, are used in the soft growing state, if a well-built propagating-house is obtainable, but in an ordinary house, a part of which is used for other purposes, the older and better ripened wood will be more successful



1164 Propagating-box or hood.

It is generally true that cuttings of hardened wood will always root, although they require more time and may not make the best plants, but it is not true that cuttings of the soft wood will always root In many cases, as in the rose, they succumb before they callus, much less produce roots In plants of rapid growth and good vitality, the proper condition of the soft growing wood for cuttings can be determined by its readiness to snap, not bend, when bent back the hardened wood is in the right state as long as it continues to grow

The treatment of cuttings in both classes is practically the same They should be planted in sand under glass

The wood for soft cuttings should be fresh, and precautions should be taken to prevent wilting during making and planting if the weather is hot, sprinkle the floor and bench of the workroom: if they are delicate and exposed for an hour or more, lay them between folds of moistened paper. The average length of these cuttings is from 1 to 3 inches, but they can be made longer or shorter, much depends upon the nature of the plant. The best growers prefer short cuttings; the advantage of a long piece to begin with is more than offset by greater danger of wilting and consequent retrogression It is not necessary to cut to a bud, i. e., at the node, in the more easily handled plants except in some herbaceous tuberous-rooted plants, like dahlia (see Fig 1170), and *Salvia patens*, in which a crown must be formed to insure future growth Make the cut where it will give the proper length A part of the leaves should be removed, always enough to secure a clean stem for planting, and as many more as are needed to prevent disastrous wilting: this factor varies greatly In a hardwood cutting of lemon verbena all leaves are taken off, in zonale geraniums from the open ground few if any are left, in coleus and verbena about one half are removed, while in *Olea fragrans*, *Daphne odora*, and heath, only enough for planting Use a sharp knife; but scissors are handy for trimming and sometimes for making cuttings of those small-wooded plants which root easily.

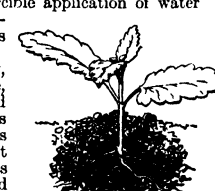


1166. Cutting of soft growing wood. (as of Coleus.)

The cuttings of plants with milky juice should be washed before planting. Sometimes the lower ends are allowed to dry for several hours, the tops being protected against wilting Large and succulent cuttings, e g, of pineapple, cotyledon, and cactus, should be dried before planting by letting them lie on the surface of the propagating-bed for several days, or they may be planted in dry sand at first Under these conditions a callus forms which tends to prevent decay; but the wood must not shrivel

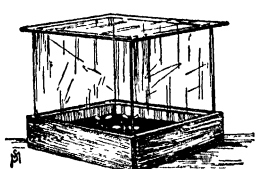
Peter Henderson has introduced a method which is likely to increase the percentage of rooted plants, and which is desirable in slow-growing varieties, like the tricolor geraniums He advises that the cutting should be partly severed and allowed to hang to the parent plant for a few days, this results in a partial callus or even roots, before the cutting is entirely removed

In planting cuttings, use a dibble or open a V-shaped trench Never thrust the cutting directly into the soil Plant deep enough to hold the cutting upright and no deeper (as in Fig 1171), making due allowance for the sand settling; the distance apart should be just enough to prevent them from pressing against each other. It must be remembered that they stay in the bed only until rooted. As soon as growth begins, they are potted off. When the cuttings are inserted, the sand should be firmly pressed about them, and they should be watered with a syringe or with a fine rose; the forcible application of water compacts the sand, thus excluding air, and prevents undue wilting



1167. A rooted verbena cutting.

Give shade immediately, using lath shutters outside, cloth screens or papers placed directly on the cuttings within, and attend to this very carefully for the first few days. Lift the shades early in the afternoon, and put them on late in the morning, but keep them on during the middle of the day, thus gradually accustoming them to full light.



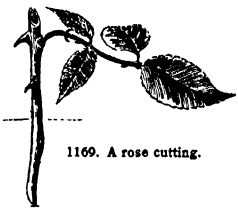
1165. Small propagating-box, adapted to a window.

Cuttings should never suffer from dryness. The sand should always be kept moist to the verge of wetness. Ventilation should be given on bright days, but all exposure to draft avoided. A good temperature for propagating is from 60° to 65° F, increasing these figures for tropical plants and reducing them for more hardy kinds. It is debatable whether bottom heat and

confined air are advisable for cuttings of growing wood. The older gardeners employed both, but now neither is commonly used, except for tropical plants, like croton, or when a constant succession of crops of cuttings is required. There is no doubt that with this aid cuttings will root more quickly, but more skill and care are required, neglect bringing on fungous disease, which results in unhealthy plants or total loss. If bottom



1168. A geranium cutting.



1169. A rose cutting.

heat is used, the average temperature of the bed should be 10° or so above that of the air, but less will suffice Indeed, in beds made as described above, in good weather the sand is enough warmer than the greenhouse atmosphere to answer every purpose If a confined air is wanted, ventilation and shading must be carefully looked after, and precautions taken against the accumulation of condensed moisture within the bell-glass or frame

Although it is tender plants, in the main, that are propagated by cuttings of growing wood, the above methods can be practised advantageously with some hardy plants The wood, which is invariably more successful if hardened, is obtained either from plants forced for this purpose, e. g , spirea, *Deutzia gracilis*, or it is gathered in June and July out-of-doors, e g., lilac, hydrangea They should be potted off in 2- or 3-inch pots, in a rather sandy soil, when the roots are from ¼ to ½ inch long It is sometimes good economy to box them, i e , plant them a few inches apart in flats, when not immediately required

Some hardy perennials, like *Phlox subulata*, *Campanula carpatica*, *Gentiana acaulis* and the hardy candytuft, can also be easily increased in this way. Make the cuttings 2 to 3 inches long and plant in flats or pots in sand or a sandy soil in October, November or December, before any hard frost Keep in a coolhouse and pot off when rooted They make nice plants for planting out the following spring Plants of this same nature can also be propagated in the open air in autumn. Make the cutting longer, 6 inches when possible, and do the work earlier, in September or in August in some cases.



1170 Hardened-wood cutting of dahlia



1171. A carnation cutting.

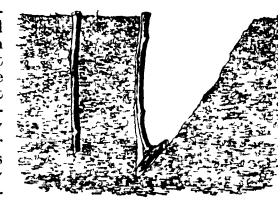


1172. Hardwood cutting of currant.

Cutting of ripened or dormant wood. Figs 1172–1174.

Many plants grow readily from twigs of the year's growth taken in fall or winter or very early spring. The "soft-wooded" plants usually propagate most readily by this means. These cuttings of mature wood may be either long or short.

Long cuttings of ripened wood in open air.—This method is used to propagate many hardy trees and shrubs, e.g , willows, currants, grapes, forsythia. Wood of the current year's growth is gathered in autumn or early winter, before severe frost, and either stored in a cool cellar, covering with moss or fresh earth to prevent drying, or immediately made into cuttings These cuttings are usually 6 inches or more long and should contain at least two buds. It is not necessary to cut to a bud at the base, but the upper cut should be just above one Figs 1172, 1173 They should be tied in bundles with tarred rope, taking care to have them lie "heads and tails" to facilitate planting, and with the butts on the same level, to promote callusing. They should then be buried in well-drained soil, with the butts down and protected against frost In early spring they should be firmly planted in V-shaped trenches in well prepared soil set an inch or so apart, with the rows 1 or 1½ ft apart The upper bud should be just at the surface; to prevent suckers the lower buds may be removed In autumn they should be dug, graded and heeled-in for winter Some varieties will require a second or third year's growth in the nursery, others are ready for permanent planting, as willows and poplars, which often grow 6 feet the first year This is one of the very cheapest ways of propagating, and will pay when only 25 per cent root. This method is generally used with deciduous-leaved plants, but some conifers, e.g , Siberian arbor-vitæ, will strike Remove enough twigs to get a clean stem for planting, and allow 2 or 3 inches of top above ground.

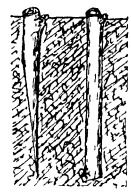


1173. Cuttings of grape, to show how planted.

The excrescences, knots or knaurs, which are found on the trunks and the main limbs of olive trees, are sometimes used as cuttings for propagation

Short cuttings of ripened wood (Fig 1174) Cuttings of this class are used under glass with tender or half-hardy species, and sometimes with new introductions, in cases in which the grower is short of stock, and when the plant is delicate and small The wood should be gathered before severe frost and the cuttings made and planted directly in October and November Make them from 2 to 4 inches long (sometimes a single eye only is used) and plant with a dibble, in pure sand in pots, pans or flats (boxes about 16 inches square and 3 inches deep). If a layer of potting soil is placed under the sand, the young plants have something to feed on and do not need to be potted so soon after rooting; if this is done, drainage should be given It is important to keep them cool until a callus is formed or roots produced If the buds start into growth before this, the cuttings become exhausted and are likely to die After rooting,—the time required varies from one to six months—they may either be potted or the strong-growing sorts be planted out in well-prepared beds in May or June, where they are likely to make a satisfactory growth. The weaker kinds may remain a year in pots or flats, be wintered in a pit, and planted out the next spring. Some greenhouse plants, e.g., camellia, laurestinus, tender grapes,

are propagated in this way with cuttings of fully ripened wood, and others, as cactus and dracena, with wood which is much older They should be given the care described under the head of "Cuttings of growing wood" (p. 927), but they must not be forced too hard at first The temperature should be regulated by the nature of the plant The safest rule to follow is to give a few degrees more heat for propagating than the plant received when the cutting was removed.



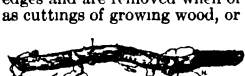
1174. Short cuttings of ripened wood.

Hardy shrubs can also be propagated by cuttings of growing wood, somewhat hardened, planted in coldframes in June and July. They are called "cuttings of green wood," and are made from 4 to 6 inches long and sometimes longer. They are closely planted in sand, or soil one-half sand and one-half leafmold, in rows 4 to 6 inches apart. They must be carefully watered, shaded and ventilated for ten days or more after planting. Much of the success of this method depends upon the weather; it brings in a gambling element a few hot and dry days are dangerous A light hotbed may be used instead of a coldframe but this means more care. The rooted plants are left in the frame all winter, protected and planted out the following spring.

Root-cuttings Fig 1175.

The cuttings of this class are made of either root or rootstock and are useful in propagating some plants, either in the greenhouse or in the open air Tender plants, like bouvardia, and those which are hardy but of delicate growth, e g, *Anemone japonica*, are handled under glass, blackberries, horse-radish, and so on out-of-doors The cuttings are made in autumn or winter, the roots of hardy plants being gathered before severe frost and either planted directly or kept in moss until spring. This process of storing develops a callus and has a tendency to produce buds For greenhouse work, the cuttings are made from 1 to 2 inches long, the larger roots being selected, although the small ones will grow They are planted in pans or flats, in soil composed of equal parts sand and well-rotted leaf-mold Ordinarily they are set horizontally If planted vertically, in cuttings from the true root, the end which was nearest the crown should be uppermost, but if made from the rootstock, that end should be uppermost which grew farthest from the crown In either case they should be covered, as seeds are covered, and the whole made firm Root-cuttings of hardy plants should be kept cool at first and brought into heat only when ready to grow They may be kept in a pit or cool cellar Tender plants require the same or a little higher temperature than that in which they thrive

In sweet potato, the tuber is cut lengthwise and laid, with the cut side down, on moist sand or moss, the edges being slightly covered. Buds develop on these edges and are removed when of proper size and treated as cuttings of growing wood, or allowed to remain until rooted. In dracena (see Fig 1052, page 842)—and this applies to stem- as well as root-cuttings—the buds are not taken off until rooted the original cutting remains in the sand and sometimes produces a second or even a third crop. The tuberous rootstock of *Arum maculatum*, and plants of like nature, can be cut into pieces, remembering that the bud-producing portion of arum is the top, and each part will grow successfully Exercise care in watering and maintain a good temperature.



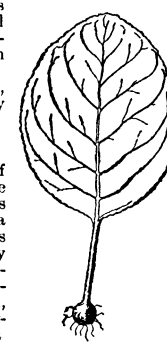
1175. Root-cutting of blackberry. (×⅛)

The rootstocks of cannas are cleaned and cut into pieces 1½ to 2 inches long and planted in a warmhouse in February (Fig 784, p. 657). As soon as buds push and roots form they are potted off and grown until the season for bedding out. Dahlias are not, properly speaking, propagated from rootstock, but by division; the plant cannot produce adventitious buds. There must always be a bit of the crown attached to the tuber The propagation of dahlias so closely resembles the methods here described that it is perhaps well to mention it

Root-cuttings for planting in the open ground are made from 4 to 6 inches long, and are planted firmly in V-shaped trenches or furrows in spring, being covered 2 inches or more deep Roots as large as one's little finger are chosen, and good results are secured with plants of vigorous growth In plants like lily-of-the-valley, common lilac, calycanthus, Scotch and moss roses, unless short of stock, it is better to encourage the natural growth of the suckers and propagate by division, but they all can be multiplied as above described

Variegation, curiously enough, is not always reproduced by means of root-cuttings.

Leaf-cuttings. Fig 1176.



1176 Leaf-cutting of gloxinia

Many leaves are capable of producing roots Some have the further power of developing buds after rooting, and of these last a few furnish an economical means of bud-propagation, particularly when the stem growth is insufficient In cotyledon (echeveria) the whole leaf is used, the smaller ones from the flower-stalk being often the best Choose those that are fully matured, and dry them for a few days on sand, but do not let them shrivel The treatment, otherwise, is as given above for cuttings of growing wood. In gloxinia and other Gesneraceæ, the whole leaf (Fig 1176), half a leaf, or even a lesser portion, is used When enough clear petiole is obtainable, no further preparation is needed When a part only of the leaf is planted, some of the blade must be cut away As a rule, no bud is developed the first season a tuber is formed, which will grow in due time



1177. Lily scale producing bulblets.

The common *Begonia Rex* is increased by leaves in various ways The whole leaf may be planted as a cutting, keeping the petiole entire or cutting it off where it unites with the blade, or the whole leaf may be pinned or weighted to the surface of moist sand (Figs 501-503, p 470), and, if the principal veins are severed at intervals of an inch, a plantlet will appear at every cut The best way is to divide the leaf into somewhat triangular pieces, each part having a strong vein near the center Plant in sand, in good temperature, and treat precisely as if they were cuttings of growing wood Roots and buds will soon grow, and a good plant will result within a reasonable time Pot off when roots are ¼ inch long Certain other begonias may be similarly multiplied.

Other cuttings

The thickened scales of bulbs, like lilies, can be used for propagation. Remove the scales intact and plant upright, like seeds, in soil made of equal parts of sand and rotted leaf-mold (Fig 1177). September and October are the usual months for this work. If they

are kept in a cool greenhouse, the young bulblets will appear in the course of the winter, but top growth will come later, in summer. This is a slow, laborious process, and is seldom practised except in propagating new varieties. The granular scales of achimenes and plants of like nature can be used for propagating, sowing them in a sandy soil as seeds are sown; but this method is not a good one in ordinary cases The scales of *Zamia horrida* have been made to produce new plants, as have also the tunicated scales of an amaryllis.

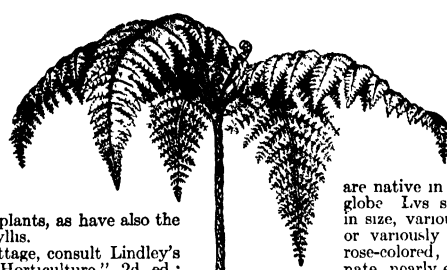
For further details of cuttage, consult Lindley's "Theory and Practice of Horticulture," 2d ed.; Burbidge, "The Propagation and Improvement of Cultivated Plants," Peter Henderson's "Practical Floriculture;" Bailey's "Nursery-Book."

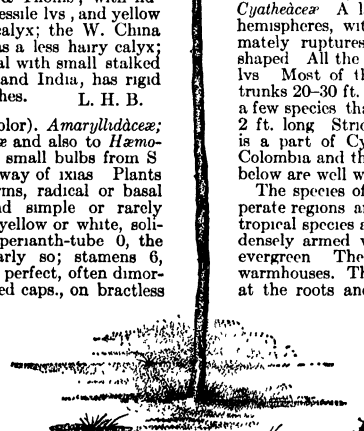
B. M. WATSON.

CYANÁNTHUS (Greek for *blue flower*). *Campanulàceæ* Ten or a dozen herbs, probably mostly perennial, of the high mts of Cent and E. Asia, with showy blue fls. terminating the ascending mostly simple hairy sts : corolla funnelform, tubular or bell-shaped, 5-lobed; stamens free from the corolla, the ovate anthers more or less connate around the pistil fr a caps with persistent calyx, loculicidally 3–5-valved lvs. alternate, usually small, entire or somewhat lobed **C. lobàtus,** Wall , may be expected in collections of choice alpines. 4–5 in.: lvs. small, narrowing to base, tooth-lobed at summit: fls bright blue, 1 in. diam , resembling a shining periwinkle fl , funnelform with reflexed lobes, the corolla exceeding the calyx-tube and hairy in the throat B M 6485 Other species mentioned in recent horticultural literature are *C. microphyllus,* Edgew. (*C. lanfòlius,* Wall), with slender wiry sts , small entire lvs , and fls like those of *C. lobatus* but with very hairy throat and longer narrower segms ; *C. incànus,* Hook. f. & Thoms , with numerous wiry sts , small nearly sessile lvs , and yellow campanulate fls. with hairy calyx; the W. China form of this (var. *leiocàlyx*) has a less hairy calyx; *C. Hoòkeri,* Clarke, is an annual with small stalked lvs and blue fls , from China and India, has rigid sts. with short lateral fl -branches. L. H. B.

CYANÉLLA (from the blue color). *Amaryllidàceæ;* it has been referred to *Liliàceæ* and also to *Hæmodoràceæ.* A half-dozen or less small bulbs from S Afr., sometimes grown in the way of ixias Plants with rhizomes or tunicate corms, radical or basal lanceolate or linear lvs , and simple or rarely branched sts fls violet, rose, yellow or white, solitary or racemed-paniculate; perianth-tube 0, the segms. distinct or very nearly so; stamens 6, attached to base of segms , all perfect, often dimorphous· fr. a loculicidal 3-angled caps., on bractless pedicel. The cyanellas are summer- and fall-flowering bulbs with us. The following are the kinds likely to be found: **C. capénsis,** Linn. Lvs. lanceolate, undulate: st. panicled, leafy, 1 ft.: fl purple. B M. 568. **C. lùtea,** Linn f. (*C. odoratissima,* Lindl) Less branched. lvs. linear-lanceolate, acuminate, not undulate: fls. rose, changing to yellow. B.R. 1111.

L. H. B.





1178. Cyathea meridensis.

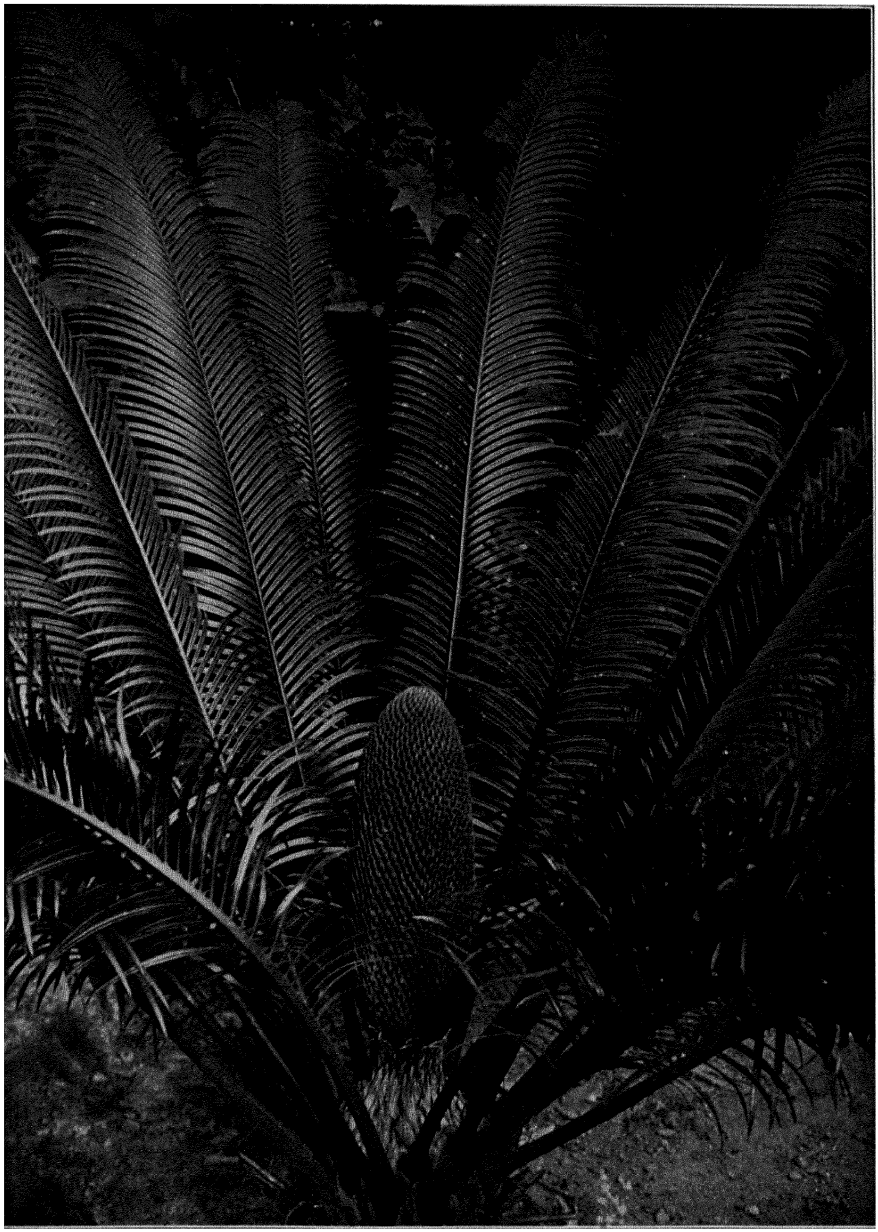
CYANIDING, CYANIDIZING: *Diseases and Insects,* p. 1044, discussion of fumigating by hydrocyanic acid gas.

CYANOPHÝLLUM: *Tamonea.*

CYANÒTIS (Greek, referring to the blue petals). *Commelinàceæ.* Probably 40 creeping, ascending or weak branching often woolly or hairy herbs, much like Tradescantia; they are native in warm countries about the globe Lvs sheathing, small or medium in size, various· fls in scirpoid cymes or variously disposed, mostly blue or rose-colored, sepals 3, lanceolate-carinate, nearly equal, usually combined at base into a short tube; petals 3, also nearly equal, often connate in a tube, the limb spreading and suborbicular; stamens 6, all perfect, nearly equal, ovary sessile, 3-celled and each cell 2-ovuled Easy of cult.; prop by cuttings There are few species in cult ; perennial; grown in greenhouses or warmhouses. **C. hirsùta,** Fisch & Mey , from Abyssinia, villous or glabrous, has erect st , globose tubers, linear soft-hairy lvs , and rose-colored perianth and blue-bearded filaments B M 7785 **C. barbàta,** Don, of E India, has elongated branching nearly glabrous st , narrow-oblong or nearly linear lvs , and blue spatulate-oblong petals free to the base: ovary hirsute at apex and the style bearded **C. kewénsis,** Clarke, of E Indies, is procumbent, reddish-hairy, leafy, the branches fleshy lvs a half or more longer than broad, sessile and amplexicaul petals rose-purple, ovate, free, filaments bearded B M 6150 (as *Erythrotis Beddomei*) **C. nodiflòra,** Kunth, of S Afr , is cobwebby or woolly but becoming glabrous, the fibrous roots terminating in tubercles. lvs narrowly lance-linear: petals blue, lightly connate. B M. 5471 L. H. B.

CYÁTHEA (Greek, *a cup,* alluding to the indusia). *Cyatheàceæ* A large genus of tree ferns in both hemispheres, with a globose indusium which ultimately ruptures at the apex and becomes cup-shaped All the species in cult have decompound lvs Most of them are large plants, species with trunks 20–30 ft. high being common, but there are a few species that have lvs. and sts. no more than 2 ft. long Strictly speaking, the genus Alsophila is a part of Cyathea Many other species from Colombia and the W Indies besides those described below are well worthy of cult

The species offer a great variety. Those of temperate regions are mostly stout and not spiny; the tropical species are more slender and in many cases densely armed with stout spines All species are evergreen The culture of cyatheas is simple in warmhouses. They require an abundance of water at the roots and the trunks should be kept constantly moist The foliage lasts longer if it has been inured to the sun during summer Like all other tree ferns, cyatheas need little pot-room They rarely produce adventitious growths along the trunk or at the base and none is proliferous. The plants are, therefore, usually propagated by spores, which germinate freely, making attractive young plants in two seasons. (Adapted from Schneider, "Book of Choice Ferns")



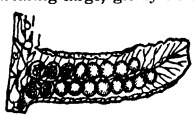
XXXIII. Cycas circinalis, the male plant.

A. *Rachides unarmed. lvs. white beneath.*

dealbàta, Swartz. Rachides with pale rusty wool when young. lvs firm, bi-tripinnate, almost pure white beneath New Zeal —*C. Smíthii,* Hort., is regarded by some as a horticultural variety.

AA. *Rachides unarmed lvs. green beneath.*

Búrkei, Hook Stalks with tubercles near the base bearing large, glossy rusty scales lvs bipinnate, with broad pinnules S Afr



1179 Fruiting pinnule of Cyathea meridensis.

meridénsis, Karst. Figs. 1178, 1179 Lvs. tripinnatifid, with oblong-lanceolate pinnæ and rather narrow lanceolate pinnules; segms scaly on the ribs beneath. Colombia.

AAA *Rachides spiny lvs. green beneath*

medullàris, Swartz Lvs bi-tripinnate, densely scaly when young, with soft, deciduous hair-like scales, segms coarsely serrate or pinnatifid, on spore-bearing lvs New Zeal.

C. angolensis, Welw A greenhouse species said to have fronds 6–8 ft long produced from a trunk which attains 12–15 ft. Trop W Afr

L M UNDERWOOD.

CŸCAS (Greek *kúkas,* the name of a palm tree) *Cycadàceæ* Several beautiful palm-like plants, common in cultivation under glass. Plate XXXIII

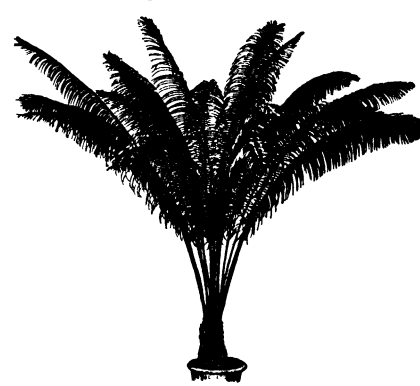
The Cycadaceæ are of great interest because they occupy a place intermediate between flowering plants and the cryptogams Like the former they have fr with a large starchy endocarp, but like the latter their sexual prop is accomplished by means of spermatozoids and archegonia, corresponding to the male and female elements in animals The plants are dioecious, the male infl is in the form of an erect cone composed of modified staminal lvs which bear on the under surface globose pollen sacs corresponding to microsporangia, the female infl consists of a tuft of spreading carpellary lvs. having their margins coarsely notched, in the notches are situated the ovules, which are devoid of any protective covering, and correspond to macrosporangia Pollination under natural conditions is effected by the wind The pollen settles on the ovules and sends down a tube into the tissue of the nucellus Archegonia are formed, egg-cells develop, and in the pollen-tube are produced spermatozoids provided with minute movable cilia by which they are propelled, very much as in the spermatozoa of animals These are discharged over the archegonia and fecundate the egg The discovery of spermatozoids in the cycads was made by a Japanese student, S Ikeno, while investigating the process of reproduction of *Cycas circinalis* Those of Zamia, endemic in Fla, were described and figured by H J. Webber, who found the mature spermatozoids of the latter genus to be the largest known to occur in any plant or animal

Most of the species of Cycas are arborescent, having a trunk marked with rings of growth and with the scars of fallen petioles The trunk is usually simple and columnar (though sometimes it is branched), and is elongated by a terminal bud The pinnate leaves form a beautiful terminal crown like that of a palm or tree-fern Cycads are found among the fossils of many geological formations, especially in those of the early Mesozoic. The latter formations are grouped together on this account, and the geological epoch which they represent is sometimes designated as the "Age of the Cycads"

Cycads are among the most ornamental plants of tropical and subtropical gardens In the United States they are often designated "sago palms," although they have nothing in common with a palm except the general habit of growth. In Florida, according to H Nehrling who has a plantation at Gotha, near the center of the state, they thrive equally well on high pine land and in the rich soil of the low hummocks *C. circinalis* is apparently the most sturdy of the cultivated species. It is almost free from diseases; but it is more sensitive to cold than *C revoluta.* The latter, on the other hand, is subject to diseases in low flat wooded situations. A third species, *C. siamensis,* which is comparatively rare, seems to be perfectly hardy in Florida In cultivating cycads, Nehrling has attained the best results by keeping the weeds away from the base of the trees and loosening the soil from time to time, taking care not to injure the small network of tubercle-bearing roots surrounding the trunk The tubercles, which are about the size of a pea, are interesting to the plant physiologist, and are apparently conducive to the plant's well-being Nehrling gathers the pollen from the male plants and sprinkles it by hand over the female flowers to insure fertilization of the naked ovules.

Plants are propagated by seeds, which keep well for a month or more after ripening According to E. N. Reasoner, they should be sown in shallow boxes or the greenhouse bench, lightly covered with sand, and after germination, potted off in small pots of moderately rich, light soil The growing plants do best in partial shade The old plants frequently send up suckers around the base of the trunk These may be taken off when in a dormant state and rooted, care being taken to remove the leaves to guard against excessive transpiration Growing cycads require sunshine and moisture.

The beautiful glossy leaves of cycads are used in many countries for ornamenting temples and for decorating altars On the island of Guam they are used for palm leaves on Palm Sunday, and in the early days they were carried by children in religious processions, marching from one village to another under the guidance of the Jesuit missionaries Cycads are popular conservatory plants, of easy culture, and tenacious of life, even when neglected for a long time Their stems



1180. Cycas pectinata.

deprived of leaves are easily transported in bulk and will soon resume growth when planted. In the southern United States, cycads are injured by frost but often revive after having apparently been killed.

A. *Margins of pinnæ flat.*

B. *Modified fr-bearing lvs. (carpophylls) spinous-toothed along the margin.*

C. *Scales of male infl. tapering into a long spine.*

D. *Lvs. 5–8 feet long, with pinnæ 10–12 in. long.*

circinàlis, Linn. (*C. Thouársii,* R. Br.). FERN PALM. A palm-like tree with cylindrical trunk and a crown of

glossy, fern-like, stiff but gracefully curved pinnate lvs.: trunk clothed with the compacted woody bases of petioles, usually columnar and simple, but often branching when the terminal bud has been cut off, or in clusters of several springing from the base of an old trunk which has been cut down; in addition to the true lvs, modified lvs in the form of simple short subulate woolly prophylla; true lvs 5–8 ft long, long-petioled, the petiole bearing short deflexed spines near the base; pinnæ alternate, 10–12 in. long and quite narrow, linear-lanceolate, acuminate, subfalcate, the midrib stout and prominent beneath, bright green above, paler beneath: male infl in the form of an erect woolly cone composed of scales bearing globose pollen-sacs on the under surface and tapering at the apex into a long spine; female infl in the center of the crown of lvs., consisting of a tuft of spreading buff-colored, woolly, pinnately-notched lvs. (carpophylls) about 6–12 in. long, spinous toothed along the margin, and bearing in the notches the naked ovules, ovules 3–5 pairs, borne above the middle: fr about the size of a walnut, with a thin fleshy covering, and a fleshy starchy endosperm resembling that of a horse-chestnut. S. India, Ceylon, Sumatra, Java, Philippines, Madagascar, E. Trop Afr, Guam.—In Fla the lvs. of this species are often destroyed by sharp frosts, but the trunk is rarely injured and will soon send forth new lvs when the weather becomes warm again. Nehrling recommends that fine specimens be protected by a tent or by a house of lattice-work covered with canvas, and with the sides also inclosed if necessary In this house a large kerosene lamp will be sufficient to keep the plant from freezing. In Tampa, Fla, this species appears to flourish, some of the specimens having trunks 6–8 ft high It grows best in rich moist soil and in partial shade. On the island of Guam, the nuts of this species form a food staple for the natives in times of famine following hurricanes. These are so poisonous that the water in which the kernels are soaked is fatal to animals After having been soaked for some time and the water repeatedly changed, the kernels become harmless, and are ground up into meal and dried for future use They are usually prepared in the form of cakes, which are said to be nutritious although rather tasteless

DD. *Lvs. less than 5 ft. long; pinnæ 3–8 in. long.*

mèdia, R Br. NUT PALM of Australia. Trunk attaining height of 8–10 ft. or sometimes twice this height, rarely branched at the top: lvs. 2–4 ft. long or more, the pinnæ very numerous, straight or falcate, obtuse or pungent-pointed, flat or slightly concave above when young, prominently keeled beneath, the margins often slightly decurrent on the rachis, glabrous or slightly pubescent when young, the longer ones varying from 3–8 in., the lower ones shorter and more contracted at the base, the lowest ones prickle-like, sometimes continuing to base of petiole: cones variable in size, but apparently smaller than in *C. circinalis*, which this species otherwise resembles; seeds 1–1½ in long, glabrous. Austral, along the northern coasts; also Queensland.



1181. Cycas revoluta.

CC. *Scales of male infl. shortly acuminate.*

Rúmphii, Miq. Closely related to the preceding, but growing taller in its natural habitat, sometimes reaching a height of 20 ft. or more. lvs. shorter and with fewer lfts. scales of male cone thickened and obliquely truncate at the tip, with a short upcurved sometimes caducous point; carpophylls a foot long, narrower than in *C circinalis*, with an entire often elongate subulate tip, seeds oval or subglobose, 2–2¾ in long by 1½–1¾ in diam Moist wooded regions of Burma, Ceylon (possibly intro.), Andaman Isls, Nicobar, Malaya, New Guinea, and N. Austral —This species when growing in cult. is usually much lower, and has a full large crown of lvs, with lanceolate pinnæ thinner and paler than those of *C circinalis* Much grown in tropical gardens of E. Indies, male plants rare.

BB *Modified fr.-bearing lvs. pectinate along the margins*

C. *Trunk much swollen at the base blade of carpophyll ovate-rhomboid*

siamênsis, Miq. A small palm-like tree sts 2–6 ft, much swollen at the base. lvs 2–4 ft, stiff spreading, pinnæ 3–8 in long, linear mucronate-acuminate, blade of carpophyll tawny-woolly when young, at length glabrescent above, ovate-rhomboid, long-acuminate, margin deeply pectinate lacerate scales of male infl. about ¾in long, with a slender terminal point of the same length: seeds 1½ in long, obovoid-oblong Burma, Siam, Cochin China —Apparently hardy in Fla It is rare, occurring in only a few gardens It is a beautiful species, easily recognizable by its trunk which is swollen very much like that of Dasylirion, and according to Nehrling grows much faster than the species more commonly cult It is certainly deserving of more general cult.

CC. *Trunk not swollen at the base· blade of carpophyll broadly orbicular.*

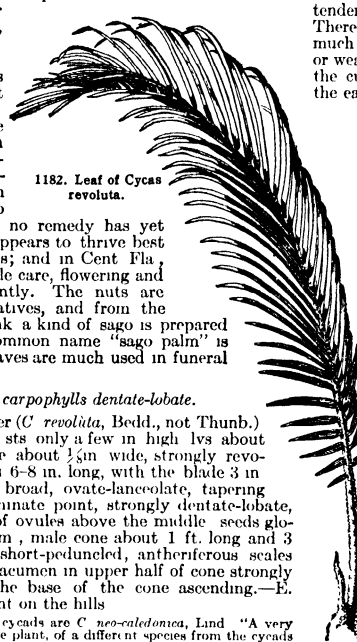
pectinàta, Griff. Fig 1180 A glabrous evergreen palm-like tree, to 10 ft high in its native habitat but usually much shorter in cult lvs ascending, recurved, 5–7 ft. long, pinnæ 7–10 in long, narrowly linear tapering into a minute apical spine, subfalcate, blade of carpophyll covered with dense tawny wool throughout, 6 in. long, broadly orbicular, long-acuminate, its margin deeply subulate-pectinate, stalk about equal in length to the blade with 2 or 3 pairs of ovules above the middle; spiny marginal teeth ¾in long, terminal point 1½ in long, tapering from a flat base, with 1 or 2 spinous teeth seeds about 1½ in long, ovoid. male cone 18 in long, 6 in diam, cylindric-ovoid; anther-bearing scales 1½ in. long, 1 in diam, deltoid-clavate, the apex much thickened, abruptly acuminate, terminal point 1½ in long, spine-like, ascending India, Nepaul, East Bengal, 2,000 ft elevation, Assam, Martaban, in pine forests G F. 4:114 (adapted in Fig. 1180).

AA. *Margins of pinnæ revolute.*

B. *Blade of carpophyll pectinate.*

revolùta, Thunb. SAGO PALM. Figs. 1181, 1182 A graceful palm-like tree or shrub, becoming 6–10 ft high, with the trunk simple or branching lvs long and recurved (2–7 ft.); pinnæ numerous, subopposite, curved downward, narrow, stiff, acute, terminating in a spine-like tip, dark shining green, the margin revolute; carpophylls with the blade broadly ovate, densely clothed with brownish felt-like wool, pectinate, ovules 2 or 3 pairs borne near the base: fr. ovate, compressed, red, about 1½ in long. S Japan. —This is the most common cycas in conservatories It is of Javanese origin and is much hardier than the species mentioned above. In Fla. it is usually found in all of the better parks and gardens, where it is suitable as a center about which to arrange other ornamental

shrubs According to Nehrling, this species is of slow growth. In the male plants there are usually several heads The male infl is usually 18–20 in long and cylindrical in form The female infl is in the form of a semi-globose head, yielding 100–200 large bright red nut-like seeds, which ripen about Christmas time. The new lvs. appear all at one time, usually in May They have a beautiful glaucous green color and at first stand erect Young plants are easily grown from seeds Unfortunately this beautiful species is, in Fla., subject to blight for which no remedy has yet been found It appears to thrive best in open situations; and in Cent Fla., it grows with little care, flowering and fruiting abundantly. The nuts are eaten by the natives, and from the pith of the trunk a kind of sago is prepared for which the common name "sago palm" is given it. The leaves are much used in funeral decorations



1182. Leaf of Cycas revoluta.

BB *Blade of carpophylls dentate-lobate.*

Béddomei, Dyer (*C revoluta*, Bedd., not Thunb.) A low shrub with sts only a few in high lvs about 3 ft long, pinnæ about ½in wide, strongly revolute, carpophylls 6–8 in. long, with the blade 3 in long and 1 in broad, ovate-lanceolate, tapering into a long-acuminate point, strongly dentate-lobate, bearing 2 pairs of ovules above the middle seeds globose, 1½ in diam., male cone about 1 ft. long and 3 in. diam, very short-peduncled, antheriferous scales long-acuminate, acumen in upper half of cone strongly deflexed, near the base of the cone ascending.—E. Madras, abundant on the hills

Other cultivated cycads are *C neo-caledonica*, Lind "A very ornamental palm-like plant, of a different species from the cycads ordinarily grown," intro into the U S by W T Swingle Much like *C circinalis* but with fronds narrower and pinnæ closer — *C Normanbyana*, Muell, intro into the U S from France by W T Swingle, a species with oblong-obovate lvs, having numerous linear pinnæ 6 in long Austral —*C Riuminiana*, Regel St rather stout lvs bright green, erect, spreading in a vase-like crown, the pinnæ fine-pointed Philippines I H 11 405 W E Safford

CYCLAMEN (classical name, probably from the Greek word for circle, in allusion to the spirally twisted peduncles) *Primulàceæ* Herbaceous and low plants, with a flattish tuber or corm, grown sometimes in the open and one of them much prized as a florist's and window-garden subject

Flower single, on a scape, with usually 5-parted calyx and corolla (the parts strongly reflexed), 5 connivent stamens, with pointed sessile anthers, 1 style and stigma, and a 5-splitting caps lvs cordate or reniform, long-petioled, entire or sinuate-dentate: fls nodding or declined, purple, rose or white.—About 20 species of the Medit region, extending to Cent Eu. *C persicum* is the source of the standard florists' cyclamens Most of the other species are essentially outdoor plants. They are little known in outdoor planting in N. Amer., however. The European catalogues list several species aside from *C. persicum*, and they are here described; and others are included in the supplementary list that are recently mentioned in horticultural literature. Old English name sow-bread, from the tubers being sought by swine Consult Fr. Hildebrand, Die Gattung Cyclamen, Jena, 1898; also Pax & Knuth in Engler's Pflanzenreich, hft 22, 1905.

All cyclamens are very beautiful, and would be much more popular were they hardy in our eastern climate. On the Pacific slope many of them probably would be perfectly at home as outdoor plants, producing a great number of flowers above the bare soil in the depth of winter before the leaves are developed —It is, however, with the Persian cyclamen (*C persicum*), which is tender, that florists have had the greatest success. There is no common winter-flowering subject of as much value for duration in bloom, variety of coloring, or wealth of color. It is preferable at all times to begin the culture of Persian cyclamen with seeds, sown in the early winter months Grow on without any check for the following year. They should bloom freely about fifteen months from planting Old tubers, such as are offered in fall with other florists' bulbs, rarely give satisfaction as compared with a packet of seeds It is not the nature of the plant to have all its roots dried off, as if it were a hyacinth or tulip Our summers are rather too warm to suit cyclamen perfectly, and it will be found that the most growth is made in the early autumn It is best to give the plants a little shade in the hot months, such as a frame outdoors near the shade of overhanging trees at midday This is better than growing them under painted glass, as more light is available, together with plenty of fresh air on hot days It will be found that cyclamen seeds require a long time in which to germinate,—often two months. This is due to the fact that the seed produces a bulb or corm before leaf-growth is visible As soon as two leaves are well developed, place the plants around the edge of 4- or 5-inch pots until every one is large enough for a 3-inch pot The roots are produced sparingly in the initial stages, and too much pot-room would be fatal at the start By the middle of summer another shift may be given, and in September all will be ready for the pots in which they are to flower,—5- or 6-inch pots, according to the vigor of the plants. It will always be found, however, that there will be a certain percentage that will not grow, no matter how much persuasion is used These may be thrown away, to save time and labor early in the season In the house they should have the lightest bench It is impossible to grow them in a warm, shady house About 50° at night is the ideal temperature when in flower The best soil is a fresh, tufty loam, with a fourth or fifth of well-rotted horse-manure, to which add some clean sand if the soil is heavy. At all times, the pots should be well drained — The Giganteum strains of the Persian cyclamen produce the largest blooms, but at the expense of quantity For the average cultivator it is better to try a good strain that is not gigantic. There is a recent departure in the form of crested flowers. Cyclamens come true to color from seeds, and one can now buy named varieties that will reproduce themselves almost to a certainty —Of recent years cultivators have had much trouble with a tiny pest or mite that attacks the plants and renders them useless for bloom. Its work is done mostly after the plants are taken into the greenhouse and when about to mature into blooming specimens If the first flowers come deformed or abnormally streaked with colors that are darker in shade, it is a sure indication that the pest is present. Frequent light fumigation with hydrocyanic acid gas as soon as the pest is discovered will in time eradicate it, but being very small, and able to hide under the divisions of the calyx, seldom coming out except on bright days, makes the pest a difficult one to fight. The gas cannot be used during sunshine. Tobacco stems used freely between the pots is a good preventive measure. Greenfly is likely to attack the

plants at all stages of growth. In the frames the plants may be plunged in tobacco stems, and in the greenhouse they must be fumigated or vaporized with some of the nicotine extracts. Great vigilance must be exercised in growing cyclamens. (E. O. Orpet.)

INDEX.

æstivum, 5
africanum, 7.
album, 1, 2.
alepicum, 1.
Atkinsii, 3
atro-rubrum, 1.
autumnale, 8.
cilicicum, 6.
Clusii, 5
cordifolium, 5
coum, 2, 3.
elegans, 3.
europæum, 5.
ficariæfolium, 8.
floribundum, 5.
giganteum, 1.
hederæfolium, 1, 8.
ibericum, 3.
indicum, 1
latifolium, 1.
libanoticum, 4.
macrophyllum, 1.
magnificum, 1.
neapolitanum, 8.
orbiculatum, 5.
Papilio, 1.
persicum, 1.
punctatum, 1.
punicum, 1.
purpureum, 1.
purpurascens, 5.
pyrolæfolium, 1.
roseo-superbum, 1.
rubrum, 1.
saldense, 7.
sanguineum, 1.
splendens, 1
subhastatum, 8.
vernale, 3, 8.
vernum, 2
violaceum, 1.

A. *Plant blooming in spring (or in winter under glass).*

B *Corolla-lobes not eared.*

1. **pérsicum,** Mill. (*C hederæfòlium*, Sibth. & Smith. *C indicum*, Linn *C. latifòlium*, Sibth. & Smith. *C. macrophyllum*, Sieb. *C pùnicum*, Pomel. *C. pyrolæfòlium*, Salisb.) Fig 1183. The common greenhouse or Persian cyclamen, in many forms: tuber large, flattened endwise, corky on the outside: lvs. appearing with the fls., ovate, crenate-dentate, base deeply cordate, usually marbled or variegated with white fls. on scapes 6–7 in high, large, scentless, white, purple-blotched at the mouth, but with rose-colored, purple and spotted forms, the segms. oblong-spatulate in shape, not eared or lobed at the base: pedicel not coiling in fr. Greece to Syria. The large-fld. cult forms are grouped as follows by Pax & Knuth: Var **álbum** (*C. alépicum*, Hort.). Pure white. Var. **gigantèum.** White with red throat; very large. Var. **magnífícum** (var. *punctàtum*). White, speckled with red, large. Var. **rùbrum.** Red Var. **sanguíneum.** Light blood-red, large. Var. **rôsea-supérbum.** Brilliant rose-red, large. Var. **purpùreum** Purple with bluish markings, large. Var. **violàceum.** Violet-red. Var. **àtro-rùbrum** and var. **splèndens.** Dark red, large The var *gigantèum* (*C. gigantèum*, Hort.) is the common large-fld., improved form of the florist's cyclamen. There are also double-fld. forms (R H. 1886, p 250); also fimbriate or crested forms, *C Papilio* (I H 43:63. G F. 5:235. G C. III. 21:71; 23:173). Other portraits of *C persicum* are: B M 44. I H. 35:43 Gn. 47.378; 48:182. J H III. 34 578 Gt. 44, p. 203; 45, p 164. F.S. 22:2345 A G 14:390–2; 17:261. A F. 7:521–5; 11:1176–9; 12:499. The species is frequently figured in the trade catalogues.



1183. Cyclamen persicum. Showing a flower of perfect form, and the crested variety. (×½)

2. **còum,** Mill. (*C. vérnum*, Sweet). Tuber smaller than in the last, globose or flattened: lvs. with or preceding the fls, nearly orbicular or round-reniform, entire, firm, not marbled nor variegated: fls. small, scentless, half or less as large as those of the last, purple and spotted in the throat. S. E. Eu. to Persia. B.M. 4. L.B.C. 2:108. F.S. 22:2345.—There is a white-fld. form (*C. álbum*, Hort.).

3. **ibéricum,** Goldie (*C. còum* var. *ibèricum*, Boiss. *C. élegans*, Boiss. & Buhse. *C vernàle*, Koch) Dwarf: lvs appearing before the fls, ovate-orbicular and rounded at the apex, entire or obscurely undulate, more or less zoned with white above fls purple with a darker colored throat. Caucasus.—Perhaps a geographical form of *C. coum.* **C. Átkinsii,** Moore, is *C. coum* × *C. ibericum*, Hildeb. Lvs. reniform, apex rounded, more or less shining, deep green, spotted silver-white, the corolla-lobes pale rose or white and usually lined or spotted red. F.S. 23 2425.

BB. *Corolla-lobes eared.*

4. **libanóticum,** Hildeb. Tuber globose with a cork-like covering: lvs. autumnal, the blade obcordate, sinuate, dentate or crenulate or rarely entire, marked with white above, deep violet or purple beneath fls fragrant; calyx-lobes oblong-acuminate, the margin lightly undulate, 5-nerved, corolla-tube somewhat globose-campanulate, the lobes lightly eared at base and broad-ovate, entire, pale or deep rose-color with a deep red T-form mark at the base, style exserted. Lebanon

AA *Plant blooming in summer and autumn*

B. *Corolla-lobes not eared.*

5 **europæum,** Linn (*C Clùsii*, Lindl *C æstivum*, Park *C. cordifòlium*, Stokes *C floribùndum*, Salisb *C. orbiculàtum*, and *C purpuráscens*, Mill.) Tuber with corky exterior lvs ovate-orbicular or reniform, entire or nearly so, with a deep and narrow basal sinus, more or less white-marbled above, purple-tinted beneath. fls on scapes 4–5 in high, bright red and very fragrant, not spotted, the corolla-segms oblong-spatulate (¾in or less long), calyx glabrous pedicel spirally coiling in fr. Cent. and S. Eu B R 1013.—Lvs appearing with the fls, more or less evergreen. Variable

6 **cilícicum,** Boiss & Heldr Much like *C. europæum*: tuber hairy: fls pale rose, with purple at the mouth, about twice larger; corolla-lobes elongated; calyx puberulent. Sicily. G C. III. 23:81

BB *Corolla-lobes eared.*

7. **africànum,** Boiss. & Reut (*C. saldénse*, Pomel). Large: tuber large: lvs ovate-cordate to reniform, coarsely toothed, pale beneath, dull and pale green marbled above: calyx pubescent, the lobes broadly ovate-acuminate, corolla nearly white, faintly rose- or purple-tinged, the segms 1 in long and deep purple at the base; calyx-lobes lanceolate Algeria. B M 5758. F S. 8:841.—Little known in this country, but sold by the American agencies of the Dutch bulb houses.

8 **neapolitànum,** Tenore (*C autumnàle*, Boos *C. ficariæfòlium* and *C subhastàtum*, Reichb *C. hederifòlium*, Ait *C vernàle*, Mill.). Tuber very large, black, thick-rinded: lvs. variable, from hastate to round-reniform, more or less wavy-plaited on the edges, green or somewhat parti-colored: calyx small; corolla pink or rarely white, the segms. short and twisted and the edges raised and white-edged at the base; calyx-lobes triangular to oblong. S. and E. Eu. B.R 24:49. Gn. 51, p. 37

C. æquinóctium, Hildeb. Intermediate between C. græcum and C pseudo-græcum, from the former it differs in its small fls. and other parts and from the latter in having more rounded lvs Greece. —*C. grǽcum*, Link Autumn-flowering. lvs obcordate, irregularly cartilaginous-dentate· corolla-lobes lanceolate or oblong-lanceolate, eared at base, rose-colored with deep purple at base S E Eu —*C. hiemàle*, Hildeb. Winter-flowering lvs round-reniform, bright green and silver-zoned. fl. purple with deep red in the throat, corolla-lobes round-ovate, not eared. Asia Minor —*C. Jóvis*, Hildeb Differs from C neapolitanum in its more slender fls with longer lobes of calyx and corolla Asia Minor —*C. maritimum*, Hildeb Lvs. variable in form, mostly ovate, brown-green fls. in Sept., inconspicuous, pale rose with marked throat, the corolla-lobes rounded Asia Minor —*C. Miltiaraktsi*, Hort =C græcum — *C pseudo-græcum*, Hildeb Differs from C græcum in having filaments and anthers longer, the latter 3-angled and acuminate. corolla pale rose or almost white Crete —*C. pseudo-ibéricum*, Hildeb. Spring-flowering lvs obcordate, rounded at base and top, the margin cartilaginous-crenulate, deep green and spotted silvery white fl violet, spotted with darker color, white at base, corolla-lobes oblong-ovate, not eared pedicel spiral in fr Probably Asia Minor —*C. pseudo-maritimum*, Hildeb Differs from C. maritimum in lvs being lanceolate-acuminate, calyx-lobes rounded and corolla-lobes long-acuminate Asia Minor —*C. repándum*, Sibth & Smith Spring-flowering tuber small lvs cordate, undulate-lobed, the lobes usually mucronate fl beautiful purple, the throat constricted and deeper-colored. Cent. and E Medit basin.

L. H B

CYCLANTHÈRA (Greek, *anthers in a circle*). *Cucurbitàceæ*. Annual- or perennial-rooted herbs, one of which is sometimes grown for its ornamental character.

Climbing by tendrils, glabrous or pubescent: lvs. entire, lobed or 5–7-foliolate: fls. monœcious, minute, yellow, greenish or white, with their parts in 6's, stamen 1 with a 1-celled anther. The plant is a climbing half-hardy annual of easy cult The seed should be started indoors early. The genus is near Echinocystis and Elaterium, and has more than 30 species, all from Trop Amer

pedàta, Schrad Annual· st. glabrous lvs pedately 5–7-foliolate, the lfts. sessile or nearly so and lanceolate or oblong-lanceolate, serrate· tendrils 3–4-parted: male fls small, in panicles equaling or exceeding the lvs : fr. nearly sessile, somewhat soft-prickly or smooth, oblong and attenuate at base, green becoming yellowish white, 2-locular Mex south —A strong ornamental climber. *C explòdens*, Naudin, with somewhat 3-lobed lvs. and short spiny explosive fr., may be in cult. L. H. B.

CYCLÁNTHUS (*flowers in a circle*). *Cyclanthàceæ*. A Trop American genus of 4 species giving name to a small order which is allied to the palms. They are acaulescent palm-like herbs with a milky juice: lvs. long-stalked, entire or bi-furcate, the segms lanceolate, 1-nerved: fls fragrant. The species are not in the American trade Cult of Carludovica (which see). *C. bipartìtus*, Poit., of Guiana, has lvs. sometimes divided into 2 long narrow lobes, the petioles being 3–6 ft. long spadix straight and cylindrical, in a 4-lvd. yellow spathe, the scape 2 ft long. G W. 8, p. 153; 15, p. 610. *C. cristàtus*, Klotzsch, of Colombia, has short-stalked bifid lvs, with the parts falcate and connivent: spadix about 8 in. long. G W. 8, p 202. *C. discolor*, Hort., has young lvs. streaked with brown-orange: lvs. bifid, the parts lanceolate, acuminate, the margins frilled Probably S. Amer. *C. Godseffiànus*, Hort., exhibited in 1892, "has noble lvs. of a rich green color, oblong, obovate, tapering to a sheathing stalk." Sander.

CYCLOBÒTHRA: *Calochortus*.

CYCLOLÒMA (Greek for *circle* and *border*, from the encircling wing of the calyx). *Chenopodiàceæ*. One weedy herb, *C. atriplicifòlium*, Coulter (*C. platyphýllum*, Moq.), of sandy soils from Minn, west and south, which was once intro as the "cyclone plant," since the plant is a tumble-weed or rolls before the wind when it is matured and becomes detached from the soil. The plant is a much-branched rank-growing annual, 1–2 ft. high, pubescent or nearly glabrous, with narrow but flat and sinuate lvs., and bractless fls. in an open panicle. The fls. are very small, perfect or sometimes lacking the stamens; calyx 5-cleft, the lobes strongly keeled and becoming winged and inclosing the seed Plant not fleshy or jointed.

CYCLÓPHORUS (Greek, *circle-bearing*). *Polypodiàceæ*. An E Indian and Malaysian genus of simple-lvd. ferns, related to some species of Polypodium. The genus is characterized by having creeping scaly rootstocks, simple lvs usually densely covered with star-shaped scales, at least on the back. The sori are round, naked, and placed so closely together as to appear often completely to cover the back of the lf. The venation consists of a very fine close network difficult to distinguish. Often listed in trade under Polypodium

Língua, Desv. (*Niphóbolus Língua*, Spreng.) Lvs. 6–12 in long, on short stalks, the lf.-blades thick, leathery, narrowly oblong, 4–8 in long, 1–2 in. broad, densely covered beneath with rusty white scales. Var. **corymbífera**, Hort. A form with the tips of the lvs. much forked, making the blade much broader than in the type Var. **variegàta**, Hort. A form with "light yellow lines about ⅛in. wide and ¾in. apart, running across the fronds at right angles to the midrib." See also *Polypodium*.

R. C. Benedict.

CYCNÒCHES (Greek, *swan's neck*, referring to the shape of the column). *Orchidàceæ*. Epiphytic orchids, requiring warmhouse treatment when growing.

Pseudobulbs fusiform: lvs. plicate· fls. of 2 sexes, the perianth alike, the lip entire, or that of the staminate very different, with the sepals and petals narrower, the lip clawed and with finger-like projections from the side, the column much elongated and arched; pollinia 2 Both sexes may be produced in the same plant. A third form of fl., usually perfect, occasionally appears; this is intermediate between the others —About a dozen species of Trop. Amer.

A. *Perianth alike in both sexes; lip entire.*

chlorochílon, Klotzsch Pseudobulbs 5–7 in tall. lvs. lanceolate· raceme erect, 2- or 3-fld ; fls 4–6 in. across; sepals and petals yellowish green, acute, the lateral sepals broader than the dorsal, lip obovate or elliptic, acute, a dark green depression near the triangular erect callus. Venezuela. G.C. III 3:145 I H 35:65. R. 1:39. J.H. III. 35:285. Gn. 49, p. 403; 51:172.

ventricòsum, Batem. Pseudobulbs 8–10 in. tall: lvs. lanceolate· raceme drooping, 4–6-fld.; fls 4–5 in. across; sepals and petals yellowish green, acute, the petals broader than the sepals, lip white, cordate, acuminate, clawed, a black callus at the junction of the claw with the lip. Guatemala.

AA. *Perianth differing in the sexes; lip with finger-like lateral projections.*

aùreum, Lindl. Male racemes pendulous, 8–12-fld ; fls. 2–3 in. across, yellow, red-spotted; sepals and petals similar, the former spreading, the latter reflexed; lip clawed, the dilated middle giving rise to a number of projections, forked at the end. Cent. Amer. J.F. 3:264.

pentadáctylon, Lindl. Male racemes usually pendulous, many-fld.; sepals and petals greenish yellow barred with brown; lip white, red-spotted, with 5 finger-like projections; female racemes erect, few-fld.; sepals and petals broader than in the male fls., spotted; lip ovate, entire. Brazil. B.R. 29:22. J.H. III. 62: 305. O R. 8·312.

peruviàna, Rolfe. Male racemes pendulous, many-fld ; sepals and petals light green, copiously brown-spotted; lip, with its projections, white. Peru. Lind. 7:301.

C densiflòrum, Rolfe Male racemes pendulous, many-fld., the fls greenish with purple blotches, female racemes short, erect, 2-fld., the sepals and petals green, the lip ivory-white. Colombia. O R. 17 204, 20·331. B M 8268 —*C. maculátum*, Lindl. Male racemes pendulous, the sepals and petals light yellowish green, spotted with red-purple, the lip white Mex. O. 1910 104 O.R. 17.273, 20:315.

George V. Nash.

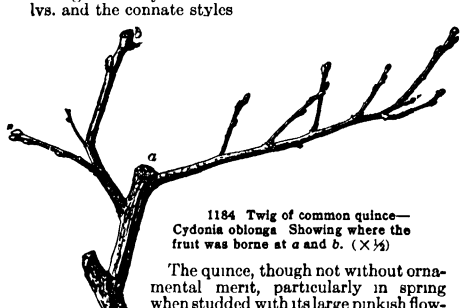
CYDÍSTA (Greek, *kydıstos*, most glorious; alludıng to the beautıful flowers). *Bignonıàceæ*. Ornamental vines, grown for their beautıful flowers

Evergreen shrubs, climbıng by lf.-tendrıls. lvs. opposıte, with 2 lfts, the rachıs elongated ınto a simple slender tendrıl, sometımes wantıng fls ın terminal or axıllary panıcles, sometımes 2, calyx campanulate-turbınate, truncate or wıth 5 short teeth; corolla funnel-form-campanulate, wıth ımbrıcate lobes, stamens 4, ınclosed, with spreadıng anther-cells, dısk wantıng; ovary lınear, with numerous ovules ın 2 rows caps. lınear, septıcıd, with numerous, nearly orbıcular, wınged seeds —One or 2 species ın the W. Indıes and S Amer. Closely allıed to Bignonıa, but easıly dıstınguished by ıts sımple slender tendrıls, by the panıculate fls, the usually truncate calyx and the wantıng dısk. Suited for cult ın tropıcal and subtropıcal regıons only and as a stove plant ın the N. For cult. and prop., see *Bignonıa*.

æquinoctiàlis, Mıers (*Bignònıa æquinoctiàlis*, Lınn.). Hıgh climbıng lfts ovate to ovate-oblong, obtuse-acumınate, undulate, lustrous, reticulate, 3–4 ın. long; petıoles ½–¾ın long. calyx campanulate-turbınate, truncate; corolla whıte or pınk, wıth dark pınk or purplısh veıns, 2½ ın long W. Indıes, Brazıl —The *B æquinoctialis* var. (B R. 9:741) wıth yellow fls ın elongated racemes ıs *Anemopægma Chamberlaynıı*, Bur & Schum (*Bignonıa Chamberlaynıı*, Sıms B. M. 2148. F S. 3:235. P.M. 14 3) See page 502. ALFRED REHDER.

CYDÒNIA (the fruıts known to the Romans as *Mala Cydonıa*, apples from Cydon, now Canea, ın Crete). *Rosàceæ*, subfamıly *Pòmeæ* QUINCE Shrub or small tree, grown for ıts fruıt, whıch ıs much used for preserves and sometımes baked

Branches unarmed: lvs. decıduous, alternate, petıoled, stıpulate, entıre fls whıte or lıght pınk, rather large, termınal on short leafy branchlets, petals 5; stamens numerous, styles 5, free, ovary 5-celled, cells wıth many ovules: fr a 5-celled, many-seeded pome.— One species from Persıa to Turkestan The genus Chænomeles, often ıncluded under Cydonıa, ıs easıly dıstınguished by the serrate or crenate chartaceous lvs. and the connate styles



1184 Twıg of common quınce—Cydonıa oblonga Showıng where the fruıt was borne at *a* and *b*. (×½)

The quınce, though not without ornamental merıt, particularly ın sprıng when studded wıth ıts large pınkısh flowers and again ın autumn when loaded wıth ıts golden fragrant fruıts, ıs rarely planted as an ornamental shrub, but chıefly, though not very extensıvely, grown for ıts fruıt whıch ıs made ınto preserves. It ıs of slow growth and prefers heavy and rather moıst soıl. It may be propagated by seeds stratıfıed and sown ın sprıng, but ıs usually ıncreased by cuttıngs of one- to four-year-old wood, taken ın fall and stored until sprıng ın sand or moss ın a cellar or frame; also by layers and buddıng, or by graftıng on vıgorous growıng varıetıes. See *Quınce*.

oblónga, Mıll. (*C. Cydònıa*, Pers *C vulgàris*, Pers. *Pỳrus Cydònia*, Lınn.). QUINCE. Fig 1184. Shrub or small tree to 15, rarely to 25 ft, wıth slender, spıneless branches. lvs. oval or oblong, rounded or slıghtly cordate at the base, acute, entıre, vıllous-pubescent beneath, 2–4 ın long: fls. whıte or lıght pınk, 2 ın across: fr. large, yellow, vıllous, pyrıform or globular. May; fr ın Sept. and Oct. Cent and E Asıa. Gn. 33, p. 491 F S R 2, p. 379· 3, p. 283. Seeds have mucılagınous and demulcent properties. Var. **pyrıfórmis,** Rehd. (*C vulgàris* var *pyrıfórmis*, Kırchn.) Fr. pear-shaped, the typıcal form Var **lusitánica,** Schneıd. (*C lusıtánica*, Mıll.) Fr pear-shaped and ribbed lvs. larger, of more vıgorous growth Var. **malifórmis,** Schneıd. (*C malifórmis*, Mıll.). Fr. apple-shaped. Var **pyramidàlis,** Schneıd. Of pyramıdal habıt. Var. **marmoràta,** Schneıd. Lvs whıtısh and yellow varıegated For pomological varıetıes, see *Quınce*

For *Cydonia japónica*, Pers., *C. Maùle*, Moore, and *C sınénsis*, Thoun, see Chænomeles. ALFRED REHDER.

CYMBÍDIUM (*boat*, from the Greek, referrıng to the shape of the lıp). *Orchıdàceæ*. Handsome epıphytal, rarely terrestrıal orchıds, requırıng warmhouse condıtıons

Stems pseudobulbous or not so· lvs coriaceous, long, rarely short, persıstent. sepals and petals sub-equal, labellum usually trı-lobed, adnate to the base of the column, column erect; pollınıa 2 —Species 30 and more, tropıcal or subtropıcal, found on mountaıns at hıgh elevatıons ın Asıa, and a few species ın Afr. and Austral

These are among the most decoratıve of orchıds when ın bloom, and are attractıve all the tıme owıng to the graceful folıage seen on well-grown specımens There are now many handsome species and varıetıes and these ın their turn have produced, at the hands of the hybrıdızer, many fine decoratıve plants, so that a house of cymbıdıums produces flowers most of the tıme, and these last many weeks ın full beauty There are few orchıds whose flowers last so long, and the spıkes of bloom, often 2 to 3 feet ın length, are useful for decoratıve purposes of all kınds, either on the plants or cut The recent species, *C. ınsıgne*, ıs the most beautıful of all and has already lent ıtself to hybrıdızatıon, so that to the very many known hybrıds *C. ınsıgne* wıll soon add ıts ınfluence and coloring —Cultıvated cymbıdıums are terrestrıal, wıth thıck fleshy roots best contaıned ın pots A portıon of tough fıbrous loam should be added to the osmundıne, about half of each wıth plenty of broken charcoal to keep the whole porous The plants wıll do well for years without dısturbance at the roots, but when thıs ıs necessary, great care must be taken not to ınjure them Dıvısıon ıs, ın fact, very dıfficult to accomplısh when the pots are full of roots, and ıt ıs best practıce to pot the plant ın a larger receptacle if the roots are healthy, washıng out loose earth and removıng dead portıons of roots first. Cymbıdıums may be grown ın a temperature of 50° as a mınımum ın wınter, must not be subjected to strong sunlıght after March, and never allowed to become dry at the roots, as these are more or less actıve, even ın wınter Beıng terrestrıal, weak manure-water may be applıed durıng actıve growth. Many specıes thrıve well when planted out ın large palm and fern houses among rocks arranged ın a natural manner, and when the plants are placed so that the flower-spıkes are on a level wıth the vısıon, they have a charmıng effect for many weeks when ın bloom, and the envıronment suıts them well. Of the few well-marked species, there are many forms that have been collected and when flowered ın cultıvatıon, proved dıstınct. These ın some cases have been called new specıes, but are now beıng better understood; some prove to be natural hybrıds, others are varıetıes. (E. O. Orpet.)

A. *Fls. whıte.*

ebúrneum, Lındl. Sts. tufted: lvs. dıstıchous at base, 1 or 2 ft. long, lınear or lorate, bıfıd at apıces:

peduncles not so long as the lvs, few-fld.; fls about 3 in across, ivory-white, sometimes tinged with rose; sepals and petals oblong-lanceolate; lip 3-lobed with a golden yellow ridge running down the center Khasia Hills, at an elevation of 5,000–6,000 ft. B.R. 33·67. B M. 5126. Gn. 46, p. 398. G C. III. 35:99 Var. **Goodsoniànum,** Hort. Fls white, with broad rose-purple band down middle of lip. Var. **Dayànum,** Hort (*C. Dayànum,* Reichb. *C ebúrneum Dáyi,* Jenm). Lvs. longer and narrower: lip with a row of purple spots each side of disk.



1185. Cymbidium giganteum. (×⅓)

AA. *Fls. not white.*

B. *Infl. arching or erect.*

C. *Sepals and petals veined with red, brown or purple.*

D *Ground-color of sepals and petals not white*

E. *Middle lobe of lip purple-maroon, margined yellow.*

Lowiànum, Reichb f. Pseudobulbs oblong: lvs. 2–3 ft long, linear-acute, recurved racemes many-fld ; fls. about 20 in number, 3–4 in across, sepals and petals oblong-lanceolate (lateral ones sub-falcate), greenish yellow marked with brown, lateral lobes of lip yellowish, midlobe reflexed, purple-maroon, margined with yellow Burma Gn 48, p. 263. Gng. 5.73 A F. 34 1089 R B 30 276. Var. **Mandaiànum,** Hort. (*C. Mandaiànum,* Hort), has yellow fls.

EE *Middle lobe of lip yellow, spotted.*

gigantèum, Wall. Fig. 1185 Fls. dull purple (brownish, or yellowish green striped with purple), sepals and petals oblong, the petals narrow and shorter, midlobe of lip reflexed, yellow, spotted with red, lateral lobes yellowish green. Nepal B M 4844 P M 12·241

Traceyànum, Hort Pseudobulbs and foliage as in *C giganteum·* racemes 3–4 ft long, ascending, 15–20-fld , fls 4–5 in. across, sepals and petals greenish yellow, lined with crimson; middle lobe of lip oblong, reflexed, crisped, cream-white, crimson-spotted Burma C O 4 R B 29·25.—By some considered a natural hybrid between *C grandiflorum* and *C. giganteum.*

DD *Ground-color of sepals and petals white, flushed rose*

insígne, Rolfe (*C. Sánderi,* Hort *C. insígne Sánderi,* Hort) Lvs up to 3 ft long· infl long, ascending; fls. rosy white; sepals and petals elliptic; lip marked with lines of purple dots, the middle lobe short, obtuse, emarginate; disk yellow C O 10 B M. 8312 O. 1911. 64. R.B. 33·53. R H 1907·496. G C III 37:115.

CC. *Sepals and petals not veined.*

tigrìnum, Parish. Lvs. oblong-lanceolate· peduncles slender, 3–6-fld.; sepals and petals linear-oblong, acute, green, spotted at base, petals often paler and with more spots than the sepals, lip with yellow, red-brown striped lateral lobes; midlobe white, transversely streaked with purple. Burma. B.M.5457. A G 22 715

grandiflòrum, Griff. (*C Hookerianum,* Reichb f) Lvs about 2 ft. long, acute. peduncle arching above, erect at base; fls from 6–12, large, sepals and petals oblong, greenish, lip yellow, spotted with purple. Sikkim. B M. 5574.

BB. *Infl pendulous.*

péndulum, Swartz The leathery lvs distichous, 2–3 ft long, broadly linear· fls yellowish; side lobes and midlobe of lip rose-color; the disk more or less white with yellow crests; sepals and petals narrowly oblong, with a purple median line. E Indies

Finlaysoniànum, Lindl (*C péndulum,* Lindl) Lvs. ensiform raceme many-fld ; sepals and petals linear-oblong, obtuse, dull yellow, sometimes with a reddish median line, lateral lobes of lip crimson; midlobe white, tipped with crimson Malaysia. Var. **atropurpùreum,** Hort. Lvs. narrower, racemes longer, with larger fls sepals and petals purplish, front lobe of lip white, spotted with purple Borneo

C Alexánderi, Hort Hybrid between C eburneo-Lowianum × C insigne —*C aloifólium,* Swartz Racemes many-fld , arched, fls. pale purple, black-striped E Indies —*C Ballianum,* Hort Natural hybrid between C eburneum × C. Masterst —*C Colmanæ,* Hort Hybrid between C eburneo-Lowianum × C eburneum Dayanum —*C Cravenianum,* Hort Hybrid between C Lowianum × C Traceyanum —*C Devonianum,* Paxt Racemes many-fld , pendulous, sepals and petals greenish or reddish yellow, spotted or lined with purple, lip purple India C O 8 —*C eburneo-giganteum,* Hort Hybrid between C eburneum × C giganteum.— *C eburneo-Lowianum,* Hort Hybrid between C eburneum × C Lowianum —*C ensifólium,* Swartz Lvs ensiform, acute racemes many-fld , fls greenish yellow, purple-veined, sepals and petals linear-oblong, acute, lip spotted India Japan B M 175 — *C erythrostylum,* Rolfe Sepals and petals white, lip yellowish white, lined red-purple, column crimson Annam B M 8131. G C III 40 286 —*C gallonense,* Hort Hybrid between C Lowianum × C Traceyanum —*C Gammieanum,* Rolfe Supposed to be a natural hybrid between C giganteum × C elegans G C III 38 427 —*C glebelandense,* Hort Hybrid between C Schroederi × C insigne —*C Gotthianum,* Hort Hybrid between C eburneum × C insigne Sanderi Fls white, the sepals with a faint greenish tinge, the lip blotched with ruby-purple G C III 49 180 —*C. Hollordianum,* Hort Hybrid between C grandiflorum × C eburneum —*C Holmesianum,* Hort Hybrid between C Masterst × C giganteum —*C Huttoni,* Hook f =Grammangis —*C Iangleyénse,* Hort Hybrid between C Lowianum × C Devonianum Sepals and petals greenish brown, the lip marked with reddish brown G C III 49 146 —*C Lindleyi*=(?) —*C longifólium,* Don Lvs linear, acuminate racemes suberect, fls about 12, sepals and petals green, striped brownish purple, the sepals oblong, the dorsal one broader and incurved, lip with the lateral lobes purple-lined, the middle lobe and disk white Himalayas G M 54 472 —*C longifolium,* Hort Hybrid between C Lowianum × C tigrinum — *C Lowi-grandiflorum,* Hort Hybrid between C Lowianum × C grandiflorum —*C Lowi-Masterst,* Hort Hybrid between C Lowianum × C Masterst —*C Masterst,* Griff =Cyperorchis —*C Parishi* var *Sanderæ,* Rolfe (C Sanderae, Hort) Sepals and petals ivory-white, the front lobe of lip heavily blotched with crimson-purple, the crests orange-yellow Burma G C III 35 338 —*C Pauwelsii,* Hort =C insigne × C Lowianum concolor —*C pinnulum,* Rolfe Scape 4–6 in long, many-fld , sepals light reddish brown, lip white with red-brown spots, disk and keels bright yellow China —*C rhodochilum,* Rolfe A striking plant raceme many-fld , sepals and petals pale green; the latter with darker green spots, lip with the lateral lobes pale green, margined crimson, the middle lobe obcordate, crimson, with a yellow central band which is green-spotted Madagascar B M. 7932-3. O R. 14 209 A F 18 810. G C III 37 378 Gn 61, p 383 —*C. rosefieldense,* Hort Hybrid between C Traceyanum × C grandiflorum. —*C Sandersonii*=Anselliu —*C Schraderi,* Rolfe Petals and sepals lanceolate, green, lined and dotted with reddish brown, lip light yellow striped with brown Annam —*C Simonsianum,* Ruiz & Prantl Sepals and petals grayish white, streaked blood-red in the center, lip white, streaked blood-red, the middle lobe revolute, with a yellow blotch Assam B M 7863 —*C Stepdanum,* Pynært Hybrid between Cyperorchis Masterst × Cymbidium giganteum Sepals and petals yellowish green, the lip white marked brown and yellow R B 36 397 —*C. Veitchii,* Hort Hybrid between C eburneum × C Lowianum Fls fragrant, about 5 in across, sepals and petals white, tinted yellow, lip white, tinted yellow, with a large V-shaped purple-crimson spot on the middle lobe. G C III 47 407 O R 12 369, 16 325 C O 1 —*C virescens,* Lindl. Sepals and petals greenish, the lip yellow, red-blotched Japan — *C Wigansianum,* Hort Hybrid between C eburneum × C Traceyanum.—*C Wilsonii,* Hort Sepals and petals green, indistinctly marked at base with lines of reddish dots, lip cream, the lateral lobes lined with sepia-brown and reddish markings on the front lobe China G C III 35 157 —*C Winnianum,* Hort Hybrid

between C. giganteum×C. eburneum. Racemes 10–15-fld.; fls. about 4 in. across, sepals and petals ivory-white, lip ivory-white, spotted with crimson. O.R. 1 361, 12 369 G M 51 179 — C. *Woodhamsiànum*, Hort Hybrid between C Lowianum× C Veitchii G 30 107 —*C. woodlandénse*, Hort Hybrid between C Traceyanum×C Mastersii —*C Zaleskiànum*, Hort. Natural hybrid between C. giganteum×C. grandiflorum.

GEORGE V. NASH.†

CYMBOPÉTALUM (Latin, signifying *boat-petal*, from the shape of its petals) *Annonàceæ*. A group of plants remarkable for the fragrance of their aromatic flowers.

Flowers with the 3 inner petals having the margin incurved somewhat like the upper part of the human ear, the several-ovuled carpels forming a cluster issuing from a globose mass of stamens: fr. in the form of separate oblong berries borne on the hardened torus or receptacle and resembling that of our papaw (*Asimina triloba*).—Several species, all of them endemic in Trop Amer. Among the species thus far described are *C. brasiliensis*, Benth. (*Uvaria brasiliensis*, Velloso). *C. penduliflorum*, Baill. (*Unona penduliflora*, Dunal). *C. longipes*, Diels, and *C stenophyllum*, Donnell Smith.



1186. Cymbopetalum penduliflorum. (×½)

penduliflòrum, Baill. XOCHINACAZTLI. TEONACAZTLI SACRED EARFLOWER of the Aztecs. OREJUELA. FLOR DE LA OREJA. MEXICAN EARFLOWER. Figs. 1186, 1187. A shrub or small tree with distichous, membranaceous, subsessile lvs. oblanceolate in form, subcordate and usually unequal at the base, acute at the apex. solitary fls borne on long slender peduncles issuing from the internodes of the smaller branches; sepals broadly ovate or suborbicular, cuspidate, reflexed at length; outer petals similar to the sepals but much larger; inner petals thick and fleshy, their margin involute, causing them to resemble a human ear — The pungently aromatic fls. when fresh are greenish yellow, with the inner surface of the inner petals inclining to orange-color, at length turning brownish purple or maroon, breaking with a bright orange-colored fracture. The tree is planted for the sake of its fragrant fls., the petals of which are dried and are used medicinally as well as for imparting a spicy flavor to food. They were used by the ancient Mexicans before the intro. of cinnamon and other spices from the E. Indies for flavoring their chocolate. Though described by Hernandez more than two centuries ago, the botanical identity of the xochinacaztli remained unknown until quite recently (see Smithsonian Report for 1910, pp. 427–431, 1911). This species is native of the mts. of S. Mex and Guatemala. A closely related species, *C. stenophyllum*, Donnell Smith, was discovered by Capt John Donnell Smith in the Dept of Quetzaltenango, Guatemala; and another species, *C. costaricense*, Safford (*Asimina costaricensis*, Donnell Smith) was collected by Adolfo Tonduz in the Dept. of Talamanca, Costa Rica, in April, 1894. Steps have been taken by the Bureau of Plant Industry to intro. into the U. S. *C. penduliflorum*, seeds of which have been sent from Guatemala by the American Consul-General, George A. Bucklin. The other Cent American species, as well as *C. brasiliense*, recently collected by Henry Pittier in Venezuela, are equally worthy of cult. in greenhouses and in the warmer regions of Fla., Calif. and the Island possessions.

W. E. SAFFORD.

CYMBOPÒGON (Greek *kumbo*, a cup, and *pogon*, beard). *Gramíneæ* Oil-producing grasses.

The genus resembles Andropogon, of which it is considered by some a subgenus, but differs in having some of the lower pairs of spikelets in each spike staminate The spike-like racemes are borne in pairs at the ends of the short branches of the infl and are subtended by a somewhat inflated sheath —About 40 species, mostly of the tropics of the Old World Several species furnish essential oils and some are cult for that purpose They are known under the general name of oil grasses or lemon grasses. Some of the more important are. *C. Schœnánthus*, Spreng CAMEL HAY. Fig 1188. G.W 14 399; *C Nárdus*, Rendle CITRONELLA GRASS Gn 12.495, *C. citràtus*, DC. LEMON GRASS Gn 12 495 For a full account of these, see Kew Bull. Misc. Inf. No 8, 1906. See also *Vetiveria*.

A. S HITCHCOCK.



1187 Cymbopetalum penduliflorum

CYNÁNCHUM (Greek, *dog strangle*) *Asclepiadàceæ* Herbaceous or sometimes half woody at the base, twining, sometimes seen in gardens.

In the restricted sense as limited by Bentham & Hooker, perhaps 25 species differing from Vincetoxicum in having a scale or ligule on the inside of each of the 5 parts of the crown lvs opposite, cordiform or hastate: fls small, in umbelliform or racemiform cymes; calyx 5-parted; corolla nearly rotate, deeply 5-cut, the lobes oblong or roundish; corona membranaceous, adnate to the stamen-tube, cup-shaped or at base ringed, 5-lobed opposite the anthers and with inner scales or small lobes follicles rather fleshy, acuminate and smooth —The genus is mostly of S. Eu , Afr., Asia and Austral Schumann in Engler & Prantl combines Vincetoxicum and other genera with it, making more than 100 species in the warmer parts of both hemispheres. Vincetoxicum is here kept distinct.

acuminatifòlium, Hemsl. (*Vincetóxicum acuminàtum*, Decne. *V japónicum*, Hort) MOSQUITO PLANT CRUEL PLANT. Perennial; erect or nearly so, or the tips showing a somewhat twining habit· sts grayish and more or less angular· lvs. opposite, broadly ovate and acuminate, short-petioled, strongly pinnate-veined, entire, usually conspicuously gray-pubescent beneath:

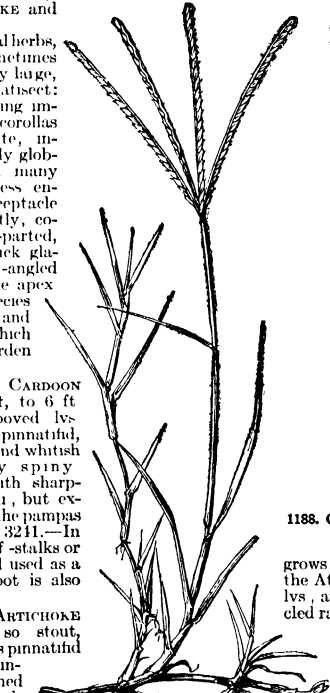
fl -clusters lateral (1-2 between the lvs), shorter than the lvs ; fls white, small, in umbel-like cymes fr. a milkweed-like follicle Japan —In the fls mosquitos and other insects are caught, much as they are in other asclepiadaceous plants The native *Amsonia Tabernæmontana* is sometimes sold as this plant, and it has been figured as such. This plant attracted attention some years ago as a curious garden subject Other species are mentioned in foreign gardening literature, but they are apparently not in the American trade *C acùtum*, Linn , with cordate smooth lvs and white or rose-colored fragrant fls , is a climber in S Eu , reaching 10 or 12 ft *C formòsum*, N E Br , is glabrous, with petiolate ovate, elliptic or oblong-ovate acuminate lvs fls in large lateral pedunculate cymes, corolla pale green, deeply lobed, corona tubular-bell-shaped, 15-crenulate, prominent Peru L H. B.

CÝNARA (involucre spines likened to a dog's tooth). *Compósitæ*. ARTICHOKE and CARDOON

Thistle-like perennial herbs, mostly coarse, and sometimes prickly lvs commonly large, variously lobed or pinnatisect: head large, terminating important branches, the corollas violet, blue, or white, involucre broad or nearly globular, with bracts in many series and more or less enlarged at the base, receptacle fleshy and plane, bristly, corolla slender-tubed, 5-parted, not ligulate fr a thick glabrous compressed or 4-angled achene with a truncate apex —Ten or a dozen species in the Medit region and Canary Isls , two of which are grown as garden vegetables

Cardúnculus, Linn CARDOON (which see) Robust, to 6 ft tall and more st grooved lvs very large, deeply pinnatifid, grayish green above and whitish beneath, prominently spiny heads purple-fld , with sharp-pointed scales S Eu , but extensively run wild on the pampas of S Amer. B M 3241.—In cult , the thickened lf -stalks or ribs are blanched and used as a pot-herb, and the root is also edible

Scólymus, Linn ARTICHOKE (which see) Not so stout, usually 3–5 ft · lvs less pinnatifid and spiny. scales of involucre broad, thickened at base, unarmed · heads larger than in *C Cardunculus*, the receptacle enlarged and fleshy —Probably a derivative of the last L. H. B.



1189. Cynodon dactylon. (Natural size)

CÝNODON (Greek *kuon*, a dog, and *odons*, a tooth). *Graminæ* Low creeping perennials, used for lawns and pasture.

Flowers in slender digitate spikes; spikelets 1-fld., compressed, awnless, sessile in 2 rows along one side of a slender rachis —Species 4, in warm regions

dáctylon, Pers (*Capriòla dáctylon*, Kuntze) BERMUDA-GRASS WIRE-GRASS Fig 1189 Sts flattened, slender, creeping and rooting at the nodes, producing numerous slender or stout creeping rootstocks blades hairy around the base. spikes 4–5, 1–1½ in long Dept Agric , Div Agrost 20 99 —A native of the warmer parts of the Old World, now widely distributed in the warmer parts of the western hemisphere Cult as a pasture and lawn grass in the southern states Often a troublesome weed in cult ground A fine-lvd form with runners above ground, much used in the S for lawns, is called St Lucie grass In Eu the stolons are said to be used medicinally like couch-grass, principally as a diuretic

C incompletus, Nees BUG COUCH-GRASS Occurs in E and S Afr and also New S Wales, where it is used as a pasture grass It is reported as poisoning stock, at certain stages of its growth producing hydrocyanic (prussic) acid

A S HITCHCOCK



1188. Cymbopogon Schœnanthus. (×⅓)

CYNOGLÓSSUM (Greek, *hound's tongue*, from the shape and soft surface of the lvs of the commonest species). *Borragìnàceæ* A widely dispersed genus of little horticultural interest, being mostly tall, coarse, weedy herbs Lvs alternate fls always in elongated, often 1-sided racemes · Species 75 **C. officinàle,** Linn , Fig 1190 (stick-tight), has a bur that becomes attached to clothing and to fleece of sheep It is a biennial weed, naturalized from the Old World; grows about 2 ft high in pastures and waste places of the Atlantic states, and has soft-pubescent, lanceolate lvs , and dull red-purple (sometimes white) fls. in panicled racemes. Root and herbage possess medicinal properties **C. grande,** Douglas Once cult. from Calif as a hardy border perennial; grows about 2 ft high, with lower lvs ovate-oblong, or somewhat heart-shaped at the base, acute or acuminate, 4–8 in long, on margined petioles of about the same length upper lvs smaller, ovate to lanceolate, abruptly contracted into shorter winged petioles · fls violet or blue For *C appendìculatum*, Linn , see *Solenanthus* A new plant, **C. furcàtum,** Wall , has recently been



1190 Bur of Hound's tongue or stick-tight. (×1½)

intro. It is a hairy herb, 1–3 ft. high, with large lvs. and numerous blue fls. in clusters as in forget-me-not. India Fls. in June. See page 3567

C. amabile, Stapf & Drummond. Allied to C. furcatum, but has larger fls. Perennial. S W. China. N. TAYLOR.†

CYNÓRCHIS (Greek for *dog orchid*). *Orchidàceæ*. Terrestrial orchids, grown in the warmhouse.



1191. Cynosurus cristatus. (×½)

Flower-clusters loose; sepals and petals similar, or the petals smaller, spreading; lip spreading, 3-5-lobed, spurred; anther short, with 2 points, between which arises the middle lobe of the beak.—About 25 species, of the Mascarene Islands and tropical Africa.

The following have been in cult *C. compacta*, Reichb f Fls white, the disk of lip red-spotted Natal B M 8053 O R 19 265. —*C. Lowiana*, Reichb f Lateral sepals light green, the lip bright rose-purple, the spur clavate Madagascar B M. 7551 (as *C. purpurascens*) O R 19 273 G C. III 43 184 —*C. Mórlandii*, Rolfe Racemes 5–9-fld.; fls medium-sized, lilac Mozambique —*C. purpurascens*, Thomas Fls numerous in a spike-like raceme or head, rose, with the disk of the lip white Mascarene Isls B M. 7852. O R 14 305, 15 121, 19 272 G C. III 29: 87, 35 227 —*C. rubiana*, Rolfe Raceme spike-like, densely fld , fls rose-purple, the sepals glandular-hairy Madagascar B M. 7845

GEORGE V NASH.

CYNOSÙRUS (Greek *kuon*, a dog, and *oura*, a tail). *Gramineæ*. DOG'S-TAIL-GRASS Cespitose grasses with flat blades and spike-like panicles, two species of which are cultivated as ornamental grasses and in lawns and pastures

Spikelets of 2 forms in small fascicles, the terminal spikelets perfect, the lower sterile, consisting of several empty glumes.—Species about 6, in the north temperate regions of the Old World.

cristàtus, Linn. CRESTED DOG'S-TAIL. Fig 1191. Perennial, 1–2 ft.: spike 1–3 in long; awns shorter than the lemmas. Eu. Dept. Agric., Div. Agrost. 20:146. —Sometimes used in mixtures of lawn or pasture grasses.

élegans, Desf. Annual, 6–18 in.: panicle loose, 1-sided, about 1 in long; awns silky, longer than the lemmas, sometimes as much as 1 in. Eu —Used for dry bouquets. A. S HITCHCOCK

CYNTHIA: *Kriyna*.

CYPÉLLA (application obscure). *Iridàceæ*. South American bulbs, resembling Iris

Half-hardy. bulb tunicate: lvs radical or cauline: fls 1–3 from a spathe, yellow, orange or blue; segms free, narrow or broadly unguiculate, the outer ones spreading and the inner erect and somewhat recurved at the apex. The genus differs from Iris and Morœa in its stigmas, which are neither petal-like nor filiform, but erect, and in the anthers, which are broad, erect, not curved, bearing the pollen on their edges, also in the plaited lvs. Perhaps a half-dozen species —The bulbs should be set out in spring, lifted in fall and stored over winter Prop by offsets or by seed, which should be sown as soon as ripe. The blue-fld species are presumably equally worthy of cult. For the still showier *C. cærulea*, see *Marica*.

A *Style appendages spur-like.*

Hérbertii, Herb. Lvs. about 1 ft. long, linear, acuminate, twice plaited, the angles of the plaits winged: scape 2–3 ft. high, erect, flexuose, glaucous, branched, many-fld ; fls 3 in across, chiefly yellow, odorless, soon withering; outer segms bearing a rather long cusp or tail. S. Brazil. Uruguay. Argentine B.R. 949 (as Morœa) and B M. 2599 (as Tigridia) show very distinct colors, but Baker says there is a lilac variety

plúmbea, Lindl. Three to 4 ft , the st glaucous, round and thickish: lvs not very close together, sheathing at the base, plicate and glaucous· fls fleeting, at their best early in the morning, not unlike those of *Iris versicolor*, and the same color; style slender, broadening at the apex into a spur-like appendage Trop. S Amer.—Has been offered under the name *C. platensis*, which is otherwise unknown in botanical and horticultural literature.

AA *Style appendages petal-like, flat.*

peruviàna, Baker Lvs 6–9 in. long, linear, narrowed gradually from the middle both ways, glabrous, plaited. fls 2–3 in a solitary stalked cluster, soon withering, chiefly yellow; segms with a distinct long claw and a proportionately shorter and broader blade and a shorter cusp, at the base spotted brown. Peru B M. 6213

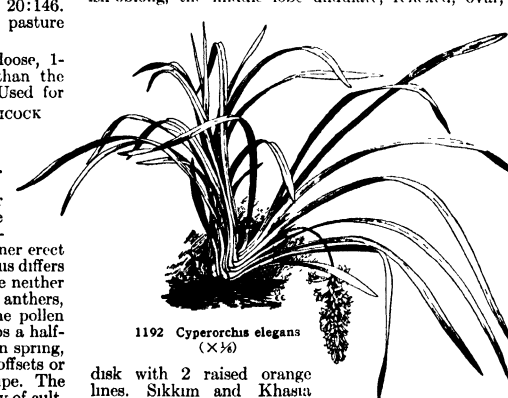
N TAYLOR †

CYPERÓRCHIS (*Cyperus* and *Orchis*, from the sedge-like appearance) *Orchidàceæ* Epiphytic orchids, thriving in the warmhouse.

Very closely allied to Cymbidium, from which it differs in the narrower sepals and petals which are connivent to the middle or beyond, thus preventing the full expansion of the fl , and by the straight narrow lip —There are 3 species, natives of the Himalayas and the Khasia Hills.

élegans, Blume Fig. 1192 Pseudobulbs short, 2–3 in long. lvs linear, up to 20 in long, streaked, pale yellow-green raceme many-fld , dense, pendulous, fls yellow, 1½–2 in across, sepals and petals linear-oblong, the recurved tips acute; lip cuneate, 3-lobed, the middle lobe oblong, short, obtuse, disk with 2 raised orange lines Himalayas. B M. 7007

Mástersii, Benth (*Cymbidium Mástersii*, Griff) Pseudobulbs 4–10 in long: lvs. up to 2½ ft long, acute. racemes 6–10-fld , fls about 2 in across, almond-scented, ivory-white; sepals and petals oblong-linear, lip usually spotted rose-purple, the lateral lobes roundish-oblong, the middle lobe undulate, reflexed, oval,



1192 Cyperorchis elegans (×⅙)

disk with 2 raised orange lines. Sikkim and Khasia Hills. B R 31:50. F.M. 1879:346; 1880:391. Lind. 5:222 J.F 3:289. O. 1910:8. GEORGE V. NASH.

CYPÈRUS (ancient Greek name). *Cyperàceæ*. A large genus of the sedge family, inhabiting both tropical and temperate regions. The species in cult are all perennials from rootstocks or tubers lvs grass-like st. simple and mostly naked above fls perfect, without

perianth, bolle in small, compressed spikes, which are variously aggregated in compound umbels, the latter surrounded by foliaceous bracts, styles and stamens 3.—A few are cult. in jardinières, aquatic gardens and aquaria Several others are pests in cult fields P 3567

INDEX.

alternifolius, 3.	fertilis, 5.	natalensis, 4.
compressus, 7.	flabelliformis, 2.	Papyrus, 1.
conglomeratus, 8.	gracilis, 3	pungens, 8
diffusus, 6	*laxus*, 6	rotundus, 11.
elegans, 6	longus, 10.	strigosus, 13.
esculentus, 12.	lucidus, 9.	variegatus, 3.

A *Basal lvs much reduced or wanting.*

B. *Umbel-rays nearly 100, much longer than the 3–10 involucral lvs*

1 **Papyrus,** Linn (*Papyrus Antiquorum*, Willd). Egyptian Paper Plant Papyrus. Cespitose, strict, tall and stout, 4–8 ft. high. st obtusely 3-angled, smooth: involucral lvs only 3–10, small, 3–6 in long, 3–12 lines wide, lanceolate, acute primary rays of the umbel very numerous, slender, furrowed, equal and drooping, 10–20 in long, secondary bracts prominent, filiform, 1–6 in long, spikelets clustered and sessile, pale chestnut, scales obtuse, rachis strongly winged. Egypt, Palestine Gn 30, p 348, 57, p 105 G M. 40 799 G W 2, p 571 —For aquaria and damp soil. Not hardy N.

BB. *Umbel-rays 25 or less.*

C. *Involucral lvs very numerous, somewhat separated, much exceeding the umbel, rachis scarcely winged*

D *Scales broadly ovate. lvs scabrous throughout*

2 **flabellifórmis,** Rottb Rhizome horizontal, stoloniferous, stout st stout, spongy at base, 2–4 ft high, obtusely angled: involucral lvs 15–25, 2–8 lines wide, 6–16 in long, strongly nerved or plicate: umbel lax, about a third as long as involucre, spikelets very numerous, elliptic-oblong, very flat, lustrous, 2½–3½ lines long, scales firm, lustrous, scarcely striate, carinate, barely acute, closely imbricated, pale brown with dark brown area on each side. Afr —Rare in American trade Tall and palm-like; used by the natives for wickerwork, very ornamental in water-gardens.

DD *Scales lanceolate lvs scabrous only at apex*

3 **alternifòlius,** Linn Umbrella Plant Umbrella Palm Fig 1193 Cespitose, strict, 1–4 ft high st. nearly terete, ribbed, smooth and slender involucral lvs about 20, spreading or slightly drooping, linear, 4–8 in long, 2–5 lines wide, plain umbel open, rays only 1–3 in long, spikelets numerous, ovate-lanceolate acute, very flat, 2 lines long, pale brown suffused with darker brown, dull, scales thin, very acute, somewhat nerved Madagascar.—Much used for aquaria and jardinieres Gn 35, p 573 A G. 17:57 V 4 159; 5 39 Var. **variegàtus,** Hort. St and lvs striated with white, sometimes entirely white Var **grácilis,** Hort Plant smaller and more slender: involucral lvs much narrower and shorter, and not so spreading —The above description is from Boeckeler, and from a specimen from Madagascar The plant in cult under the name *C alternifolius* may not be that species The lvs are too long, too scabrous and too veiny, and the spikelets are elliptic-oval, or oval, 2 lines long, and have broader and more closely overlapping scales than in the typical form. The illustrations cited are probably of the garden plant.

CC. *Involucral lvs about 3, contiguous, shorter than umbel; rachis strongly winged.*

4 **natalénsis,** Hochst. Rhizome long, stout and hard, 2 lines thick, scaly: st. solitary, 2–3 ft high, the size of a goose-quill, triangular: lvs. 2–6 in long, often wanting; involucral lvs. 3, only 1–3 in long: umbel rather dense; spikelets 5–9 (rarely 12) lines long, linear-lanceolate, scarcely compressed, rigid; scales obtuse, not carinate, nerved, shining, pale or brownish. Natal. —Decorative. Not hardy.

AA. *Basal lvs well developed.*

B. *Sts. very short, 3–5 in high. umbel-rays up to 2 ft. long, weak, decumbent.*

5. **fértilis,** Boeck. Roots fibrous: lvs. numerous, about equaling the st, 3–7 lines broad, margins strongly scabrous, involucral lvs 6–7, short: rays flaccid, pendulous, often rooting at apex, spikelets few, ochraceous or olive, oblong or oblong-lanceolate, obtuse, slightly compressed, 8–10-fld, 3–4 lines long; scales obtuse, nerved W Afr. G W 8, p 523 —Recently intro, and excellent for hanging-baskets. The umbel-rays often bear plantlets instead of spikelets



1193. Cyperus alternifolius or umbrella plant.

BB. *Sts. longer than the umbel-rays.*

C. *Rachis of spikelet wingless scales broad, much overlapping, acute or mucronate. spikelets lanceolate or lance-oblong.*

D. *Involucral bracts 2–6 lines broad, about 6–12 in number.*

6. **diffùsus,** Vahl (*C élegans*, Hort *C láxus*, Hort) Roots fibrous: st solitary, 1–3 ft high basal lvs many, equaling the st, 2–7 lines broad, margin scabrous, involucral lvs 4–15 in long, 2–6 lines broad, longer than the infl umbel diffuse, spikelets greenish yellow or pale brown, linear oblong or ovate-lanceolate, 3–8 lines long; scales loose, soft, dull, midrib deeply striate, cuspidate Tropics G C II 1874 99, III 13: 41.—For table decoration As now interpreted, *C. elegans*, Linn, is a more rigid plant with narrower lvs.

DD *Involucral bracts 1½ lines broad, or less, 3–6 in number*

E. *Lvs. flaccid: infl usually open; spikelets very flat; scales 1½ lines long.*

7. **compréssus,** Linn Roots fibrous: st. cespitose, 2–16 in. high: lvs 2–3, slightly shorter than the st, scabrous only near apex: umbel of several pedunculate, sessile heads, or reduced to 1 sessile head, spikelets lance-oblong or lance-linear, 4–12 lines long, scales soft, carinate, acuminate, striate close Tropics —Cult. in Eu

EE. *Lvs. rigid: infl. congested, spikelets thicker; scales 2½ lines long.*

8 **púngens,** Boeck Roots of coarse lanate fibers: st 6–20 in high, stiff, terete above lvs several, with conspicuous, loose, brownish sheaths, equaling the st.



1194 Cyperus esculentus —Chufa.

or shorter, narrow, ½ to ¾ lines broad, thick and rigid: umbel congested, often simple, spikelets 5–9 lines long, lanceolate or ovate-lanceolate, pale brown; scales firm, with thin margins, obscurely carinate, inconspicuously striate, apiculate, midrib obscure, close N Afr and S W. Asia —By some authors united with *C conglomeratus,* Rottb , under the latter name There is some reason to suspect that the plant in the trade under this name may not be this species

CC *Rachis of spikelet with scarious, winged margin; scales obtuse or obtusish, less overlapping: spikelets linear*

D *Lvs thick, glossy*

9. **lûcidus,** R Br Rhizomes short and thick: sts. stout, 2–3 ft or even 4 ft high, sharply 3-angled lvs. equaling the st or longer, 3–6 lines wide, margins scabrous, involucral lvs 3–6, the lower very broad, often 1½–3 ft. long: umbel large, lax, compound, rays many, 9 in long or less; spikelets spicate, rich deep brown, lustrous, linear, flattish, acute, 4–6 (rarely 7–8) lines long, wings of rachis narrow, scales loosely imbricated, few-nerved, 2 lines long. Austral.

DD. *Lvs. thinner, duller.*

E *Rootstock long, stout, 2–2½ lines thick.*

10 **lóngus,** Linn Sts 2–4 ft high, acutely angled, stoutish lvs. several, with long sheaths, about equaling the culm 2–4 lines wide; margins finely scabrous; involucral bracts very long, often 8–24 in.; umbel lax, the rays 12 in or less long; spikelets 3–15 lines long, linear, dull, dark chestnut-brown, rarely paler, slightly compressed; scales 1¼–1½ lines long, scarcely carinate, obscurely striate, midrib green. Eu —Cult in Eu.

EE. *Rootstock long, slender, tuber-bearing*

F. *Scales dark reddish brown*

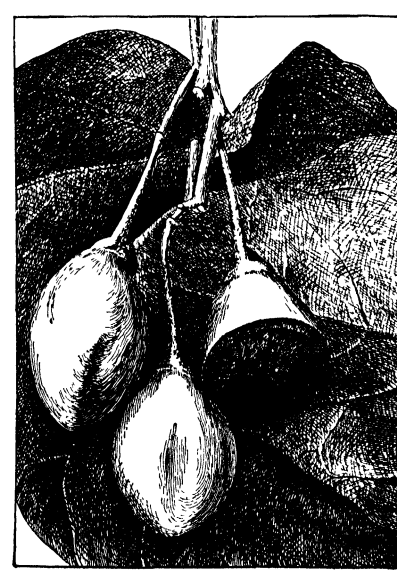
11. **rotúndus,** Linn. Nut-Grass Coco-Grass. Rootstocks ¼ line thick: sts. 4–24 in high, bulbous, thickened at the base, rather slender, 3-angled lvs several, usually shorter than the st , only 1–2 (rarely 3) lines wide; margins finely scabrous; involucral bracts 2–4, scarcely longer than the infl umbel lax; rays few, 4 in. long or less; spikelets linear, 5–12 lines long, inconspicuously spicate on the branches, few in a cluster, dull; scales 1¼ lines long, scarcely striate, obscurely carinate; midrib green achenes linear, acute Tropics and subtropics.—A weed southward

FF *Scales brownish chestnut or straminous.*

12 **esculéntus,** Linn Chufa Fig 1194; also Fig 959. St 8 in. to 3 ft. high, stoutish lvs several, equaling the st or slightly shorter, rarely longer, 2–4 lines wide; involucral lvs exceeding the infl umbel open, rays ½–4 in long; spikelets very numerous, spicate on the branches, crowded, divaricate, brownish straminеous, linear, 4–12 lines long, scarcely compressed, scales lax, several-nerved, dull, rarely carinate, midrib somewhat green achenes oblong, obtuse Tropics and subtropics —A weed in sandy cult fields northward and southward; rarely grown for the edible tubers

EEE *Rootstock globular spikelets straminеous*

13 **strigósus,** Linn Running rootstocks absent, not tuber-bearing sts rather stout, 1–3 ft high, sharply 3-angled, base bulbous lvs numerous, usually equaling the st , 2–4 lines wide, more or less scabrous, involucral bracts 6–12 in long, usually exceeding the infl umbel open, rays several, 6 in long or less; spikelets very numerous, spicate on the branches, crowded, divaricate, linear-subulate, 5–8 lines long, scarcely compressed; scales 1½ to 2 lines long, appressed, dull, striate, midrib green N Amer —Hardy perennial, used for the border of aquatic gardens K M Wiegand.



1195. Cyphomandra betacea. (×½)

CYPHOKÉNTIA (allied to Kentia, differing, among other things, in having a lateral protuberance or tumor on the fr, whence the name) *Palmàceæ* Feather-lvd robust spineless palms, of very few species in New Caledonia, suitable for the warmhouse but little grown. The lvs are terminal and pinnate-parted, the segms long-swordshaped and narrowed at apex, the margins at base recurved: spathe-valves 2, deciduous, bearing stout glabrous branching spadices; fls diclinous, the stamens 6 or 12 fr small, globose or ellipsoidal. Engler and Prantl combine Cyphosperma and Microkentia with this genus, comprising, about 10 species, all of New Caledonia The original species are. *C. robústa*, Brongn, with the branches of the spadix thick and long-cylindrical, fr reniform-ellipsoidal, stigma not prominent above the base, and seeds reniform; *C. macrostàchya*, Brongn., with long flexuose spadix branches, globose fr, lateral stigma, and usually subglobose seeds The cyphokentias probably require the treatment given arecas. L H. B.

CYPHOMÁNDRA (from the Greek, referring to the hump-shaped anthers) *Solanàceæ* South American spineless shrubs or small trees, one of which is sometimes grown for its edible fruit

The genus is distinguished from Solanum chiefly by the thickened connective of the anthers the plants are erect and usually stout and the large lvs are entire, 3-lobed, or pinnatisect fls pedicellate, in racemes, scorpioid cyme-branches, or arising below the nodes, calyx and corolla 5-lobed, the corolla somewhat rotate, the tube very short, anthers porose or acuminate at apex, ovary 2-celled fr an ovoid or oblong fleshy berry, many-seeded —Some 30 or more species, of little concern to the horticulturist

betàcea, Sendt (*Solànum frágrans*, Hook) TREE TOMATO Fig 1195 Cult occasionally for the egg-shaped, reddish brown, faintly striped frs, and under such conditions it becomes a tree-shaped, half-woody plant 6-10 ft high lvs large, soft-pubescent, cordate-ovate, more or less acuminate, entire fls small, pinkish, fragrant, in small axillary or super-axillary clusters fr about 2 in long, on slender stalks, 2-loculed and seedy, musky-acid and tomato-like in flavor, agreeable to those who like tomatoes Brazil B M 3684 J H III 31 470 G C III 25 105 A G 11 409 — Bears the second and third year from seed, under glass (where it must be grown in the northern states) Grown mostly as a curiosity. L H B.

CYPHOPHŒNIX (*hump* and *Phœnix*, a palm). *Palmàceæ*, tribe *Arèceæ* A rather unimportant genus of unarmed, stout-stemmed palms, with terminal pinnatisect leaves.

Leaflets acute at the apex, sword-shaped, the base often with a thickened and recurved margin; rachis stout and broad, a little convex on the lower side. spadix glabrous, with many long stout branches bearing short bracts and numerous monœcious fls; sepals thick and leathery, round and a little concave fr elongate-ovoid or rarely ellipsoid —There are only 2 species, both from New Caledonia They have something the aspect of *Kentia* from which they differ in having only 6 stamens. They are almost unknown in the trade For cult, see *Kentia* or *Howea*

élegans, Benth & Hook (*Kéntia élegans*, Brongn. & Griseb) Rachis convex below, keeled above; lfts alternate, not close together, scaly along the mid-nerve below, 3-nerved spadix more or less spreading or reflexed in age, simply branched· fr. oblong-elliptical, acute.

fulcita, Benth & Hook (*Kéntia fulcita*, Brongn.). St clothed at the base with smooth aerial roots· fr. ovoid, attenuate above —A tall graceful palm scarcely known outside of botanic garden collections

N. TAYLOR.†

CYPHOSPÉRMA (Greek, *hump* and *seed*). *Palmàceæ*, tribe *Arèceæ*. Unarmed stout-stemmed palms with a crown of pinnately divided, terminal leaves.

Leaflets leathery, sword-shaped, the apex narrowly oblique, the base with a thickened recurved margin; rachis broad and stout, slightly convex beneath, channeled above spadix smooth and much branched, the branches distichous, fls spirally disposed on the spadix, brownish, otherwise as in Cyphophœnix fr. globose or 4-5-angled —Two species of New Caledonian palms, rare in cult in U S and only doubtfully in the trade See *Cyphokentia*, for cult. see *Areca*. The young plants have rather stiff petioles, but graceful, arching lf-segms G C II 24.362.

Vieillárdii, Benth & Hook (*Cyphokéntia Vieillárdii*, Brongn). St medium height lvs pinnatisect, the lfts thick and narrowly sword-shaped fr obtuse, 4-5-angled, the seed also acutely angled.—A rare palm, known also under the names *Kentia robusta* and *K. Vieillardii* N TAYLOR.

CYPRESS. *Chamæcyparis*, *Cupressus* and *Taxodium*.

CYPRESS VINE: *Ipomœa*.

CYPRIPÈDIUM (*Venus'-slipper*). LADY'S SLIPPER. MOCCASIN-FLOWER. *Orchidàceæ*. Attractive hardy orchids, often planted in moist cool borders, bogs, and sometimes in rock-gardens

Stems very short, with a pair of lvs close to or near the ground, or long and leafy lvs commonly many-nerved fls terminal, 1 to few, withering on the ovary, lateral sepals free, or united nearly or to the apex, the dorsal sepal erect, petals generally narrower, spreading; lip saccate, rarely split down the front, ovary 1-celled, with 3 parietal placentæ —Species about 30, in the north temperate zone For the greenhouse species formerly included here, see *Paphiopedilum*, and *Phragmipedilum*.



1196. Cypripedium pubescens. (×½)

A. *Lvs 2, opposite. lip split in front.*

acaùle, Ait. Lvs flat on the ground, ovate to oblong-oval: scape with 1 fl; upper sepal and petals brownish, lanceolate; labellum pink-purple, darker veined May, June. Newfoundland to N C, west to Ind, Mich and Minn. A G. 13.514, 14·405 Gng 4:263 A F. 11:1049. G C. III. 46:209

japónicum, Thunb Lvs. above the ground roundish, undulately plicate. bract longer than the ovary: fl. terminating the scape; sepals and petals lanceolate, acuminate, greenish, dotted with red, labellum white-pink April, May Japan. G.C. III. 33 355.



1197. Cypripedium spectabile. (×⅜)

AA. *Lvs several, alternate: lip not split*

B. *Lateral sepals free.*

arietînum, R Br Plant about 6 in high, slender: lvs. lanceolate· fls small, resembling a ram's head, terminal, solitary; upper sepal ovate-lanceolate, brownish green; petals linear, labellum tapering at the apex, white veined with reddish purple, clothed with white, woolly hairs near the aperture. May. Maine to N Y, Mich and Minn, and northward B M 1569. L B C. 13:1240. F S. 20: 2095.

BB. *Lateral sepals united nearly or to the apex.*

c *Fls yellow*

pubéscens, Willd Fig 1196 Lvs oval, acute. petals usually twisted, much narrower than the ovate-lanceolate sepals; labellum pale yellow; staminodum triangular Same range as the next. May, June B M 911 (as *C parviflorum*). A.G. 13:513. Mn 7, p 5. G C. III 33.379; 47:369 —The rhizomes and rootlets are employed in medicine for their antispasmodic and nervine properties. Perhaps a form of the next

parviflôrum, Salisb Lvs ovate, acute· fls smaller than in *C pubescens*, labellum flattened from above and below, not laterally, bright yellow, staminodum triangular May, June. Newfoundland to Ga, west to Minn. and E. Kans. A G 13 515 G C. III. 46.227. —Same medicinal uses as *C pubescens*

cc. *Fls. white or greenish.*

D. *Number of fls 1–3.*

cándidum, Muhl. Lvs oblong-lanceolate· fls. terminal, solitary; sepals broader than the petals, ovate-lanceolate; petals spreading like the sepals, greenish; labellum white, striped inside with purple, staminodium lanceolate May, June. N Y., Pa, Minn, Mo and Ky.

reginæ, Walt. Fig. 1197 Plants stout: lvs oval, acute· sepals ovate, rather roundish, white; petals oblong, white; labellum white or pale pink-purple; staminodium oval-cordate. June. Maine, W. New England to Minn. and Mo, Mts. of N. C. R H 1868: 410. Gn 53, p. 77; 61, p. 191; 65, p. 447 R B 20, p 198 A F. 11:1048. Gng. 4:262, 327. G.C III 29.21, 47· 370; 50·315 Known also as *C hirsutum* and *C. spectabile.*

montânum, Douglas. One to 2 ft., leafy, pubescent: lvs. ovate to broad-lanceolate, 4–6 in long. fls 1–3, short-pedicelled, the wavy-twisted petals brownish, the inch-long lip dull white veined with purple: caps. erect or nearly so Calif. to Wash. B.M 7319.—Fragrant Grows in clumps Handsome.

DD. *Number of fls 6–12.*

califórnicum, Gray. Fig. 1198. Plants either slender or stout, varying in height, sometimes exceeding 2 ft.: lvs ovate-alternate: floral bracts very large, becoming narrowly ovate: fls small, from 6–12 open at the same time, an inch or more apart on the st ; labellum whitish; sepals oval, yellowish green; petals narrowly oblong, colored like the sepals Calif B.M. 7188. G.F. 1.281 (adapted in Fig. 1198). G.C III 41.418; 46:211.

C Calcéolus, Linn Fls. single, sepals and petals deep brown; lip yellow, slightly compressed Eu R H 1892, p 392 R B 21, 210 G C III 46 210 —*C débile,* Reichb f Lvs 2, opposite fls small, the sepals and petals pale green with a dark brown basal blotch, sometimes brown-striped, the lateral sepals united, lip white, brown-streaked about the mouth China and Japan B M 8183 — *C elegans,* Reichb f Sts 4 in tall lvs opposite fl single, the sepals and petals brown-veined, the lateral sepals united, lip brownish, corrugated Thibet —*C guttâtum,* Swartz Lvs 2, alternate fls single, white, blotched with purple N E Eu to N W. Amer B M 7746 —*C himalâicum,* Rolfe Sts up to a foot tall. lvs 3 sepals and petals brownish, deeper veined, lip brown-purple, many-nerved Bhotan —*C irapeânum,* Llav & Lex Lvs ovate-lanceolate fls several, large, pale yellow, the large lip with some scarlet spots about the mouth Mex —*C macránthon,* Swartz Fls. purple, the lip contracted at the mouth Siberia and N Asia R H 1877 310 B M 2938 G C III 46 212 —*C speciósum,* Rolfe St. leafy fls whitish or flesh-colored, veined with rose, lip subglobose. Japan B M 8386 —*C Thunbergii,* Blume Fls pale purple G C III 46 228 —*C tibéticum,* King Fls 3–4 in across, sepals and petals white, light yellow at apex, veined with maroon-purple, lip maroon-purple E Thibet and W China B M 8070 G C III. 39 347, 46 420, 49 403, 410 —*C ventricósum,* Hort Said to be a natural hybrid between C Calceolus and C macranthon G C. III 46 229

GEORGE V. NASH

CYRÍLLA (after Dominico Cyrillo, professor of medicine at Naples, 1734–1799) *Cyrillàceæ* Woody or nearly tree-like, rarely cultivated for its handsome bright green foliage and white flowers in slender racemes

Leaves alternate, without stipules, short-petioled, entire, glabrous, deciduous or nearly persistent· fls. small, white, in narrow slender racemes, 5-merous; stamens 5–10, ovary superior with 2 short styles fr a small indehiscent 2-celled caps with 2 seeds —Probably one variable species from N C to Fla west to Texas, and in W India and S Amer Plant with handsome bright green foliage, and graceful racemes of white fls, hardy north to N. Y Thrives best in humid sandy soil and shady position. Prop. by seeds and cuttings under glass, with slight bottom heat.

racemiflôra, Linn. LEATHERWOOD. Shrub, occasionally tree to 30 ft.: lvs. cuneate, oblong or oblanceolate, usually obtuse, reticulate-veined, 2–3 in. long, bright green, turning orange and scarlet in fall, but in tropical climates evergreen. racemes 4–6 in long, erect, at length nodding. B M 2456. S S. 2: 51. G.C. III. 30: 198 J.H III. 43: 197.—The variety from W. Indies has been described as *C. antillàna,* Michx, that of Brazil as *C. racemifera,* Vandelli, and a small-lvd. form from Fla. and La. as *C. parvifòlia,* Raf.



1198 Cypripedium californicum. (×⅛)

ALFRED REHDER.

CYRTÁNDRA (name refers to the curved stamens) *Gesneriàceæ* A large group of tropical shrubs and trees, two or three of which are more or less known in cult for their fls.; akin to Trichosporum (Æschynanthus); warmhouse subjects Lvs opposite, or alternate by failure of one of the pair, membranaceous, or fleshy or leathery: fls usually white or yellowish, in fascicles, heads or cymes; corolla-tube cylindrical, the limb more or less 2-lipped; perfect stamens 2, and 2 or 3 small staminodia Nearly 200 species in the islands of the Indian and Pacific oceans and in China *C. péndula*, Blume Short and stout: lvs. long-petioled, elliptic or lance-elliptic, acute, gray-blotched above: fls white with brown calyx, 1½ in. long, the corolla inflated, and purple-dotted on lower side Java *C. Pritchardii*, Seem. Lvs. petioled, elliptic, obtusely toothed, acute: fls small, white, in 3-fld cymes. Fiji Isls. L H. B.

CYRTANTHÈRA: *Jacobinia.*

CYRTÁNTHUS (Greek, *curved flowers;* from their pendulous habit) *Amaryllidàceæ* Tender bulbs from South Africa, known only in a few American greenhouses.

Flowers umbellate, pendulous or erect, usually red or white with green stripes; stamens inserted in the tube of the corolla, ovary 3-celled, crowded with numerous ovules, the seeds flat —Species 20 Their cult. is like that of hemanthus and many other bulbs from the same region They are suitable for pot culture, or for planting out in summer The following analytical key gives an idea of the group, and its 3 subgenera.

A *Fls many in an umbel, pendulous*

B. *Lvs strap-shaped (Cyrtanthus proper)*

obliquus, Ait Bulb ovoid, 3–4 in thick: lvs 10–12, strap-shaped, distichous, produced after the fls, 1½–2 ft long scape 1–2 ft long, stout, mottled; fls 10–12 in an umbel, entirely drooping, odorless, bright red, with more or less yellow, and greenish tips 2–3 in long, pedicels ½–1 in long, style not exserted. Cape Colony. B. M. 1133 L B C 10·947

BB *Lvs linear (Monella)*

Máckenii, Hook. f. Bulb 1½ in thick. lvs 2–6, appearing with the fls, linear, 1 ft long scape slender, slightly glaucous, fls 4–10 in an umbel, pure white, 2 in long, style exserted. Natal G C 1869 641 Gn. 50, p 63

AA. *Fls single, or few in an umbel, erect or slightly curved downward (Gastronema)*

sanguíneus, Hook Bulb 2 in thick lvs 3–4, appearing with the fls, lanceolate, petioled, 1 ft long scape slender, 6–9 in long, fls 1–3, bright red, 3–4½ in long, wider funnel-shaped than in the 2 preceding species, with a throat 1 in across Caffraria, Natal B M 5218 Var **glaucophýllus,** Hort A form with somewhat glaucous foliage and orange-red fls

C. Huttonii, Baker, belongs to Cyrtanthus proper, but its lvs appear with the fls, and it has 6–8 or even 12 pale red fls about 1 in long and a much shorter style than in C obliquus Cape Col by B M 7488 Gn 50 62 —*C. inaequális*, O'Brien Fls erect, coral-red, borne in umbels on scapes 1 ft high, upper segms of perianth overhanging Cape Colony G C III 37 261 —*C. Júnodii*, Beauverd Umbel 6–9-fld, fls cinnabar, yellow at apex, pendulous. Transvaal. N TAYLOR †

CYRTOCÁRPA (Greek, *curved fruit*). TAPIRA. *Anacardiàceæ* One or two Mexican trees, one of which bears a small fruit, likened to a cherry by the natives of Lower Calif.

Leaves alternate, compound. fls axillary or terminal, paniculate, polygamous. fr. an oblique drupe, 1-seeded. Intro. into S. Calif. by Franceschi Sometimes united with Tapiria (or Tapirira), from which it differs in its straight embryo and other characters

procèra, HBK Very tall tree, with slender, terete, dark purplish, resinous branches. lvs alternate, odd-pinnate; lfts 5–7 or 9, oblong, entire, with a very slight silkiness, especially below, very shortly stalked, 1 in. or more long, half as wide fls white, inconspicuous, in panicles 1–2 in. long, calyx 5-parted, villous, persistent, segms roundish; petals 5, elliptic; stamens 10; style 1. fr. the size of an olive, edible Mex. HBK. 6, t. 609

CYRTOCÈRAS: *Hoya.*

CYRTOCHÌLUM: *Oncidium.*

CYRTODÈIRA: *Episcia*

CYRTÒMIUM (Greek, *a bow*). *Polypodiàceæ.* Asiatic half-hardy or greenhouse ferns of rigid habit

Leaves simply pinnate, anastomosing veins and firm indusia fixed by the depressed center It differs from Polystichum mainly in venation —Three or four species known Culture as for Polystichum, to which it is closely allied



1199. Cyrtomium falcatum. (Leaf ×⅛)

A *Margins of pinnæ entire or slightly undulate*

falcàtum, J Smith Fig 1199. HOLLY FERN. Pinnæ glossy, ovate, falcate, the lower rounded or obliquely truncate at the base, 4–6 in long, 1–2 in. wide Japan, India —The large thick glossy foliage makes it an excellent fern for decorations One of the species used in ferndishes and one of the few species which can be made to thrive under ordinary house conditions Plants from the temperate parts of Japan will do well out-of-doors in the northeastern states if given slight winter protection For another illustration, see article on ferns **C. Bútterfieldii,** Hort, is a form of this species differing in having the pinnæ deeply serrate. **C. Rochfordiànum,** Hort, recently advertised, is a variety of *C falcatum* with fimbriated lfts Superficially these two forms resemble *C caryotideum* somewhat, but the species are entirely distinct It has begun to replace the original form in the dealers' stocks

Fórtunei, J. Smith. Pinnæ dull, lanceolate, opaque, 2–4 in long, ½–1 in. wide Japan

AA. *Margins of pinnæ toothed or sometimes lobed.*

caryotídeum, J Smith. Pinnæ larger, 5–7 in. long, 1½–2½ in. wide, often auricled on both sides at the base, sharply toothed. India. R. C. BENEDICT.†

CYRTOPÈRA. *Eulophia*

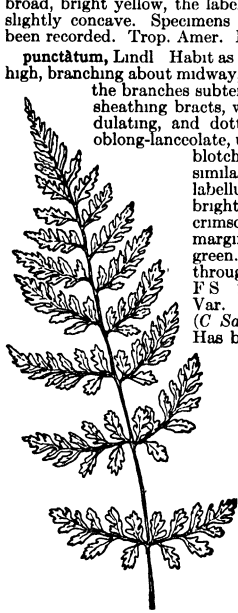
CYRTOPÒDIUM (Greek for *curved foot*, from shape of lip) *Orchidàceæ.* Epiphytes, grown in warmhouses.

Stems fusiform, bearing plicate lvs. scapes radical, bearing numerous fls., pure yellow or spotted with crimson, sepals and petals equal, free, column semi-

terete; pollinia 2, caudicle short; gland ovate.—Species 3 or 4 in the tropics. They are large-growing plants, with large and showy fls. They need a rich, fibrous soil with manure. Grow in a warm or tropical house.

Andersonii, R. Br Sts 5 ft. high. lvs. long, lanceolate, sheathing at the base· scape often 3 ft. high, branching, bearing many yellow fls ; sepals and petals broad, bright yellow, the labellum brighter, front lobe slightly concave. Specimens with over 100 fls have been recorded. Trop. Amer. B M 1800

punctàtum, Lindl Habit as above scape from 2–3 ft. high, branching about midway, dotted with dull purple, the branches subtended by membranaceous sheathing bracts, which are lanceolate, undulating, and dotted with crimson; sepals oblong-lanceolate, undulate, greenish yellow blotched with crimson, petals similar, spotted at the base; labellum ½in. long, fleshy, bright yellow, lateral lobes crimson, midlobe spotted and margined with crimson, column green. Extensively distributed through S Amer B M 3507. F S 22.2352. R.B. 30 158 Var. **Saintlegerianum,** Hort (*C Saintlegerànum,* Reich f). Has brighter markings on the bracts and fls. J H. III. 50:91.



1200. Cystopteris fragilis. (×½)

Woòdfordii, Sims (*Cyrtopèra Woòdfordii,* Lindl). Sts fusiform: lvs. lanceolate. scape radical, bearing a many-fld. raceme, fls. greenish, with a purple labellum; sepals lincar-lanceolate; petals oblong. Trinidad, Martinique B M. 1814.

C pálmifrons, Reichb f & Warm Sts about 2 ft. tall, clothed with the lemon-yellow, purple-margined sheaths lvs 6–8 in long panicle 12–15 in long, many-fld , fls about 1 in. across, lemon-colored, spotted rose-pink. Brazil B M. 7807.

OAKES AMES
GEORGE V. NASH.†

CYRTOSPÉRMA (Greek, *curved seed*) *Aràceæ* A handsome warmhouse tuberous foliage plant, with large, hastate red-veined leaves resembling an alocasia, but easily distinguished by its spiny stems

Herbs with tubers or long rhizomes. lf.- and fl -stalks often spiny or warty. lvs hastate or sagittate; petioles long, sheathing at the base.—Cyrtosperma has 10–12 species, remarkably scattered in the tropics. Cult. presumably same as alocasia.

Jóhnstonii, N. E. Br. (*Alocàsia Jóhnstonii,* Hort.). Tuberous: petiole 2–2¾ ft. long, olive-green, spotted rose, covered with fleshy, spine-like warts: lvs. sagittate, depressed in the middle, 1½–2 ft. long, olive-green, with prominent and beautiful red veins above I H. 27:395 G W 15, p 340 —Intro from the Solomon Isls. as *Alocasia Johnstonii,* but when it flowered it became evident that the plant is a Cyrtosperma.

C. fèrox, Lind & N E. Br., is a second species of this genus, figured in I H 39 153, but not known to be in the American trade. It has narrow-sagittate lvs on slender, very prickly petioles spathe rather large, reflexed, greenish white Borneo

GEORGE V. NASH.†

CYRTÓSTACHYS (Greek for a *curved spike*). *Palmàceæ,* tribe *Arèceæ.* Three or four palms of the Malayan region of stately habit, but little known in this country.

Stem spineless, slender and tall, crowned by a graceful cluster of pinnately divided lvs.: lfts. narrowly lanceolate, a little oblique, at the apex somewhat bifid: spadix short-peduncled, the branches more or less compressed, alternate, sometimes pendulous; fls. monoecious, the two kinds in 1 spadix; stamens 6, rarely 12 or 15: fr. small, elongate-ovoid, tipped by the persistent stigma. For cult., see *Areca.* The small and young lvs. of *C. Renda* are effective but old plants are not very attractive and scarcely known. G C. II. 24.362.

Rénda, Blume Height 25–30 ft · lfts. linear or ensiform, obtuse but somewhat obliquely bifid, delicate gray beneath, the petioles dark, brownish red. spadix 3–4 ft long, the branches nearly alternate, about 18 in. long. Sumatra. Var **Duvivierianum,** Pynært. Lf.-stalks brightly colored Malay Archipelago

Lákka, Becc. Petioles green, not over 4 in long lvs. broad, boldly arched, 3½–4½ ft. long, the lfts nearly 18 in. long, 1½ in. wide, obliquely bifid at the apex, pale beneath. Borneo.

N. TAYLOR.

CYSTACÁNTHUS (Greek for *bladder Acanthus,* because the flowers are inflated). *Acanthàceæ* Evergreen herbs of Burma and Cochin China, with showy, sessile fls in the axils of bracts, the entire infl more or less crowded into a terminal panicle or thyrse Corolla-limb spreading, unequally 5-lobed, the lobes short-rotund; stamens 2, style filiform, the stigma 2-toothed. lvs entire caps long and narrow, almost 4-sided, many-seeded Doubtfully distinct from Phlogacanthus — One species in cult This is *C. túrgida,* Nichols B M 6043 (as *Meninia turgida*) It comes from Cochin China. 2 ft. or less high, with prominently jointed sts and opposite, elliptic-lanceolate lvs fls white, yellow in the throat and pink-reticulated on the lobes April Cult as other warmhouse acanthads (See *Aphelandra* for example) Prop by cuttings of young wood There are 4 or 5 species of Cystacanthus in farther India

CYSTÓPTERIS (Greek, *bladder-fern*). *Polypodiàceæ.* Native ferns, with delicate foliage; deserve to be planted in the hardy fern garden.

Sori round, covered by a delicate indusium which is attached under one side and opens at the other, becoming hood-like in appearance and finally disappearing. The 5 species are native in the north temperate zone. Of easy cult. in shady, rich borders

bulbífera, Bernh Lvs. 8–24 in long, dark green, 3-5 in. wide, widest at the base, long tapering, tripinnatifid, bearing on the under surface of the rachis a series of bulb-like bodies, which germinate and prop new plants. Canada to N C —Thrives best on lime-bearing rocks. Exceptionally useful and attractive on damp rocky banks.

frágilis, Bernh Fig. 1200. Lvs. clustered, gray-green, 4–8 in. long besides the slender stalks, tripinnatifid, widest above the base. Widely distributed over the world at all altitudes.

L. M. UNDERWOOD.

CÝTISUS (Greek name for a kind of clover). *Leguminòsæ.* BROOM. Woody subjects, chiefly grown for their profusely produced yellow or sometimes white or purple flowers.

Mostly low shrubs, rarely small trees: lvs trifoliolate, sometimes unifoliolate, rather small, alternate, deciduous or persistent, sometimes few and minute and branches almost leafless: fls. papilionaceous, axillary or in terminal heads or racemes, yellow, white or purple; stamens 10, connate; style curved· pod flat, dehiscent, with few or many seeds; seeds with a callose appendage at the base.—About 50 species in S and Cent Eu , Canary Isls , N Afr and W. Asia. For a monograph of the genus see Briquet, Etude sur les Cytises des Alpes Maritimes (1894)

The brooms are ornamental free-flowering shrubs,

blooming most in early spring and summer. Nearly hardy North are *C. hirsutus, C supinus, C. scoparius, C nigricans, C. leucanthus,* while the evergreen species *C canariensis, C monspessulanus, C. filipes* are hardy only South Most of the species are well adapted for borders of shrubberies, and thrive in almost any well-drained soil and in sunny position; they naturalize themselves often very quickly in dry, gravelly soil, where few other plants will grow, *C scoparius* especially does so. The cytsus ought to be transplanted carefully and when young, as they do not bear transplanting well as older plants Some dwarf species, like *C Ardoinii, C kewensis, C emeriflorus, C purpureus* and *C. leucanthus* are very handsome for rockeries The evergreen *C canariensis* and *C racemosus* are much grown in the North as greenhouse shrubs, blooming profusely in early spring, also the white *C multiflorus* and *C filipes* make handsome pot-plants, and may be had in bloom in February with gentle forcing. For pot-plants, a light sandy loam with peat added forms a suitable compost After flowering the plants should be cut back and repotted as soon as they start into new growth After repotting, they are kept close and often syringed until they are established, then they ought to have plenty of air and only slight shade When the new growth has been finished they may be put in the open air until frost is threatening During the winter they should be kept in a cool greenhouse with plenty of light and carefully and moderately watered From January they may be transferred gradually in a warmer house for forcing Cuttings started in early spring, transplanted several times and then gradually hardened off, can be grown into flowering specimens for the following spring Propagated by seeds sown in spring and by greenwood cuttings under glass, they are also sometimes increased by layers or by grafting As stock *C nigricans* is much used, or *Laburnum vulgare* for small standard trees, for plants grown in the greenhouse or South, *C canariensis* is a good stock

Of cytsus, the young growths root readily in December and January in the ordinary way They should be shifted on as they grow Good-sized plants can be produced if shifting and pinching is not neglected By the following winter, the winter-propagated plants should be in 5-inch pots, in which size they are most useful Keep very cool during winter, and withhold any forcing They flower in March, or, if kept at a night temperature of 45°, as late as April Syringe at all times to prevent red spider To produce good-sized plants in one year, it is best to keep them plunged on a bench under the glass the entire summer, with little shade Older plants can be plunged out-of-doors during July, August and September. (William Scott)

INDEX

albo-carneus, 5
albus, 2, 5, 9, 10, 12.
Andreanus, 12
Ardoinii, 7
atropurpureus, 5
Attleyanus, 15
canariensis, 15
candicans, 14
cantabricus, 12.
capitatus, 1.
carneus, 5
decumbens, 6
elongatus, 3, 5, 13.
Everestianus, 16.
filipes, 11
grandiflorus, 12.
hirsutus, 3
incarnatus, 9.
kewensis, 8
leucanthus, 2
Linkii, 9
linifolius, 18
longespicatus, 13
luteus, 10
maderensis, 17
magnifolius, 17
mons-pessulanus, 11.
multiflorus, 9
nigricans, 13
ochroleucus, 12
pallidus, 2, 12.
palmensis, 11.
pendulus, 5, 12.
polytrichus, 3.
præcox, 10
proliferus, 4.
purpureus, 5
racemosus, 16, 17.
ramosissimus, 15.
ruthenicus, 3
schipkaensis, 2.
scoparius, 12
splendens, 17.
stenopetalus, 17.
sulphureus, 12
supinus, 1.

A. *Calyx tubular, much longer than wide· lvs always 3-foliolate branches terete. (Tubocytsus)*

B. *Fls. in terminal heads with bracts at the base, yellow to white*

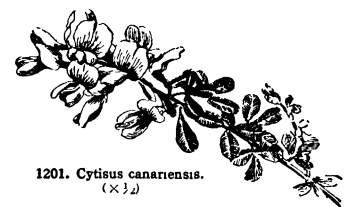
1. supinus, Linn (*C. capitàtus*, Scop) Shrub to 3 ft, with erect, or sometimes decumbent, villous branches lfts obovate or oblong-obovate, sparingly appressed pubescent above, villous pubescent beneath, ¾–1 in. long: fls yellow, brownish when fading, nearly 1 in. long; standard pubescent outside or nearly glabrous: pod villous, 1–1½ in long July, Aug Cent. and S. Eu L B.C. 5.497 J H III. 31:161 (as *Genista*).

2 **leucánthus,** Waldst & Kit (*C albus*, Hacq). Upright shrub, to 3 ft., with villous branches lfts. 3 oblong-obovate, obtuse or acutish, appressed pubescent, sometimes glabrous above, ciliate, ⅓–¾in. long fls. 3–6, yellowish white, calyx appressed-villous, standard pubescent outside pod about 1 in long, appressed pubescent. June, July S E Eu Var **pállidus,** Schrad (*C pállidus*, Kerner) Fls pale yellow. Var. **schipkaénsis,** Dipp Low shrub, about 1 ft. high: fls white Bulgaria —The oldest name for this species is *C albus*, but as the same combination has been used by many writers for *C multiflorus*, the name *C. leucanthus* is here used to avoid possible confusion

BB. *Fls axillary, distributed along the branches.*

C *Color of fls yellow*

3 **hirsûtus,** Linn (*C elongàtus*, Hort, not Waldst & Kit *C. polýtrichus*, Bieb *C ruthénicus*, Hort., not Fisch) Shrub, to 3 ft, with erect or procumbent, villous, terete branches lfts obovate or obovate-oblong, villous pubescent beneath, ½–¾in. long. fls.



1201. Cytisus canariensis. (×⅓)

2–3, short-petioled; calyx villous pubescent, standard glabrous on back. pod 1 in long, villous May, June. Cent and S Eu Orient B M 6819 (lfts erroneously shown as serrate) L B C 6 520 (as *C. falcatus*). B R 14.1191 (as *C multiflorus*).

CC *Color of fls white or purple.*

4. **proliferus,** Linn Shrub, to 12 ft, with long and slender pubescent branches lfts oblanceolate, silky pubescent beneath, green and sparsely pubescent above, 1–1¾ in long· fls white, 3–8, pedicels rather long, tomentose; calyx tomentose, standard pubescent outside. pod densely tomentose-villous, 1½–2 in long. May, June. Canary Isls B R 2 121 L B C 8.761. G. 32 291 —Recommended as a fodder plant for Calif.

5 **purpùreus,** Scop Procumbent or erect shrub, to 2 ft, quite glabrous lvs rather long-petioled, lfts oval or obovate, dark green above, ½–1 in long fls 1–3, purple, calyx reddish pod black, 1–1½ in long May, June S Austria, N Italy B M 1176 L B C. 9 892 G C III 36 217, 50 163 Gn 21, p 421. J H III 49 399 Var **álbus,** Kirchn Fls. white. G 6 433 Var **álbo-cárneus,** Kirchn (var *cárneus*, Hort) Fls light pink Var **atropurpùreus,** Dipp. Fls dark purple Var **elongàtus,** André (var *péndulus*, Dipp), with slender, pendulous branches and purple fls, is sometimes grafted high on Laburnum. There exists an interesting graft hybrid of this species and *Laburnum vulgare*, for which see *Laburnum Adami*.

AA. *Calyx campanulate, as long or only slightly longer than wide branches grooved or angled.*

B. *Fls. axillary along the branches.*

C. *Lvs. simple· fls. yellow procumbent shrubs. (Corothamnus)*

6 **decúmbens,** Spach. Prostrate shrub, 4–8 in. high: branchlets 5-angled, glabrescent: lvs oblong-obovate,

obtuse or acutish, pilose on both surfaces, ciliate, ⅓–¾in. long. fls. yellow, 1–3; calyx sparingly pilose; standard broadly obovate, ½in. broad. pod ½–¾in. long, pilose, with 3–4 seeds. May, June S Eu. B.M. 8230. L.B C. 8:718.

CC. *Lvs. 3-foliolate (in Nos. 9 and 10 partly simple).*

D. *Plant a prostrate shrub. fls yellow or yellowish white. (Trianthocytisus)*

7. **Ardoinii,** Fournier. Prostrate shrub, about 1 ft. high: branchlets grooved, pubescent: lvs. long-petioled; lfts. 3, linear-oblong, acute, covered with spreading hairs, ¼–½in. long fls golden yellow, 1–3, crowded at the end of short lateral branchlets, nearly ½in. long: pod very villous, ¾in long April, May S France. Moggridge, Flora of Mentone 58 —Very handsome, but tender.

8. **kewénsis,** Bean (*C Ardoinii* × *C. multiflorus*). Prostrate shrub: lfts 3, linear-oblong, clothed with short soft pubescence, ⅛–½in long. fls yellowish white, 1–3, along slender branches, ½in. long May. Originated at Kew Gn 60, p 348; 69, p. 282, 73, p. 228; 75, p. 273. G.M 44·579; 51:355 G.W. 16, p. 610.—Like the preceding well adapted for rockeries or for forming a close covering to the ground.

DD. *Plant an upright shrub: foliage scarce.*

E. *Style slightly curved, shorter than keel: fls. white or yellowish white. (Spartothamnus.)*

9 **multiflòrus,** Sweet (*C. álbus,* Link, *C. Linkii,* Janka. *Spártium multiflórum,* Ait.). Shrub, to 3 ft., with slender, erect, grooved branches pubescent at first: lvs. short-petioled, 1- to 3-foliolate, lfts. obovate-oblong to linear-oblong, ¼–½in long, sparingly appressed-pubescent. fls. axillary, 1–3, white, ⅛–½in. long: pod appressed-pubescent, usually 2-seeded May, June. Spain, N Afr Gn 64, p. 251; 69, p. 92, 72, p. 276. G M 49.579. G.W 5, p. 111. Var **incarnàtus,** Sweet. Fls. white, slightly blushed. L.B.C. 11.1052 (as Spartium).

10 **præcox,** Bean (*C multiflorus* × *C purgans*) Shrub, to 10 ft, with slender upright or arching branches: branchlets grooved, pubescent at first lfts usually 1, sometimes 3, short-petioled, oblanceolate or linear-spatulate, silky pubescent, ⅛–¾in. long: fls 1–2, yellowish white, very numerous along the slender branches, nearly ½in long pod appressed-pubescent, about 1 in long, usually 2-seeded May. Of garden origin. G.C. III. 29 41. Gn. 56, p. 37; 65, p 438, 69, p. 318. G M. 44·581, 52.183. M.D G. 1903.265. G.W. 3, p 221 Var **álbus,** Smith Dwarfer, more pendulous· fls white Gn 75, p 192 Var **lùteus,** Smith Dwarf fls. yellow —This hybrid is one of the most floriferous of all brooms

11. **fílipes,** Webb (*Spartocýtisus filipes,* Webb). Shrub, with slender, angulate, thread-like branches: lvs slender-petioled, 3-foliolate, nearly glabrous; lfts. linear-lanceolate: fls axillary, 1–2, fragrant, pure white; wings much longer than the keel Feb –May Teneriffa —As *C palmensis,* Hort, in the American trade.

EE. *Style longer than keel, spirally incurved. fls. bright yellow or partly crimson, rarely pale, large. (Sarothamnus)*

12. **scopàrius,** Link (*Sarothámnus scopárius,* Winim. *Spártium scopárium,* Linn) Scotch Broom Shrub, to 10 ft., with erect, slender branches· lvs short-petioled, 1–3-foliolate; lfts. obovate or oblanceolate, sparingly appressed-pubescent, ¼–½in. long· fls. usually solitary, ¾in long; calyx and pedicels nearly glabrous: pod brownish black, glabrous, villous only at the margin. May, June. Cent. and S. Eu G. 25·169.—The tops are used for their sedative and diuretic properties In Germany the fls also are used medicinally Var **Andreànus,** Dipp (*Genísta Andreàna,* Puissant) Fls. yellow with dark crimson wings. R.H. 1886:373. Gt. 40.1342 R B 19.129. J.H. III. 32:462.—A beautiful and striking variety. Var. **álbus,** Loud. (var. *pállidus,* Hort var. *ochroleúcus,* Zabel., var. *sulphùreus,* Arb Kew). With yellowish white or pale yellow fls. Gn. 61, p. 299; 65, p 375. G.M. 44:580. Var. **péndulus,** Arb. Kew (*C. grandiflòrus,* Hort, not DC *C cantábricus,* Hort, not Willd.) With slender pendulous branches There is also a variety with double fls —All the vars. are more tender than the type. The Scotch broom, *C. scoparius,* has become established in this country, as a naturalized plant, in waste places from Nova Scotia to Va; and it is also reported from Vancouver Isl It is also recommended by landscape gardeners for covering raw and broken places Its yellow fls and nearly bare sts make a unique combination in the American landscape Even when it kills to the ground in winter, it throws up its sts again in the spring

BB. *Fls in terminal racemes, sometimes umbellike, yellow branches very leafy.*

C. *Foliage deciduous branches terete. racemes very long and slender. (Phyllocytisus)*

13 **nígricans,** Linn (*Lembótropis nígricans,* Griseb). Shrub, 2–4 ft, with erect, appressed-pubescent branches· lvs long-petioled; lfts obovate or oblong-obovate, glabrous above, appressed-pubescent beneath, ⅛–1 in long: racemes very long and slender, 3–8 in. long June, July. Germany, N Italy, Hungary. L.B.C. 6.570. B R 10.802 B M 8479 R B 26 3. Var. **elongàtus,** Borkh (var. *longespicátus,* Hort). Blooming again in fall at the top of the elongated fruiting racemes. R.H. 1891, p 149 (as var *Carlieri*)

CC. *Foliage persistent· branches grooved. (Teline)*

D. *Lvs. distinctly petioled, obovate or obovate-oblong.*

E. *Racemes nearly capitate, 3–9-fld, at the end of short lateral branchlets*

14. **monspessulànus,** Linn (*C cándicans,* DC. *Genísta cándicans,* Linn) Shrub, to 10 ft· branches villous-pubescent when young lvs short-petioled, usually glabrous above, pubescent beneath, lfts obovate or obovate-oblong, mucronulate, ⅛–¾in long· racemes 3–9-fld, short, leafy at the base, fls fragrant, bright yellow. pod rufous-villous May, June Medit region, Canary Isls W D B 1 80 (not good)

EE. *Racemes longer, 6- to many-fld, secund, terminal and lateral*

F. *Petioles ⅓in. long or shorter, lfts usually obovate, less than ½in long*

15. **canariénsis,** Kuntze (*Genísta canariénsis,* Linn) Genista of florists Fig 1201. Much-branched shrub, to 6 ft, with villous-pubescent branches. lfts cuneate, obovate or oblong-obovate, rounded at the apex, pubescent on both sides, ¼–½in long· racemes usually many-fld, dense and rather short, fls fragrant, bright yellow. May–July Canary Isls A F 6 802 R B 26·229. Var. **ramosíssimus,** Briquet (*C ramosíssimus,* Poir. *C. Attleyànus,* Hort) Lfts very small, glabrous above. racemes short, but numerous L.B C. 13:1201 B R 3:217

16. **racemòsus,** Nichols., not Mair (*Genísta formòsa,* Hort). Fig. 1202. Shrub, to 6 ft branches pubescent. lvs rather long-petioled; lfts oblong-obovate, mucronulate, ⅛–¾in. long, silky pubescent on both sides: racemes elongated, many-fld, secund and rather loose, 2–4 in. long. Probably of garden origin and hybrid between *C. canariensis* and *C maderensis* var. *magnifoliosus* A F 6.802; 13.1136 F-E 9:431 —Better florists' plant than the last; much grown as a pot-plant and forced for early spring and Easter Var. **Everestiànus,** Rehd Fls of a deeper shade of yellow, very free-flowering. R H 1873:390.

FF. *Petioles ½in long or longer; lfts. oblong-obovate, about ½in long or longer.*

17 **maderénsis,** Masferrer (*Teline maderénsis,* Webb) Shrub or small tree, to 20 ft.: lvs. slender-petioled, crowded, lfts oblong-obovate, silky pubescent on both sides, or smooth above, acute or acutish, ⅓–¾in long: racemes 6–12-fld, rather short, fulvous or silky pubescent; fls bright yellow, slightly fragrant, pod 5–7-seeded May, June Madera Var **magnifolòsus,** Briquet (*Teline stenopétala,* Webb *C. stenopétalus,* Christ *C. racemòsus,* Marnock) Lvs larger, ½–1½ in long: racemes elongated, 10–20-fld Madera Marnock, Floricult Mag 2 19 B R 26 23 (as *Genista bracteolata*) Webb & Berthelot, Phytogr Canar 45 — Sometimes cult as *C splendens,* but less desirable as a greenhouse plant than the two preceding species.

DD *Lvs nearly sessile, linear or linear-lanceolate.*

18 **linifòlius,** Lam. Shrub, to 3 ft., with erect, appressed-silky tomentose branches: lfts linear or linear-lanceolate, acute, revolute at the margin, nearly glabrous and shining above, silvery pubescent beneath, ½–1 in long racemes short and compact, fls bright yellow pod torulose April–June Spain, N Afr., Canary Isls B M 442

C Ádami, Poir =Laburnum Adami —*C alpinus,* Mill = Laburnum alpinum —*C austriacus,* Linn Allied to C supinus. Lfts narrow, oblanceolate, silky pubescent on both sides fls yellow, calyx densely villous S E Eu, Caucasus —*C Beánii,* Nichols (C Ardoinii × C purgans) Low shrub with golden yellow fls, and narrow mostly simple lvs G 30 207 —*C biflórus,* L'Her =C ratisbonensis —*C cantábricus,* Willd Allied to C scoparius but prostrate, with silky lvs and large bright yellow fls pod villous May Spain.—*C. congéstus,* Ball (Teline congesta, Webb). Allied to C linifolius. Densely villous-tomentose, small-lvd lvs short-petioled racemes short Teneriffa —*C Dalimóri,* Rolfe (C multiflorus × C scoparius var Andreanus) Upright shrub with pale purple fls G C III 51 198 Gn 74, p 291 G M 55 11 B M 8482 There are forms with sulfur-yellow and one with orange-yellow fls —*C elongàto-purpureus,* Hort =C. versicolor —*C elongàtus,* Waldst & Kit =C ratisbonensis var elongatus.—*C emeriflòrus,* Reichb (C glabrescens, Sartor not Schrank) Allied to C Ardoini Sparingly appressed-pubescent branchlets angled fls yellow pod glabrous N Italy G W 15, p 557 —*C fragrans,* Lam Allied to C filipes Petioles short lfts densely pubescent fls fragrant, white Spring Teneriffa J H III 50 448 —*C glabrescens,* Sartor, not Schrank=C emeriflorus —*C handsu orthénsis,* Paul & Sons "A white-fld plant suitable for the rockery"—*C Hillebrandtii,* Briquet (Genista Hillebrandtii, Christ) A suffruticose species, with long, slender hairy sts and trifoliate hairy lvs Canary Isls —*C incarnatus,* Hort =C versicolor —*C Laburnum,* Linn = Laburnum vulgare —*C nubigenus,* Link=C fragrans —*C pirgans,* Willd Shrub, to 3 ft, appressed-pubescent branches striped lvs 1–3-foliolate, oblong or linear-lanceolate fls axillary, yellow, fragrant pod glabrous May–July Spain, S France —*C ramentàceus,* Sieb =Petteria ramentacea —*C ratisbonénsis,* Schaeff Allied to C. hirsutus To 3 ft branches slender, appressed-pubescent lfts. glabrous above, silky beneath fls 1–2, yellow, calyx with appressed, yellowish, silky hairs April–June M Eu, W Asia Var *elongatus,* Koch More erect fls larger, 3–5, calyx with somewhat spreading hairs B R 4 308 (as C biflorus) —*C sessilifòlius,* Linn Allied to C nigricans Quite glabrous lvs nearly sessile, with roundish-obovate lfts racemes short, 4–11-fld May, June S Eu B M 255 —*C Spachianus,* Kuntze (Genista Spachiana, Webb) Closely related to C canariensis Taller lfts obovate, acuminate racemes somewhat elongated Canary Isls B M 4195 —*C. triflórus,* L'Her Simular to C hirsutus Fls long-pedicelled, yellow, calyx-tube short, not tubular April, May S Eu, N Afr Tender F C 3 102 —*C versicolor,* Dipp (C hirsutus × C purpureus) Low shrub, with sparingly villous lvs fls yellowish white and pale purple Sometimes cult as C. incarnatus —*C Weldenii,* Vis =Petteria ramentacea.

ALFRED REHDER



1202. Cytisus racemosus.
(×⅓)

D

DABŒCIA (after its Irish name, St. Dabeoc's Heath). More commonly spelled Daboecia, and sometimes Dabeocia Syn, *Borétta. Ericàceæ* Shrub cultivated for its purple flowers appearing in summer.

Low evergreen with alternate entire lvs and drooping pedicelled fls. in long terminal racemes. corolla ovoid, contracted at the mouth and shortly 4-lobed, with recurved lobes; stamens 8, included. caps. 4-celled, dehiscent.—One species in W. Eu

This is a very pretty heath-like plant, with purple or white flowers in elegant loose racemes, well adapted for rockeries or borders of evergreen shrubberies. Requires protection North during the winter, and thrives best in a peaty, sandy soil. Propagated by seeds treated like those of Erica, and by cuttings of half-ripened wood under glass

cantábrica, Koch (*D polifòlia,* Don. *Borétta cantábrica,* Kuntze. *Menzièsia polifòlia,* Juss.) IRISH HEATH. To 2 ft branchlets glandular pubescent: lvs elliptic, the uppermost narrower, revolute at the margin, whitish tomentose beneath, shining and dark green above, ½–½in long· racemes many-fld; corolla ⅜–½in long, purple in the type June–Oct Ireland, W. France, N Spain, Azores Gn 52 344; 71, p 442, 76, p 490 Gn M 3 336 R B 3 121 Gt 47 1450 S B F G. 2.276 —There are many varieties, as **álba,** Dipp, with white fls (Gn 22, p 302), **bícolor,** Dipp (var *striàta,* Hort), with white- and purple-striped fls; **ròsea,** Rehd (*Borétta cantábrica ròsea,* Koopmann), with pink fls; **atropurpùrea,** Dipp, with dark purple fls; **nàna,** Rehd (*Menzièsia polifòlia nàna,* Lodd *M polifòlia pygmæa,* Arb. Kew). Dwarf, with small and narrow lvs. L.B C 20 1907

ALFRED REHDER.

DACRÝDIUM (Greek-made name, referring to the tear-like exudations) *Taxàceæ* About 16 species of New Zeal, Austral, Malaya and Chile, being trees or shrubs with closely imbricated scale-like lvs. on old trees and linear or linear-subulate spreading lvs. on young trees and lower branches, none apparently in the trade in this country but more or less grown in European arboreta, allied to Podocarpus, from which it differs in having dimorphic lvs, peduncle of fr dry or fleshy (fleshy and enlarged in Podocarpus), and the ovule becoming erect; and to Phyllocladus, which differs in having cladophylla and the true lvs. reduced to minute scales Dacrydium is dicecious or rarely monœcious, the fls. not in cone-like structures; male fls solitary at tips of branchlets and with the uppermost lvs, females nearly or quite terminal under the lf-like scales. seeds nut-like, ovoid, borne in a cup-like fleshy or thin aril —These more or less spruce-like trees sometimes attain a height in their native regions of 75–100 ft. Some of the species may be expected to thrive in the southern areas.

DÁCTYLIS (Greek *daktulos,* a finger) *Gramíneæ.* A perennial tufted grass with flat blades, thin prominent ligules and sheaths closed nearly to the throat, grown for forage and one form for ornament.

Panicles glomerate; spikelets 2–5-fld, nearly sessile in dense 1-sided fascicles, those arranged in a panicle; lemmas hispid-ciliate on the keels, awn-tipped, compressed.—Species 1, north temperate regions of the Old World.

glomeràta, Linn ORCHARD-GRASS Fig 1203 A coarse grass, 2–3 ft, forming large tussocks panicle a few stiff branches, expanding in fl, afterwards appressed. Dept Agric, Div Agrost 20 145 —Commonly cult as a pasture and meadow grass and useful for lawns under trees Var. **variegàta,** Hort, is a dwarf form of compact habit with foliage variegated silver and green; used for borders. Prop. by division, of easy cultivation

A. S. HITCHCOCK



1203. Orchard-grass.—Dactylis glomerata. (plant×⅓)

DACTYLOCTÈNIUM (Greek, *daktulos,* finger, and *ktenion,* a little comb) *Gramíneæ* FINGER-COMB GRASS Annual grasses with spreading or creeping stems, one of which has been offered as an ornamental subject

Spikelets several-fld, sessile, crowded in 2–6 digitate 1-sided, rather broad, flattened spikes, axis of spike extending beyond the spikelets as a naked point Species 2, warm regions of the Old World One species, **D. ægýptium,** Richt (*D ægyptiacum,* Willd *Eleusine ægýptica,* Desf *Cynosùrus ægyptius,* Linn), CROW-FOOT, is a common weed in Trop Amer The 3–5 short spikes are divaricate at the summit of the culms, about 2 in long —It has been offered as an ornamental grass for garden cult, but has little value Mojave Indians of S Calif use the grain for food In Afr a decoction is prepared from the seeds for inflammation of the kidneys.

A S HITCHCOCK

DÆDALACÁNTHUS (Greek words, signifying an *acanthad of curious structure*) *Acanthàceæ* Tropical shrubs or sub-shrubs, with blue or rose-colored flowers, sometimes grown under glass and in the open in warm countries

Leaves entire or scarcely dentate fls in bracted spikes which are sometimes paniculate, the bracts usually much exceeding the calyx, calyx deeply 5-lobed or -parted, corolla-tube elongated and slender, more or less curved, bearing an oblique spreading 5-lobed limb, perfect stamens 2, affixed in the throat, included, style slender and recurved· fr an ovate or oblong caps, the seeds 4 or fewer —Some 15 to 20 species in E. India and Malay Archipelago; by some authors the name Eranthemum is applied to these plants

and what are known as Eranthemum in this work then become Pseuderanthemum.

This genus contains some tender shrubs of rather difficult culture under glass, but great favorites in the tropics, particularly in India. *D. nervosus* is a popular winter- and spring-blooming shrub in southern Florida. It has blue flowers an inch across, five-lobed, and shaded purple at the mouth of the tube. For culture, see *Justicia*.

nervòsus, T. Anders (*Eránthemum nervòsum*, R. Br. *E pulchéllum*, Andr., and some dealers, while that of others is *E bicolor*, and that of Roxburgh is *D. purpurascens*). Fig. 1204. Glabrous or very nearly so: lvs ovate or elliptical, acuminate at both ends, somewhat crenate or entire: spikes axillary, opposite, overlapping and interrupted: bracts elliptical, acute, nervose: limb of the corolla as wide as the tube is long. India B M 1358 (as *Justicia nervosa*). Gn 51 352 G C II 21:415.—A very pretty shrub for the warmhouse, 2–6 ft., its fls being of a color that is not very common in winter-blooming plants. It is an easy subject to manage, requiring a light, rich soil, full sunlight and plenty of water. Cuttings of young growth root readily in a warmhouse.

macrophýllus, T. Anders. St pubescent toward top: lvs elliptic-lanceolate, ovate-acuminate, attenuate at base: spikes linear, somewhat interrupted: bracts elliptic, rather obtuse, nervose: fls pale violet-blue. India. B M. 6686.—Differs from *D. nervosus* in laxer infl., hairy lvs. which are scabrid-pubescent on the nerves beneath, and more pubescent shoots.

Wáttii, Bedd. (*D párvus*, C. B. Clarke). Slender, 2 ft. lvs. deep green with a light metallic shade, very broad-ovate: fls. 1 in. across, blue or violet-blue, the corolla-lobes broad-obovate and narrowed abruptly to a point, the white stigma protruding from the narrow throat. India. G M. 44:645. G C. III. 32. 311. A F. 17:382.—A good dwarf species with fls. in dense clusters, blooming in pots when 1 ft. high and flowering in Sept. Requires a warmhouse treatment, grows well in sandy loam; prop. by cuttings. L. H. B.†

DÆMÓNOROPS (probably means *God-like, of divine appearance*) *Palmàceæ*, tribe *Lepidocárpeæ*. Slender pinnate palms grown for their graceful foliage, but little known in Amer. outside of botanic gardens. Differs from Calamus (with which it is by some united) only in having the outer sheaths or spathes boat-shaped, deciduous, at first inclosing the inner sheaths, its more longly stalked fls. also separate it from Calamus.—About 85 species, all Trop. Asiatic. Only a very few are in cult. Treatment and general cultural conditions of Calamus. *D. Draco* produces some of the "dragon's blood" of commerce. See page 3568.

A. *Young lvs. green.*

B. *Sts. erect or climbing, sometimes both in one plant.*

calicárpus, Mart. (*Cálamus calicárpus*, Griff.). St. erect or climbing, 1 in. diam.. lvs. 6–8 ft. long, upper small with long flagella; lfts. numerous, 12–13 in. long, ⅛–½in. wide; petiole 1 ft., the base not gibbous or puckered. fr. about ¾in. diam., tawny. Malacca.

melanochætes, Blume. St. erect: lvs. pinnate, 10–12 ft. long in nature, the pinnæ long and narrow, dark green and drooping, furnished with many cirrhi, the petioles sharp-spined at the sheathing base: fr. yellow-green. Malaya.—Very decorative. A small form is var. **microcárpus.** Little known in U. S.

BB. *Sts. always climbing.*

Lewisiànus, Mart. (*Cálamus Lewisiánus*, Griff.). St. climbing, 1 in. diam.: petiole 1 ft., base much swollen, armed below with scattered, short, deflexed spines, and above with straight and hooked spines 1¼ in. long; lfts. 13–15 in. long, ¾–1 in. wide; sheath armed with solitary or seriate flat-back spines. fr. pale yellowish. Penang.

intermèdius, Mart. St. 15–20 ft., ¾in. diam.: lvs. long-petioled, 4–6 ft. long; lfts. opposite or scattered, 18–20 in. long, 1–1½ in. wide, linear-lanceolate, acuminate, margins and 3–5 costæ bristly above and below;



1204. Dædalacanthus nervosus. (×⅓)

rachis semi-cylindrical, sparingly armed; petiole 1 ft. long, with flattened spines. Malaya.

AA. *Young lvs. brownish or straw-colored.*

palembánicus, Blume. St. erect: lvs. pinnate, broadly ovate, bright cinnamon-brown when young, and lfts. many, long, narrow, 1½ ft. long, about ½in. wide, petioles erect, with stout spines on the back, which are deflexed and not thickened at the base and are arranged singly or in series. Sumatra. F. 1873, p. 136.

periacánthus, Miq. Height 15 ft.: resembles *D palembanicus*, but the young lvs. are nearly straw-colored, and the spines are placed in irregular rings. Sumatra.—A most graceful species.

D plumòsus, Hort. Graceful plume-like lvs., with pinnæ 4 ft. or less long, petioles with rigid black spines with white bases. India. F. 1871, p. 39.—Not in cult. in N. Amer.

JARED G. SMITH.
N. TAYLOR.†

DAFFODIL: *Narcissus.* **Daffodil, Sea:** *Pancratium.*

DÁHLIA (named after Professor Andreas Dahl, a Swedish pupil of Linnæus, and author of "Observationes Botanicæ") Syn. *Georgìna Compósitæ* Stout perennial herbs, sometimes somewhat woody, much grown out-of-doors for the rich and profuse autumn bloom. Plate XXXIV.

Tuberous-rooted (Fig. 1205): st. mostly erect, branching, glabrous or scabrous. lvs. opposite, 1–3-pinnate: heads long-peduncled, large, with yellow disk and rays in a single series and mostly in shades of red and purple and also in white (in cult.); ray-fls. neutral or pistillate, disk-fls. perfect and fertile; involucre double: the inner series of thin scales that are slightly united at base, the exterior series smaller and somewhat leafy;

receptacle plane, bearing chaffy scales, rays spreading, entire or minutely 3-5-dentate: fr. oblong or obovate, strongly compressed on the back, rounded at the apex, obscurely 2-toothed or entirely bald.—Probably 10 or 12 species, in the higher parts of Mex., some of them now much modified by cult., and the domesticated forms often difficult of systematic study. The nomenclature of the group is confused because systematists are not agreed on the rank to be given to forms that have received independent names. Voss (Blumengartnerei) combines the three species of Cavanilles, *D. pinnata*, *D. coccinea*, and *D. rosea*, all under the name ***D. pinnata***. His arrangement is as follows: *D. pinnata*, Cav., var. *coccinea*, Voss (*D. coccinea*, Cav. *D. rosea*, Cav., in part *D. frustranea*, DC. *D. crocea*, Poir. *D. bidentifolia* and *D. mexicana*, Hort.); var. *gracilis*, Voss (*D. gracilis*, Ort.), var. *Cervantesii*, Voss (*D. Cervantesii*, Lag.); var. *variabilis*, Voss (*D. variabilis*, Desf. *D. rosea*, Cav., in part *D. sambucifolia*, Salisb. *D. superflua*, Ait. *D. purpurea*, Poir.). It seems to be well, however, to keep *D. rosea* and *D. coccinea* distinct, and perhaps also *D. pinnata*, and this is the method adopted for the present treatment. Of the three Cavanillesian names, *D. pinnata* has priority.

A. *Plant very tall, tree-like*

B *Fls. nodding, bell-shaped.*

imperiàlis, Roezl. Height 6–18 ft.; sts. usually many from one base, mostly unbranched, knotty, 4–6-angled, usually dying to the ground in winter in S. Calif.; lvs. 2–3-pinnately parted; lfts. ovate, narrowed at the base, acuminate, toothed, with a few short scattered soft hairs; fls. nodding, 4–7 in. across, white, more or less tinged with blood-red, especially at the base; rays sterile or pistillate, lanceolate, sharp-pointed, not 3-toothed at the apex. Gt. 1863: 407; 56, p. 22. G. C. 1870: 459, II. 12: 437, III. 34: 178. B. M. 5813. Gn. 12: 352, 33, p. 527, 61, p. 40. R. H. 1872: 170; 1911, pp. 62–3. A. G. 15: 313. Mn. 8, p. 61.—As few conservatories can make room for so large a plant, it is common to graft this species on dwarf varieties of *D. rosea*. The inflated and pointed fl.-buds (3–4 in. long) are very characteristic. It is not known whether the original plant collected by Roezl was found in wild or cult. surroundings. This species and the next are mostly cult. under glass if cult. at the N., but this species thrives in the open in Cent. Calif.; the others are grown outdoors in summer, and the roots stored in winter. Hybrids are reported between this species and *D. excelsa*.

BB *Fls. erect, not bell-shaped, but opening out flat.*

excélsa, Benth. (*D. arbòrea*, Regel). Height to 20 ft. or more: sts. several from same base, usually unbranched, glaucous, marked with horizontal rings made by the stem-clasping base of the petioles as the lower lvs. fall away, becoming woody for several feet in mild climates: lvs. bipinnate, as much as 2½ ft. long, 2 ft. wide; lfts. as many as 25, ovate, those of the upper lvs. often contracted at the base, acuminate, toothed, pale green beneath, with a few short scattered hairs or none: fls. 4½ in. across, dilute purple, crimson-pink. G. C. II. 19: 80; III. 27: 85.—This species was described from a cult. plant with 8 rays in a single row, but with considerably elongated disk-fls. It was almost an anemone-fld. type, and all the florets were sterile. *D. arborea* has never been sufficiently described as a botanical species, but plants have been cult. for many years under this name. Var. **anemonæflòra,** Hort. Disk of lilac or yellow tubular florets; rays flat.



1205. Clustered roots of the garden dahlia

AA. *Plant medium, averaging 3 ft., commonly from 2–5 ft., rarely exceeding these extremes.*

B. *Lvs. once pinnate: st. not branching from the base: habit erect.*

C. *St. usually not glaucous: rays fertile.*

D. *Rays of the single fls. not recurved at the margins, of the double fls. never flat, but cupped.*

rósea, Cav. (*D. variábilis*, Desf. *D. Bárkeriæ* and *D. Roylèana*, Knowl. & Weste?. *D. supérflua*. Ait.



1206. Dahlia rosea (or D. variabilis). (×⅓)

D. purpùrea, Poir. *D. nàna*, Andr. *D. crocàta*, Lag. *D. coronàta*, Hort.) Fig. 1206. Lvs. typically once pinnate, sometimes bipinnate; lfts. ovate, toothed, broader and coarser than in the other species. B. R. 55. B. M. 1885.—The original of practically all the old-fashioned dahlias, particularly the Single, Pompon, Show and Fancy types. It is therefore the parent of the vast majority of the horticultural varieties. This is a wonderfully variable species. Some plants are densely hairy, others scarcely at all. The lvs. are sometimes bipinnate in parts of plants or throughout an entire plant. In double forms the rays usually have abortive pistils. Many garden forms have glaucous sts. Some authors have doubted whether this species is distinct from *D. coccinea*, but the two types are very different in the garden, although there are intermediate forms in nature.

DD. *Rays of the single fls. with recurved margins; of the double fls. not cupped, but long, flat and pointed, and some at least with recurved margins.*

Juarézii, Hort. (*D. Yuarézii*, Hort.). Cactus Dahlia. Fig. 1207. Distinct in the bloom: heads bril-

liant scarlet; fls. irregular in length and overlapping, the rays narrow. The Cactus dahlias all originated from one plant, which was flowered in Eu. for the first time in 1864, and first pictured in G C II. 12.433 (1879). F M 1879:383. Gn. 18, p 589, 19.742, 50, p. 236. G.Z. 26.49.

cc. *St. glaucous: rays not fertile.*

coccínea, Cav (*D bidentifólia,* Salisb *D Cervántesii,* Lag *D. Crócea,* Poir) Fig 1208, redrawn from B.M 762 (1804). Always more slender than *D. rosea,* with narrower lfts, and in the wild, at least, dwarfer than that species. The color range is much smaller, and does not include white or any shade of purple or crimson. The colors vary from scarlet, through orange to yellow. There are no double forms, and it has been said that this species will not hybridize with *D. rosea.* The named varieties pictured in I H. 31·515 and 533 (1881), which are emphatically declared to be varieties of *D coccinea,* are probably garden forms of *D rosea.* The only characters that certainly distinguish *D coccinea* from *D. rosea* are the glaucous sts and infertile rays of the former, but these characters break down in garden forms B.M. 762. Gn 19:154 G C II 12.525

bb. *Lvs. twice pinnate sts branched from the base: habit spreading*

Mérckii, Lehm (*D glabràta,* Lindl) Fig. 1209, redrawn from B M. 3878 (1841). Height 2–3 ft : roots much more slender than those of *D. rosea* st and lvs. wholly devoid of hairs; lvs bipinnate. floral bracts linear, fls. typically lilac; rays pistillate; outer involucral bracts linear B R 26·29 (1840) Gn. 19 154 (1881) —This is a very distinct garden dahlia, and is worth growing merely as a foliage plant The fine-cut character of the foliage makes it more attractive than the coarse foliage of most of the varieties of *D rosea.* The plants are much dwarfer and wider spreading than most florists' dahlias, and show no st. while growing. The branched flowering sts are remarkably long, slender and wiry, often rising 2–3 ft above the foliage. The rays are very short and often roundish, with a short sharp point instead of 3 minute teeth There are no red, yellow or white forms in nature. The roots of this and *D coccinea,* being slenderer than those of *D. rosea,* must be preserved with greater care in winter.

D gràcilis, Ort Lvs bipinnate and ternately divided, glabrous, the lfts small, ovate and coarsely toothed fls brilliant orange-scarlet, outer bracts of involucre almost orbicular 4–5 ft, making a dense bush with very slender growths, bearing heads 2½–3 in across Apparently not in general cult —*D pinnàta,* Cav Plant scarcely 3 ft high, glabrous lvs 5-foliolate, lfts ovate, crenate-dentate, glaucous beneath, sessile, rachis winged fls large, solitary, female corolla large, blue-red, exterior involucre with 6-7 bracts, ovate, narrowed toward the base, spreading and reflexed-incurved, the interior with coriaceous lobes The plate of Cavanilles shows semi-double fls , i e with several rows of rays, with the rays incurved at the margin and becoming at the base nearly tubular.—*D Zimapánii,* Roezl, is by some retained in Dahlia and by others referred to Bidens, in this work it is described under Cosmos (C. diversifolius).

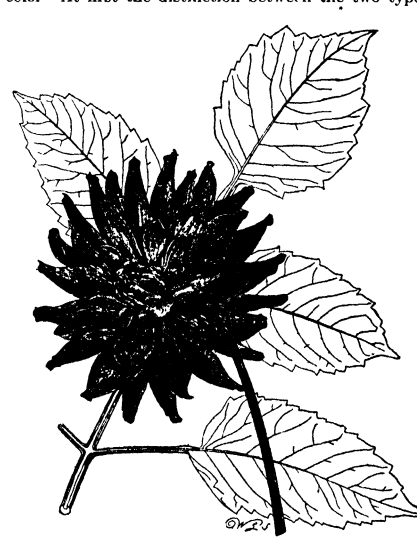
WILHELM MILLER.
L. H. B.†

Types and varieties of the dahlia.

Practically all of the named varieties of dahlias have come from one immensely variable species, usually known as *D. variabilis,* but more properly as *D. rosea.* For garden purposes, however, a second form of great importance, *D. Juarezii,* the parent of the Cactus forms, must be kept distinct. There are other species cultivated to a slight extent. It is curious that these showy plants should be closely related to a common weed, the beggar's tick, of the genus Bidens; but other species of Dahlia have leaves whose forms pass gradually into those of Bidens. Other close allies are Cosmos and Coreopsis. Cosmos flowers are some shade of purple, rarely white in wild nature, and only one species has yellow flowers; Coreopsis has yellow flowers only; Bidens, yellow or white, and none of these genera has produced double-flowered forms of the first importance. Dahlia has all these colors and more, being far richer in bright reds, and lacking only sky-blue and its closely related hues, which are seen to perfection in the China asters.

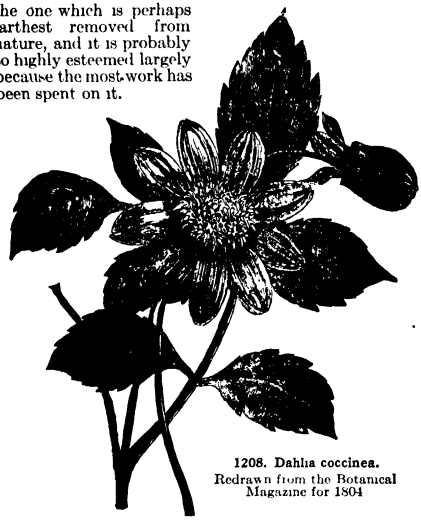
Although dahlias are popular plants, especially in old gardens, they are destined to still greater popularity from the new "Cactus," "Decorative," "Peony-flowered," and "Collarette" types. There exists a prejudice against dahlias in many localities in which these new types have never been seen. This prejudice is part of a reaction against formal and artificial flowers in general The old-time dahlias were round hard and stiff like a ball The new-time dahlias are flatter, and tend toward loose, free, fluffy chrysanthemum-like forms. The dahlia has now become immensely variable

Of the important and very variable florists' flowers, the dahlia was one of the latest to come into cultivation The first break of considerable importance in the wild type occurred about 1814 Up to that time there were perhaps a dozen well-marked colors in good single-flowered varieties. Dahlias had been cultivated in Europe since 1789, and it is a curious fact that they showed signs of doubling the very first year of their European residence, but it was not until twenty-five years later that a marked gain in doubling was made The dahlia seemed to be undeveloped until 1814, when the era of doubling began Before another twenty-five years had passed, the dahlia had sprung into the front ranks of garden plants In 1826 there were already sixty varieties cultivated by the Royal Horticultural Society In 1841, one English dealer had over 1,200 varieties. Today it is not uncommon for the leading tradesmen to keep 500 to 1,000 distinct varieties. In the absence of good records, it is conjectured that over 3,000 different names of varieties have been published in the catalogues Most of the varieties are the Show and Fancy types, which are as spherical and regular as possible, and differ only in color At first the distinction between the two types



1207. The original Cactus dahlia —D. Juarezii.
Reduced from the Gardeners' Chronicle, where it was first pictured

seems to have been the same as that between "self-colored" and "variegated" flowers in general Lately, for purposes of exhibition in prize competitions, the following arbitrary distinction has been adopted· A Show dahlia (Fig. 1210) is often of one color, but if the edges of the rays are darker than the ground-color, the variety may be exhibited in the Show section A Fancy dahlia (Fig. 1211) always has two or more colors, and if the rays are striped or if the edges are lighter than the ground-color, the variety must be exhibited in the Fancy section The two types reached full perfection certainly by 1840, and after that date the improvements were mostly in matters of secondary importance. Most of the longest-lived varieties belong to the Show and Fancy type. These types held full popularity until about 1879, when the first Cactus dahlia appeared in England with a promise of new and freer forms This form is the one which is perhaps farthest removed from nature, and it is probably so highly esteemed largely because the most work has been spent on it.



1208. Dahlia coccinea.
Redrawn from the Botanical Magazine for 1804

A reaction against formalism in all departments of life and thought set in about the time of the American Civil War It was in the sixties that the Japanese chrysanthemums did much to emancipate the floral world. With dahlias the reaction came much later and has proceeded more slowly. The first Cactus dahlia was so called because of its resemblance in form, but chiefly in color, to the brilliant crimson-flowered *Cereus speciosissimus*, a well-known garden plant (which is known in the present work as *Heliocerus speciosus*). The name is now highly inappropriate because the color range of the pure Cactus type has been extended to include all of the important well-defined colors of which the dahlia seems capable The original Cactus dahlia was named *Dahlia Juarezii*, after President Juarez, the "Washington of Mexico." It was pictured for the first time in the Gardeners' Chronicle for 1879, and this interesting picture is here reproduced in a reduced size in Fig 1207. The type is still cultivated under the same name and in all essentials seems to be unchanged. Forms of the Cactus dahlia are shown in Figs 1212, 1213

The origin of the Cactus type, as of all the other types of dahlias, is uncertain, and our efforts to secure full and definite information upon some of the most interesting points may perhaps always be baffled.

A Dutch dealer secured a root from Mexico that produced one plant which is the parent of all the Cactus forms. It is not known whether the seed which may have produced the original root came from a wild or a cultivated flower It has been said that seedlings of *D. Juarezii* have produced in cultivation forms approaching the Show type of *D rosea* The reverse process is also said to have taken place, but full, authoritative and convincing statements are wanting In the garden, *D. Juarezii* is exceedingly distinct from the florists' forms of *D. rosea* It is usually a slenderer, taller and longer-jointed plant, with much handsomer and more delicate foliage, the leaves being narrower than in the coarse and almost ugly foliage of the old forms It has another peculiarity of growth, which is still one of the most serious defects in the true Cactus type: the plants tend to hide some of the flowers beneath their foliage. This comes about in a curious way At a node between two young leaves there commonly appear, at about the same time three new growths; the middle one develops into a flower with a naked stalk only 2 or 3 inches long, while the side shoots quickly overtop it and repeat the same threefold arrangement The other most serious objection to the true Cactus type is that it does not stand shipment well and does not last so long as a cut-flower as the Show dahlias

The Decorative or Cactus Hybrid types are numerous, and their popularity is more modern They have been largely seedlings from show flowers Their rays are rarely, if ever, received at the margins All the other types of dahlias are well defined, and a single picture of each one will represent its type with sufficient exactness No one picture, however, can give any conception of the great variety of forms included in this more or less open horticultural section The name Cactus Hybrid means practically "miscellaneous," and is analogous to the "Japanese" section of chrysanthemums It is on this section and the pure Cactus type that the greatest hopes for the future of the dahlia are based

Dahlias considered to be of true Decorative type are those possessing broad flat and nearly straight petals, arranged somewhat irregularly, but the flowers are not spherical in shape like the Show dahlia, but are inclined to be flat and massive, and are always full to the center Dahlias of this character score a greater number of points at exhibitions

The Colossal dahlia is the basis of much discussion, especially at exhibitions, the cause of debate being that these dahlias are in reality not classified, that is, the same variety is exhibited in one display as a Show dahlia, and in the next as a Decorative dahlia, but in reality there should be a Colossal class for this type of dahlia. This type, if it may be so called, has large cupped but not quilled rays or petals, the flowers are 5 inches and over in diameter, and spherical in shape; they therefore partake of both types, but are sufficiently different to spoil the harmony, when exhibited in either the Show or Decorative class "Le Colosse" is the first of this type of dahlia, and hybridization has given a large number of seedlings, which are almost identical in form, shape, and size, the most prominent being at present American Beauty, Giant Purple or Royal Purple, J. K Alexander, Surpasse Colosse, and Janne (Yellow) Colosse.

The Pompon type is a small form of the Show and Fancy types It has the same colors and the same form, but the flowers are smaller and more abundant. As a rule, the smaller the flowers the prettier and more individual they are. The larger they are, the more they suffer by comparison with the Show type. Perhaps their greatest point is their productiveness When profusion is the main idea, not great size and quality, the Pompons are the favorite type of dahlia for cut-flowers.

The Single dahlias may be freely produced, but they are not so lasting for cut-flowers. The Single type has had many ups and downs In the reaction against formalism, it came to the front about 1881, and for several years thereafter several hundred forms were kept distinct and they were made the chief feature of the European shows When the dahlia first came into cultivation, its rays were relatively long, slender, acuminate, notched at the end, and with such wide spaces between the tips of the rays as to give the flower a stellate appearance. In the course of the evolution of the single type, the gardeners retained the most regular and symmetrical forms. Single dahlias with always and only eight rays were preserved. The rays of dahlias became broader and rounder, as in Fig 1214, until finally in pedigree varieties the vacant spaces were closed up The same mental ideals have produced the rose-petaled geraniums and the shouldered tulips In a high-bred single dahlia there are no minute teeth or notches at the tips of the rays



1209. Dahlia Merckii.
Redrawn from the Botanical Magazine, for 1841

Most of the single dahlias of high pedigree have rays of uniform coloration with no secondary color at the base, but a few have a distinct ring of color at the base, often called an "eye or crown," which is sometimes yellow and rarely red or some other color Usually the rays of a single dahlia are spread out horizontally, sometimes they bend back, and rarely they bend inwards and form a cup-shaped flower These three forms can doubtless be separated and fixed during those periods when the interest in the Single type warrants it. Semi-double forms are frequent (Fig. 1215)

Single dahlias are likely to lose some of their rays after a day or two in a vase In cutting them it is well to choose the younger flowers A vigorous shake often makes the older ones drop their rays. It is an easy matter to keep the seeds from forming, simply by removing the flowers as they mature, and by so doing save the strength of the plant for the production of flowers

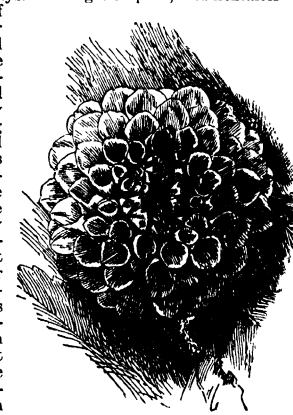
There are three other dahlia types of minor importance,—the Single Cactus, the Pompon Cactus and Tom Thumb The Single Cactus type differs from the common Single type in having rays with recurved margins, which give a free and spirited appearance to the flowers. Instead of spreading out horizontally, the rays often curve inward, forming a cup-shaped flower This type originated with E. J. Lowe, Chepstow, England, was developed by Dobbie & Co. about 1891, and was first disseminated in 1894. The Single Cactus dahlias are very interesting and pretty. The Tom Thumb type is a miniature race of round-rayed single dahlias, which grow from 12 to 18 inches high, and are used for bedding. The type originated in England with T. W. Girdlestone, and was developed and introduced by Cheal & Sons.

The "green" dahlia (*Dahlia viridiflora*, Hort) is an interesting abnormal form in which the rays are partially or wholly suppressed, and the chief feature of interest is a confused mass of green, not resembling petals at all, but evidently a multiplication of the outer involucral scales, which, in the dahlia, are green, leafy bracts. The "green" dahlia is not unhealthy; it is as strong and vigorous as any of the other forms, but very unstable and variable, producing flowers of solid green color, others of green with small cup-shaped crimson-scarlet petals intermingled, and others of solid crimson-scarlet color, and all on the same plant This freak was pictured as long ago as 1845 in G C , p. 626; and again in G C III 30. 294

Another interesting variation which hardly ranks in present importance with the eleven types contrasted below is the laciniated form, which makes a very pretty though rather formal effect Examples are Germania Nova, Mrs A W. Tait and its yellow variety among large double forms, and White Aster among the Pompons In these cases, the notches at the tips of the rays, instead of being minute and inconspicuous, are deepened so much that they give the laciniated effect At present this form is available in a very narrow range of colors It is not probable that it will be an important factor in producing chrysanthemum-like forms

Another form which baffles description, but is nevertheless very distinct, is that of Grand Duke Alexis It is nearer the Show type than any other, but is perhaps best classed with the Cactus Hybrid section, simply because it seems advisable to keep the Show type the most sharply defined of all It is a very flat flower, and the rays are remarkably folded, leaving a round hole at the top of each one. Up to 1909 the variety of colors of the type of Grand Duke Alexis has been increased, including the varieties Dreer White, Mrs Roosevelt, Purple Duke, Pythias, W. W. Rawson, and Yellow Duke

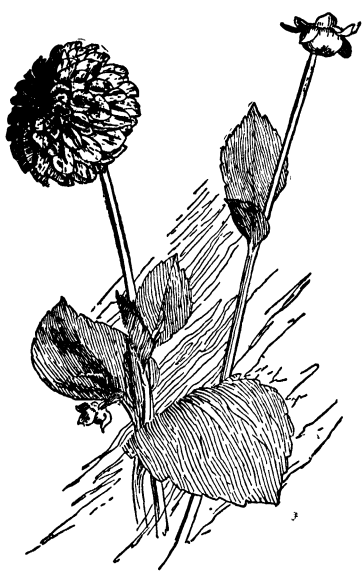
About midway between Grand Duke Alexis and the Show or cupped type is an interesting form, the "quilled" dahlia, a name which is perhaps necessary, though unfortunate In A. D Livoni the rays are rather tightly folded for about two-thirds of their length, leaving a round hole at the tip as in Grand Duke Alexis, but giving a peculiar whorled effect, which plainly shows the spiral arrangement of the successive tiers of rays. Among Pompons, Blumenfalter is an example of this rosette-like or quilled form, and many colors are procurable However, the word "quilled" usually suggests a long tube with a flared opening, whereas in the form described above the margins of the ray are merely rolled tightly together, but not grown together into a thin seamless tube Perhaps the most important variation that has not yet appeared in the dahlia is the wonderful elongation of the disk florets



1210. A Show dahlia.

into long, thin, variously colored tubes which have produced such charming effects in the China aster and have culminated in the marvelous grace of many chrysanthemums The dahlia may not be denied such possibilities, for in G C III 20 339 (1896) a new dahlia was described in which the quills are really tubes for two-thirds of their length.

The Collarette dahlia is a very novel and distinct type The flowers are single, with an additional row of short petals around the disk, which forms a frill or collar usually of a different color from the remainder of the flower. The same method obtained in the development of the Collarette dahlia as in the development of the Single dahlia Varieties having only eight rays or petals, with the additional collar, and presenting a symmetrical and concentrated impression, were preserved The collar consists principally of three or four smaller and more gracefully curved rays, produced at the disk, at the center of each of the eight larger rays or petals, and taking the same direction as the large rays, thus showing distinctly the golden yellow center, so pronounced in the Single dahlia The first Collarette dahlia was President Viger, and was originated at Parc de la Tete d'Or, or in the gardens of the City of Lyons, France, then under the supervision of Professor Gerard, who was succeeded by M Chabannes President Viger was first shown in 1900 at the Universal Exposition, and offered for sale in 1901 by Rivorie Pere & Fils of Lyon. In 1902 appeared the variety Joseph Goujon also obtained at the Parc de la Tete d'Or, Lyon, then in 1903 Rivorie offered Etendard de Lyon and Gallia, which figured with honor for that firm. During the next ten years, from 1903 until 1913, all the known varieties of the Collarette dahlia were developed by Rivorie Pere & Fils, and appeared in the following order 1903, Etendard de Lyon, and Gallia; 1904, Mme LePage Viger, La Fusee, Duchesse J Melsi D'Ehril-Barbo, Prince Galitzine, Comte Cheremeteff, and Maurice Rivoire; 1905, Exposition de Lyon Orphee, and Prince de Venosa;



1211. A Fancy dahlia of the Pompon type. (×½)

1906, Merveille de Lyon, Mme Georges Bernard, Comte Nodler, Deuil de Brazza, Princesse Olga Altieri, Corbeille de Feu, and Signorina Rosa Esengrini, 1907, Comtesse Dugon, Ami Cachat, and Volcan; 1908, Jupiter, Pluton, Pan, Etoile de Moudiere, and Mme. Chamrion; 1909, M. Mery de Montigny;



1212. A Cactus dahlia (×⅓)

1910, Abbe Hugonnard, Comte de Vezet, Mme. Pile, Souvenir de Bel-Accueil, and Vicomtesse des Mons; 1911, General de Sonis, and Deuil du Docteur Ogier, 1912, Cocarde Espagnole, Etincelant, and Stella, 1913, Geant de Lyon, Maroc, and Etoile de Monplaisir In 1912, J K Alexander, a dahlia specialist in East Bridgewater, Massachusetts, succeeded in developing the first Collarette dahlia of American origin, the variety Champion, this added the red and yellow coloring to the type Previous to 1912, three other foreign varieties, Directeur Rene Gerard, Mme. E. Poirier, and Souv de Chabanne, found their way to America, and were offered the following year in the leading seedsmen's catalogues The year 1913 gave a collection of nearly fifty distinct named varieties of the Collarette dahlia, including every known color in the dahlia world.

The Holland Peony-flowered dahlia is now the most popular dahlia, possessing an entirely original form, resembling the semi-double peonies; the flowers are broad, flat, somewhat irregular in form, and are produced with remarkable freedom on long stems. This type of dahlia has proved the most satisfactory for garden purposes, the plants being covered with flowers the entire season The origin of the Holland Peony-flowered dahlia, like all other types, is uncertain, and all efforts to secure full and definite information are unfruitful. Originally the Holland Peony-flowered dahlia was grown for some years in Germany in a mixture known as "Half-double Giant Dahlias" A Dutch grower, H. Hornsveld of Baarn, Holland, was

the first to note their possibilities, and selected from these "mixed dahlias" the best varieties, from which he propagated; then he drew the attention of the public to his new varieties, which he named and offered for sale. Other growers in Holland followed his example with great success. The Holland Peony-flowered dahlia was imported to America in 1908, and simultaneously appeared in the catalogues of the leading growers and seedmen. The number increased rapidly, and in 1910 appeared new varieties of American origin, notably the new varieties originated by the W. W. Rawson Co., of Boston, Massachusetts. The most prominent varieties are the following Andrew Carnegie (1908), Bertha Von Suttner (1908), Caesar (1911), Cecilia (1911), Dr K W. van Gorkum (1906), Dr. Peary (1911), Duke Henry (1906), Geisha (1908), Germania (1906), Glory of Baarn (1906), Glory of Groenekan (1907), H Hornsveld (1907), Hugo de Vries (1907), H J Lovink (1911), Kaiserin Augusta Victoria (1907), King Edward (1909), King Leopold (1906), La Rainte (1907), Mannheim (1908), Merveille (1907), Miss Gladys Dawson (1908), Paul Kruger (1906), P. W. Jansen (1907), Queen Alexandra (1909), Queen Emma (1906), Queen Wilhelmina (1906), Snow Queen (1907), and Sherlock Holmes (1912)



1213. Single cactus dahlia. (×⅓)

The fragrant dahlia is the pride of the true Peony-flowered type, possessing a pleasing and agreeable odor, so long desired The fragrant dahlia was first detected by J Herbert Alexander, in the year 1912, on the trial-grounds of J K Alexander of East Bridgewater, Massachusetts, hybridization and propagation was begun immediately with the new variety, and in 1913 a collection of five fragrant dahlias appeared in Alexander's catalogue

The main types of dahlias may perhaps be distinguished more clearly by the following scheme:

A. *Plants very dwarf*

1 THE TOM THUMB TYPES.

AA. *Plants not very dwarf*

B *Fls single*

C. *Rays flat, not recurved at the margins*

2. THE SINGLE TYPE Fig 1214

CC. *Rays with recurved margins*

3. THE SINGLE CACTUS TYPE Fig 1213

BB *Fls double*

C. *Size of fls small, 1–2 in, across.*

D. *Rays cupped*

4. THE POMPON TYPE Fig. 1211. Also called "Bouquet" and "Lilliputian"

DD. *Rays flat.*

5. THE POMPON CACTUS TYPE.

CC. *Size of fls. large, 3–5 in. across, averaging 4 in*

D *Rays cupped.*

E. *Colors single, or the edges darker than the ground-color.*

6. THE SHOW TYPE. Fig 1210

EE. *Colors 2 or more, striped, or with edges lighter than the ground-color.*

7. THE FANCY TYPE.

DD. *Rays not cupped, but long and flat, or with recurved margins.*

8. THE CACTUS TYPE. Figs 1207, 1212.

DDD. *Rays various in form.*

9. THE DECORATIVE TYPE

10. THE COLLARETTE TYPE.

11. THE PEONY-FLOWERED TYPE; including the fragrant dahlia Fig. 1215.

Useful dahlias for various purposes, as they exist in North America in 1913.

Cactus dahlias, for cut-flower purposes—Alexander, Alight, Alfred Vasey, Clara G Stedwick, Countess of Lonsdale, Dainty, Effective, Eureka, Floradora, Forbes Robertson, Flame, Glory of Wilts, Golden Gem, Gazelle, Gabriel, Gen Buller, Helene, Henri Cayeux Hereward, Iverna, Jeannette, J H Jackson, J Weir Fife, Killarney, Lightship Lady Fair, Lady Colin Campbell, Lord of the Manor, Mary Service, Mrs DeLuca, Mrs H L Brouson, Mrs Winchester, Mrs Mortimer, Mrs Geo Caselton, Mme Henri Cayeux, Mrs MacMullan, Reine Cayeux, Rosa Starr, Reliable, Stella, Sirus, Sandy, Thomas Wilson, and Yonne Cayeux

Cactus dahlias for exhibition purposes—Amazon, Cincher, Diavolo, Master Carl, Mercury, Mrs S T Wright, Rev Dr Baker, Rev T W Jameson, Royal Scarlet, Schneewitchen, Snowstorm, T G Baker, Wellington, Whirlwind, White Swan, Wm Marshall, W B Childs

Decorative dahlias for cut-flower purposes—Delice, Himmlische, Jack Rose, Jeanne Charmet, John R Baldwin, Minos, Maid of Kent, Mme A Lumere, Mme Victor Vassier, Mme Van den Dael, Perle de la Tete D'or, Reggie, Souv de Gustave Douzon, Wilhelm Miller

Decorative dahlias for exhibition purposes—American Beauty, A F Johnson, Blue Oban, Gigantea, Grand Duke Alexis, Gettysburg, Le Grand Manito, Le Mont Blanc, Les Allees, Mme Helene Charvet, Mme Augusta Lumere, Mademoiselle Guly Miquel, Madame Devinat, Mme Marzi, Morocco, Peerless, Perle de Ocean, Papa Charmet, Ville de Lyon, Yellow Colosse

Peony-flowered dahlias for cut-flower purposes—Admiration, Bertha Von Suttner, Goddess of Fame, Geisha, Marie Studholme, Mrs A Platt, Mrs Jacques Futrelle, Queen Wilhelmina, and Sunrise

Peony-flowered dahlias for exhibition purposes—Hampton Court, King Leopold, Priscilla, Snow Queen, Solfatara, Duke Henry, and Hollandia

Collarette dahlias for massing—Exposition de Lyon, Maurice Rivoire, and President Viger

Show dahlias for exhibition purposes—Acquisition, Alice Emily, Acme of Perfection, Brown Bess, Dreer's White, Dr Keynes, David Johnson, Emperor, Ivanhoe, Harrison Weir, Mrs Susan Wilson, Mme Heine Furtado, Mme Marika Anagnostaki, Mme Alfred Mireau, Merlin, Muriel, Norma, Nugget, Queen of Autumn, Rosebud, Stradella, Standard, W P Laird, and Wm Dodds.

Among the Show dahlias that are the best for flowering are A D. Livoni, Arabella, Ansonia, Dr J P Kirkland or Cuban Giant, Dorothy Peacock, Imperial, Miss Fox, Perfection, Storm King, and White Queen

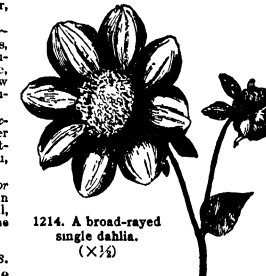
Show dahlia for bedding purposes—White Bedder.

Fancy dahlias of merit—Chorister, Chas Turner, Dazzler, Dorothy, Distinction, Duchess of Albany, English Dandy, Eric Fisher, Gloire de Gunsecard, Frank Smith, Frederick Smith, General Grant, Gold Medal, Goldsmith, Geo Barnes, Hercules, Les Amours de Madame, Lucy Faucett, Mme Lily Large, Polly Sandall, Rebecca, Rev. J B McCamm, S Mortimer, Sunset, and Wizard

Pompon dahlias for borders or hedges—Achilles, Crusoe, Darkness, Fascination, Mabel, Pure Love, Rosalie, Red Indian, Snow Clad, Vivid, and Winifred

Pompon dahlias for exhibition purposes—Amber Queen, Ideal, Harry, Little Mary, Rosebud, Shalu, and Spy

Pompon dahlias for flowering purposes—Klein Domtea, Darkest of All, Fairy Queen, Star of the East, and Spy.



1214. A broad-rayed single dahlia. (×⅓)

Societies and shows.—The dahlia is one of about a dozen

genera of plants whose horticultural value has been attested by permanently successful special societies. There are national dahlia societies in England and America. Dahlia shows are usually held the second or third week in September. On December 21, 1906, the New England Dahlia Society was chartered; this Society led to great advancement in the dahlia, holding an annual exhibition in Boston, and issuing monthly a paper known as the "Dahlia News." Great interest was fostered, and in 1913 its membership list included nearly every state in the Union, and six foreign countries. At the present date of writing the New England Dahlia Society is considering the adoption of a new charter, whereby it can become the National Society. Other societies devoted to the welfare of the dahlia have been recently formed, principally "The Dahlia Association of Seattle," "Tacoma Dahlia Society," "Inter-town Dahlia Association" in Connecticut.

Literature.—As in many other cases, the magazine literature of the dahlia is the most bulky, and, in some respects, more important than the books on the subject. C. Harman Payne published a bibliography in G.C. III. 21: 329 (1897). There had been about twenty-five books devoted to the dahlia, many of them pamphlets and cheap cultural manuals. These books were mostly published from 1828 to 1857, with none in North America for nearly forty years after that date until 1896, when Lawrence K. Peacock's book, "The Dahlia," appeared. The first American treatise was by E. Sayers, published at Boston, 1839. Many interesting facts came out in 1889, the centennial year of the dahlia. A report of the National Dahlia Conference is reprinted from the Journal of the Royal Horticultural Society for 1890, but Shirley Hibberd's statements therein regarding the botany of the dahlia agree very poorly with Hemsley's revision of the genus in G.C. II. 12: 437, 524, 557 (1879). In 1906 W. W. Wilmore published "The Dahlia," a handsomely illustrated American manual, valuable to both amateur and professional. The annual catalogues of the leading dahlia specialists furnish much valuable matter, and cultural hints, and are the most up-to-date issues in the dahlia line.

WILHELM MILLER.
J. K. ALEXANDER.

Cultivation of the dahlia.

The dahlia has no very special or particular requirements, and yet many growers fail of the best success because the few demands are not well met.

Propagation.

There are four methods by which dahlias are propagated: by cuttings (the commercial method), by division of roots (the amateur's method), by grafting to perpetuate rare kinds, and by seeds, to produce new varieties.

Cuttings.—Propagation by cuttings is employed mainly by commercial growers, and though the amateur may propagate plants successfully, the attention a few cuttings would probably require is so great that it would be cheaper to buy plants. The roots are planted closely in benches in the greenhouse early in January, and cuttings are made from the young shoots as fast as they form the third or fourth set of leaves. These cuttings are carefully trimmed and placed in pure sand in the propagating-bench, using a dibble and putting the cuttings in rows about 3 inches apart and ½–1 inch between the cuttings.

The propagating-bench is made by running a flue, hot-water or steam pipes beneath an ordinary bench, and boarding up the side to confine the heat. Although there may be a difference of opinion among propagators, yet a bottom of sand heat of 65°, with the temperature of the house from 5° to 10° less, will give the best practical results. With this temperature, the cuttings will root in about two weeks, and will be far stronger than if rooted in less time with greater heat. As soon as cuttings are rooted, they are potted off into small pots and grown in a cool greenhouse until danger of frost is over, when they are planted out in the open ground. Cuttings made too far below a joint, or too late in summer, will produce flowering plants but no tubers.

Division of roots.—This is the easiest and most satisfactory way for amateurs. As the eyes are not on the tubers, but on the crown to which the tubers are attached, care must be taken that each division has at least one eye, otherwise the roots will never grow. It is, therefore, best to start the eyes by placing the roots in a warm, moist place a short time before dividing. The roots are sometimes placed in a hotbed, and shoots grown to considerable size, then set out as plants, but this plan has many drawbacks, and is not advised.

Grafting.—A very interesting, though not profitable mode of propagation is by means of grafting. The top of the tuber is cut slantingly upward, and the cutting slantingly downward, placed together and tied with raffia or any soft, handy material. They are then planted in a pot deep enough to cover the lower part of the graft with earth, and they will soon adhere if placed under a hand-glass or in a frame. Grafting is practised only for the preservation of rare and weak-growing sorts.

Seeds.—The chief use of seeds is the production of new varieties. Seeds are also used by those who chiefly desire a mass of color, and are not particularly desirous of finely formed blooms. If planted early enough indoors and transplanted to the open as soon as safe, fine masses of color can be secured before frost, and the roots of the more desirable kinds can be saved, and will give even better results the next season.

Field or garden requirements.

Dahlias are easily destroyed by high winds unless they are given a protected position, and they need plenty of air and sunlight for best results. In shaded, close, airless quarters the growth is sappy, and the flowers are poorly colored.

The soil is not so important, except in its ability to hold moisture during severe droughts. Any rich soil that will grow corn will also grow dahlias to perfection, if all other conditions are favorable. They will grow equally well in clear sand, clay or gravel, if the proper kinds and quantities of plant-food are added and well and thoroughly worked in. It is, however, unreasonable to expect dahlias or any garden plants to succeed in a hard clay, devoid of humus, easily baked and never tilled.

Feeding.—It is always best to broadcast the manure and plow or spade it into the soil, thorough spading is absolutely necessary if the manure is not well decomposed. On heavy clay or gravelly soils, loose coarse manure may be used, but on light or sandy soils, manure should always be fine and well rotted. Commercial fertilizers are also largely used, and are most valuable when used in connection with manure. Any good fertilizer, rich in ammonia and phosphoric acid, with a liberal amount of potash, will answer at the time of planting, but as a top-dressing later, nothing equals pure bone-meal and nitrate of soda, four parts bone-meal to one part soda.

Kinds of stock.—Dahlias are offered in five forms: large clumps, ordinary field-roots, pot-roots, green plants and seeds. The clumps give the best satisfaction the first year, but are entirely too large and unwieldy for anything but a local trade and exchange among amateurs. The ordinary field-roots are the most valuable, as they can be handled easily and safely, and always give satisfactory results. Pot-roots are largely used in the mailing trade, and, while they will not give as good results the first year, are valuable for shipping

long distances where larger roots could not be profitably used, owing to heavy transportation charges. Green plants are mainly used to make up any deficiency in the field-crops, owing to unfavorable seasons, or an unusual demand for certain varieties

Planting —There is diversity of opinion as to the proper time to plant dahlias, but the writer has always found it best to plant early, and would advise planting large strong roots about two weeks before danger of frost is over This would be, in the vicinity of Philadelphia, about April 15, and as it requires from two to three weeks for the plants to get up through the ground, there will be no danger, while the plants will bloom that much earlier It is best, however, not to plant small roots or green plants until danger of frost is over—in the vicinity of Philadelphia, about May 1 to 10, according to the season. A good rule to follow everywhere would be to plant small roots and green plants as soon as danger of frost is past, and large roots about three weeks earlier



1215. A semi-double form of dahlia.

Tillage —The first requisite of successful garden cultivation is thoroughly to stir the soil to considerable depth and enrich it, if it is not already rich, by broad-casting and plowing or spading in a good coat of well-rotted manure. Too much stress cannot be placed upon the thorough preparation of the land, as it not only allows the roots to go down deep after the moisture more readily during dry weather, but affords good drainage during excessive rains Having prepared the land as above, mark out rows 4 feet apart and 6 to 8 inches deep, and plant the roots from 18 inches to 3 feet apart in the row, according as solid rows or specimen plants are desired

In its early stage of development, the dahlia grows very rapidly, and should be kept thoroughly tilled But while deep tillage is beneficial during its early stages of development, it is almost fatal to the production of flowers if practised after the plants come into bloom Therefore, when the plants begin to bloom, cease deep tillage, and stir the soil to the depth of 1 to 3 inches only, but stir it often, and never allow the surface to become hard and baked This will not only prevent excessive evaporation of moisture and keep the under soil cool and moist, but will also prevent the destruction of immense quantities of feeding-roots

As long as the roots supply more nourishment than is needed to support the plant, both the plant and the flowers increase in size and beauty, but as the supply gradually becomes exhausted, the plants cease growing and the flowers become much smaller This condition is what is generally called "bloomed out," but what is really "starved out," and can easily be prevented if the proper attention is given to the plants As soon as the flowers begin to grow smaller, broadcast around each plant a small handful of pure bone-meal, and nitrate of soda, in proportion of four parts bone to one part soda, and carefully work it into the soil

Watering —This is a debatable subject, and, although a judicious application of water during a severe dry spell is very beneficial, yet in nine cases out of every ten in which water is applied, a thorough stirring of the surface soil would give better results

Many persons think Dahlias should be watered every evening, and as soon as they are up begin watering them daily unless it rains This practice is very injurious, as it causes a rapid but soft growth, and as the soil is seldom stirred, the roots become so enfeebled that they are unable to supply the needs of the plant, as a consequence, but few buds are formed, and they generally blast before developing into flowers In other cases, as the enthusiasm wears off, watering is stopped, probably right at the beginning of a severe drought, and the weak, pampered plants are fortunate to survive, much less bloom

If large, strong roots are planted and the soil is kept thoroughly stirred, there will be little need of artificial watering until after the plants come out in full bloom However, if it should become hot and dry after the dahlias come into bloom, it would be very beneficial to give them a thorough watering once each week or ten days during the continuance of the drought But care should be taken to stir the soil to the depth of 1 to 2 inches the next day, carefully pulverizing it later in order to break the natural capillarity by which the moisture is evaporated

The best rule to follow is not to allow the plants to suffer for want of moisture, not to water them except when they need it, but to water them thoroughly when necessary, and not to allow excessive evaporation for want of frequent stirring of the soil.

Training —In planting the roots or tubers, place them on their sides with the eye as near the bottom as possible, and cover only 2 to 3 inches deep. As soon as the shoots appear, remove all but the strongest one, and pinch out the center of that one as soon as two or three pairs of leaves have formed, thus forcing it to branch below the level of the ground As the plants develop, the soil is filled in gradually by subsequent hoeings By this method the entire strength of the root and the soil is concentrated on the one shoot, causing it to grow vigorously, while the pinching back not only causes it to branch below the surface of the soil, and thus brace it against all storms, but also removes all of those imperfect, short-stemmed flowers that appear on some varieties If the plants are pinched back low, as described, there is no danger of the branches splitting down, as the soil around them will hold them securely in place However, when they branch above ground and are inclined to split down, drive a short stout stake near the stem and tie the branches to it These short stakes are not to hold the plants up, but to prevent the branches splitting down when the above directions have not been followed closely

By this method it is possible to grow dahlia blooms on stems from 18 inches to 2 feet long It has always been thought necessary to tie dahlias to stakes to prevent them from being blown down by heavy winds. The system of staking is not only unsightly during the early stage of their growth, but is attended with considerable labor and expense Staking, however, is unnecessary, if the directions already given are followed, as the plants will branch out below the surface of the ground, and the stems will become so heavy as to resist the strongest winds The plants are one-third dwarfer, compact and regular in form, and produce much finer flowers on long stems well supplied with buds and foliage.

Storing the roots —As soon as the plants are killed by frost, lift the roots, and, after removing all the soil possible from them, allow them to dry in the air for a few hours, when they should be stored in the cellar or

some other cool place secure from frost. If the cellar is very dry or is not frostproof, put the roots in a barrel or box and cover completely with dry sand or some other suitable and convenient material, such as sawdust or tanbark, to prevent freezing or loss of vitality by drying or shriveling. LAWRENCE K. PEACOCK.

DAHOON HOLLY: *Ilex Dahoon.*

DÀIS (Greek, *pine torch;* application not obvious) *Thymelæàceæ.* Contains a woody plant that yields a strong fiber, and is also rarely cultivated for ornament, especially in Florida and southern California, and possibly in a few northern conservatories

Tender deciduous shrubs lvs opposite, often crowded at the ends of branches fls in terminal heads, perianth-tube cylindrical, often curved, stamens 10, in a double series, the alternate ones shorter, upper or all exserted, style exserted The plants are prop with difficulty by cuttings of half-ripened wood. The single cult. species has lvs resembling the smoke tree, or Cotinus, and bears long-stalked umbel-like heads of starry pink fls, with floral parts in 5's The genus has 2 species, 1 from S Afr and 1 from Madagascar

cotinifòlia, Linn Lvs opposite and alternate, oblong or obovate, acute at both ends involucre a half shorter than the fls : head about 15-fld ; fls ½in across, fragrant S Afr. B M 147 G W 8, p 313 —Said to bloom profusely at Santa Barbara but not to produce seed. L. H. B

DAISY (i. e., *day's eye,* in allusion to the sun-like form of the flower). A name applied to the flowers of many Compositæ, but it properly belongs to the *Bellis perennis* of Europe, a low early-flowering plant, which, in its double forms (Fig 535, Vol I), is widely known as a garden subject (see *Bellis*) The American congener is *B integrifolia,* Michx , an annual or biennial, very like the Old World species, ranging southwestward from Kentucky; it is not domesticated In North America, the word daisy is applied to many field composites, particularly to those of comparatively low growth and large flower-heads Unqualified, the word is commonly understood to mean *Chrysanthemum Leucanthemum* (Fig 937), an Old World plant that has become an abundant field weed in the eastern part of the country This plant is also frequently known as the ox-eye daisy, although in parts of New England it is called whiteweed, and the term ox-eye is applied to *Rudbeckia hirta,* which has a yellow-rayed head. Kin to the *Chrysanthemum Leucanthemum* are the Paris daisies, or marguerites, of the conservatories (see *Chrysanthemum*) The wild asters (Fig 1216) are called daisies, especially Michælmas daisies, in many parts of the country, particularly west of New York Spring-flowering erigerons also are called daisies The Swan River daisy is *Brachycome iberidifolia* (Figs 621, 622, Vol I) The African daisy of gardens is Dimorphotheca. L. H. B.



1216. Wild aster, or Michaelmas daisy. (×½)

DALBÉRGIA (N. Dalberg, a Swedish botanist, 1730 to 1820). *Leguminòsæ* Nearly 100 species of trees, shrubs, or climbers, belonging to tropical regions all over the world, a few of which have been introduced to North America, one for timber.

Leaves alternate, odd-pinnate (rarely 1-foliolate) without stipules: fls small, numerous, purple, violet or white, in forking cymes or irregular cyme-like panicles, which are axillary or terminal, papilionaceous, with ovate or orbicular standard. fr an indehiscent narrow pod, 1-seeded at middle and with few seeds toward the ends, the seeds compressed and reniform.

Sissoo, Roxbg A good-sized tree, 80 ft. high in India. lvs pinnate. lfts 5, alternate, stalked, obovate, abruptly acuminate, pubescent beneath: fls white, in short, axillary panicles —In India considered one of the best timbers, whenever elasticity and durability are required Intro at Santa Barbara, where it is hardy but growth said to be very slow. The Sissoo tree is worth trial in nearly frostless districts, especially along sandy river banks. It improves sterile lands. Experiments in Egypt have shown its most remarkable property of standing severe droughts, as well as submersion for a long period. The wood is very elastic, seasons well, does not warp or split, is easily worked, and takes a fine polish It is also a durable wood for boats The tree is raised easily from seeds or cuttings, and is of quick growth. Other species of Dalbergia are of economic value and have been sparingly planted

DÀLEA (Samuel Dale, 1659–1739, English botanist and author on pharmacology). Syn *Parosèla Leguminòsæ* More than 100 herbs and small shrubs bearing purple, blue, white or even yellow fls in terminal or lateral spikes or heads, odd-pinnate lvs , and usually glandular-dotted, a very few of which have been cult ; probably none is now in the American trade. Fls papilionaceous, the standard mostly cordate or eared and clawed and attached in the bottom of the calyx, the wings and keel attached or adnate to the stamen-tube and usually exceeding the standard, stamens 10 or 9, monadelphous fr a small usually 1-seeded mostly indehiscent pod inclosed in the calyx The species occur from the N U S to Chile and the Galapagos Isls They grow in the U S , mostly on prairies and in dry soil; some of these species might make acceptable border plants Those that have received most attention are tropical species, as *D mutábilis,* Willd , of Mex , with fls white changing to violet, (B M 2486) and *D Mutisii,* Kunth (properly *Psoràlea Mutisii,* HBK), of the northern Andes, with deep blue fls in cylindrical heads, these are to be regarded as greenhouse perennials. L H B

DALECHÁMPIA (from J Dalechamps, French savant of sixteenth century) *Euphorbiàceæ* Climbing or rarely erect tropical shrubs; one rarely cultivated in warmhouses for its ornamental bracts

Leaves alternate, simple, stipules large: fls small, monœcious, apetalous, in dense clusters, with 2 conspicuous, colored involucral bracts; calyx valvate, styles united, ovules 1 in each of the 3–4 cells —About 60 species scattered through the tropics Plukenetia, a related genus, is without the large involucre

Dalechampia Roezliana was described by Hooker in 1867 as one of the noblest plants introduced for many years, comparable with the bougainvilleas and surpassing them in size of bracts and brilliancy of color It is not so fine a florists' plant as the poinsettia, but is worth trial in the finer conservatories It requires well-drained sandy, peat soil, and is propagated by cuttings

Roezliàna, Muell Arg (var *ròsea,* Authors) Erect shrub, 3–4 ft high, much branched, leafy· lvs 6 in. long, sessile, obovate-oblanceolate, acuminate, entire, or with coarse, obtuse teeth above the middle, narrowed to a small cordate base. bracts 2–2½ in long, broadly cordate, nearly sessile, toothed, membranaceous, distinctly nerved, rose-red, other smaller bracts among the small yellow fls ; stamens united Mex B M 5640. H F. II 11 234, pl. 8 Gt 16:532 F W 1867, p. 318 F M. 7 373, 374. F S. 16·1701–2 G.C 1867:236, desc Var. **álba,** Hort., has white bracts

J. B. S NORTON.

DALIBÁRDA (after Thomas François Dalibard, French botanist). *Rosàceæ* A low-growing native hardy herbaceous perennial, with foliage resembling violet and flowers like those of a strawberry, sometimes grown in borders and rock-gardens

This monotypic genus has lately been referred to Rubus, but it differs in habit, in the carpels being usually well defined instead of indefinite and the achenes dry instead of drupaceous fls 1 or 2 on a scape-like peduncle, white, and also others that are



1217 Dalibarda repens (×½)

cleistogamous and apetalous on short curved peduncles, calyx 5–6-parted, 3 of the parts larger, petals 5, stamens many; ovaries 5–10

rèpens, Linn (*Rùbus Dalibárda,* Linn) Fig 1217 Tufted, creeping lvs heart-shaped, wavy-toothed fls white, 1 or 2 on each scape, calyx 5–6-parted, 3 of the divisions larger and toothed, petals 5, stamens numerous; pistils 5–10 Common in woods in New Brunswick, Ont. and south and west to N J, Pa, Ohio and Minn —It blooms June-Aug It is a slow-growing plant, thriving in a deep fibrous soil and sheltered position, little grown In Fig 1217, *a* shows the perfect flower; *b*, *c*, achenes of the cleistogamous fls

L H B

DAMASK ROSE: *Rosa Damascena*

DAMASK VIOLET: *Hesperis matronalis*

DAME'S ROCKET and DAME'S VIOLET: *Hesperis matronalis*

DAMMÁRA: *Agathis*

DAMNACÁNTHUS (Greek, referring to the powerful spines). *Rubiàceæ* A tender evergreen shrub, chiefly valued for its coral-red berries, which remain on the bush until the flowers of the next season are produced

Divaricately branched, strongly spiny woody plants lvs small, opposite, leathery, nearly sessile, broadly ovate, acuminate. fls small, axillary, in 1's or 2's, white, fragrant, calyx-tube obovoid, limb 4–5-cut, corolla funnel-shaped Prop by cuttings, sometimes grown in greenhouses and perhaps adaptable for planting in the southern parts

índicus, Gaertn. Described above, being the only species as understood by some authors, but others keep *D màjor,* Sieb & Zucc (which is sometimes nearly spineless), distinct, distinguishing it by the 2–3-times larger lvs and the larger fls, others combine the two as species and variety, as **D. índicus** var **màjor,** Makino. Gt. 17·570. The species occurs from E India to Japan, the var *major* being Japanese. The species is a low thick bush, densely dichotomously branched: lvs. ovate-acute, shining green above, light green beneath, in var *major* 1½ in long The shining lvs and showy berries commend the plant to cult. L H B.

DAMPING-OFF. A gardeners' phrase for a disastrous rotting of plants, especially of seedlings and cuttings, and commonly at the surface of the ground It is usually associated with excessive moisture in the soil and air, with high and close temperatures, and sometimes poor light. Such conditions weaken the plants and allow them to fall a prey to the minute parasitic fungi which live upon the decaying vegetable matter in the soil, and can remain alive for months, even if the soil is thoroughly dry or frozen A whole bench of cuttings may be ruined in a night The skilful propagator takes every possible precaution. His benches have perfect drainage, he uses fresh sharp sand, and sometimes sterilizes it with steam heat for several hours Damping-off is one of the most trying experiences of the beginner, and nothing can prevent it but a thorough grasp of the principles of greenhouse management in general, and watering in particular (Consult articles on these subjects) As soon as the disease is noticed, the healthy plants should be removed to fresh soil, as the disease spreads rapidly If the disease appears in the entire bed, the organisms causing the trouble almost certainly are distributed generally in the sand, and sterilization either with formaldehyde solution (10 per cent strength diluted one part to fifty parts water) or with steam should be employed in all future work If only a spot here and there shows the trouble, saturate the affected area at once with formaldehyde solution, as above, or with copper-sulfate solution (one part by weight to one hundred parts of water) One of the commonest occasions of damping-off is the sudden flooding of a bed or bench after leaving it too dry for a long time

The terms damping-off and burning are also used for ruined flowers Burning is often caused by sunlight or by imperfections in glass, but a flower spoiled by dripping cold water, or by some unknown cause, is said to have a burned look D. REDDICK †

DAMSON *Plum*

DÀNAË (name of a daughter of King Acrisius of Argos) *Liliàceæ* ALEXANDRIAN LAUREL An evergreen erect much-branched shrub with thick unarmed alternate cladophylla and terminal racemes of small whitish fls, often referred to *Ruscus* It is one of the Asparagus tribe of the lily family fls nearly globular, the lobes short and erect, with a crown at the throat, stamens affixed in the tube beneath the crown, the filaments united, the anthers 6 fr a pulpy indehiscent red berry **D. racemòsa,** Moench (*Rúscus racemòsus,* Linn *D Laùrus,* Medikus), occurs from Greece to Persia, making a bush 4 ft high, with ovate-lanceolate, nearly sessile, about 5–7-nerved leaf-like cladodes Recently intro in S Calif, but is little known in this country Ornamental for porches, vases, and similar uses L H. B.

DANÆA (a personal name). *Marattiàceæ.* A small genus of tropical American fern-like plants, with synangia sessile, arranged in rows, and covering the entire under surface of the leaf. They are apparently not in cultivation in America

DANDELION (i e, *dent de lion,* French for *lion's tooth;* referring to the teeth on the lvs.) The vernacular of *Taráxacum officinàle,* Weber, a stemless perennial or biennial plant of the *Compósitæ,* a common weed, much collected in spring for "greens" and in improved forms sometimes grown for that purpose.

Dandelion is native to Europe and Asia, but is naturalized in all temperate countries. On the Rocky Mountains and in the high North are forms that are apparently indigenous. A floret from the head of a dandelion is shown in Fig 1218. The ovary is at *e;* pappus (answering to calyx) at *a,* ray of corolla at *c;* ring of anthers at *b,* styles at *d.* The constricted part

at *e* elongates in fruit, raising the pappus on a long stalk, as shown in Fig. 1219, and thus is the balloon of the dandelion formed. A dandelion plant, with its scattering fruits, is shown in Fig 1220 Another species of dandelion is also naturalized in this country, but is not so common; it is the red-seeded dandelion (*T. erythrospérmum*, Andrz.), with red fruits, not reflexed involucral scales, and shorter beak.



1218 Floret of Dandelion.

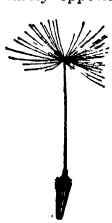
The dandelion is much prized for "greens." For this purpose it is cultivated in parts of Europe, also about Boston and in some other localities in this country There are several improved large-leaved varieties, mostly of French origin Some of these named forms have beautiful curled leaves Seeds are sown in the spring, and the crop is gathered the same fall or the following spring,—usually in the spring in this country. Commonly the seeds are sown where the plants are to stand, although the plantlets may be transplanted. The plants should stand about 1 foot apart each way, and a good crop will cover the land completely when a year old. Sandy or light loamy soil is preferred. The crop is harvested and marketed like spinach The leaves or heads are often blanched by tying them up, covering with sand or a flower-pot The plants are sometimes grown more closely in beds, and frames are put over them to force them Roots are sometimes removed from the field to the hotbed or house for forcing. When treated like chicory (which see), the roots will produce a winter salad very like *barbe de capucin*. Roots of dandelion dug in fall and dried are sold for medicinal purposes in drug-stores under the name of Taraxacum.

L. H. B.

DANGLEBERRY: *Gaylussacia frondosa.*

DÁPHNE (Greek name of *Laurus nobilis*). *Thymelæàceæ*. Ornamental woody plants, chiefly grown for their handsome foliage and sweet-scented, white, purple, lilac or rarely greenish flowers, which, with some species, in warmer climates, often appear in the winter

Low deciduous or evergreen shrubs: lvs. alternate, rarely opposite, entire, short-petioled fls in clusters, short racemes or umbels, apetalous, mostly fragrant; calyx-tube cylindric or campanulate, 4-lobed, corolla-like, usually clothed with silky hairs outside, stamens 8, in two rows, included; stigma capitate, sessile or nearly so: fr. a fleshy or leathery 1-seeded drupe. —About 50 species in Eu. and Asia. For a monograph of the section *Daphnanthes* see Keissler in Engler Bot. Jahrb 25.29–124 (1898); see also Nitsche, Beitrage zur Kenntnis der Gattung Daphne (1907).


1219 Mature fruit of dandelion.

Only *D Mezereum*, with very early lilac fragrant flowers and decorative scarlet fruit, and some low evergreen species, like *D Cneorum* and *D. Blagayana*, are hardy North, while most of the evergreen species can be recommended only for warmer climates. *D. Genkwa* with lilac flowers appearing before the leaves, and *D. pontica* and *D Laureola*, with large evergreen leaves, are hardy as far north as New York. *D. odora* is fairly hardy in Washington, D. C

In California, according to Franceschi, the species most commonly grown is *D. odora*, the plants being mostly imported from Japan Many plants are also sent from Japan for eastern greenhouse culture A decoction of the bark of *D Mezereum* is sold in drug-stores under the name of mezereum. It is stimulant and diuretic. It is also known as olive spurge

Daphnes thrive best in a well-drained light soil and in a partly shaded position, but some, as *D. Cneorum* and *D Blagayana*, which are exceedingly pretty plants for rockeries, do better in sunny situations In the North, *D. odora* and its varieties are often grown in pots for their sweet-scented and handsome flowers appearing during the winter A sandy compost of peat and loam in equal proportions will suit them, they require a good drainage and careful watering during the winter, and pots not larger than just necessary should be given; they may also be planted out in a cool greenhouse and trained as a wall plant. *D. Genkwa*, with abundant lilac flowers before the leaves, is sometimes forced


1220. The Dandelion. (×⅔)

Propagation is by seeds, sown after maturity or stratified, but germinating very slowly, also by layers put down in spring and taken off the following year The evergreen species may be increased by cuttings of mature wood in fall under glass, and kept in a cool greenhouse during the winter. If gentle bottom heat can be given in early spring, it will be of advantage to the development of the roots; softwood cuttings taken from forced plants may also be used *D odora* is often veneer-grafted on seedling stock of *D Laureola* in winter, or on roots of *D Mezereum*, also other species are grafted on roots of *D. Mezereum* *D. Cneorum* and probably its allies are readily increased in spring by removing the earth around the plant, pegging down the branches and filling with fine compost almost to the tops of the branches. Next spring, if the compost is carefully removed, a large number of little buds, each supplied with a white root, are found along the branches; they are easily detached and planted in pans or boxes.

INDEX.

alba, 1, 10.
alba-plena, 1.
australis, 7.
autumnalis, 1.
Blagayana, 5.
burifolia, 6
Cneorum, 4.
collina, 7
Dauphinii, 9
Delahayana, 7.
Delphinii, 9
Fioniana, 6
Fortunei, 3
Genkwa, 3
grandiflora, 1.
Houtteana, 2.
hybrida, 9.
indica, 10.
japonica, 11.
Jenkwa, 3
Laureola, 13.
major, 4
marginata, 10.
maximus, 4
Mazelii, 11
Mezereum, 1, 2
neapolitana, 7
odora, 10
odorata, 10.
olefolia, 8.
oleoides, 6.
Philippii, 13.
plena, 1.
pontica, 14.
punctata, 10.
purpurea, 13.
retusa, 12
rubra, 10.
sericea, 7, 8.
sinensis, 10.
Verlotii, 4.

A. *Foliage deciduous· fls axillary along the branches of the previous year, appearing before the lvs.*

B *Lvs alternate, glabrous. (Mezereum.)*

1 **Mezèreum,** Linn Erect shrub, with stout branches, to 4 ft : lvs. alternate, cuneate, oblong or oblanceolate, glabrous, grayish beneath, 1–3 in. long: fls usually 3, sessile, silky outside, fragrant, lilac-purple, appearing long before the lvs · fr roundish ovoid, scarlet Feb–April. Eu to Altai and Caucasus Gn. 29 602, 33, p 514; 69, p 131 V 2.206 Var **álba,** Ait, has white fls and yellow fr Gn 29:602; 69, p 131, 74, p 255 G C. III. 21·183, 185, 38.153 R H 1905, p. 532 Var **plèna,** Schneid (var *álba-plèna*, Hort), has double white fls Gn 29 602 Var **grandiflòra,** Dipp (var *autumnàlis*, Hort) With larger brighter purple very early fls, sometimes blooming in fall.

2 **Houtteàna,** Planch. (*D Mezèreum* var *atropurpùrea*, Dipp) Shrub, to 4 ft, with erect, stout branches: lvs alternate, cuneate, oblong-lanceolate, glabrous, coriaceous and often persistent, purple. fls appearing before the lvs, lilac-violet, 2–4, in short-peduncled clusters April F S. 6 592.—Of garden origin, supposed to be a hybrid between *D. Laureola* and *D. Mezereum.*

BB *Lvs opposite, silky below. (Genkwa)*

3 **Génkwa,** Sieb & Zucc (*D. Jénkwa,* **Hort**). Shrub, to 3 ft, with slender branches: lvs opposite, oblong-elliptic, appressed-pubescent on the veins beneath, 1¼–2 in long fls lilac, 3–7, in short-stalked clusters, scentless, densely silky-villous outside March, April. Japan S Z 75 Gt 15 499 F S 3 208 G M. 35 292 Gn 42 91, 76, p 105 R B 10 73 Var. **Fórtunei,** Franch (*D Fórtunei*, Lindl), has larger fls and larger less regularly opposite lvs.

AA *Foliage evergreen, alternate (see also No. 2). (Daphnanthes)*

B. *Fls. in terminal heads, rarely axillary and pinkish.*

C *Habit low, procumbent or trailing*

4 **Cneòrum,** Linn Fig 1221 With long, trailing, pubescent branches lvs crowded, cuneate, oblanceolate, mucronulate, finally glabrous, dark green and glossy above, glaucescent beneath, ½–1 in long fls in sessile, many-fld heads, pink, fragrant Apr, May, and often again in summer Mts of Cent Eu B M. 313. L B C 18 1800 Gn 33, p 514, 45, p 237, 62, p 83. G C III 47 21 G M 47 117. M D G. 1900 417, 418; 1906 75 G W 14, p 625 V 2 342, 4.168 Var. **màjor,** Dipp Of more vigorous growth, with larger fls Gn 51, p 358, 65, p 457 Var **Vérlotii,** Meissn. (*D Vérlotii*, Gren & Godr) Lvs longer, mucronate fls 2 weeks later than the type R H 1901, pp 304, 305, 1902 552 Var. *máximus* of European nurseries =*D neapolitana.*

5 **Blagayàna,** Freyer Branches often ascending, glabrous. lvs cuneate, obovate or oblong, glabrous, 1–1½ in long heads many-fld ; fls white or yellowish white, fragrant, nearly glabrous outside, almost 1 in long April, May Mts of S E Eu B M 7579 F S 22·2313 Gt 29 1020 Gn 14.200; 35, p 540; 42, p 95, 50, p 26, 67, pp 287, 71, pp 7, 247; 73, p 241. G C II 13·245, 17 505, III. 11:491; 32 300, 301; 38 171.

CC. *Habit erect, 1–4 ft. high.*

D. *Lvs. less than 2 in long, usually pubescent: perianth densely pubescent outside.*

E. *Lobes of perianth lanceolate, acute; heads without bracts*

6 **oleoides,** Schreb (*D buxifòlia*, Vahl). Shrub, to 3 ft. branches pubescent. lvs obovate-elliptic to obovate-lanceolate, usually mucronulate or acute, villous-pubescent on both sides or finally glabrous above, punctulate with whitish dots, 1–1½ in. long: fls. in few-fld heads without bracts, white or pale lilac, with ovate-lanceolate, pointed lobes, ½in long. S. E. Eu. L B C. 3 299. B M. 1917.—Very variable in shape and pubescence of lvs Var **Fioniàna,** Hort, with obovate-lanceolate, obtuse lvs and lilac fls, is said to be a hybrid between this species and *D collina*

EE. *Lobes of perianth ovate, obtusish; heads with bracts at the base.*

7. **collina,** Smith (*D austràlis*, Cyrill. *D sericea*, Hort, not Vahl) Shrub, 1–3 ft : branchlets villous. lvs. scattered, oblong-ovate to oblanceolate, obtusish, glabrous and shining above, tomentose below, 1–1¾ in. long fls rosy purple, fragrant, ¾in long, in 10–15-fld heads, lobes broad-ovate, obtuse, about as long as tube, bracts broadly oval, tomentose, about half as long as the fls, persistent for some time April–June. Italy, Crete, Asia Minor B M 428 B R 24:56. Var. **neapolitàna,** Lindl (*D neapolitàna*, Lodd. *D. Delahayàna*, Hort) Lvs glabrous or nearly so. L B. C. 8·719 B R 822 By some supposed to be a hybrid of *D. collina* and *D. Cneorum.*

8 **sericea,** Vahl (*D oleifòlia*, Lam) Shrub, 1–2 ft. branchlets short, puberulous or nearly glabrous: lvs crowded at the end of the branchlets, lanceolate or oblanceolate, acute or acuminate, glabrous above, appressed pubescent beneath, sometimes nearly glabrous, ½–¾ in long fls in 3–8-fld heads, rose-colored, ¾in long, lobes broadly ovate, obtuse, a third shorter than tube bracts obovate, silky, soon drooping May, June Sicily, Crete, Asia Minor Ann Mus Hist Nat. Paris 10 20 —Rare in cult ; usually confused with the preceding species.



1221. Daphne Cneorum.

DD *Lvs. usually longer than 2 in, glabrous (or slightly pubescent beneath in No 9.): perianth glabrous or pubescent*

E. *Apex of lvs obtuse or acutish.*

F. *Heads of fls all terminal, usually many-fld; bracts persistent*

9 **hýbrida,** Lindl (*D Daùphini*, Hort. *D Délphini*, Lodd) Garden hybrid of *D collina* × *D odora* Similar to *D odora*, but hardier Erect shrub, to 4 ft. lvs cuneate, oblong-elliptic, dark green and shining above, glabrous or slightly hairy along the veins beneath when young, 2–3 in long fls reddish purple, pubescent outside, very fragrant, rather large, in few-fld. heads B R. 1177.

10 **odòra,** Thunbg (*D sinénsis*, Lam *D índica*, Loisel, not Linn) Shrub, to 4 ft, with glabrous branches. lvs oblong-elliptic, acute at both ends, bluntly pointed, glabrous, 2–3 in long fls in dense, terminal heads, very fragrant, white to purple, ovary glabrous; bracts 6–10, lanceolate, persistent Winter and spring. China, Japan Gn 28.8 J H III 50 367. V 4:318 Gng 2 211 Var **álba,** Hemsl Fls. white Gn 28.8, 37, p 10; 76, p 240. G 8:45; 22 9 Var. **punctàta,** Hemsl Fls in dense heads, white, spotted outside with red B M 1587. Var **marginàta,** Hort Lvs bordered yellow fls red. P M 8.175 and R H 1866 252 (as *D. japonica*) A.G 22 843. Var. **rùbra,** Sweet Fls. purple S B F G II 4:320 G C III 21:173 —By some botanists *D odora* and *D sinensis*, Lam (*D. indica*, Loisel), are considered distinct species *D. odora* has larger fls about ¾in long, glabrous outside, the bracts shorter than the fls., and

usually oval lvs , while *D. sinensis* has fls. about ½in. long, slightly silky outside, the bracts longer than the fls , and usually oblong-elliptic lvs.; but it is doubtful whether these characters are constant.—*D. odorata*, Hort , is a common misprint in catalogues for *D. odora*. *D. odorata*, Lam.= *D. Cneorum*.

FF. *Heads of fls. axillary and terminal, few-fld.; bracts caducous; perianth glabrous*

11. japónica, Sieb. & Zucc. (*D. Mazélia*, Carr.). Shrub, to 4 ft.: branches glabrous. lvs. oblong-deltoid, gradually narrowed at the base, nearly sessile, 2–4 in. long. heads axillary and terminal short-peduncled, 3–4-fld.; fls. pink, short-pedicelled, ½in long; lobes ovate, obtuse, as long as tube, bracts ovate-lanceolate, ciliate, slightly shorter than fls , peduncles and pedicels silky. Spring. Japan, China. Gn 14.442.

EE. *Apex of lvs. usually emarginate*

12. retùsa, Hemsl Shrub, 2–3 ft · branchlets pubescent at first, soon glabrous: lvs oblong or oblanceolate-oblong, obtuse and usually emarginate, narrowed at the base into a short petiole, glabrous, 1–3 in. long, ½–⅔in wide fls white, tinged outside rose or violet, glabrous, fragrant, ¾in long, in many-fld terminal heads; lobes slightly shorter than tube; bracts 3–4, oval or obovate, ciliate, deciduous, shorter than fls.: fr. red. May. W. China. B.M. 8430.—Recently intro. and apparently fairly hardy; a very desirable plant.

BB. *Fls. axillary, yellowish or greenish white, glabrous outside.*

13. Laurèola, Linn. Shrub, to 4 ft.. lvs. cuneate, obovate-lanceolate, acute, shining and dark green above, glabrous, 2–3½ in. long: fls. in 5–10-fld , nearly sessile racemes, yellowish green, scentless fr black. March–May. S. Eu., W. Asia. Gn. 29, p. 602 (poor). Var. **Philippii,** Arb. Kew (*D. Philippi*, Gren. & Godr.). Lower lvs obovate: fls. often violet outside; bracts as long or longer than the fls. Pyrenees.—Var. *purpùrea* of the Kew Arboretum=*D. Houtteana*.

14. pontica, Linn. Shrub, to 5 ft : lvs. cuneate, obovate or obovate-lanceolate, acute, shining, glabrous, 2–3 in. long: fls. in long-peduncled, 1–3-fld. clusters, greenish yellow, fragrant, with linear-lanceolate lobes. April, May S E. Eu , W. Asia B.M. 1282. G.C. II. 14:209. G.W. 5, p 261.

D alpina, Linn Erect shrub, to 2 ft · lvs deciduous, cuneate-lanceolate, sparingly silky fls white or blushed, terminal, fragrant. May, June S Eu L B C 1 66 Gn 29, p 603 — *D. altàica*, Pall. Shrub, to 4 ft . lvs. deciduous, cuneate, oblong-lanceolate, glabrous, fls. white, in terminal, 1–5-fld heads, fragrant. May, June. Altai, Songaria, Mongolia B M 1875. L B.C 4 399 —*D arbuscula*, Celak Evergreen dwarf shrub branchlets red lvs. crowded at end of branchlets, linear-oblanceolate, obtuse, pubescent or glabrous beneath, ¾in long fls pink, in 3–8-fld heads June Hungary —*D. caucàsica*, Pall Allied to D. altaica Lvs narrower fls in 3–20-fld heads Caucasus B M. 7388 —*D glomeràta*, Lam Allied to D pontica Low fls light pink, fragrant, the clusters crowded at the ends of the branches May W Asia —*D Gnidium*, Linn Evergreen shrub, to 2 ft lvs linear-lanceolate, acute, glabrous fls yellowish white, fragrant, in terminal racemes or panicles S Eu L B C. 2 150 Gn 29, p 603 —*D jezoénsis*, Maxim Upright shrub, 2 ft.. lvs oblong-obovate, persistent, obtuse, 1½–3 in long fls axillary, yellow March, Apr Gt 15 496 —*D kamtschàtica*, Maxim Low upright shrub, sparsely branched· lvs oblong-lanceolate, acutish fls fascicled, yellowish. Kamchatka, Manchuria —*D papyrifera*, Sieb =Edgeworthia papyrifera —*D petræa*, Leyb Dwarf evergreen shrub lvs linear-lanceolate, small, obtuse fls light pink, in terminal, 3–6-fld heads, fragrant June, July S Tyrol Gn 69, p 327 —*D pseudo-mezèreum*, Gray Low, almost decumbent shrub lvs lanceolate-oblong, acutish fls fascicled, axillary, greenish yellow, scentless March, Apr Japan. —*D. rupéstris*, Facch =D petræa —*D salicyfòlia*, Lam =D. caucasica —*D Sòphia*, Kalen Allied to D caucasica lvs obovate-oblong, glaucous below heads few-fld S Russia —*D striàta*, Tratt. Dwarf evergreen shrub lvs small, cuneate, linear-lanceolate, glabrous fls in terminal, many-fld. heads, pink June, July. Switzerland and Carpathian Mts —*D Vàhlii*, Keissler Allied to D collina. Branchlets thick, puberulous lvs obovate or oblong-obovate, appressed-pubescent below heads 8–10-fld bracts obovate, silky, deciduous. Crete, Asia Minor.—*D yezoénsis*, Hort. =D. jezoensis

ALFRED REHDER

DAPHNÍDIUM: *Benson.*

DAPHNIPHÝLLUM (Greek, *laurel leaf*, from the similarity of the leaves). *Euphorbiàceæ*. Broad-leaved evergreen hardy or semi-tropical shrubs or small trees, sometimes cultivated for their handsome large foliage.

Leaves large, without stipules, leathery, smooth, more or less glaucous, alternate, entire, petioled, pinnately veined: fls. dioecious, in axillary racemes or panicles, apetalous; calyx 3–8-parted, small, imbricate, stamens 5–18; pistil 2-celled, 4-ovuled. fr. a small, olive-like drupe, usually 1-seeded —Twelve to 20 species, mostly in Trop Asia, etc. The one, or possibly two, species, rarely seen in cult. in Amer , are from Japan. The large evergreen lvs. distinguish it from other hardy euphorbiaceous shrubs. They are somewhat rhododendron- or laurel-like, hardy as far north as the Middle Atlantic States, and make very handsome broad-spreading shrubs with inconspicuous fls

Daphniphyllum can be propagated by cuttings, but roots rather slowly, and if seed could be secured it would no doubt give better results The plants need protection from frost in winter till well established They are strong growers in rich soil.

macrópodum, Miq. (*D. glaucéscens*, Hort) A shrub or small tree, broad and compact, 5–10 ft high, or more in native land, smooth, twigs red: lvs. oblong, 2 × 8 in , bluish glaucous below; petiole 1–2 in. long, red; lateral veins, ⅖–⅗in. apart. fls. small, in short racemes. fr. oblong, not over ½in., black Japan and China G 18 478; 31 16 S I F 1.54

Two other names, *D. glaucéscens*, Blume, and *D jezoénse*, Hort , occur occasionally in horticultural literature The first has scarcely glaucous lvs with lateral veins ½–⅓in apart and is probably not in cult., the latter is a more dwarf form than the others.

J B. S. NORTON

DÁRBYA: *Nestronia*

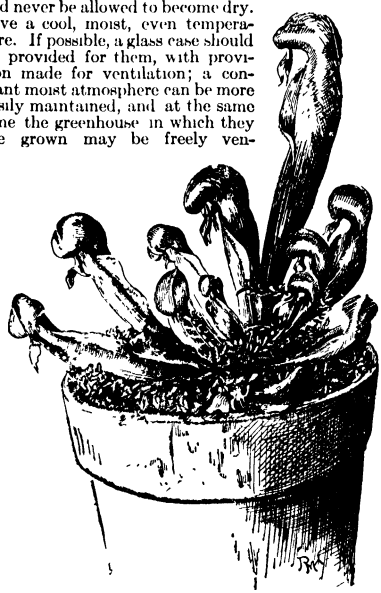
DARLINGTÒNIA (after William Darlington, of West Chester, Pa , author of "Memorials of John Bartram and Humphrey Marshall," and of "Florula Cestrica.") *Sarraceniaceæ* A monotypic genus of American pitcher-plants which, apart from their striking aspect and beautiful coloring, have acquired celebrity from their insectivorous habits

The short rhizomes grow in fine muddy soil, and produce annually a terminal rosette of lvs , all of which are modified into upright pitchers· each pitchered lf is 3–30 in long by ½–3 in. wide, is somewhat spirally twisted, hollow throughout and with a median crest or flap in front; the tube represents the hollowed lf -midrib, the flap is formed by the fused halves of the lf. that have united by their upper faces in front of the midrib; the top part of the tube curves over in rounded fashion to form a down-directed pitcher orifice, from which depends a bilobed unusually crimson and green appendage of attractive aspect, the rounded top is also beautifully mottled by white translucent areas, the pitcher exterior and the appendage bear many honey-glands, the excretion from which tempts insects toward the orifice The rounded hood is lighted within through the white areas, and bears many attractive honey-glands interspersed with down-directed hairs Tempted by the former, and impelled by the latter, insects step or drop on to the upper interior of the tube This is extremely smooth, affords no foothold, and so they soon tumble into the lower part This is covered by down-directed hairs which prevent egress of the caught prey Disintegration of the insects, amid a neutral liquid that is excreted by the pitcher-wall, then takes place and the products are gradually absorbed through thin areas of the lower cavity. Honey-secretion and insect-catching proceed most actively in May and June; by midsummer, therefore, each pitcher is filled to a depth of 4–8 in by a decaying mass of insect-remains, amid which at times centipedes or a slug may be found. The genus is native from N. Cen. Calif. to S. Ore. It occurs there on the Sierras by the edge of mountain swamps or "deer-licks" at an elevation of 2,000–8,000

ft. Specimens were first hurriedly collected by W. D. Brackenridge of the Wilkes Exploring Expedition, on the southern slopes of Mt Shasta, when the explorers were retreating before attacking Indians The specimens were described and named by Torrey

Darlingtonias have been grown outdoors in the East the year round in a few special localities. Edward Gillett at Southwick, Massachusetts, grows them in a favored spot without artificial protection. F H Horsford can preserve them at Charlotte, Vermont, with the aid of a winter mulch

As greenhouse plants, darlingtonias require the same treatment as their allies, sarracenias, dioneas and droseras A well-grown collection of these plants is not only very interesting and curious, but also very beautiful To succeed, they must occupy a shaded position, and never be allowed to become dry. Give a cool, moist, even temperature. If possible, a glass case should be provided for them, with provision made for ventilation; a constant moist atmosphere can be more easily maintained, and at the same time the greenhouse in which they are grown may be freely ventilated without injury to these plants The material in which they grow best is two-thirds fern-root fiber with the dust shaken out, and one-third chopped sphagnum moss and silver sand, with a few nodules of charcoal added. About the first week in July is perhaps the best time for potting, though one must be guided by the condition of the plants, choosing a time when they are the least active When well established they will require potting only once in two years The pots should be placed in pot-saucers as a safeguard against their ever becoming dry, and all the space between the pots should be filled with sphagnum moss up to the rims of the pots. A temperature of 40° to 45° during winter, with a gradual rise as the days lengthen in spring, will suit them admirably During the summer they should be kept well shaded, or they may be removed to a well-shaded frame outside in some secluded position free from hot drying winds. Propagation of these plants is effected by division of the roots, or by seeds sown on live sphagnum moss in pans, the moss being made very even and the pans placed either under a bell-jar or glass case in a cool moist atmosphere (Edward J Canning)



1222 Young plant of Darlingtonia.

californica, Torr Fig. 1222. Rootstock horizontal: lvs 5–8 in annual rosettes, long-tubular, somewhat twisted, with median anterior flap, green below, green mottled with white over the arched hood, orifice down-directed with bilobed red and green appendage in front: fl-stalk 10–30 in., bearing scattered bracts, fl solitary, inverted; sepals 5, pale green, petals 5, yellowish to brown-red with red veins; stamens 15–12, inserted below ovary, ovary obconic with depressed apex, style 5-lobed with radial stigmas caps. obovate, surrounded by the persistent sepals Flowers from May to July, according to elevation B H 5·113. F.S. 14.1440. F M 1869 457. B M 5920. I H 18.75 G C III. 7·84, 17.304, 24 339 —Intro into cult in 1861. Var. **rùbra,** Hort. Differs from type in being a reddish hue.

D. Colùrtii=Sarracenia Courtii

J. M MACFARLANE.

DARNEL. *Lolium perenne.*

DARWÍNIA (Dr. Erasmus Darwin, an English nature-student). *Myrtàceæ.* About 40 Australian evergreen shrubs, a very few of which are sometimes grown for the colored flower-like campanulate involucres that hold their condition 3–5 months; not in the American trade Lvs few and usually heath-like: fls small, inclosed in petal-like bracts at the summit of the branches; calyx-lobes 5, petals 5, stamens 10, alternating with staminodia, ovary 1-celled, the fr. 1-seeded The darwinias prop from well-ripened tips of side shoots taken in early autumn or in spring They require greenhouse or intermediate temperatures **D. Hookeriàna,** Benth (*Genétyllis fuchsioìdes,* Hort) Lvs linear-oblong, ½in long, scattered sts red inner bracts of hanging involucre 1 in long, bright red, the outer ones shorter and greenish and passing into the st-lvs fls small, greenish white, usually about 6 in each involucre B M 4860 (as *Genetyllis macrostegia*) G C III 43 243 F S. 10, 1009 **D. macrostègia,** Benth Lvs elliptic-oblong, ¾in or less long, scattered inner bracts 1½ in. long, creamy white with red splashes and stripes, the outer ones shorter and more colored, the lowest ones passing into the foliage B M 4858 (as *Genetyllis tulipifera*). I H. 2.73 F S 10 1064.

L H B

DASHEEN. Edible crown-tubers of Colocasia, lately cult in the U S to some extent See p. 830, also *Taro*

DASYLÍRION (Greek, *tufted lily*) *Liliàceæ* Stiff shoot-trunked desert plants, with crowded leaves and elevated panicles of small mostly white or whitish flowers

Caudex or trunk erect and woody lvs numerous, near the top of the trunk, long and rigid, usually prickly-margined fls dioecious, in dense racemes which are crowded into a narrow compound panicle, perianth campanulate, the segms toothed, distinct and nearly equal, obtuse, stamens 6, exserted, style short, stigmas 3: fr dry and indehiscent, 3-winged, 1-celled and 1-seeded —About 15 species Mex, to Texas and Ariz Monograph in Proc Amer. Phil. Soc. 50, p 404 (1911).

Dasylirions are highly ornamental plants, well adapted for rockeries, for isolated specimens on lawns, decoration of conservatories, staircases and similar uses, and eminently suitable for terraces and vases, in the formal style of gardening The leaves are in large number, inserted in a symmetrical way, so as to form a dome or globe-shaped, regular head, more or less serrulated, and in some species ending in a brush-like tuft of dried fibers The tall panicles of numberless whitish green minute flowers are also a striking feature, standing far above the crest or crown of leaves They are of the easiest possible culture, and will stand some degrees of frost, particularly if kept dry Easily propagated from seeds and from cuttings of the branches when produced, as they do not sucker as a rule These plants are inferior to *Yucca filamentosa*

in hardiness, showiness and regularity of flowering, but they have an individuality of their own. They are especially esteemed in California, where the great flower-stalks, 8 to 10 feet high, give a strong impression of the desert The individual flowers are not highly colored, but the spikes are several feet long These and related plants have been the subject of recent revision. Beaucarnea is now considered to be distinct, and a new genus, Calibanus, is erected by Rose on *D. cæspitosum.* These new treatments are explained under Nolina.

A. *Lvs flat, prickly-margined.*

B. *Lvs. usually green, splitting into fibers at tip, narrow.*

texànum, Scheele Lvs ½in x 2–3 ft, glossy green: prickles yellow, turning brown infl 9–15 ft high. fr elliptical, ⅜ x ⅝ in, shallow-notched. S. Cent. Texas.

acrótriche, Zucc (*D. acrótrichum,* Baker *D. grácile,* Planch. *Bonapártea grácilis,* Otto *Roulinia grácilis,* Brongn *Yúcca grácilis,* Otto. *Y acrótricha,* Schiede. *Barbacènia grácilis,* Brongn *Lattèa grácilis,* Hort). Lvs very narrow, ⅜in x 2–3 ft, sometimes dull or pale· prickles pale yellow, brown at tip infl 9–15 ft. high fr round-cordate, ⅛ x ¼in, shallow-notched E Cent Mex Abhandl Akad Muench Cl 2, 3 1 B M 5030. F S. 1448; 7, p. 10 G C. III 19, p 204.

graminifòlium, Zucc (*Yúcca graminifòlia,* Zucc). Lvs ½in x 3 ft, glossy green. prickles very short, yellowish white. fr elliptical, ¼ x ⅜in E Cent. Mex. Abhandl. Akad. Muench, Cl 2, 3.1. Allgem. Gartenz. 9:1.

BB. *Lvs. glaucous and dull.*

C *The lvs not shredded at tip, narrow.*

glaucophýllum, Hook (*D glaùcum,* Carr. *Bonapártea glaùca,* Hort) Lvs ½in x 3–4 ft: prickles yellowish white infl 12–18 ft high· fr. elliptical, ¼ x ⅜in E Cent Mex B M 5041 G C II. 13, p 205, III 40, p 247. Rep Mo. Bot. Gard 14, p. 12.

CC. *The lvs. splitting into fibers at tip, wider.*

serratifòlium, Zucc (*D laxiflòrum,* Baker. *Yúcca serratifòlia,* Schultes. *Roulinia serratifòlia,* Brongn). Lvs 1–1½ in x 2–3 ft., rough prickles rather long, sometimes ¾in apart. S. E. Mex. Abhandl Akad. Muench, Cl 2, 3 1

Wheèleri, Wats With distinct short trunk: lvs. nearly 1 in x 2–3 ft, nearly smooth prickles yellow, browning at tip. infl 9–15 ft. high: fr round obovate, ¼ x 1/16in, openly notched. S E Ariz and adjacent region Pl World, 10, p 254 Publ Carnegie Inst. 99.58. Icones Sel Hort. Thenensis, 225.

AA. *Lvs. 4-sided, neither prickly nor usually brush-tipped*

longissimum, Lem. (*D. quadrangulàtum,* Wats. *D. juncifòlium,* Rehnelt) Trunk 3–6 ft. high: lvs very numerous, ¼in x 4 6 ft, dull green: infl 6–18 ft high· fr. ⅝ x ⅜in, scarcely notched E. Mex. B M 7749. G F 36, p 280 Bull Soc. Tosc. Ort 9, p. 236; 35:6. Dic Natur, 34, p 340. R H. 86, p. 66.

D Hookeri, Lem =Calibanus Hookeri, Trel (see Nolina). —*D juneum,* Zucc =Nolina Hartwegiana —*D. longifòlium,* Zucc.=Nolina longifolia

WILLIAM TRELEASE.†

DATE. A palm, *Phœnix dactylifera,* Linn, native to North Africa or Arabia and extensively planted in countries inhabited by Arabs, and having arid or desert conditions Figs 1223–1226 It is also grown to some extent in southern Asia and southern Europe and in other tropical and subtropical countries. It is of very ancient cultivation, having been grown along the Tigris and Euphrates Rivers for four thousand years or more. It has long been planted casually in parts of Mexico and the southwestern parts of the United States, and is now becoming a fruit of commercial promise in some of these regions.

The date palm reaches a height of 100 feet, making a nearly straight, shaggy trunk, and it continues to bear for one or two centuries. It is dioecious, the males usually equaling the females in a batch of seedlings, this constituting one of the great disadvantages of raising seedling dates The Arabs practise artificial pollination by tying male flowers on the pistillate clusters. The flowers are produced early in the spring, from six to twenty clusters appearing on a mature tree The female or fertile clusters of good size will produce as much as twenty to forty pounds of dates As with apples and other fruits, there are many varieties differing in quality, seedlings do not reproduce the variety, so that propagation of named varieties must be accomplished by other means

The date is the fruit, being essentially a drupe, measuring 1 to 3 inches long The date of commerce is the cured and dried natural fruit. The sweet nutritious pulp of the fruit constitutes one of the most important foods of the Arabs The leaves and other parts of the plant afford materials for dwellings and many domestic uses The wood or trunk is used for timber The importation of dates into the United States amounts to about $500,000 worth annually No doubt the consumption will be greatly increased when a home-grown and clean-packed product is obtainable

Aside from the direct uses of the plants and the fruits, the date palm is valuable as a cover for other crops in the hot and dry regions Beneath the palms, other fruits, vegetables and many crops may be grown with more safety than in the open blazing sun It is probable, therefore, that the date palm will become a feature of the farming in all the regions of the Southwest in which it thrives.

The general situation

In Florida, California, and restricted areas of a few other states, the date has been grown for decorative purposes for more than a century At the missions founded by the Spaniards at St Augustine, and other places in Florida, and that long line of missions extending from far into Mexico northward and westward through southern New Mexico, Arizona and California, it is likely the date was planted wherever the climatic conditions were favorable to its growth Within the borders of the United States the greater number of these early plantings were in Florida or along the coast of southern California, regions where the sum total of summer heat is not sufficient to develop the date fruit perfectly. The date, as a fruit-producer, being indigenous to a desert environment, does not take kindly to humid regions, even where it is not sufficiently cold to prohibit the growth of the tree It is not only a question of maturing the tree or even of producing the fruit but also of bringing the fruit to perfect ripeness For this reason the greater number of the early plantings in this country matured little fruit, while that produced was of poor quality, although in many instances the trees grew luxuriantly and to large size In the more arid parts of Lower California and Sonora, where there is sufficient water for irrigation, the early plantings have been continued down to the present time, and dates of fair quality have been grown for many years. Moreover, each year the area devoted to dates is increasing, and with the recent studies of the life-history of the plant by Swingle and others the adaptation of regions is now better understood and undoubtedly the future plantings will be made with much better assurance of success. Modern date culture in this country may be said to have begun with the planting of imported Egyptian and Algerian palms and seedlings principally in Salt River Valley, Arizona, in the years 1890–1900 Toumey's studies of these early plantings resulted in Bulletin No 29 of the

Arizona Station Studies of conditions in the Saharan region and the importation of varieties by the United States Department of Agriculture, were made in 1899 and 1900 These results were set forth in Bulletin No. 53 of the Bureau of Plant Industry, by Swingle Stations for testing the introductions were provided by Arizona in 1899, by California in 1904, and by Texas in 1907 Subsequent large importations were made by Fairchild and Kearney, as described in Bulletins Nos 54 and 92 of the Bureau of Plant Industry of the national Department of Agriculture

Dates unquestionably can be grown profitably in many of the hot dry irrigated valleys in the southwestern parts of the United States The Salton Basin in southern California promises particularly well for date-culture because of the high temperature, and here even the famous Deglet Noor date of the Sahara will ripen fully, even in cool seasons Considerable attention is also being given to dates in the newly developing Imperial Valley In northern California, the date can undoubtedly be grown for home use in many regions, even north of San Francisco, it finds good conditions for commercial culture in parts of Arizona, and there are probably adaptable regions in Texas The date can endure more alkali than any other profitable fruit crop, and this fact will extend the range of its usefulness When once well established, brief temperatures as low as 10° F do not do serious harm to date palms

While date trees have been grown in the United States and Mexico for certainly more than a century, and while much fruit has been produced incidentally here and there, largely as a by-product, nevertheless date-growing on a commercial scale is yet a new and experimental industry in this country Although it promises well, the business requires experience and skill, and it must be established only in those regions which are particularly adapted to it, especially those that have an extremely hot summer climate As yet, the returns from date-culture are almost impossible of determination As nearly always happens with new and promising industries, doubtful claims have been made for profits of date-culture by interested parties. It must be borne in mind that practically all the varieties now recommended for commercial cultivation in this country are of Old World origin Although many seedlings are being raised, it is yet too early to designate any one of them as superior for general orchard planting It is advisable that in the regions in California and Arizona, and elsewhere, that are adapted to dates, numbers of seedlings should be raised from the best varieties, care being taken that they have been pollinated from the best males, in this way the chance will be increased of originating varieties that are especially adapted to the region The business must be developed by residents and those who study the conditions closely from year to year

According to Swingle, at present less than a dozen varieties among the 200 or more on trial at the government date-gardens in the Southwest can be said to be well enough known to warrant planting on a commercial scale The Deglet Noor and the Tazizaoot can be recommended for orchard planting in the Coachella and Imperial Valleys of California, the Halawy, the Khadrawy, the Maktoom, and the Hayany are promising for cooler regions, such as the Salt River Valley of Arizona, and may be planted in the California date regions on a scale not too large for the early markets; the Rhars is excellent for home use as a fresh date, but is of little commercial value, the Thoory is a dry date of great promise, but it is as yet doubtful whether dry dates can be marketed advantageously on a large scale without an expensive publicity campaign. To plant other varieties that are new or inadequately tested, involves a considerable element of risk The fact that they appear satisfactory in the Old World deserts is no guarantee that they will grow, bear, and ripen fruit properly in the Southwest or that their fruit will prove acceptable to American buyers Any planting of a variety on a large scale before it has been thoroughly tested must be considered as a speculation. It would be much safer for those who expect to grow dates on a commercial scale to limit themselves at first to those varieties that have been tested by public and private agencies, and to learn all phases of the culture, curing, packing, and marketing of the fruit of one or more of the standard varieties This is the best possible preparation for the efficient culture of new sorts when they have been sufficiently tested in the government or other adequately supervised testing-gardens to render it desirable to test them on a commercial scale



1223 Young date palm, with growing suckers or offshoots.

in private culture The government, through the Department of Agriculture, has taken special pains to safeguard the young industry.

Propagation.

It is always preferable to propagate dates from suckers unless one desires to originate new varieties, not only on account of the knowledge of the sex (it being hardly necessary to state that the sex of a sucker is the same as that of the plant from which it is taken), but on account of the ability to make a selection in the variety and quality of the fruit

Dates are easily grown from seed if the ovules have been properly pollinated Seeds may be planted in any month immediately after they are taken from the fruit, particularly in the mild climates of the Salton Basin, Lower Colorado Valley, and Salt River Valley Unless the conditions are good, however, it is better to stratify them in a box between layers of moist sand and allow them to remain for three to six weeks in order that the seed-coats may be softened It is important, however, that in the stratifying-box the seeds do not sprout, as they are easily damaged after sprouting takes place The seed may be sown in nursery rows and the young seedlings transplanted after one, two or three years, or if the field is well prepared, and has good irrigation, the seed may be planted directly in the fields where the palms are permanently to remain. If they are placed directly in the field, it is well to plant them in rows 25 to 30 feet apart and to allow the young plants to stand

3 to 5 or 6 feet apart in the row. When the dates come into bearing, the undesirable ones and the males may be removed and the probability is that a sufficient number of good varieties will remain to make the row properly continuous; and the rows will be far enough apart for the regular or permanent plantation.

Suckers or offshoots are taken from the base of the young palm (Figs. 1223, 1224) One to several suckers may be removed each year, averaging two to four for the productive period, and when they are three to six years old and have begun to develop roots of their own. All species belonging to the genus Phœnix are difficult to transplant with uniform success. Frequently as high as 50 per cent of transplanted dates die even when watered daily and given the best of care. In planting suckers with the best of attention, a percentage die; while without care not one in a hundred will grow. It is due not so much to the lack of experience in removing the suckers as to lack of proper care after removal, that so large a percentage fail

Suckers may be removed at any time during the spring or early summer, or even in the winter, if proper care be given them after removal If they are to be planted in the open ground it is advisable to remove them in spring or early summer, April probably being the best month In winter, when the plants are at a standstill, the suckers may be removed with comparatively small loss, if the "bulbs" or bottoms be not less than 4 inches in diameter It is necessary, when suckers are removed at this season, to set them in rather small pots, so that the earth, which should be given a daily soaking, may have a chance to get warm quickly. The pots should be kept in a dry greenhouse, or, better yet, imbedded in a hotbed of manure, covered with the customary frame and glass In all cases the leaves should be cut back to 6 to 12 inches in length, and sometimes they are removed. Transplant only when the ground is warm

If proper attention can be given it is best to plant large suckers where they are to remain, as a second chance for loss occurs when they are transplanted from a nursery to the position that they are finally to occupy. An iron bar weighing thirty to forty pounds, and flattened to a 4–6-inch cutting end, may be used to cleave the offshoots from the tree The leaf-stalks should be cut away, exposing the bulb of the sucker, care being taken not to injure the bulb in removing. One should cut in rather deeply at either side, not being afraid of injuring the old plant, cutting out a V-shaped portion extending from the base of the bulb downward for a few inches. Wounds may be painted with coal-tar to prevent bleeding and evaporation. It is important, when planting the suckers in the field, to set them so high that the crown-bud will not be covered with water during irrigation, in order to avoid decay and death

A successful method of rooting the suckers is to bank up earth about the base of the parent tree and above the base of the suckers, and keep moist by watering daily to induce formation of roots. Suckers may be partially severed from the old stock before the banking is done, or after the roots have started When the roots are well grown, the suckers may be transplanted with little loss

The suckers will grow perfectly well, however, if no roots are left attached. The offshoots may be cut away from the parent plant, with all the leaves removed, and leaving only the bud in the center or at the apex surrounded by the leaf-stalks Such offshoots will stand very much exposure and may be shipped long distances without being packed in moist material, care being taken that the boxes are so filled with packing that they will not be jammed or bruised in transportation After they are planted, they should be kept constantly moist about the bottom and should not be allowed to suffer any check. The Arabs apply water every day for thirty or forty days and then continue to irrigate each week until the following winter, care being taken not to water too much If these precautions are taken and if the offshoots are planted in warm ground, there need be very little loss They should never be set in the open ground when the soil is cold, as in fall or winter If the offshoots are to be taken off at that time, they must be grown in pots or in some similar way, as described above.



1224 Deglet Noor date palm about eight years old, with offshoots and ripe fruit.

The growing of dates.

The date palm grows in nearly all kinds of soil, if only the climatic conditions are right. If it be sufficiently irrigated and have the requisite amount of heat, the soil seems to be a secondary consideration In general it may be said, however, that sandy-loam soils of the desert, with a small percentage of clay and slightly charged with salts, are preferable to rich and heavy soils, suitable for growing ordinary crops. The question of water is of great importance in the culture of dates, as it is necessary that the roots of the date palm be in moist earth throughout the year In general, the amount of water required for successful culture is considerable. If sufficient water cannot be supplied by natural methods, one must resort to irrigation Water should be supplied at frequent intervals throughout the year. However, the most should be supplied in the spring before blooming, and in the fall prior to the ripening of

the fruit. The amount of water for each palm depends so much upon soil and local conditions that an estimate would be worthless. Care should be taken not to irrigate to excess at the time of blooming and immediately after, as it will militate against the successful setting of the fruit. The date seems to enjoy not only a high atmospheric temperature, but a high temperature of the water supplied in irrigation as well. In irrigating small crops by flooding, it is necessary in midsummer to irrigate late in the afternoon or at night in order to prevent scalding. Care should be taken, in the hotter part of the year, that the date palm is not subjected to hot water about the roots, rising above the soil for a considerable length of time, and later left until the soil becomes exceedingly dry and baked by the sun. Such extremes sometimes seriously injure or destroy the tree.



1225. An American seedling date.

The date palm comes into bearing early, examples being known in California of fruits being produced two years after the seeds were planted. It usually requires six to eight years, however, for seedlings to bear any considerable quantity of dates. Under the best date-culture, seedlings are not used but the plants are propagated by means of suckers, as already explained; these suckers soon become established and will bear abundantly in five or six years afterwards. After ten or fifteen years, the palm may be considered to be in full bearing and should continue to produce indefinitely. It should yield 100 to 200 pounds of fruit annually, although there are cases of very much higher yields than this. To conserve the strength of the parent plant, the suckers should not be allowed to grow around the base in large numbers. Usually not more than three or four of these suckers or offshoots are allowed to remain at any one time. After the palm is in full bearing and has a trunk a few feet high, the offshoots cease to be produced. It is recommended, however, that one offshoot be left attached to the mother plant in order to replace the tree in case of an accident. If the date palm is allowed to grow as it will, it becomes a clump of many trunks, surrounded by a jungle of offshoots.

It is advised that the date palm be planted at distances of not less than 26 to 33 feet. Other crops can be grown between the trees till they come into bearing heavily, or even continuously.

Under proper cultivation, the date palm should produce from ten to fourteen leaves each year. A well-developed tree will have at one time from thirty to sixty leaves, the old ones dying away below while new ones are forming at the top. The different varieties show great variation in rapidity of growth, form and length of leaves, size of stem, and general aspect of plant. The stem of the date palm is very rigid. When the stem reaches a height of 5 or more feet it is frequently necessary to tie the growing bunches of dates securely to the lower leaf-stalks, that they be not broken and injured by the wind before maturity.

While it is possible to produce dates by depending on wind-pollination from male to female trees, this process is much too uncertain for commercial culture and requires a very large number of male trees. In commercial plantations, one male tree to 100 females is sufficient; but this requires that the pollinating shall be performed by hand. Small separate twigs or branchlets of the male inflorescence, from 4 to 6 inches long and bearing thirty to fifty flowers, are tied on the female cluster. Inasmuch as the flowers in the female cluster mature at different times, it is necessary to repeat the operation of pollination. In old plantings, persons must climb the trees in order to perform this operation, but for the first ten or fifteen years of bearing the clusters are so near the ground that little if any climbing is required. Each female flower produces three ovaries. After pollination, two of these ovaries fail and one matures into the date. In case there is no pollination, all three of the ovaries will develop but will be seedless and the fruit will be inferior.

As with other fruits, it is often necessary to thin the dates on trees, particularly on young trees that tend to overbear. Even on old trees, best results are to be secured if only eight or ten bunches are left.

Usually the dates in an entire bunch do not ripen at the same time. Picking off the dates as they ripen is a practicable operation when labor is cheap. In general, however, it probably will be found the better plan to cut the entire bunch at once. This may require some special operation in the handling and curing. Some varieties require practically no special handling or curing and are ready to ship as soon as they have ripened naturally. Usually, however, the bunch must be ripened much as a bunch of bananas is cured, by being cut off and hung in a moist and warm place. It has been found that in Arizona the best varieties of dates may not ripen naturally on the tree. Freeman's experiments at the Arizona Experiment Station show that conditions favorable for the rapid ripening of the Deglet Noor may be produced artificially in an oven. The degree of moisture and temperature may be carefully regulated. In this ripening process, there is not only a change in the sugar-content but the tissues of the date are softened, the tannin is precipitated and the astringency of the fruit is thereby relieved. Vinson found that dates may be ripened artificially by means of chemical reagents. Artificial ripening by means of heat, moisture, and chemical stimulation makes possible the production of commercial crops at altitudes too high and cool to mature many medium and late varieties. Losses by rain, insects, and birds are minimized, and greater cleanliness secured. Last year over half the crop from miscellaneous varieties at the Tempe Date Orchard (Arizona) would have been lost but for artificial methods of ripening. These methods are cheap and practicable. In connection with ripening operations, the fruit can be pasteurized at a temperature of 65° to 70° C. (149°–158° F.) and then packed under cheese-cloth to secure it from contamination by flies and other insects. Recent experiments by Drummond show that fumigation with carbon bisulfide kills insect eggs, and is preferable to pasteurization with varieties inclined to be sticky. In 1910, Swingle discovered the process now in use for ripening Deglet Noor dates by



1226. Fruit clusters of date, as grown in Arizona.

keeping them in moist atmosphere in closed packing-boxes which are kept warm at night and heated to 80° or 90° F. during the day Deglet Noor dates ripen perfectly by this process and remain light-colored while those ripened by the rapid process are darkened. Freeman's rapid process will ripen greener dates, however.

For further discussion, see *Phœnix;* also the bulletins of the United States Department of Agriculture, and of the experiment stations of Arizona and California.

J. W. Toumey.
L. H. B †

DATÍSCA (old Greek name, applied to some doubtful plant). *Datiscàceæ.* Tall perennial herbs, one of which is sometimes planted in gardens

Glabrous branching hemp-like plants with pinnately compound or ternately divided alternate lvs., the lfts. or segms lanceolate and usually serrate or toothed: fls. usually dioecious, the staminate fascicled in the axils and short-pedicelled the pistillate racemose on axillary branchlets, stamens in sterile fl 8–12–25, mostly opposite the calyx-lobes, stamens sometimes present in fertile fls but few and perhaps alternate with calyx-lobes, ovary 3-angled at top, with 3 styles which are 2-parted: fr. a narrow ribbed many-seeded caps., opening between the styles at the top —Species 2, one in S E Eu and W Asia, and the other in Calif and Mex ; the former is in cult abroad, requiring no special treatment, prop. by seeds and division

The family Datiscaceæ is placed near Begoniaceæ and Cactaceæ It comprises two other genera of tall trees, neither of which is recorded as in cultivation; these are Octomeles, with two species in the Malayan archipelago, and Tetrameles, with one species in East India to Java

cannabìna, Linn. Three to 7 ft.: lvs odd-pinnate; the lfts. of 3 pairs, 2 in. long, deeply serrate, long-acuminate: fls small, yellow, the females in long and open panicles. Eu —Attractive bushy plants with graceful foliage; both sexes should be grown, the female being the finer for ornament

D glomeràta, Brew & Wats , the American species, is apparently not in cult 2½–4 ft , stout, glabrous, the sts clustered lvs ternately divided or lobed staminate fls in clusters of 3, pistillate fls 4–7 together or scattered along short branchlets It is the durango-root of the Coast ranges and Sierra Nevada

L. H. B.



1227. A triple form of Datura fastuosa, commonly known as D. cornucopia.

DATÙRA (Arabic name) Syn. *Brugmánsia. Solandceæ.* Thorn-Apple Several large plants cultivated for their huge trumpet-like flowers, which have an odor that is very pleasant to some persons

Annual or perennial herbs, shrubs, and trees: lvs. large, entire or wavy-toothed: fls large, solitary, erect or pendulous, mostly white, with more or less violet, rarely red or yellow; calyx 5-toothed, sometimes breaking apart near the base or splitting lengthwise; corolla trumpet-shaped, with spreading 5–10-toothed limb; stamens 5, all perfect, slightly or not at all exserted, the filaments slender; style long, the stigma 2-lobed: fr a large 2-celled caps., mostly prickly or spiny, usually dry and 4-valved at top but sometimes fleshy and bursting irregularly, with large seeds.—Some 15 species, mostly strong-smelling, in the warmer parts of the globe, some of them weeds.

A few daturas are grown as flower-garden subjects, or the shrubby kinds under glass or as tub specimens The most popular kind in northern gardens is commonly called *D. cornucopia* (Fig 1227), which is especially interesting when its flowers develop two or three well-defined trumpets, one within another Sometimes, however, these double flowers are a confused mass of petalage Double and triple forms are likely to occur in any of the species described below. The horn-of-plenty has been especially popular in America since about 1895, when it was found in South America by an orchid collector of the United States Nursery Company, and soon became widely distributed in "yellow, white, blue and deep carmine," all double forms Daturas contain strong narcotics Large doses are poisonous, small doses medicinal Separate preparations of Stramonium seed and leaves are commonly sold in the drugstores. *D. Stramonium* (Fig 1228) is the thorn-apple or Jamestown weed, the latter name being corrupted into jimson weed Its foul, rank herbage and large spiny fruits are often seen in rubbish heaps At the first successful settlement in America—Jamestown, Virginia, 1607—it is said that the men ate these thorn-apples with curious results Capt John Smith's account of their mad antics is very entertaining It has been conjectured that this same plant was used by the priests at Delphi to produce oracular ravings The seeds of *D sanguinea* are said to have been used by Peruvian priests that were believed to have prophetic power

Daturas are of easy culture Some are treated as tender annuals In the North the woody species can be grown outdoors in summer, and stored in cellars during the winter; in the South and in southern California they are almost everblooming They are sometimes kept in cool conservatories the year round, in which case they should be planted in the border, as they rarely flower well in pots, their roots being large and spreading and requiring a constant supply of moisture. This method produces great quantities of bloom in spring. After flowering, the plants should be cut in to the main limbs

A. *Fls. red.*

sanguínea, Ruiz & Pav Tree-like shrub, 4–12 ft. high: branches fragile, leafy at the apex lvs clustered, 5–7 from the same point, ovate-lanceolate, acuminate, almost 7 in long, 2½–2¾ in wide, pubescent on both sides, shining green above, paler beneath, the lower lvs wavy or angled, upper one entire; petioles 2½ in. long, channeled, pubescent. peduncles terminal, fls pendulous, brilliant orange-red, about 8 in long; calyx ovate, 5-angled, variegated, inflated. Peru B R. 1739 (as *B bicolor*) F S. 18:1883 —All the other species are said to be easily raised from cuttings, but this is very slow to take root.

AA *Fls. yellow.*

chlorántha, Hook. Shrub, glabrous throughout: lvs. broadly ovate, almost triangular; margin wavy, with short, rather sharp, very distinct teeth: peduncles axillary, very short; fls pendulous, yellow; calyx tubular, with 5 nearly uniform, short, triangular teeth. Habitat unknown. B M. 5128 Gn 46:429, 49, p. 379.—Datura "Golden Queen" is presumably a horticultural variety of this species While this species is horticulturally distinct by reason of its yellow fls., it is a doubtful species botanically, being founded on a very double garden form of unknown origin In Vilmorin's

Blumengartneri, by Voss, it is referred to *D. humilis*, Desf., but *D. humilis*, in turn, is perhaps a form of *D. fastuosa*.

AAA. *Fls. normally white (sometimes touched with violet) or purple.*

B. *Plants tall, 7–15 ft. high: blossoms pendulous.*

C. *Calyx tubular, with 5 obscure teeth.*

suavèolens, Humb & Bonpl (*D. Gárdneri*, Hook) ANGEL'S TRUMPET. Tree-like shrub, 10–15 ft high lvs ovate-oblong, 6–12 in long, 2¼–4 in wide, entire, glabrous, petioled, often unequal at the base. fls 9–12 in. long; calyx inflated, angled, glabrous, with 5 obscure teeth; corolla-tube plaited, the limb with 5 short lobes, anthers crowded together. Mex. G C. III 11 593, 23.71 S H 2 433.—The double form is much commoner in the gardens than the single. This is the plant which is usually cult as *D arborea*. It is said to be very distinct from the true *D. arborea* of Linn., but it can be separated with certainty by the calyx.

CC. *Calyx spathe-like, not toothed.*

arbòrea, Linn. (*Brugmánsia arbòrea*, Steud.). ANGEL'S TRUMPET. Small tree: lvs ovate-lanceolate, margin entire, never wavy or angled, pubescent, in pairs, one a third shorter than the other; petioles 1 in. or more long fls with a musk-like odor; calyx tubular, entire, spathe-like, acuminate; corolla-tube terete, the lobes of the limb very long; anthers distinct, not conglomerate. Peru and Chile. G C II 11:141.—Most of the plants cult. under this name are presumably *D suaveolens*. The extent to which the true *D. arborea* is cult. is undetermined.

BB. *Plants less tall, only 2–5 ft. high.*

C. *Blossoms erect, calyx not spurred.*

fastuòsa, Linn (*D. Hummàtu*, Bernh. *D* and *B cornucopia*, Hort.) Fig. 1227. Annual, 4–5 ft high, herbaceous. lvs ovate-lanceolate, acuminate, acute and unequal at the base, toothed or wavy, glabrous on both sides, solitary, upper ones in pairs one of which is larger, 7–8 in long, 2½–3½ in wide, petioles 1½–2½ in long. fls 6½–7 in long, violet outside, whitish within, calyx purple, angled, 2 in long, 5-toothed, the teeth triangular lanceolate, acuminate, 5 lines long, 2–3 lines wide. caps spiny, subglobose, 1¼ in diam. Native of India. Naturalized in the tropics of both worlds. F S 14 1457. Gn 46 224. I H 12 25.—The commonest garden datura. Resembles the common *D. Stramonium*, but fls larger. Var **álba,** Clarke (*D alba*, Nees), has fls white or nearly so. (*D álba* var *africàna*, Fedde, is distinguished by its larger lvs, longer calyx, and corolla glabrous outside. Italian Somaliland.) Var **dùbia,** Clarke (*D. dùbia*, Don. *D Nithummàtu*, Dunal), has spineless frs. Var **Huberiàna,** Hort., is a thick bushy cult. form with large fls of several colors, running into yellowish, blue and red; it is said to be a hybrid with *D chlorantha*.

meteloìdes, DC (*D Wrìghtu*, Hort.). Perennial (cult. as an annual. N.), glaucescent and puberulent. branches slender, forked. lvs unequally ovate, almost entire, acuminate, acute at both ends, upper lvs often in pairs, the larger 2–2½ in long, 8–9 lines wide, petioles thickened at the base, 4–5 lines wide. calyx tubular, the teeth mostly 5, corolla about 4–8 in long, or twice as long as the calyx, 5-toothed, the teeth slender-subulate. caps 2 in diam., succulent, prickly. Texas to Calif. Gt 1859·260. R H 1857, p 571. F S 12·1266.—Fls white, suffused with violet, fragrant. Occurs also in Northern Mex.

CC. *Blossoms pendulous; calyx with a long spur.*

cornígera, Hook (*D.* and *B. Knìghtu*, Hort.). Height 3–4 ft.: branches downy: lvs chiefly at the ends of branches, ovate, petioled, acuminate, margin entire, wavy or angled. fls pendulous, white or creamy white, very fragrant at night, striated, 5-lobed, the lobe terminated by a long awl-shaped spreading or recurved point, stamens included. Mex. B M 4252. *Brugmansia Knightii* seems to be a trade name for only the double form. Gn. 45, p. 549.

Weedy annual species of Datura, intro. from the tropics or warm countries and run free in this country, are *D. Mètel*, Linn. Pubescent. lvs entire or slightly toothed. calyx tubular, corolla-limb 10-lobed, 4 in. across. caps nodding, prickly. 3–5 ft. fls white.—*D Stramònium*, Linn. Fig. 1228. The common stramonium or jimson-weed. glabrous, green-stemmed. lvs ovate, sinuate or angled or even cut-toothed. caps erect, with stout prickles. 2–4 ft. fls white. A very similar species but with a smooth and spineless caps is *D inermis*, Jacq.—*D Tátula*, Linn. Differs from *C Stramonium* in having purple sts., and violet-purple or lavender fls., and prickles of the caps more nearly equal.



1228. Pods of Datura Stramonium. (×⅓)

Other daturas more or less cult. abroad are: *D ceratocàula*, Ort. Annual, 2 ft. branches horn-shaped. lvs broad-lanceolate. fls very large, inside white or light violet, outside bluish, opening late in afternoon. tall middle of forenoon. fr. hanging, smooth. Trop. Amer. B M 3352.—*D coccínea*, Hort.=*D De Noteri*.—*D colossea aurea*, Hort. Garden hybrid, parentage not reported, with bright golden yellow fls.—*D De Nóteri*, Hort. P–obably annual. 3 ft. fls fragrant, brilliant red, freely produced. S Afr.—*D ferox*, Linn. St. thick, glabrous, red at base but otherwise green- or white-punctate. lvs rhombic-ovate, angled-toothed. calyx 5-angled and about 5-parted, corolla light blue, the limb angulate. fr. unequally spiny, with 4 large spines at top. S Eu.—*D quercifolia*, HBK. Annual, with green sts., the young growth somewhat pubescent. lvs deeply sinuate-pinnatifid. fls. as in *D Tatula*. caps bearing large and unequal flattened prickles that are sometimes ½ in. long. Mex.

WILHELM MILLER.
L. H B.†

DAUBENTÒNIA: *Sesbania*.

DAÙCUS (ancient Greek name). *Umbellíferæ*. Perhaps 60 annual and biennial herbs of very wide distribution. One or 2 species are native to N. Amer.; one species of Daucus is the common garden carrot, and the wild form of the same species is an abundant old-field weed in the northeastern states. Aside from the carrot, there are no horticultural members of the genus. Daucus comprises bristly or setose slender plants, with pinnately decompound and often finely divided lvs., very small fls. in compound involucrate umbels, and oblong mostly dorsally flattened frs. The species are mostly of the temperate regions of Eu., Afr. and Asia.

Caròta, Linn. Figs. 821, 822. Bristly biennial, with twice- or thrice-pinnatifid lvs., the ultimate divisions cut and pointed. fls. crowded in umbellets, mostly white but sometimes blush or even pale yellow, some of the marginal fls. larger, rays of umbel numerous, involucre of many elongated-subulate divisions. fr. (or "seed") small, greenish or brownish, somewhat convex on one side and plane on the opposite side

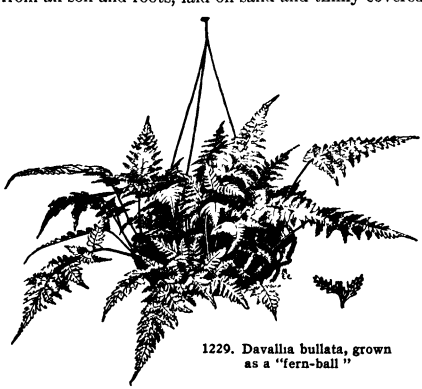
grooved, bristly, aromatic. Eu. Under cult., the root has been greatly developed into many edible forms.

Var. **Boissièri,** Schweinf., from Egypt and also in Spain, has blood-red or violet-colored roots. Gt. 1904:1527. L. H. B.

DAVÁLLIA (a personal name). *Polypodiàceæ.* Ferns, some of them grown under glass, and the smaller species making good plants for hanging-baskets

Tropical plants, usually with firm, somewhat finely divided foliage and coriaceous semi-cylindric indusia, which are attached at both the base and sides, opening toward the margin of the leaf —Some twenty species, in many parts of the globe, some of them epiphytes.

The diverse habits of growth of the many different species of davallias, and their good lasting qualities, peculiarly fit them under ordinary care for decorative purposes, when delicate and graceful plants are desired. Among the many species, the following are most often seen and best adapted for commercial purposes. *D. bullata, D. parvula,* very dwarf; *D. pentaphylla,* young fronds of a dark bronzy green, and *D. Tyermannii* (Humata), are well adapted for hanging-baskets. *D. dissecta* and var. *elegans, D. concinna* (Loxoscaphe), *D. fijiensis* and vars *plumosa* and *major, D. fæniculacea* (Loxoscaphe), *D solida, D pallida* (syn. *Mooreana*) and *D pyxidata* are adapted for large specimen plants. *D. tenuifolia* (*Odontosoria chinensis*) and vars. *stricta* and *Veitchiana* are desirable for fern-dishes, because of their dwarfish habit of growth and the ease with which they may be raised from spores —Old plants of davallia may be cut into a number of smaller ones with a sharp knife. Planted firmly into shallow pans and placed in a temperature of 60° to 65° F., they soon develop into symmetrical plants. The rhizomes should be firmly fastened to soil by strong copper-wire staples, where they will root in a short time. To gain a large number of small plants, the rhizomes should be detached, cleaned from all soil and roots, laid on sand and thinly covered



1229. Davallia bullata, grown as a "fern-ball"

with moss Placed in a shaded position in a temperature of 65° to 70° F., and kept moderately moist, a number of small plants will develop from the dormant eyes, which may be separately potted as soon as of sufficient size. Spores of davallia should be sown on a fine compost of soil, leaf-mold or peat and sand in equal parts, and placed in a shaded position in a temperature of 60° to 65° F. All the operations of propagation of davallias will be most successful if conducted during the spring months All davallias delight in a rich and open compost, an abundance of light and air, and moisture at their roots, a temperature of 60° to 65° F. and a thorough syringing every bright day. (N. N. Bruckner)

INDEX.

bullata, 3.
canariensis, 8.
decurrens, 6.
denticulata, 5.
dissecta, 11
divaricata, 12
elegans, 5, 8, 11.
fijiensis, 10.
major, 10
Mariesii, 4.
Mayi, 6
Mooreana, 13.
ornata, 7.
pallida, 13.
parvula, 2
pentaphylla, 1.
plumosa, 10
polyantha, 12.
pyxidata, 9.
solida, 7.
superba, 7.

A. *Lvs. once pinnate, with few linear segms.*

1. **pentaphýlla,** Blume. Lvs. scattered, from a stout fibrillose rootstock, 1-pinnate, with 1 terminal and 4–6 pairs of lateral pinnæ, 4–6 in long, ½in. broad; sori in marginal rows. Java and Polynesia.

AA. *Lvs. tri- or quadri-pinnatifid, deltoid.*

B. *Length of lvs. less than 1 ft.*

2. **párvula,** Wall. A tiny fern with scaly creeping rootstocks, the lvs. sessile or with stalks 1–2 in. long, the blades ½–¾in long, ½in broad, triangular, 2–3 pinnatifid, the segms. threadlike, pointed Singapore and Borneo.

3. **bullàta,** Wall Figs 1229, 1230 Rootstock creeping, clothed with whitish or light brown hair-like scales: lvs. scattered, 6–10 in. long, 4–6 in wide, quadripinnatifid, with deeply incised segms , texture firm. India to Java and Japan. F E 11 543 —Often sold for house cult in the form of a fern-ball

4. **Màriesii,** Moore. Rootstock stout, with brownish scales, which are lanceolate from a broad dilated base: lvs deltoid, 4–6 in each way, with the pinnæ cut away at the lower side at base, segms short-linear, 1-nerved; sori intramarginal Japan G C. III 13·571.

BB. *Length of lvs 1–2 ft*

C. *Foliage commonly tri-pinnatifid*

5. **denticulàta,** Mett (*D élegans,* Swartz) Rootstock clothed with woolly fibers lvs 9–15 in wide, with the main rachis slightly winged toward the apex; indusia several to a segm , with the sharp teeth projecting beyond the cups Ceylon to Austral. and Polynesia

6 **decúrrens,** Hooker Rootstock stout, creeping, fibrillose. lf -blade 1–2 ft long, 9–15 in broad, triangular, the main rachis scarcely winged at the apex, 3-pinnate, the segms linear-oblong, broadly toothed; sori inside the margin Philippines. Var. **Màyi,** Hort. Graceful, much divided lvs.

7. **sólida,** Swartz (*D ornàta,* Wall) Rootstock clothed with appressed scales or fibers· lvs 1–2 ft long, 12–15 in wide, the center of the apex broad and undivided, segms. broad and slightly cut; indusia marginal Malaya Var. **supérba,** Hort Lvs flat, in young state tinted with red

CC *Foliage commonly quadri-pinnatifid.*

8. **canariénsis,** Smith Rootstock stout, densely clothed with pale brown linear scales· lf -blades 12–18 in long, triangular, with ovate-rhombic, deeply incised segms , sori on entire segms , or with a horn outside. Spain, Canaries, N. Afr. Var. **élegans,** Hort Lvs. finely divided.

9 **pyxidàta,** Cav. Rootstock clothed with pale brown linear scales: lf -blades tri-quadri-pinnatifid, 6–9 in broad, with oblong segms ; sori with a broad space outside, which is extended into a horn-like projection. Austral

10 **fijiénsis,** Hook. Lvs 6–12 in broad, with the lower pinnæ deltoid and the segms. cut into narrow, linear divisions ⅛–¼in long; sori on the dilated apices of the segms with no horn Fiji Isls A F. 6·900, 9 233 G C III. 23:323 —One of the finest species, with numerous varieties. Considered by some botanists to be a variety of *D. solida* Var. **plumòsa,** Bull Distinct from the species by the gracefully drooping habit and feathery nature of the pendulous lvs. Var **màjor,**

Moore. More robust: lvs. not so fine, lighter color than the species.

11 **dissécta,** J. Smith. Rootstock stout, with dense, rusty scales. lvs. 10–12 in. broad, on straw-colored stalks, segms oblong, cuneate at base, with simple or bifid lobes, sori minute, often with 2 projecting horns. Java. Var. **élegans,** Hort. Similar to type but with more graceful habit.

BBB. *Length of lvs. 2–3 ft.*

12. **divaricàta,** Blume (*D. polyántha,* Hook.). Rootstock with linear rusty scales: lvs. tri-pinnatifid, sometimes 2 ft. broad, with deltoid segms. cut into linear-oblong lobes; sori at some distance from the edge. India to Java and Hong Kong.

13 **pállida,** Mett. (*D. Mooreàna,* Mast.) Rootstock stout, with lanceolate dark brown scales lvs with straw-colored stalks 12–18 in long, quadri-pinnatifid, with deltoid, stalked segms, the ultimate obovate-cuneate, bearing the sorus on the upper side at the base. Ancityum and Borneo A F. 6:901; 9:231. A. G 13.143

For *D concinna* and *D fæniculacea,* see Loxoscaphe *D platyphylla,* see Microlepia, *D stricta,* see Stenoloma, *D tenuifolia,* see Stenoloma, *D Tyermannii,* see Humata

Several other ferns are in trade under the name Davallia, which are properly referred to other genera Of these, disposition should be made as follows. *D alpina*=Humata repens, *D angustata*=Humata heterophylla, *D brantheni*=Saccoloma inæquale, *D retusa*=Odontosoria retusa, *D tenuifolia*=Odontosoria chinensis *D amœna* and *D decora* are names of uncertain standing and application.

R. C. BENEDICT.†

DAVÍDIA (after Armand David, French missionary, botanized in China from 1862 to 1873) *Nyssàceæ.* Ornamental deciduous trees, cultivated for their handsome foliage and the large and showy white flowers.

Leaves alternate, slender-petioled, dentate, without stipules: fls. polygamous, in dense subglobose heads consisting of numerous staminate fls and 1 bisexual fl, with 2 large bracts at the base; sepals and petals wanting, stamens 1–7, with slender filaments; ovary 6–10-celled, with rudimentary perianth and a circle of short stamens on top of the ovary at the base of the short and thick style, with spreading stigmas: fr a drupe with a 3–5-seeded stone.—One species in W China

This is a handsome tree of pyramidal habit, with rather large and attractive bright green foliage, and an object of striking beauty when studded with the very large creamy white floral bracts The tree has proved hardy in favorable positions as far north as Massachusetts, it seems to be somewhat tender only while young Apparently it grows well in any good fresh soil Propagation is by seeds sown in spring, which soon germinate, and by cuttings in summer of half-ripened wood under glass, also by layers.

involucràta, Baill Pyramidal tree, to 60 ft, with upright or ascending branches: lvs. cordate-ovate, acuminate, coarsely serrate, strongly veined, bright green and finally glabrous above, densely silky pubescent below, 2¼–5 in long: heads terminal, peduncled; bracts 2, opposite, rarely 3, ovate to oblong-obovate, entire or serrate, creamy white, of unequal size, the larger to 7 in long and to 4¼in. broad: drupe oblong-ovoid, brownish, punctulate, about 1½ in long. May, June: fr. in Oct W. China. Var. **Vilmoriniàna,** Hemsl (*D. Vilmorniàna,* Dode. *D. làta,* Dode). Lvs glabrous and glaucescent below, or only sparingly pubescent while young. B.M 8432 H I. 20·1961 G C. III. 33:235; 39:346. J.H S. 1903 57, 37:129, fig. 113. R.H. 1906, pp. 297–9; 1907, p 321. R B. 34:230. This variety is better known in cult. than the type. It was intro. in 1897 by Farges who sent seeds from which a single plant was raised by Vilmorin. Later E. H. Wilson sent seeds of the variety as well as the type, from which a large stock of plants was raised by Veitch

ALFRED REHDER.

DAY FLOWER: *Commelina*

DAY LILY: *Funkia* and *Hemerocallis.*

DEAD NETTLE: *Lamium.*



1230. Davallia bullata. (×½)

DEBREGEÀSIA (derivation unknown, probably named after a person) Syn, *Morocárpus. Urticàceæ.* Upright shrubs, grown for their handsome foliage and ornamental yellow or red fruits, which are edible.

Leaves alternate, short-petioled, serrulate, 3-nerved at the base, rugose above, tomentose beneath; stipules bifid: fls. monœcious or dioecious in unisexual globose clusters arranged in small axillary cymes; staminate fls. with usually 4-parted perianth, with 4 short stamens; pistillate with urceolate or obovate perianth much contracted at the mouth, with very short usually 4-toothed limb, adnate to the ovary; stigma penicillate, on a short style or sessile: fr subglobose consisting of numerous small 1-seeded fleshy drupelets —Five or 6 species in China, S. Asia and Abyssinia.

The two species in cultivation, neither of which is yet in trade, are spreading tender shrubs with handsome slender foliage, dark green above, whitish below, and small usually orange-red fruits resembling in shape a small mulberry and produced profusely along last year's branches. *D longifolia* is a stove-plant; *D. edulis* is hardier, and at the Arnold Arboretum survives the winter outdoors It is, however, killed back nearly to the ground, but sends up numerous shoots, and although it does not flower and fruit, it is an attractive bush on account of the striking contrast of the dark green lustrous upper and the white lower surface of the leaves. Propagation is by seeds and by greenwood cuttings under glass.

edùlis, Wedd. (*Morocárpus edùlis,* Sieb. & Zucc.). Shrub, to 6 ft.: branchlets appressed-pubescent, soon glabrous: lvs. oblong-lanceolate to elliptic, acuminate, serrulate, rugose and smooth above, whitish tomentose below, 3–5 in. long: fr. orange-red, globose, about ½in across, in small dichotomous cymes in June. China, Japan.

longifòlia, Wedd. (*D. velùtina,* Gaud. *Conocéphalus níveus,* Wight). Shrub, to 8 ft.: branchlets villous: lvs. lanceolate to oblong-lanceolate, acuminate, serrulate, rugose and rough above, white-tomentose beneath, 4–7 in long fr. orange-yellow or red, ½in across, in small dichotomous cymes. Subtropical Himalaya to Java. R H. 1896, p. 321. G.C. III 39:232, suppl.

ALFRED REHDER.

DECABELÒNE: *Tavaresia.*

DECAÌSNEA (after Joseph Decaisne, French botanist, who wrote much on the botany of cultivated plants; 1809–1882). *Lardizabalàceæ* Woody subjects grown for the large pinnate foliage and the conspicuous fruits

Upright sparingly branched shrubs: lvs. odd-pinnate, large, with opposite entire lfts fls polygamous, in axillary racemes, slender-pedicelled; sepals 6, petaloid, long-acuminate; petals wanting; stamens 6, the filaments in the staminate fl connate into a column, pistils 3, growing into rather large oblong follicles with numerous seeds in two ranks imbedded in a white pulp —Two species in E Himalayas and in W China

These are distinct-looking shrubs, in habit resembling a large-leaved sumac, with long racemes of pendulous greenish flowers similar in shape to those of a yucca, but are smaller, and with conspicuous blue or yellow fruits which are edible, but insipid. The Chinese species has proved hardy at the Arnold Arboretum in sheltered position, while the Himalayan is tender They prefer a sheltered situation of warm southern exposure and do not seem particular as to the soil. Propagation is by seeds

Fargesii, Franch Shrub, to 15 ft : lvs to 3 ft long, glabrous; lfts 13–25, elliptic, acuminate, short-petioled, bright green above, glaucescent below, 2–5 in long· racemes upright, many-fld ; fls nodding, campanulate, greenish, 1–1¼ in long, sepals lanceolate, long-acuminate, much longer than the stamens fr pendulous, oblong-cylindric, deep blue, 3–4 in long, about 1 in thick, with numerous black seeds about ½in long· April, May; fr in Sept. W China B M 7848. R H. 1900, pp 270, 271, 273 M D 1912.197

D insignis, Hook f & Thoms In habit, lvs and fls , very little different from the preceding species, but fr yellow, thicker, curved. E Himalayas B M 6731 F S 13 1335 I H 3 91

ALFRED REHDER

DÉCODON (Greek, *ten-toothed*) *Lythracex* A hardy perennial herb sometimes offered by dealers in native plants Decodon is sometimes considered a subgenus of Nesæa, but is latterly kept distinct as a monotypic genus It is distinguished from Lythrum by having 5 (rarely 4) petals instead of 6, and 10 stamens while Lythrum has mostly 6 or 12 It has opposite or whorled lvs , the upper with axillary, short-stalked clusters of fls

verticillàtus, Ell (*Nesæa verticillàta,* HBK) SWAMP LOOSE-STRIFE WATER-WILLOW Smooth or downy sts. recurved, 2–8 ft long, 4–6-sided lvs lanceolate, nearly sessile· petals 5, cuneate-lanceolate, rose-purple, ½in long, stamens 10, half of them shorter. Swampy grounds, N E to Fla , west to Minn and La —Desirable for colonizing about ponds and in very wet places. It runs into 2 or 3 varieties

DECUMÀRIA (Latin, *decumus,* tenth, referring to the number of the parts of the flower) *Saxfragàceæ.* Climbing shrubs, cultivated for their handsome glossy foliage and clusters of attractive white flowers

Climbing by aerial rootlets lvs deciduous, opposite, petioled. fls in terminal peduncled corymbs, small, white, perfect, sepals and petals 7–10; stamens 20–30: fr a 5–10-celled ribbed caps opening between the ribs, with numerous minute seeds.—One species in E. N. Amer. and one in China.

These are ornamental climbing shrubs with handsome glossy foliage and fragrant white flowers, forming a corymb of feathery appearance, well adapted for covering walls, rocks, trellis work and trunks of trees; tender, but the American species survives in sheltered positions as far north as Massachusetts, while the Chinese is more tender. They thrive in almost any humid soil Propagation is by greenwood cuttings in summer under glass, rarely by seeds

bárbara, Linn. (*D. sarmentòsa,* Bosc). Climbing to 30 ft , but usually less high lvs. ovate, obtuse or acute, remotely denticulate or entire, glabrous and shining above, 2–4 in long and 1–2 in broad corymbs 2–3 in broad, semiglobose May, June. Va. to Fla , west to La B.B. (ed. 2) 2.233. Mn. 1:41. G.C. III. 46 242, suppl.

D sinénsis, Oliv Very similar to the preceding, less high lvs. generally oblong, obtuse or obtusish, 1½-3 in long and ½–1 in. broad pedicels appressed-pubescent Cent China H I 18 1741.

ALFRED REHDER.

DEERBERRY: *Vaccinium stamineum.*

DEERGRASS *Rhexia.*

DEERÍNGIA (Karl Deering, died 1749; born in Saxony, practicing physician in London and author of catalogue of plants of England) *Amarantàceæ.* About a half-dozen species of climbing herbs or subshrubs, from Madagascar to Austral , one of which is offered in Calif Lvs alternate fls dioecious or perfect, numerous and small, in terminal spiciferous panicles, parts of fl 5, spreading under the succulent indehiscent fr , stamens 5, united into a ring **D. baccàta,** Moq (*D celosioìdes,* R Br), in Austral , E Indies and elsewhere, is a smooth woody climber, 10–12 ft lvs ovate or ovate-lanceolate, acuminate, entire. fls in slender interrupted spikes 1 ft or less long, greenish white berry red, nearly globular, ¼in or less diam. B M 2717 The plant offered as *D variegata,* described as a slender-growing shrub that will climb if shoots are trained up, long spikes of white fls , and lvs margined with white, is probably a form of this species, or it may be *Bosea Amherstiana* (*D Amherstiana,* Wall), which has a form with variegated lvs L H. B.

DEINÁNTHE (Greek *extraordinary,* referring to the flowers being large for the group) *Saxifragàceæ* Herbs or sub-shrubs of 2 species, 1 in Japan and 1 in China, at least the Chinese species having been offered in England Of the Hydrangea tribe, allied to Cardiandra, but lvs opposite rather than alternate and style 1-5-forked rather than 3 and separate. *D cærùlea,* Stapf, from China, is a perennial herb, 1–1½ ft high, with horizontal stout rootstock, the solitary st from the tip of the rootstock lvs about 4 at the top of the st , ovate or broad-elliptic, sharply toothed fls sterile and fertile, the former few, the fertile much larger and nodding, the petals bright blue, stamens blue, all constituting a terminal panicle B M 8373 *D bifida,* Maxim , has creamy white or pure white fls with yellow stamens, a different infl , and lvs. deeply bifid at apex L. H B

DELABÉCHEA RUPÉSTRIS: *Sterculia rupestris*

DELÁRBREA (after a French naturalist) *Araliàceæ.* Tall tender shrubs from New Caledonia, grown in hothouses

Leaves alternate, decompound, gracefully arching, the lfts leathery and entire or slightly cut. fls falling very early, in large umbellate-paniculate clusters, not very showy Distinguished from Aralia by its round, not angled frs —Two species. Cult same as Aralia.

spectábilis, Lind & André (*Aràlia concínna,* Nichols). St ashy gray, with brown, warty spots. lvs odd-pinnate, lfts in 8–10 pairs, each lft entire or 3-toothed or twice cut, sometimes so deeply cut as to make 3 entirely free segms. I H 25.314.—Under the name of *Aralia spectabilis,* two different plants have been sold One is *Aralia filicifolia* The two plants can be distinguished at a glance The primary division of the lf in *A filicifolia* is long and narrow, thrice as long as in *D. spectabilis,* and tapering to a long point, while in *D spectabilis* the primary division of the lf. is short and has 3 well-marked segms In *A. filicifolia* the secondary divisions are deeply and irregu-

larly cut; in *D. spectabilis* they are merely serrate. The two plants are also immediately distinguished by the black spots on the st. of *D. spectabilis*.

N. TAYLOR.†

DELAVÀYA (after J. M. Delavay, French missionary, who explored the flora of S. W. China). *Sapindàceæ*. A tree from S. W. China, allied to Xanthoceras, but differing chiefly in its 3-foliolate lvs and in the much smaller fls. with a cupular disk. The only species, *D. toxocárpa*, Franch (*D yunnanénsis*, Franch), is a small tree, to 25 ft. lfts lanceolate, serrate, glabrous, to 7 in long: fls. about ½in. across, white. fr a 2–3-lobed woody caps with large brownish black seeds. Reported as recently intro. but probably hardy in warmer temperate regions only. ALFRED REHDER

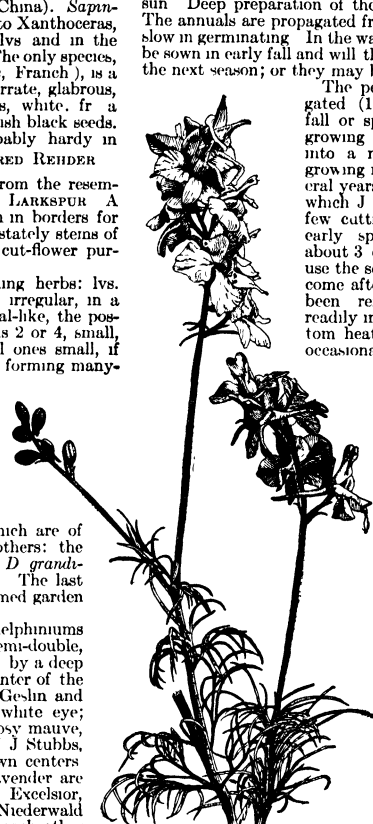
DELPHÍNIUM (Greek, *a dolphin*, from the resemblance of the flower). *Ranunculàceæ*. LARKSPUR A group of beautiful hardy plants grown in borders for their handsome spikes of flowers and stately stems of foliage They are of great value for cut-flower purposes as the blooms keep well

Annual or perennial, erect, branching herbs: lvs. palmately lobed or divided: fls. large, irregular, in a showy raceme or panicle, sepals 5, petal-like, the posterior one prolonged into a spur, petals 2 or 4, small, the posterior ones spurred, the lateral ones small, if present, the few carpels always sessile, forming many-seeded follicles Full double forms are very common in a number of the species (compare Figs 1232, 1233) A Gray, An attempt to distinguish between the American Delphiniums, Bot Gaz 12 49–54, 1887 E Huth, Monographie der Gattung Delphinium, in Eng Bot Jahrb 20 322–499, 1895. There are about 60 species, native of the north temperate zone, four of which are of much greater popularity than the others: the annual, *D. Ajacis*, and the perennials, *D grandiflorum*, *D hybridum* and *D formosum* The last three have been especially prolific in named garden varieties See page 3568

Some of the garden varieties of delphiniums are as follows. King of Delphiniums, semi-double, and Duke of Connaught, distinguished by a deep intense blue and conspicuous white center of the large singular flowers, Mme Violet Geslin and Julia, cornflower-blue varieties with white eye; Amos Perry, a combination of rich rosy mauve, flushed with sky-blue, Lizzie and Rev J J Stubbs, spikes of vivid azure around deep brown centers Combinations of sky-blue, pink and lavender are striking characteristics of Diademe, Excelsior, Grille, Hallgarten, Libelle, Minerva, Niederwald and Seidenspinner, distinguished from each other by white, brown or black centers. The petals of Carmen are of deep gentian-blue and pink, surrounding a brown center; those of Lamartine and Musea, lavender-blue; and Felicite, sky-blue.—Of the perpetual-flowering Belladonna class, the trade offers the following named hybrids: Capri, clear sky-blue; Moerheimen, pure white, Nassau, Mr Brunton and Persimmon variations in sky-blue and azure; while the light graceful spikes of Semiplenum and Grandiflora show a clear intense cornflower-blue.—Perfect double-flowering delphiniums, though very handsome, are shy seeders and a small percentage come true to color and variety. They do not seem to share in the great popularity of the singles. Of the latter the old species *D. chinense*, *D. Davidii*, and the rather hard to handle but otherwise beautiful yellow *D. Zalil*, are well worth cultivating (R. Rothe.)

Rocket and Candelabrum are names used to designate the forms of inflorescence in the two annual species. The "Rocket" or spike-like form is more commonly found in the Ajacis type, and the "Candelabrum," with a number of short spike-like heads of different heights, is found more often in Consolida

Delphiniums thrive in any good garden soil, but are improved by a deep, rich sandy loam, exposed to the sun Deep preparation of the soil is very important. The annuals are propagated from seed, which are very slow in germinating In the warmer latitudes they may be sown in early fall and will then produce flowers early the next season; or they may be started indoors.



1231. Delphinium Ajacis. (×½)

The perennials, may be propagated (1) By root-division in the fall or spring. The large strong-growing species may be divided into a number of plants after growing in the flower-bed for several years (2) By cuttings, about which J B Keller says: "Take a few cuttings from each plant in early spring, when growth is about 3 or 4 inches long, or else use the second growth, which has come after the flower-stems have been removed Cuttings root readily in a shaded frame, no bottom heat being required, but an occasional sprinkling during dry and hot weather is necessary. When rooted they are treated like seedlings" (3) By seeds started in the greenhouse or hotbed in March or even earlier. The young seedlings should be given plenty of room by transplanting as they grow, and may be set in the open garden by June. If started thus early they flower the first autumn The seed may be planted in late spring or summer, care being taken to water well during dry weather, and flowers will come the next summer. To get the best results, the perennials should be transplanted every 2 or 3 years Two good crops of blossoms may be secured in one season by cutting away the flower-stems of the first crop as soon as the flowers have faded; of course no seeds will be produced in this way

In most climates where they are grown the roots of the perennials are left unprotected, in the open garden, during the winter This plan can be improved by giving the bed or border a good dressing of barnyard manure about the time the ground begins to freeze in the fall This will greatly enrich the soil and also protect the underground buds during winter. A much better show of flowers will be the result. Because of their ability to use much fertility, it is well to spade in the manure instead of removing it in the spring. A top-dressing of manure near the plants in midsummer is used to aid in forcing the "fall" or second crop of flowers This dressing conserves the soil-moisture, prevents weeds, and adds plant-food Such applications of manure will make the plants more vigorous throughout. They will flower more profusely and if desired, the roots can be divided much more freely.

INDEX.

Ajacis, 1.
albidum, 18.
albo-pleno, 17.
album, 17, 18.
alpinum, 16
altissimum, 14.
azureum, 18.
Barlowii, 27.
bicolor, 7.
Brecku, 17
Brunonianum, 8.
cardinale, 4.
carolinianum, 18
cashmerianum, 10.
chellanthum, 24.
chinense, 17.
coelestinum, 25.
columbianum, 22.
Consolida, 2.
cultorum, 28
decorum, 9
elatum, 16.
exaltatum, 15.
flore-pleno, 17.
formosum, 25
grandiflorum, 17
hybridum, 6, 17, 27, 28
imperialis, 2.
Maackianum, 26.
Menziesii, 12.
mesoleucum, 19.
nudicaule, 3.
Nuttallii, 22.
occidentale, 23.
pauciflorum, 13.
Przewalskianum, 5.
Przewalskii, 5.
pyramidale, 16.
scopulorum, 23.
simplex, 21.
sinense, 17.
subalpinum, 23.
sulphureum, 6.
tricorne, 11
trollifolium, 20.
vimineum, 18.
virescens, 18.
Walkeri, 10.
Zalil, 6.

A. *Annuals: petals only 2, united: follicle 1.*

1. **Ajàcis,** Linn. Fig. 1231. An erect annual, about 18 in. high, with a few spreading branches: lvs. of st. sessile, deeply cut into fine, linear segms.; root-lvs. similar, but short-petioled: fls. showy, blue or violet, varying to white, more numerous than in *D. Consolida*, in a spicate raceme; petals 2, united; calyx-spur about equaling the rest of the fl.: follicle only 1, pubescent; seeds with wrinkled, broken ridges May–Aug. Eu. R.H. 1893, p 228 Same figure in S H 2·282 —The season of flowering is governed largely by the time of sowing the seeds If sown in the fall, as may be done in warm climates, the plants will produce fls by May or June. But if the seeds be sown in spring no fls. should be expected before July or Aug.

2. **Consólida,** Linn. (*Consólida arvénsis*, Opiz). An erect, hairy annual, 1–1½ ft high· lvs similar to *D. Ajacis* fls. few, loosely panicled, pedicels shorter than the bracts, blue or violet or white; petals 2, united: follicle 1, glabrous; seeds with broken, transverse ridges. June–Aug. Eu. Baxter Brit Bot. 4, t. 297. R H. 1893, p. 228 (var *ornatum Candelabrum*). G Z. 15:81. Var. **imperiàlis,** Hort. (*D. imperiàlis fl. pl*, Hort.). Fls. double From the English gardens —See above species for sowing of seeds.

AA. *Perennials, pure species: petals 4: follicles 3–5 (Nos. 3–27).*

B. *Sepals red.*

3. **nudicaùle,** Torr & Gray St 1–1½ ft. high, glabrous, branched, few-lvd.: lvs. rather succulent, 1–3 in. across, lobed to the middle or farther 3–7 times, the secondary lobes rounded and often mucronate; petioles 3–5 in. long, dilated at the base. fls panicled; sepals bright orange-red, obtuse, scarcely spreading, shorter than the stout spur, petals yellow, nearly as long as sepals: follicles 3, spreading and recurved, soon becoming glabrous; seeds thin-winged Apr.–July. Along mountain streams, N. Calif. B.M. 5819. F S. 19:1949. R.H. 1893, p. 259.—A good perennial in the E.



1232. Single larkspur. —D. grandiflorum.

4. **cardinàle,** Hook. St. erect, 2–3½ ft. high and much higher under favorable conditions, partly pubescent: lvs smooth, fleshy, deeply 5-parted, the parts cut into long, linear lobes: raceme elongated, many-fld.; fls. bright red, with petal-limbs yellow: follicles glabrous, usually 3; seeds smooth. July, Aug. S. Calif. B M. 4887. Gt. 6:328. F.S. 11:1105. R B. 6:101. Gn. 19:234.

BB. *Sepals clear yellow or tipped with blue.*

5. **Przewálskii,** Huth (*D. Prsewalskiànum*, Hort). Nearly glabrous, often branched at base, erect, varying much in height: lvs 3–5 times deeply parted, parts divided into narrow, obtuse lobes: fls clear yellow, or sometimes tipped with blue; spur equaling the sepals: follicles 3, densely hairy. July, Aug. Asia.—Intro 1892.

6 **Zàlil,** Aitch & Hemsl. (*D. sulphùreum*, Hort *D. hybridum* var *sulphùreum*, Hort). St. nearly simple, erect, 1–2 ft high, rather glabrous, or becoming so. lvs. of several narrow, linear lobes, dark green; petioles not dilating at the base: fls. large, light yellow, in long racemes· follicles 3, longitudinally furrowed and ribbed, seeds with transverse, fibrous plates. June, July. Persia. Intro. 1892. B.M. 7049. Gn. 50:434; 54, p 347; 71, p. 285 G. C. III. 20.247 — Seedlings from tubers and plants die down as if dead; but they make a second growth after a short period of rest.



1233 Double larkspur — D grandiflorum

BBB. *Sepals blue or varying to white.*

C. *Height 1½ ft. or less.*

D. *Petioles dilating at the base.*

7 **bicolor,** Nutt Erect, rather stout, ½–1 ft high, from fascicled roots: lvs small, thick, deeply parted and divisions cleft, except perhaps in the upper lvs, segms linear and obtuse: raceme rather few-fld, the lower pedicels ascending 1–2 in; sepals nearly equal, ½in long or more, blue, upper petals pale yellow or white, blue-veined, lower petals blue follicles glabrous or becoming so May–Aug. Dry woods, Colo, west and north to Alaska

8. **Brunoniànum,** Royle. Musk Larkspur Sts. erect, ½–1½ ft high· plant somewhat pubescent upper lvs. 3-parted, lower ones reniform, 5-parted, segms deeply cut, musk-scented fls large, light blue with purple margins, center black, spur very short, sepals 1 in. long, membranous and often clinging until the fr. is mature: follicles 3 or 4, villose June, July. China. B M. 5461. R B. 1863·34

9. **decòrum,** Fisch & Mey. St. slender and weak, ½–1½ ft high, smooth or nearly so lvs few, bright green; upper ones small, 3–5-parted into narrow lobes; lower and radical ones somewhat reniform in outline and deeply 3–5-parted, lobes often differing widely: fls. in a loose raceme, or somewhat panicled, sepals blue, ½in long, equaling the spurs, upper petals at least tinged with yellow. follicles 3, thickish, glabrous. Spring. Calif. Intro. 1881 B R. 26:64.

DD. *Petioles hardly dilating at the base.*

E. *Upper petals never yellow*

10. **cashmeriànum,** Royle. Plant pubescent, not very leafy: st. simple, erect, slender, 10–18 in. high: root-lvs. orbicular, 2–3 in. diam, 5–7-lobed, coarsely, acutely toothed and cut; petiole 5–8 in long; sts -lvs. short-petioled, 3–5-lobed, cut like the radical ones, all rather thick, and bright green. infl. corymbose, the branches rather spreading; fls. 2 in. long, deep azure-blue; spur broad, obtuse, inflated, decurved, little over half as long as sepals; upper petals almost black, 2-lobed, lateral ones greenish: follicles 3–5, hairy. July–Sept. Himalayas. B.M. 6189 Gt 32·1105 Gn 18.568. R.H. 1893, p 259.—Hardy in Mass., and choice.

Var **Wálkeri,** Hook. St. very short, leafy, many-fld.: upper lvs. less lobed or almost entire, small, long-petioled: fls. very large, light blue with yellow petals. Suited to rockwork B.M. 6830.

EE. *Upper petals yellow or striped with yellow.*

11. **tricórne,** Michx. St succulent, about 1 ft. high: lvs. 3–5-parted, with 3–5-cleft linear lobes, petioles smooth, hardly dilating at the base· fls large, blue, rarely whitish; upper petals sometimes yellow, with blue

veins, lower ones white-bearded; sepals nearly equaling the spur: follicles 3–4, very long, becoming glabrous, strongly diverging; seeds smooth. May. Northern states L.B C. 4.306 —Very beautiful and much used. Best for rockwork The foliage dies down in midsummer and the plant appears as if dead.

12 **Menziesii,** DC Plant sparingly pubescent: st. simple, slender, ½–1½ ft. high, few-lvd.: lvs. small, 3–5-parted, the divisions mainly cleft into linear or lanceolate lobes; petioles hardly dilating at the base: fls. in simple, conical racemes; sepals blue, somewhat pubescent outside, nearly equaling the spurs in length; upper petals yellowish. follicles 3, pubescent, or sometimes glabrous; seeds black, winged on the outer angles. Apr.–June. On hills, Calif. and northward to Alaska. B R 1192

13. **pauciflòrum,** Nutt. Roots oblong or fusiform, fasciculate-tuberous. sts. slender, nearly glabrous, ½–1 ft high lvs. small, parted into narrow, linear lobes; petioles not dilating at base fls. and fr. similar to those of *D. Menziesii,* but on shorter pedicels. May, June. Colo. to Wash and Calif. Intro. 1892.

cc. *Height usually more than 1½ ft.*

D. *Seeds wrinkled or smooth, not winged nor scaly.*

E *Follicles always 3.*

14 **altíssimum,** Wall Plant shaggy-hairy above: st tall and slender, branched lvs. palmately 5-parted, the divisions 3-lobed and toothed: bracts long-lanceolate fls blue or purple, in long, branching racemes; spur straight or slightly incurved, equaling the sepals; petals 2-lobed follicles 3, erect; seeds not winged or scaly. Aug , Sept Himalayas.

15 **exaltàtum,** Ait St stout, 2–4 ft. high, smoothish: lvs flat, nearly glabrous, deeply cleft into 3–7 wedge-shaped lobes, which are often trifid; petioles usually not dilated at the base fls blue, with yellow on the upper petals, medium in size, on long, crowded, erect, pyramidal racemes, sepals nearly equaling the spur in length: follicles 3, pubescent or smooth; seed-coats irregularly wrinkled. June–Aug. Borders of woods, Ala. to Minn.

16. **elàtum,** Linn. (*D. alpìnum,* Waldst. & Kit. *D. pyramidàle,* Royle) Bee Larkspur Glabrous, 2–6 ft high. lvs somewhat pubescent, 5–7-parted, part rather narrow, cut-lobed; upper lvs. 3–5-parted, petioles not dilated at the base. raceme much like *D. exaltatum* or more spike-like, fls. blue, with dark violet petals, sepals ovate, glabrous, nearly equaling the spurs. follicles 3, seeds transversely wrinkled, not scaly June–Aug B R. 1963 (as *D. intermedium*). F S. 12 1287 (var *fl.-pl.*). R.H. 1859, p. 529; 1893, p. 258. —A polymorphous and complex species of Eu. It is probable that all or nearly all the plants sold here under this name should be called *D. exaltatum,* which is a closely allied species.

17. **grandiflòrum,** Linn. (*D. sinénse,* Fisch.). Figs. 1232, 1233 St rather slender, 2–3 ft. high. lvs. rather small, many times parted into nearly distinct, narrow, linear lobes· fls large, blue, varying to white, the spur and lower petals often violet, upper petals often yellow; spurs long and taper pointed: follicles 3, pubescent; seeds triangular, coats wrinkled, not scaly. Blooms in midsummer Siberia. Intro. 1880. B.M. 1686. Gn. 46: 484. Var **álbum,** Hort. Fls. pure white. Var. **álboplèno,** Hort. Fls. double and pure white. Var. **flòre-plèno,** Hort. (var. *hybridum fl.-pl.,* Hort). Fls. double, blue, very pretty. R H. 1893, p. 259; 1895, p. 379 (same).—This group includes the most common and the most beautiful of the perennial delphiniums. Grandiflorum is also one of the most stately. Its striking foliage remains beautiful throughout the growing season. It is usually planted well back in the hardy border because of its height, smaller plants being in front. They may be massed as close as 2 ft. or less but produce a fine effect when 4 ft. apart.

Var. **chinénse,** Fisch. St. very slender, not much branched: lvs and fls like the type, but fls. more numerous China. L B.C. 1:71 —A favorite garden form. The double blue form has been known as *D. Bréckii,* Hort.

EE. *Follicles varying from 3–5.*

18. **caroliniànum,** Walt. (*D azùreum,* Michx. *D. virèscens,* Nutt.). Plant somewhat pubescent: st. 1½–2½ ft. high, not much branched· lvs 3–5-parted, the divisions 3–5-cleft into usually linear lobes: racemes spicate, usually many-fld.; fls. azure-blue, but varying to whitish or white; sepals often with a brownish spot: follicles 3–5, oblong, erect; seeds transversely wrinkled. July. N C. to Ill , west and south P M. 16·258 Var **álbum,** Hort. (var *álbidum,* Hort.). Sts 2–3 ft high: lvs. larger than the type and with border divisions: fls. creamy white.—The double form of this is not much used.

Var. **vimíneum,** Gray. St. 2–4 ft. high, sometimes branched, broader-lvd , looser-fld.: fls. violet or white. Texas. B.M. 3593. B.R. 1999 (as *D. azureum*).

19. **mesoleùcum,** Link. St. 3 ft. high, pubescent above: lvs. 3–5-parted, the segms. wedge-shaped and deeply serrated; petioles somewhat dilated at the base: fls. blue, with pale yellow or whitish petals: seeds not seen. June. Nativity not known.

DD *Seeds winged.*

E. *Upper petals never yellow.*

20. **trolliifòlium,** Gray St 2–5 ft., leafy, often reclining. lvs. thinnish, large, often reniform at base, 3–7-parted; lobes wedge-shaped, incised. racemes in larger plants 1–2 ft. long and very loose; fls blue, with upper petals white; spur and sepals each ¾in long: follicles glabrous; seeds with thin wing or crown at the end. April. Moist grounds, Columbia River. Intro. 1881.

EE. *Upper petals often yellow*

21. **símplex,** Douglas St nearly simple, 2–3 ft high, soft-pubescent throughout: lvs. many-parted, into linear divisions and lobes: racemes dense, little branched, fls pale blue, with upper petals yellow, lower petals white-bearded, sepals equaling the spur follicles 3, pubescent; seeds dark, with margins white-winged. June. Mts. of Idaho and Ore. Intro. 1881.

22. **Núttallii,** Gray (*D columbiànum,* Greene). St. erect, simple, nearly glabrous, leafy, 1½–2½ ft.: lvs. thinnish, 3–5-parted, parts divided into many linear-oblong lobes· racemes long, many-fld ; sepals deep blue, ovate, sparingly pubescent, shorter than the spur; petals blue or upper ones yellow, lower ones white-bearded follicles 3, pubescent, rather erect; seeds thin, dark, with yellow wings Summer. Low, open woods, Columbia River Intro. 1892.

23. **scopulòrum,** Gray. St 2–5 ft , glabrous, at least below: lvs. 5–7-parted, the upper ones the more narrowly cleft; petioles dilating at the base: racemes simple, densely many-fld ; fls. blue or purple, rarely white, upper petals often yellow; spur ½in. long, equaling the sepals: follicles 3, pubescent; seeds large-winged Aug , Sept. Moist ground, west of Rockies.—A polymorphous species.

Var. **subalpinum,** Gray (*D. occidentàle,* Wats.) A smaller plant, pubescent above: broader divisions of lvs., shorter racemes, larger and deeper-colored fls : follicles glabrous. Wasatch Mts.

24. **cheilánthum,** Fisch St. erect, simple or branched, 2–3 ft.: lvs. glabrous or slightly pubescent, 5-parted, the lobes pointed, sub-trifid, and somewhat toothed: fls. dark blue, the upper petals sometimes pale yellow, the lower ones inflexed, ovate, entire; spur

rather long, straight or somewhat curved: follicles 3, either glabrous or pubescent; seeds 3-cornered, 3-winged, not scaly. June, July. Siberia B R. 473. J.F. 1, pl. 49. Gt. 13:253. P.M. 16:258 (as *D. magnificum*).

DDD. *Seeds scaly.*

25. **formòsum,** Boiss. & Huet. Fig. 1234. St. strong, 2–3 ft., hairy below, rather glabrous above· lower lvs. 5–7-parted, long-petioled; upper ones 3–5-parted, short-petioled or sessile, all alternate: racemes many-fld ; fls blue, with indigo margins; spur long, violet, bifid at the tip· follicles 3, pubescent; seeds scaly. June, July. Asia Minor perhaps, but the origin of it is disputed. F.S. 12:1185 R.H. 1859, p. 528. G Z 1: 144. H F. 8.99.—The most permanent form for naturalizing, because it is so hardy. If given rich soil and good cult , it is one of the most effective for use in the permanent fl.-border. Var. **cœlestìnum,** Hort. Fls. light blue.



1234. Delphinium formosum. (×⅓)

26 **Maackiànum,** Regel. Erect, 3 ft high, pubescent or glabrous, branched above: lvs. pubescent on both sides, base often truncate or reniform, 3–5-parted, the parts serrate; petioles dilated at the base: peduncles yellow-hairy, with the bracts often inserted above the base; fls. in loose panicles; sepals blue, half as long as the spurs; petals dark violet: follicles often glabrous, ¾in. long; seeds small, distinctly scaly July. Siberia

27. **hýbridum,** Steph. St 3–4 ft , pubescent above· root somewhat bulbous: lvs. 5-many-parted; lobes linear; petioles dilated and sheathing at the base racemes dense; fls blue, lower limbs white-bearded; spur straight, longer than the sepals· follicles 3, hairy; seeds ovate, with transverse scales. June–Aug. Mts. of Asia. R H. 1893, p. 258; same cut in S.H. 2:282 — There are many double and semi-double varieties of this type. This is the tallest and most robust of the popular species of Delphinium. It will respond well to fertilizer and cult. When the clumps become large and strong they are usually set about 4 ft apart. Young plants may be set 2 ft apart and thinned a year or two later.

Var. **Bárlowii,** Paxt Very large, semi-double fls., deep blue, with brownish center. A supposed hybrid with *D. grandiflorum.* B.R. 1944. Intro. 1892.

AAA. *Perennial. garden hybrids.*

28. **cultòrum,** Voss (*D. hýbridum,* Hort , not Steph.). The general mixed and more or less undefinable hybrid delphiniums, constituting some of the choicest garden and border plants of many colors, single, semi-double and double.

D. cærulèscens, Freyn A fine Asiatic species, with single and double forms P M 16 258 —*D. cándidum,* Hemsl A dwarf perennial fls pure white Uganda. H M 8170.—*D. cardiopétalum,* DC , is a pretty annual, branching very low, the outer branches very short, giving a pyramidal form when covered with blue fls. R H 1893, p 228 —*D. caucásicum,* C A Mey. (D. speciosum var. caucasicum, Huth) Similar to D cashmerianum —*D. Davídi,* Franch Hairy lvs 3-parted almost to the base fls light blue China —*D. divaricátum,* Ledeb Allied to D Consolida, but taller, more branched, with smaller more abundant fls Caucasus and Caspian region R H 1912, p 513 —*D. macrocéntron,* Oliv Perennial, hairy in nearly all parts fls blue and green or yellow and green E Trop Afr B M 8151 —*D. Moerheimei,* Hort A garden hybrid —*D. Párdonii,* Craib Fls blue in somewhat lax raceme China —*D. Párryi,* Gray, is also listed in the trade, and is closely allied to D Consolida —*D. Wheèleri* is listed in the trade and is doubtless a variety of D speciosum, Bieb , from E Asia. Many other species may be expected in the lists of collectors and fanciers

K. C. Davis.

DEMAZÈRIA: *Desmazeria.*

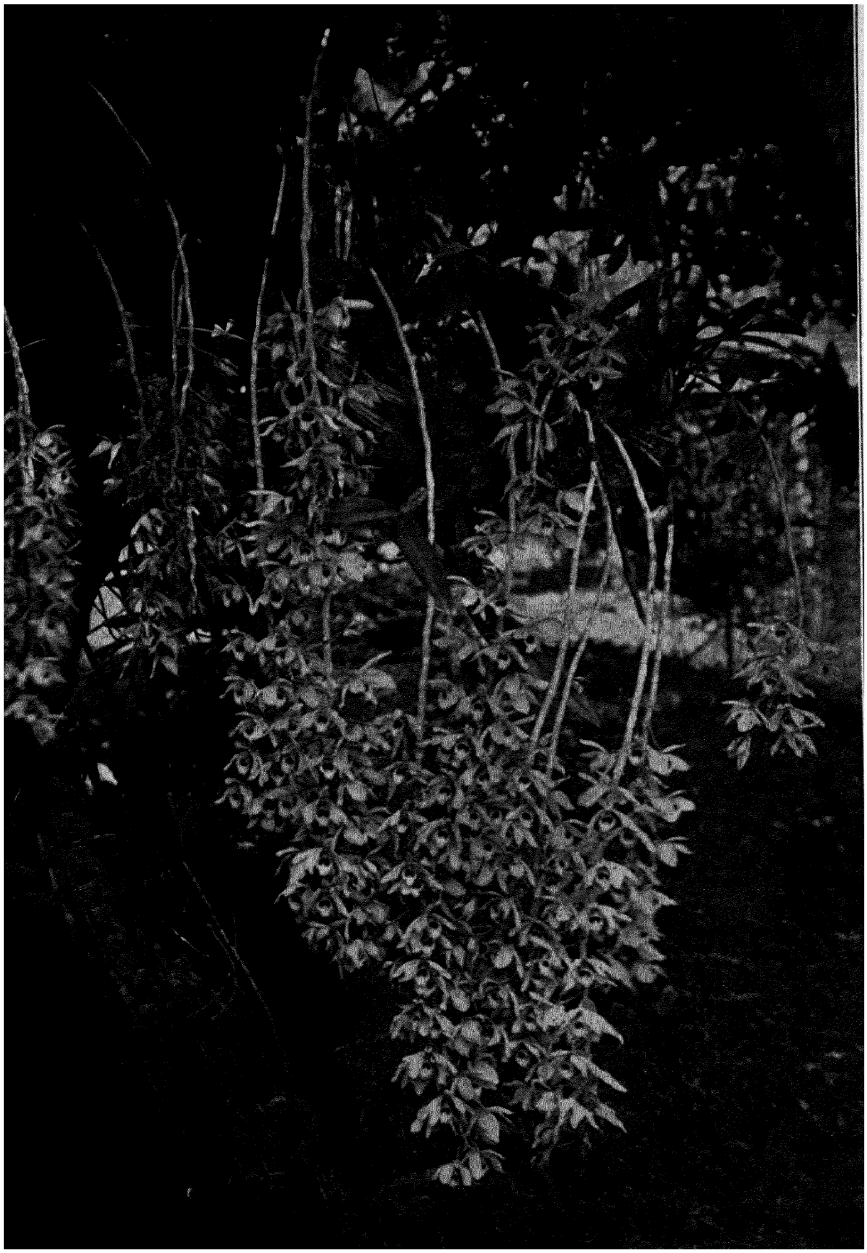
DEMERARA ALMOND: *Terminalia.*

DÉNDRIUM. *Leiophyllum*

DENDRÒBIUM (*tree* and *life,* they are epiphytic). *Orchidàceæ.* Epiphytic orchids of great horticultural merit, grown in hothouses and greenhouses

Pseudobulbs (sts), tufted or arising at intervals from a creeping st sometimes very short and thick, more commonly elongated and often thickened at or near the base, naked or leafy at time of flowering. fls. usually showy, rarely small, in terminal or lateral racemes which are long and lax or short and dense, sometimes of a few fls , or sometimes reduced to 1 or 2, sepals about equal, the dorsal free, the lateral adnate obliquely to the foot of the column, forming either a short sac-like or long spur-like foot or mentum, petals usually resembling the dorsal sepal, either broader or narrower; lip jointed or adnate to foot of column, 3-lobed or entire; pollinia 4 —A large genus of about 600 species, ranging from India and Ceylon to Austral , New Zeal , Japan, and the Pacific Isls , being especially numerous in the Malay Archipelago. There are numerous hybrids, artificially produced

There are two well-marked sections in this genus for the guide of the cultivator, the evergreen and the deciduous The first named should not be allowed to become dry at the roots at any period, or loss of vigor will result Among these, also, are some that need warm-house treatment all the time, such as *D Phalænopsis, D bigibbum, D Bensoniæ, D Brymerianum, D Dearei,* and others There are, in fact, but few among the evergreen species that need a coolhouse, and of these *D formosum, D infundibulum* and its variety *Jamesianum* are conspicuous Apart from these, the evergreen dendrobes should be kept in a warmhouse during winter where 60° F may be maintained — All the deciduous species (typified by *D Nobile, D Wardianum* and *D Pierardii*) need a marked resting period, easily determined by the finishing up of the growth in autumn, and the swelling of the nodes for flowering in spring When at rest, it does not hurt the plants to be subjected to a low temperature of 45°, and it may be done to retard plants for later blooming, allowing the day heat to be regulated by the sun, with plenty of ventilation on favorable days. After the pseudobulbs have flowered, they cease to be of value to the plants, and should be cut out; if there are portions that have not produced flower-buds, these may be used for propagation, cutting the pieces into lengths of several joints or nodes, and laying them on moss in a warm propagating-house or -case, when they will soon produce growths The above also applies to the hybrids, now so numerous, that have been raised from the deciduous Indian species.—Another section that requires warmth in winter, and now very much grown for cut bloom, is represented by *D. Phalænopsis* and *D. bigibbum.* These are Australian, quite distinct in growth, and usually short-lived in cultivation The flowers are produced freely for a



XXXV. Dendrobium superbum as grown in the American tropics.

few years, are very decorative, and the plants may be increased by taking off the young plants that often appear on the stems These often can be grown on to strong flowering specimens, and thus the stock maintained When wintered in a temperature less than 60°, the plants suffer, and great care is necessary at the time the young growths appear in spring to prevent damping off. Small pots or pans are best, and always keep the plants suspended near the sun and air The evergreen tropical species, as *D densiflorum*, *D. thyrsiflorum*, *D aggregatum*, *D Farmeri*, *D moschatum*, *D. fimbriatum* and *D Dalhousieanum*, also need warmth in winter and must not be dried severely during the resting-period or loss of vigor will ensue at the price of blooming This section of the genus produces flowers from the old stems for many years It frequently happens that growths made in India will bloom long after the plants have become established in gardens It is thus unwise to cut old growths unless they become withered or dead Enough water may be given to keep the plants plump, and the flowers will be produced freely in their season In some species, growth begins before or at the time of bloom This is usually a sign of extra vigor and should not be discouraged The proper time to repot with all plants of flowering age, is when they begin to recuperate in early summer after the bloom is past, young roots will be seen pushing out at the base of the stems, and if this is anticipated by a week or two, the new material is soon taken to by the roots and no check is experienced Good sound osmundine is the best material, always using small receptacles rather than large, and if larger than a 6-inch pot or pan, use perforated ones The roots do not like exposure, but the material will be kept in a sweet healthy condition Moss is best avoided in most cases, it often fails to grow, and is inimical to the welfare of the plants, when it does grow, it holds too much moisture about the roots. (E O Orpet)

INDEX.

aggregatum, 57.
albens, 23
albiflorum, 32, 70
albo-luteum, 66
albo-sanguineum, 50
album, 28, 32, 33, 46, 74
Amesiæ, 32
amœnum, 22
anceps, 2
anophtalmum, 54
anosmum, 48
Aphrodite, 41
aureum, 16
Armstrongiæ, 32
Ashworthianum, 32
aureo-flavum 70
aureum, 34, 42
Ballianum, 32
barbatulum, 67
Barberianum, 16.
Bensoniæ, 29
bicameratum, 58
bigibbum, 62
Bozzalii, 31
brachystachyum, 55.
breviflorum, 58
Broneckartii, 69
Brymerianum, 36
Bullenianum, 14
Bullerianum, 31
Calceolaria, 38
calliblepharis, 58
cambridgeanum, 53.
candidum, 20, 62
capillipes, 71
carinatum, 7
chlorocentrum, 51.
chrysanthum, 54.
chrysotis, 55
chrysotoxum, 72
clavatum, 43
cœrulescens, 32
Colmanianum, 32
Cooksonianum, 32
crepidatum,, 28
cretaceum, 30
cruentum, 3
crumenatum, 76
crystallinum, 23
cucullatum, 25
cumulatum, 12
Dalhousieanum, 37
Dartoisianum, 29, 64
Dayanum, 48.
Dearei, 13
densiflorum, 66, 74.
Devonianum, 15
dixanthum, 39
draconis, 10
elegans, 32, 71
erythroxanthum, 14.
ferox, 59
fimbriatum, 40
Findlayanum, 18
Fitzgeraldii, 61
formosanum, 32
formosum, 9
Fowleri, 33
Freemani, 20
Farmeri, 70
fuscatum, 44
Fytchianum, 67.
Gibsonii, 44.
giganteum, 9, 19, 27, 48
Goldiæ, 61
gratiosissimum, 31.
Griffithianum, 75.
Guiberti, 75
heterocarpum, 42.
hololeucum, 63
Hookerianum, 55.
Huttonii, 48
infundibulum, 6
Jamesianum, 6
japonicum, 21
jaspidium, 32.
Jenkinsii, 56
Kingianum, 60
lasioglossum, 45
latifolium, 25
leucolophotum, 68
Linawianum, 17
Lindeniæ, 63
lituiflorum, 20
Loddigesii, 47
longicornu, 5
Lowii, 8
luteolum, 51
luteum, 37, 53
MacCarthiæ, 49.
Macfarlanei, 1
macranthum, 18
macrophyllum, 48, 59
magus, 29
microphtalmum, 54.
monile, 21
moniliforme, 17
moschatum, 38
murrhinacum, 32.
niveum, 11.
nobile, 32
nobilius, 32.
nodatum, 41
ochreatum, 53.
oculatum, 40
Owenianum, 32.
Palpebræ, 65, 70.
Parishii, 26
Paxtonii, 54
pendulum, 16
Phalænopsis, 63.
Pierardi, 25
præmulsum, 27.
pulchellum, 47.
Rajah, 32
ramosum, 52
regium, 34
rhodopteryginm, 35.
rhomboideum, 42
Richardii, 48
roseum, 28, 67
Rothschildianum, 63.
Rothwellianum, 32.
rubescens, 63
Ruckeri, 52
salaccense, 14
Sanderianum, 32.
scabrilingue, 4
Schneidcianum, 32

INDEX, CONTINUED

Schrœderi, 74.
Schrœderianum, 32, 63
Scortechinii, 48.
secundum, 11
Sedeleianum, 47.
signatum, 29.
splendens, 63
Statterianum, 63.
stenopterum, 59
suavissimum, 72
sulcatum, 73
sulphureum, 42.
summitense, 32
superbiens, 61
superbum, 48
thunderschyense, 63.
thyrsiflorum, 66
Tollianum, 32.
tortile, 64
transparens, 24
Veitchianum, 59
virginale, 32
Walkerianum, 66.
Wardianum, 33
xantholeucum, 33.

GENERAL KEY TO SECTIONS.

A. *Lvs. equitant.*
SECTION I. Species 1 and 2.

AA *Lvs not equitant*
B. *Lf -sheaths black-hairy*
SECTION II. Species 3-10

BB *Lf -sheaths not black-hairy*
C *Pseudobulbs not thickened at base.*
D. *Mentum or chin of fls elongated*
SECTION III Species 11-14.

DD *Mentum or chin of fls short (rather long in D ramosum)*
E. *Fls usually in pairs, rarely 1 or 3 or more*
F *The pseudobulbs leafless at flowering time.*
SECTION IV Species 15-44.

FF. *The pseudobulbs leafy at flowering time*
SECTION V Species 45-55.

EE. *Fls in 3- to many-fld. racemes (single in D Jenkinsii)*
F. *The pseudobulbs 1-lvd , short, fusiform.*
SECTION VI. Species 56 and 57.

FF *The pseudobulbs several-lvd*
G *Racemes very short, glomerate*
SECTION VII Species 58.

GG *Racemes usually long, not glomerate*
H. *Sepals and petals hairy externally, lateral lobes larger than middle lobe of lip.*
SECTION VIII. Species 59.

HH. *Sepals and petals glabrous externally*
I. *Pseudobulbs gradually attenuated from a thick bulbous base.*
SECTION IX Species 60.

II *Pseudobulbs not bulbous at base*
J *Fls , at least the lip, purple or red*
SECTION X Species 61-63.

JJ *Fls white or yellow*
SECTION XI. Species 64-75.

CC *Pseudobulbs fusiform-thickened above base, attenuated beyond*
SECTION XII Species 76.

SECTION I.

A *Pseudobulbs leafy at base, naked above* 1 **Macfarlanei**
AA *Pseudobulbs leafy throughout.... .* 2 **anceps**

1 **Macfárlanei,** Reichb Pseudobulbs erect, nearly cylindric, up to 9 in. tall, 2–3-lvd.: lvs 3–4 in long: racemes 8–15-fld , fls 4–5 in. across, white, except the purple markings on lateral and middle lobes of lip. New Guinea

2 **ánceps,** Lindl. Pseudobulbs tufted, compressed, 5–8 in. long lvs up to 3 in long, fleshy, laterally compressed fls axillary, solitary or in very short racemes, lemon-yellow at maturity Trop Himalayas B R 1239 B M 3608 and L B C. 19 1895 (as *Aporum anceps*).

SECTION II.

A. *Raceme 1–2-, rarely 3-fld*
B. *Mentum of fls very short, sepals and petals green, yellow-margined* 3. **cruentum**
BB. *Mentum of fls long, extinguisher-shaped*
C. *Sepals and petals white, not keeled*
D. *Fls 1½–2 in across, lateral lobes of lip manifest*
E. *Middle lobe yellow, reflexed, lateral lobes yellowish green* 4 **scabrilingue**
EE *Middle lobe white, yellow-marked, fimbriate* 5 **longicornu**
DD. *Fls 3 in across, lateral lobes of lip indistinct.* 6 **infundibulum**
CC. *Sepals yellowish white, keeled* . 7 **carinıferum**
AA *Raceme 3–8-fld*
B *Fls yellow* ... . 8 **Lowii**
BB *Fls white*
C *Petals broad, oval or obovate* . 9 **formosum**
CC *Petals oblong-lanceolate, narrow.* 10. **draconis**

3 **cruéntum,** Reichb. Pseudobulbs erect, 10–12 in. tall fls. 1½–2 in. across, sepals triangular-ovate, keeled; petals linear, lip 3-lobed, the lateral lobes scarlet, the middle lobe pale green, red-margined. Malay Penins. G C. III 18 91

4 **scabrilíngue,** Lindl Pseudobulbs erect, 8–14 in. tall fls about 1½ in across, sepals and petals similar, ovate-lanceolate, white; lip 3-lobed, the lateral lobes yellow-green, the middle lobe reflexed, yellow with orange-yellow lines. Burma. B.M. 5515 (as *D. hedyosmum*).



1235. Dendrobium Dearei.
(×½)

5. **longicórnu,** Lindl. Pseudobulbs 8–14 in tall, slender fls 2–3 in across, white except a central orange or yellow band on lip; sepals and petals similar, elliptic-oblong, lip fimbriate, spur slender. Burma. B R. 1315.

6. **infundíbulum,** Lindl Pseudobulbs up to 2 ft. long, cylindric, slender: fls. about 3 in across, white except the yellow blotch on the lip; sepals oblong-elliptic, less than half as broad as the nearly rhomboid petals; lip resembling a wide-mouthed funnel Burma. B.M. 5446. I H 21:172 C O 6 Var **Jamesiànum,** Hort. (*D Jamesiànum,* Reichb) Pseudobulbs stouter and stiffer: lateral lobes of lip roughened on the inner surface; disk cinnabar Gn. W 9.485

7 **carinıferum,** Reichb. Pseudobulbs 6–10 in tall, nearly cylindric. fls about 1½ in. across; sepals yellowish white, fading white, narrower than the ovate white petals; lip 3-lobed, the triangular lateral lobes red-orange, the middle lobe hairy, red-orange at the base, the front part white or pale orange; spur long, obtuse. Burma.

8. **Lòwii,** Lindl. Pseudobulbs 8–15 in tall, slender: fls 1½–2 in. across, buff-yellow, sepals narrower than the undulate petals, lip distinctly 3-lobed, the lateral lobes tipped with red, the oblong middle lobe reflexed, marked with 6 lines of red hairs. Borneo B M 5303. F S 23.2395 C.O 30

9 **formòsum,** Roxbg Pseudobulbs up to 1½ ft. tall, cylindric fls. 3–4 in across, white except the yellow mark on lip; sepals oblong-elliptic, about half as broad as the obovate petals; lip retuse, erose Khasia Hills B R 25 64 F S 3.226 P M 6 49. C O 8. O R 15. frontispiece Var. **gigantèum,** Hort Fls. 4–5 in. across G C III 24.471 Gng. 1·118–9 F.E. 10.1240. F S 16 1633–4 G 25 385

10. **dracònis,** Reichb. Pseudobulbs up to 1½ ft. tall. fls about 1½ in across, white except for some orange-red stripes at base of lip, sepals narrower than the petals, lip 3-lobed, the lateral lobes small, the oblong-oval middle lobe crisped and minutely toothed. Burma. B M. 5459 (as *D. eburneum*).

SECTION III.

A. *Raceme secund* .. ..11. **secundum**
AA *Raceme not secund.*
B *Bracts small racemes not capitate*
C *Fls rosy purple, about 1 in across* 12. **cumulatum**
CC *Fls white, about 2½ in across* 13 **Dearei**
BB *Bracts large, colored racemes capitate* 14 **Bullenianum**

11 **secúndum,** Wall Pseudobulbs up to 2 ft tall, cylindric fls narrow, less than 1 in. long, rosy purple, on one side of the raceme; lip with an apical orange blotch Sumatra B R 1291 B M 4352 C O 35. Var **níveum,** Hort Fls white.

12 **cumulàtum,** Lindl Pseudobulbs up to 2 ft long, pendulous fls rosy purple, in short racemes with a purple axis; sepals and petals similar, oblong, lip oblong-obovate, spur obtuse, slightly curved. Burma. B.M 5703

13 **Dèarei,** Reichb. Fig 1235. Pseudobulbs up to 3 ft long fls white, 2–2½ in across, in 5–7-fld. racemes, sepals lanceolate, acuminate, about one-third as broad as the oval petals, lip oblong, obscurely 3-lobed, a pale yellowish green band across the middle; spur funnel-shaped, elongated Philippines. V.O. 3 37 G W. 1 225 O 1912 18 C O 36

14 **Bullenianum,** Reichb f (*D salaccénse,* Hort, not Lindl *D erythroxánthum,* Reichb f). Pseudobulbs 10–18 in tall racemes densely fld , fls yellow, striped with purple, dorsal sepal and petals oblong; lateral sepals oblong, acute, about as long as the obtuse spur, lip oblong, from a long linear base, acute. Philippines

SECTION IV.

A *Sepals and petals not yellow*
B *Lip deeply fimbriate* 15. **Devonianum**
BB *Lip entire or minutely fimbriate.*
C. *Nodes of pseudobulb much thickened*
D. *Pseudobulbs thick.*
E *Internodes abruptly depressed-globose, thickened at apex* 16 **pendulum**
EE. *Internodes gradually thickened toward apex*
F. *Front lobe of lip ovate, reflexed, purple* 17. **Linawianum**
FF *Front lobe of lip orbicular-ovate, yellow* 18 **Findlayanum**
DD *Pseudobulbs wand-like, slender* 19 **Falconeri.**
CC. *Nodes not thickened, or but slightly so*
D *Internodes usually more than 5 times longer than broad*

E. *Lip curved like a trumpet, sepals and petals purple*....20. **lituiflorum**
EE. *Lip not curved.*
F *Fls white* . . 21. **monile.**
FF. *Fls with sepals and petals white, tips colored.*
G. *Throat of lip yellow*
H. *Middle lobe violet, white-margined* .22. **amœnum**
HH *Middle lobe yellow, tip rose* . 23 **crystallinum**
GG *Throat of lip purple* 24 **transparens**
FFF *Fls with sepals and petals mauve, lip primrose* 25. **Pierardii**
DD *Internodes usually less than 5 times longer than broad*
E *Fls 2½ in across or less.*
F *Color violet-purple* . 26. **Parishii**
FF. *Color white or lilac*
G *Lip primrose-yellow, sepals and petals lilac* 27 **primulinum**
GG. *Lip with ground color white, a large light or dark yellow blotch in center*
H *Blotch not marked, base plaited* . 28 **crepidatum**
HH. *Blotch marked*
I *With 2 basal purple spots* 29 **Bensoniæ**
II. *With reddish orange lines*
J. *Shape of lip obtuse, blotch light yellow* 30. **cretaceum**
JJ. *Shape of lip acute, blotch deep yellow* 31. **gratiosissimum**
EE. *Fls exceeding 2½ in across*
F *Ground-color of sepals and petals white*
G *Throat deep purple* 32 **nobile**
GG *Throat yellow, with 2 purple spots* 33. **Wardianum**
FF. *Ground-color of sepals and petals rose*
G. *Front lobe of lip rose, the throat yellow* 34. **regium**
GG *Front lobe of lip white-margined, the throat with 2 dark spots* . .35 **rhodopterygium**
AA. *Sepals and petals yellow*
B. *Lip deeply pectinate-fringed* . . . . 36 **Brymeri-anum**
BB. *Lip not fringed*
C *Disk pilose, 2 large purple fringed spots at base of lip* 37 **Dalhousiæanum**
CC. *Disk not pilose, nor with fringed spots*
D. *The lip slipper-shaped* ....38. **moschatum**
DD *The lip not slipper-shaped.*
E. *Uncolored, yellow*
F *Shape of sepals and petals acute, lip minutely serrate* 39 **dixanthum**
FF. *Shape of sepals and petals obtuse, lip fimbriate* 40 **fimbriatum**
EE. *Bi-colored, yellow with purple markings*
F. *Apex of lip acute; sepals and petals pale yellow*
G. *Front lobe nearly rhomboid, cream-margined* 41. **Aphrodite**
GG. *Front lobe ovate, red-lined, the apex recurved* 42 **aureum**
FF. *Apex of lip rounded, sepals and petals rich yellow.*
G. *Fls. 2½ in or more across, lip with a single large spot.*
H. *Lip serrate or shortly fimbriate, floral bracts large.* . 43. **clavatum**
HH. *Lip fimbriate, the divisions branched, floral bracts small* 40. var **oculatum**
GG. *Fls. about 2 in across, lip with 2 spots.* .....44. **Gibsonii**

15. **Devonianum,** Paxt. Pseudobulbs up to 3 ft long, round, pendulous: fls single or in pairs, about 2 in across, sepals and petals white tinted amethyst at the apex, the sepals about half as broad as petals, lanceolate, the petals ovate, acute, ciliate; lip white, fringed, the apex purple, and 2 orange blotches in the throat N India to S China B M. 4429. J.H. III 31 197, 52.317. G C III. 7.680. C O. 23. O R 4 177, 12 152

16 **pendulum,** Roxbg Pseudobulbs abruptly swollen at the nodes, up to 2 ft long, somewhat pendulous. fls solitary or 2 or 3 together, 2–2½ in long, sepals and petals white, purple-tipped, acute, the petals broader than sepals, lip white, ciliate, pubescent on upper surface, the center yellow, the front margin purple Moulmein B M 5766 (as *D. crassinode*). C O 19 O R 2 177; 8 177 Var **Barberianum,** Hort Fls brighter, the apical spots larger and deeper.

17 **Linawianum,** Reichb (*D monilifórme*, Lindl, not Swartz) Pseudobulbs with internodes gradually thickened toward apex, up to 1½ ft. long, clavate: fls in pairs or 3's, about 2 in across, sepals and petals rosy purple above, white below, the sepals half as broad as petals, lip obscurely 3-lobed, small, the front lobe purple, the lower part white with 2 purple spots on disk China and Japan B M 4153 P M 3 77

18 **Findlayanum,** Par & Reichb. Pseudobulbs with internodes gradually thickened toward apex, up to 1½ ft long fls in pairs, 2–3 in across; sepals and petals pale lilac, the sepals much narrower than the petals; lip yellow, white-margined Burma B M 6438. Gn 49 446 G M 44 373 (var *roseum*). O R 8 169

19 **Falconeri,** Hook Pseudobulbs slender, up to 1½ ft long fls solitary, 2–3 in across, sepals and petals white, purple-tipped, the former tinged with pale rose, the petals broader than sepals, lip obscurely 3-lobed, the throat deep purple, with an orange spot on each side and a white band in front, the acute apex purple N India B M 4944. I H. 23 243 F M. 1876 226 G Z 31 145. Var **gigantèum,** Hort. Pseudobulbs larger fls larger and lasting longer.

20 **lituiflorum,** Lindl Pseudobulbs up to 2 ft long, pendulous fls in pairs, rarely more, 2–2½ in across; sepals and petals amethyst, the former paler at base, the latter the more richly colored, the sepals much narrower than the petals, lip curved like a trumpet, the opening turned up, the throat purple, surrounded by a white zone, the margin purple Burma B M 6050 Var **candidum,** Reichb Fls larger, the sepals and petals white, the lip sulfur-yellow. Var. **Freemanii,** Hort. Sepals and petals deeper in color, the lip with a sulfur-yellow zone

21 **monile,** Kranzl (*D japónicum*, Lindl) Pseudobulbs up to 1 ft long, slender-clavate: fls solitary or in pairs, fragrant, white except for a few purple spots on the lip, sepals narrower than petals, both acute; lip acuminate, reflexed at apex S Japan B M 5482

22 **amœnum,** Lindl Pseudobulbs up to 1½ ft long, slender fls solitary, or sometimes in 2's or 3's, about 2 in across, sepals and petals white, amethyst-tipped, lip with the front lobe ovate, amethyst margined with white. Nepal B M 6199. G C II 16 625

23. **crystallinum,** Reichb f Pseudobulbs up to 2 ft long, somewhat pendulous. fls. solitary, or sometimes in 2's or 3's, about 2 in across, sepals and petals white, tipped with amethyst, or this sometimes lacking in the sepals which are much narrower than the petals, lip with a yellow middle lobe margined white Burma B M 6319. Var. **albens,** Hort Sepals and petals pure white; lip rich yellow tipped with white.

24. **transpàrens,** Wall Pseudobulbs up to 20 in. long, slender: fls in pairs or 3's, about 1½ in. across, white, the sepals, petals and lip tipped pale mauve, sepals lanceolate; petals oblong-elliptic; lip recurved

at the obtuse apex, the disk with a large purple spot India. B M. 4663. J.F. 1:68. C.O. 27.

25. **Pierárdii,** Roxbg. (*D. cucullàtum,* R. Br). Pseudobulbs up to 3 ft. long, slender, pendulous: fls. commonly in pairs, up to 2 in. across, sepals and petals pale rosy mauve, acute, the sepals lanceolate much narrower than the elliptic-oblong petals; lip obscurely 3-lobed, pale primrose-yellow, pubescent on the upper surface, purple-streaked at base India B R 548 (as *D cucullatum*); 1756. Gn 55, p 405 F S 9·955 L B C 8·750. C.O pl 26. B M 2242 (as *D. cucullatum*); 2584. Var. **latifòlium,** Hort. Lvs. broader.

26. **Párishii,** Reichb. f. Pseudobulbs up to 15 in. long, curved, rather stout: fls solitary, or in 2's or 3's, amethyst-purple with 2 maroon spots on each side of the throat of lip, sepals oblong-lanceolate, narrower than the oval-oblong petals; lip downy, apiculate. Moulmein. B.M 5488.

27. **primúlinum,** Lindl. Pseudobulbs up to 20 in. long, erect or nearly so, rather stout: fls. solitary or in pairs, 2–3 in. across; sepals and petals pale mauve-lilac, oblong, obtuse; lip pale primrose-yellow, purple-streaked at base, the middle lobe very broad Nepal and Sikkim Gt 1861.326. J.H III 50·377 B.M. 5003 (as *D nobile,* var) Var. **gigantèum,** Hort Pseudobulbs pendulous, more slender: fls. larger, the lip sometimes veined with pale rose

28 **crepidàtum,** Lindl. Pseudobulbs up to 1½ ft. long, nearly erect, rather stout, longitudinally marked with white lines fls in 2's or 3's, about 1½ in. across; sepals and petals white, tinted lilac, obtuse, the sepals oblong, narrower than the petals; lip white tinted lilac, sometimes downy, the front lobe obtuse or retuse, the middle orange-yellow Assam. B.M 4993, 5011 C.O 40. Var. **rôseum,** Hort. Fls. darker. Var. **álbum,** Hort. Fls white

29 **Bénsoniæ,** Reichb. f (*D Dartonsiànum,* De Wild *D. signàtum,* Reichb f.). Pseudobulbs up to 32 in. long, erect, rather slender. fls solitary, or in 2's or 3's, 2–2½ in across, white, the disk of the lip yellow with 2 maroon spots; sepals oblong, obtuse, much narrower than the petals, lip with the front lobe orbicular, denticulate, downy on the upper surface. British Burma. B M 5679, 8352. O R 11 241; 16:68. F M. 355. Var. **május,** Hort. Fls. larger.

30 **cretàceum,** Lindl Pseudobulbs up to 15 in long, rather stout, curved, pendulous. fls solitary, about 1½ in across, cream-white, with a large light yellow spot on lip streaked with orange-red; sepals and petals lanceolate, obtuse, lip with the front lobe orbicular-ovate, obtuse, downy. Khasia Hills. B.R. 33 62. B M 4686. F S 8·818. J F 4·344.

31. **gratiosíssimum,** Reichb. f. (*D. Bózallu,* Reichb. f *D. Bullerànum,* Batem). Pseudobulbs up to 1½ ft long, somewhat thickened from a slender base: fls in 2's and 3's, 2–2½in. across, white, the sepals, petals and lip tipped with rose-purple; sepals oblong-lanceolate, narrower than the ovate-lanceolate petals; lip with the front lobe broadly ovate, acute, a large yellow orange-streaked blotch in the center. Burma and Moulmein. B M. 5652. F.M. 315. G.W. 1, p. 227

32. **nóbile,** Lindl. Fig. 1236. Pseudobulbs up to 2 ft. long, erect or nearly so, tufted, nearly round fls in 2's or 3's, 2½–3 in. across; sepals and petals white, the upper portion, varying in extent, amethyst-purple, the sepals ligulate, the petals broader, oblong-oval, wavy-margined; lip with a broad nearly orbicular blade, downy, a large rich maroon spot in the center, inclosed by a cream-white zone, the apex amethyst-purple Himalayas to China. P M 7:7. C O 1. O R 5·209; 9:73. G.M. 47:425. J.H. III. 48:511; 56·51**1**. Var. **albiflòrum,** Hort. Fls. white, with a black-purple spot on the lip. O R. 2:113; 9·73. Var. **álbum,** Hort. Fls pure white. Var. **Amèsiæ,** Hort. Similar to the preceding, but fls larger. Var. **Ármstrongiæ,** Hort. Sepals and petals pure white, of great size; lip very dark maroon-purple. Var. **Ashworthiànum,** Hort. Fls. pure white, except the green mouth of the lip. Var. **Balliànum,** O'Brien. Sepals and petals white; lip yellowish white or white with 2 crimson spots. C.O. 1 b. Var. **cœruléscens,** Reichb. (*D. cærulèscens,* Lindl.). Shorter and more slender pseudobulbs: fls smaller and of a deeper color, and the lip-blade more oval Var. **Colmaniànum,** Hort A large, pure white variety with a sulfur-yellow disk to the lip Var **Cooksoniànum,** Reichb. f. Petals concave, approaching the lip in form, erect, with a large basal maroon blotch. C O. 1*a* O R. 2·113; 9:73. Var. **élegans,** Hort. Fls. larger and more symmetrical; petals broader, the base white; a pale sulfur-yellow zone inclosing the maroon spot on lip, which has a rose-purple apex. Var **formosànum,** Reichb. f. Pseudobulbs somewhat longer,



1236. Dendrobium nobile (×⅙)

pendulous: fls with longer pedicels, the tips of the petals and lip only purple, the mouth and mentum green. Var. **jaspídium,** Hort. Fls. very showy; apex of segms red variegated with purple. Var. **murrhinìacum,** Hort. Like var *Balhanum,* but finer. sepals and petals slightly tinged violet; disk rich violet, finely veined with rose-violet. Var. **nobílius,** Reichb. f. Fls. larger, the sepals and petals, except at the base, deep purple; lip large, rose-tipped, deep purple in the mouth. C.O. lc. G M. 46:193. O.R. 2:113; 9:73. Var. **Oweniànum,** Hort. Var. **Ràjah,** Hort. Like var. *albiflorum,* but sepals and petals broader and flushed with delicate pink. Var. **Rothwelliànum,** Hort. Var. **Sanderiànum,** Reichb. f. Resembles var *nobilius* but fls. smaller, the color more intense, the sepals and petals broader, the lip with a large black purple spot, the surrounding white zone larger R 58. O.R. 2:113; 9:73. Var. **Schneideriànum,** Reichb. f. Lip suffused with yellow, and with a deep purple spot. Var. **Schrœderiànum,** Hort. Larger fls. with broader segms, the sepals and petals white, sometimes tipped with amethyst; lip with an almost black spot, bordered with pale yellow, passing into white Var. **summitènse,** Hort Var. **Tolliànum,** Reichb. f. Pedicels twisted, the

fls. therefore appearing inverted, fls not fully opening Var **virginàle,** Hort Fls pure white, except a pale primrose tinge on the lip. G C. III. 35:357. G.M. 52: 394 O R 5 145; 8:121

33 **Wardiànum,** Warner. Pseudobulbs up to 3 ft. long, round, pendulous fls in 2's or 3's, 3–4 in. across; sepals and petals white, oblong, usually tipped with amethyst, about half as wide as the white oval petals which are amethyst-tipped, lip white with an amethyst apical blotch, the throat yellow, with a maroon spot on each side. B M 5058 I H 24 277 F R 1 231 Gn. 47, p 84 R B 23.25. J.H. III. 30 454, 32 237, 42.211 G M 45 744 C O. 5. O R 2:177, 8 177, 9.frontispiece. R 9. Var **álbum,** Williams Fls. white, except the yellow throat with 2 purple-crimson spots C O. 5a. Var. **aûreum,** Hort Sepals and petals light yellow. Var. **Fòwleri,** Hort. Lateral sepals with yellow markings and purple blotch as in the lip. G C. III 31 125 Var **xantholeûcum,** Hort Fls pure white, with a large orange-yellow disk to the lip

34 **règium,** Prain. Pseudobulbs up to 1 ft long, cylindric. fls in 2's or 3's, nearly 3 in across, sepals and petals purple-rose, darker veined, obtuse, the sepals oblong, narrower than the ovate or oval petals, lip with the limb nearly orbicular, purple-rose, the throat yellow, surrounded by a cream-white zone India. B M 8003 G C III 42.122

35 **rhodopterýgium,** Reichb f. Pseudobulbs up to 2 ft long, erect, cylindric· fls about 2½ in across, sepals and petals rosy purple, mottled with white, sepals oblong-lanceolate; petals oblong-ovate; lip crimson-purple, striated, white-margined, denticulate, with a central pale longitudinal band Burma and Moulmein

36 **Brymerìanum,** Reichb f Pseudobulbs up to 2 ft long, rather stout, a little enlarged at the middle· fls solitary or in few-fld racemes, about 3 in across, golden yellow, sepals broadly lanceolate, acutish, a little broader than the linear-oblong obtuse petals; lip with lateral lobes erect, fimbriated with short ciliate flexuous divisions, the middle lobe ovate, fimbriate with very long branched ciliate divisions, disk papillose Burma B.M. 6383 A F 6 609 G C II. 11 475, 16.689 F M n s 459 R. 92. Lind. 4 183. G Z 30 121. O.R. 12.249, 16 24

37. **Dalhousieànum,** Wall Pseudobulbs 2–4 ft long, round, rather slender racemes pendulous, 6–10-fld; fls 4–5 in across, sepals and petals pale yellow, tinted and veined with rose, the sepals ovate-lanceolate, much narrower than the ovate petals; lip concave, hairy in front, with 2 large fringed purple spots near the base. Burma B R 32 10 I H 28 423 Gn 48 222 G C III 21 157 P M 11 145 F S 7 698 C O. 7. Var **lûteum,** Hort Fls tinted sulfur-yellow, with crimson disks at base of lip.

38 **moschàtum,** Wall. Pseudobulbs up to 6 ft tall, cylindric· racemes 5–15-fld ; fls 3–4 in across, faintly fragrant of musk; sepals and petals pale yellow, tinted pale rose at apex, veined and reticulated, the sepals much narrower than petals; lip slipper-shaped, pale yellow, with 2 large maroon spots encircled with orange, the front part hairy India B M 3837 B.R 1779 (as *D cupreum*). P M 2 241 Var. **Calceolària,** Veitch Man Fls. smaller, orange-yellow, with deeper veins and reticulation, and deeper spots on lip C O. 13.

39. **dixánthum,** Reichb f Pseudobulbs up to 3 ft. tall, erect, somewhat clavate: racemes 2–6-fld ; fls. yellow, with an orange mark on lip; sepals and petals acute, the former lanceolate, narrower than the oblong, serrulate petals; lip serrulate, the blade nearly orbicular Moulmein and Tenasserim. B.M 5564.

40 **fimbriàtum,** Hook Pseudobulbs 3–5 ft. tall, cylindric: racemes 6–12-fld., pendulous; fls. 2–3 in. across; sepals and petals bright orange-yellow, the former oblong-elliptic, narrower than the oblong-oval, ciliolate petals; lip bright yellow, with an orange spot on the orbicular fimbriate blade, Nepal. P M. 2·172 J F. 3:314 G C III 25:305. C.O. 9. Var **oculàtum,** Hook Pseudobulbs shorter, more slender, the smaller fls with a maroon spot on the lip B.M. 4160. I H 1:15 C.O. 9*a* P M. 6:169 (as *D. Paxtoni*). F S 7:725 (as *D. Paxtoni*)

41. **Aphrodite,** Reichb f. (*D. nodàtum,* Lindl) Pseudobulbs up to 1 ft long, slender, branched fls. solitary or in pairs, 2–3 in across; sepals and petals cream-colored, the former lanceolate, narrower than the ovate petals, lip cream-colored, with a large saffron-yellow spot in the middle, and 2 maroon spots at base, the front lobe nearly rhomboid, acute Moulmein and Tenasserim B M 5470 F S 15.1582

42 **aûreum,** Wall (*D heterocárpum,* Wall. *D rhomboídeum,* Lindl) Pseudobulbs up to 1½ ft. tall, erect, somewhat clavate. fls. in 2's and 3's, fragrant, 2-2½ in across; sepals and petals cream-colored, acute, the former oblong-lanceolate, a little narrower than the oblong-ovate petals, lip yellow, streaked with reddish purple, the front lobe ovate, acuminate, recurved, the disk velvety Trop. Himalayas to Philippines B M 4708 F S 8·842 P M. 14, p. 68, desc J F 4 386 C O 10 R 63 B R 29 17 J H III. 52.405, 57·3 O R 8 41, 169 Var **sulphûreum,** Hort Fls sulfur-yellow, with the usual orange-colored markings

43 **clavàtum,** Wall Pseudobulbs up to 3 ft. long, cylindric, pendulous racemes 4–6-fld , fls 2–3 in across, sepals and petals orange-yellow, the former oval-oblong, about half as wide as the nearly orbicular petals, lip bright yellow, with a maroon blotch in center, the front lobe orbicular, denticulate, the upper surface pubescent Trop Himalayas to S China B M 6993

44 **Gibsonii,** Lindl (*D fuscàtum,* Lindl) Pseudobulbs up to 3 ft tall, a little enlarged in the middle, slender racemes 5–10-fld , pendulous; fls about 2 in across, golden yellow, with 2 maroon spots on the lip; sepals and petals oval-oblong, obtuse, about the same width, lip with the limb a little broader than long rounded at apex, fimbriate, villous on the upper surface Trop. Himalayas to S. China and Java. P M 5 169 B M. 6226.

SECTION V.

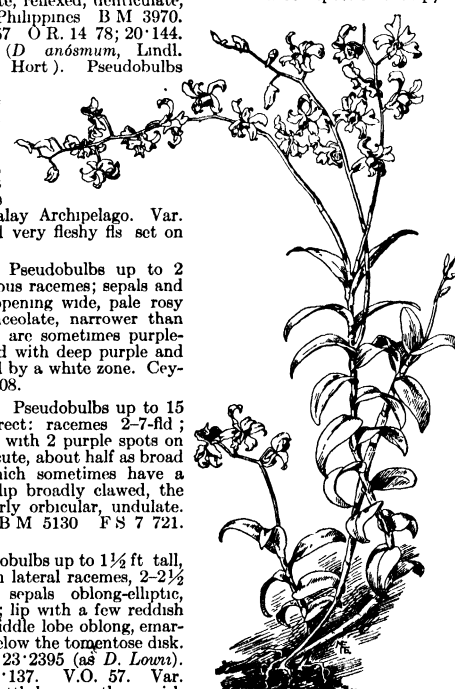
A *Sepals and petals white*
B. *Without markings*
C *Middle lobe of lip quadrate, emarginate, undulate, spur short, saccate* 45 **lasioglossum**
CC *Middle lobe of lip triangular, acute, ciliate, spur long, conic* 46 **aqueum**
BB *With purple or mauve at apex* 32 **nobile**
AA *Sepals and petals purple, mauve or lilac*
B *Base of lip inclosing column, sepals and petals widely spreading*
C. *Lip fringed, disk yellow* 47. **Loddigesii**
CC *Lip denticulate, throat deep purple* 48 **superbum**
BB. *Base of lip not inclosing column, sepals and petals ascending* . 49. **MacCarthiæ**
AAA. *Sepals and petals yellow*
B. *Color pale.*
C. *Fls. buff-yellow, lip clawed, with 2 purple spots* ..50. **albo-sanguineum**
CC. *Fls primrose-yellow, lip at base convolute around column*
D. *Middle lobe of lip oblong, emarginate, petals larger than sepals* 51. **luteolum**
DD. *Middle lobe of lip nearly orbicular, reflexed, much undulated* 52 **ramosum**
BB. *Color bright*
C. *Lip with a single large maroon blotch* .53 **ochreatum**
CC. *Lip with 2 purple spots*
D. *Margin of lip denticulate* 54 **chrysanthum**
DD *Margin of lip fimbriate, the divisions long and bearded* 55 **Hookerianum**

45. **lasioglóssum,** Reichb. f. Pseudobulbs up to 1½ ft. long, slender, pendulous, a little enlarged at the middle. fls in 2's or 3's, white, except the reddish lines on the side lobes of the lip; sepals ovate, a little narrower than the petals; lip 3-lobed, the lateral lobes rounded, denticulate, the middle lobe nearly quadrate, undulate, reflexed, the disk with a tuft of orange-yellow hairs Burma. B.M 5825.

46 **àqueum,** Lindl (*D álbum,* Wight). Pseudobulbs up to 2 ft long, rather stout, decumbent: fls. about 2 in across, solitary or in pairs, cream-white, except a yellow spot on the lip; sepals and petals similar, broadly ovate, acute; lip obscurely 3-lobed, the middle lobe triangular, deflexed, ciliate, the upper surface pubescent Neilgherry Hills. B R 29:54. B M. 4640 J F 3·262

47 **Lóddigesii,** Rolfe (*D pulchéllum,* Lodd, not Roxbg *D Seidelànum,* Reichb f.) Dwarf: pseudobulbs 3–4 in long fls solitary, about 1½ in. across; sepals and petals lilac, the sepals oblong, much narrower than the ovate petals, lip orbicular fringed, the center orange-yellow, the margin pale lilac. China. L B.C 20 1935. B M 5037

48 **supérbum,** Reichb f (*D macrophýllum,* Lindl. Plate XXXV *D. Scortéchinii,* Hook *D. macránthum,* Hook) Pseudobulbs up to 3 or 4 ft long, cylindric, pendulous. fls in pairs, 3–5 in across, with the odor of rhubarb; sepals and petals purple-lilac, acute, the former oblong-lanceolate, about half as wide as the oblong-ovate petals, lip with the tube a deep red-purple, this color appearing as 2 large spots in the throat, the front lobe acuminate, reflexed, denticulate, the upper surface pubescent Philippines B M 3970. C O 20 P M 8·97 F S 8 757 O R. 14 78; 20·144. Var. **anósmum,** Reichb f (*D anósmum,* Lindl. *D macrophýllum Dayànum,* Hort). Pseudobulbs shorter fls usually solitary, nearly odorless, smaller, the sepals and petals shorter and broader Lind. 6:264 P M 15·97 Var **gigantèum,** Reichb f Fls larger Var **Húttonii,** Reichb f Fls white, except the base of the lip and 2 spots on it which are purple. Malay Archipelago. Var. **Ríchardii,** Hort Medium-sized very fleshy fls set on long bristled pedicels.



1237. Dendrobium superbiens. (×⅓)

49 **MacCárthiæ,** Thwaites. Pseudobulbs up to 2 ft long fls in 2–3-fld pendulous racemes; sepals and petals ascending, the fl not opening wide, pale rosy mauve, acute, the former lanceolate, narrower than the oblong-ovate petals which are sometimes purple-striped, lip pale purple, striped with deep purple and with a maroon spot surrounded by a white zone. Ceylon B M 4886 G W. 14, p 408.

50 **álbo-sanguíneum,** Lindl. Pseudobulbs up to 15 in. long, stout, cylindric, erect: racemes 2–7-fld; fls 2–3 in across, buff-yellow, with 2 purple spots on lip; sepals oblong-lanceolate, acute, about half as broad as the oblong-oval petals which sometimes have a few red streaks at the base; lip broadly clawed, the blade broadly obovate or nearly orbicular, undulate. Moulmein and Tenasserim. B M 5130 F S 7 721. J.F. 2:203

51. **lutèolum,** Batem Pseudobulbs up to 1½ ft tall, furrowed, cylindric· fls 2–4, in lateral racemes, 2–2½ in across, primrose-yellow; sepals oblong-elliptic, narrower than the oval petals; lip with a few reddish streaks, slightly 3-lobed, the middle lobe oblong, emarginate, a tuft of yellow hairs below the tomentose disk. Moulmein B.M. 5441 F.S 23·2395 (as *D. Lowii*). J H III 32·143; 51 519; 54·137. V.O. 57. Var. **chlorocéntrum,** Reichb Fls. a little larger with greenish hairs on the lip. G C II 19:340.

52. **ramòsum,** Lindl. (*D. Rúckeri,* Lindl) Pseudobulbs up to 1½ ft tall, slender. fls. solitary or in pairs, about 1½ in across, sepals and petals pale primrose-yellow, the dorsal sepal oblong, the lateral triangular, the petals narrower than dorsal sepal; lip 3-lobed, the lateral lobes white, rose-streaked, the middle lobe nearly orbicular, reflexed, deeper yellow than petals, much undulated. Trop. Himalayas. B.R. 29:60.

53. **ochreàtum,** Lindl. (*D. cambridgeànum,* Paxt). Pseudobulbs up to 10 in. long, stout, curved, cylindric, decumbent. fls in pairs, 2–3 in. across, rich golden yellow, except the maroon blotch on lip; sepals and petals oblong, acute, similar; lip with the concave blade orbicular, recurved on the margin, the upper surface downy Trop Himalayas B M 4450. C O. 16. Var. **lùteum,** Hort Fls. lemon-yellow, with blotch on lip of much lighter purple than in type.

54. **chrysánthum,** Wall (*D. Páxtonii,* Lindl) Pseudobulbs up to 6 ft. long, slender, furrowed, pendulous. fls about 2 in across, in racemes of 4–6, golden, except the 2 maroon spots on the lip, sepals oblong-oval; petals broadly obovate; lip denticulate, the middle lobe orbicular. Tropical Himalayas to Burma and southern China. B R 1299 Lind 5 194 C.O. 2 G C. III. 15 565; 40 374. Var. **anophtálmum,** Reichb. f. Lip not spotted Var. **microphtálmum,** Reichb. f. Petals serrate, and the spots on the lip smaller.

55 **Hookeriànum,** Lindl (*D. chrysótis,* Reichb f). Pseudobulbs up to 8 ft long, pendulous fls 3–4 in. across, in pendulous racemes of 10–15, golden, except the 2 maroon spots on the lip; sepals and petals oblong, acute, similar, lip with the blade broadly oval, velvety on upper surface, fimbriate, the divisions long and bearded Trop Himalayas and Bengal B M 6013. Lind 16 730 I H. 20 155 J H III. 33 221 Var **brachystàchyum,** Kranzl. Fls a little larger, fewer, in shorter racemes. Khasia Hills.

SECTION VI.

A *Fls usually single.*
56 **Jenkinsii**
AA *Fls in racemes.*
57 **aggregatum**

56 **Jénkinsii,** Wall. Dwarf pseudobulbs up to 1½ in long, crowded, oblong, compressed, 1-lvd. lvs oblong, oval, 1–2 in long· fls solitary, about 1½ in across. orange-yellow, with the disk on the lip darker; sepals oval, much narrower than the rhomboid petals, the lip downy above. Assam and Burma. B R 25 37.

57 **aggregàtum,** Roxbg. Pseudobulbs ovate-fusiform, up to 2 in long, crowded, 1-lvd.: lvs. 2–3 in.

long, oblong-oval: racemes pendulous, 6–12-fld ; fls. becoming orange-yellow with age, the disk deeper; sepals ovate, about half as broad as the nearly orbicular petals; lip with a pubescent disk. Burma and China. B.R. 1695. B.M. 3643. G.C. III. 50.82. C.O. 33

SECTION VII.

58. **bicamerâtum,** Lindl (*D brevifl̀orum,* Lindl. *D. callibótrys,* Ridley) Pseudobulbs tufted, fusiform, up to 16 in long: racemes short, fascicled, on the old pseudobulbs, fls. yellow, the sepals and petals marked with red spots in lines; lip cuneate, 3-lobed, the lateral lobes small acute, the middle lobe retuse, the callus fleshy, papillate Trop. Himalayas.

SECTION VIII.

59 **macrophýllum,** A Rich. (*D Veitchiànum,* Lindl. *D macrophýllum Veitchiànum,* Hook f. *D. fèrox,* Hassk.). Pseudobulbs stout, clavate, up to 2 ft. long, furrowed, narrowed below. lvs. up to 1 ft. long. racemes many-fld., erect; fls about 2 in. across; sepals oblong-ovate, hairy externally, pale yellowish green, larger than the whitish spathulate petals; lip 3-lobed, the lateral lobes round, purple-streaked, the middle lobe broader than long, with radiating purple lines New Guinea, Java, Trimos, Philippines B M. 5649. H F. 2 132 Var **stenópterum,** Reichb f Fls. smaller, the mentum much reduced, the sepals and petals ochre, copiously dotted inside, marked outside with large brown spots.

SECTION IX.

60 **Kingiànum,** Lindl Dwarf pseudobulbs 2–3 in long, attenuated upwards from a bulbous base, 2–5-lvd : racemes few-fld , fls nearly 1 in across; sepals and petals purple, the acute ovate sepals broader than the petals, lip white, marked with purple, 3-lobed, the lateral lobes obtuse, the middle lobe reniform, apiculate; spur yellow-tipped Queensland. B.R. 31:61. B.M. 4527. J.F. 2:143. C.O. 38.

SECTION X.

A *Sepals and petals undulate; ovary same color as fl* . . . . . **61. superbiens**
AA *Sepals and petals not undulate; ovary green*
B. *Fls about 2 in across; middle lobe of lip retuse, disk papillose* .. .. **62. bigibbum**
BB. *Fls 2½–4 in across, middle lobe of lip acute, disk smooth* .....**63. Phalænopsis**

61. **supérbiens,** Reichb. f. (*D. Gòldiei,* Reichb f. *D Fitzgéraldii,* F. Muell.). Fig 1237. Pseudobulbs up to 2½ ft., cylindric, somewhat narrowed at both ends, leafy above: peduncle nearly terminal, bearing a nodding terminal raceme; fls about 2 in. across, crimson-purple, the sepals and petals often white-bordered; sepals oblong, reflexed, undulate, narrower than the obovate petals; lip 3-lobed, the lateral lobes round, the middle lobe oblong, wavy, reflexed. Austral. F M 1878·294 R 1·39. G. 34:117. G.W. 14, p. 29. G C III. 49 36. C.O 15.

62 **bigíbbum,** Lindl Pseudobulbs cylindric, somewhat fusiform, slender, up to 1½ ft. long, leafy: peduncle nearly terminal, slender, with a terminal many-fld. raceme; fls. 1½–2 in. across, purple-magenta, the lip darker; sepal oblong, acute, much narrower than the nearly orbicular petals; lip 3-lobed, the lateral lobes oblong, incurved, the intermediate one oblong, reflexed, crest white, papillose Austral. B M. 4898. F S 11:1143. Gt. 49:1473. Var. **cándidum,** Reichb. f. Fls white.

63 **Phalænópsis,** Fitzgerald. Fig. 1238. Pseudobulbs slender, up to 2 ft. long, leafy above: peduncle terminal or nearly so, slender, bearing a terminal raceme of 8–15 fls. which are 2½–3½ in. across; sepals lanceolate, acute, white, flushed pale rose, narrower than the rhomboid orbicular mauve petals with deeper veins; lip 3-lobed, the lateral lobes round, curved over the column, maroon-purple, the middle lobe pale purple, deeper veined Austral. G F. 5.440 (adapted in Fig. 1238). A F. 16: 1442. B M 6817 C O. 4 Var **hololeûceum, Hort.** Fls white. G.C III 28 230. Var **Líndeniæ,** Hort Fls large, creamy white Var **Rothschildiànum,** Kranzl Fls 4 in. across, the sepals and petals white, suffused rose, the lip rose, intensely veined Var **rubéscens,** Hort An exceptionally dark form Var **Schrœderiànum,** Hort Sepals white, the petals and lip deep violet G C III 28· 238 Var **splén-dens,** Hort. Fls bright magenta-rose, white at base of segms. Var **Statteriànum,** Sander. Fls. deep violet. Var. **thundersleyénse,** Hort A dark-colored form.



1238. Dendrobium Phalænopsis. (×¼)

SECTION XI.

A. *Sepals and petals not yellow*
B *Pseudobulbs clavate, few-jointed*
C *Fls single or in racemes of 2 or 3, sepals and petals contorted* 64 **tortile**
CC. *Fls in 6- to many-fld racemes, sepals and petals not contorted.*
D. *Lip white with a yellow spot; racemes loosely fld* . 65. **Palpebræ**
DD. *Lip entirely yellow, racemes densely fld* 66 **thyrsiflorum**
BB. *Pseudobulbs cylindric, many-jointed.*
C. *Lip white, colored at base, sepals and petals white*
D. *Middle lobe of lip broadly obcordate, resembling the petals* . 67. **Fytchianum**
DD. *Middle lobe, of lip narrowly oblong, much different from petals.*68. **leucolophotum**
CC. *Lip rose with a large orange blotch; sepals and petals rose* . .....69. **Bronckartii**
AA. *Sepals and petals yellow.*
B. *Color pale straw-color, tinted with rose.*70. **Farmeri**
BB. *Color clear yellow, not tinted.*
C *Raceme of 2–4 fls* . .....71. **capillipes**
CC. *Raceme 10- to many-fld.*
D. *Lip deeply fimbriate, the divisions ciliate* . ....72. **chrysotoxum**
DD. *Lip minutely fimbriate.*
E. *Throat of lip marked with purple radiating lines* .. 73. **sulcatum**
EE. *Throat not lined*
F. *Petals about as wide as sepals* 74. **densiflorum**
FF. *Petals nearly twice as wide as sepals* 75. **Griffithianum**

64. **tórtile,** Lindl Pseudobulbs up to 1 ft long, clavate. furrowed. fls in 2's or 3's, sometimes solitary; sepals and petals narrowly oblong, twisted, pale lilac;

lip convolute at base, nearly orbicular, primrose-yellow, with a purple basal spot. Malay Penins. B.M. 4477. O.R. 8:201. Var. **Dartoisiànum**, O'Brien (*D. Dartoisiànum*, De Wild). Sepals and petals yellowish. French India.

65. **Pálpebræ**, Lindl. Pseudobulbs up to 10 in. long, clavate, 4-angled: racemes loosely 5–10-fld.; fls. white, except the orange-yellow disk on lip; sepals oblong, narrower than the oval petals; lip oblong, downy above, fringed near the base. Burma, Siam, China.

66. **thyrsiflòrum**, Reichb f (*D. densiflòrum álbo-lúteum*, Hook). Pseudobulbs up to 2 ft. long, terete, leafy: racemes pendulous, many-fld, lateral, fls 1½–2 in. across; sepals and petals white, nearly transparent, the sepals oblong-ovate, acute, narrower than the nearly orbicular denticulate petals; lip orange-yellow, downy, the blade nearly orbicular, fimbriate Moulmein and Burma. O R 6·209. C.O. 18 Gn 60, p. 282 Gt. 55, p. 98. J H III 48·313 I H 22:207. G. 19·204 F M n s. 449 Var **Walkerianum**, Warner. Pseudobulbs longer: fls larger in longer racemes.

67. **Fytchiànum**, Batem (*D barbátulum*, Batem., not Lindl). Pseudobulbs up to 1½ ft tall, slender, erect: racemes 10–15-fld, fls. 1½–2 in. across, white, except the rosy tint on sides of lip, sepals lanceolate, about one-third as wide as the obovate petals; lip 3-lobed, the lateral lobes incurved, the middle lobe broadly obcordate, with basal tufts of yellowish hair. Burma. B.M 5444. Var. **róseum**, Berkeley Fls. rose.

68. **leucolóphotum**, Reichb f. Pseudobulbs up to 1½ ft. tall, rather stout raceme nodding, many-fld, 1-sided, on a long peduncle; fls. about 1 in across, white, except the pale green on the side lobes and base of lip; sepals oblong-linear, keeled, much narrower than the obovate petals; lip 3-lobed, the lateral lobes incurved, the midlobe narrowly oblong. Malay Archipelago.

69 **Brónckartii**, De Wild Pseudobulbs up to 3 ft. long, furrowed, terete, leafy: racemes pendulous, laxly many-fld.; fls. about 2 in. across, pale rose, except an orange blotch on lip, sepals elliptic-oblong; petals elliptic-ovate; lip nearly orbicular, denticulate, the disk velvety Annam. B M 8252. R B. 33·369.

70 **Fármeri**, Paxt (*D. Pálpebræ*, Hook. not Lindl.). Pseudobulbs up to 1½ ft tall, 4-angled, clavate, leafy: racemes pendulous, laxly many-fld; fls about 2 in. across; sepals and petals pale straw-color, tinted rose, the sepals oblong, acute, narrower than the broadly oval petals; lip nearly orbicular, deep yellow, downy above. Sikkim to Nepal and Burma B.M 4659. F S 7.741 J F 307 C O. 30. Var **albiflòrum**, Hort. Sepals and petals white Var. **aùreo-flàvum**, Hook. Sepals and petals golden.

71. **capíllipes**, Reichb f. Dwarf: pseudobulbs 2–3 in. long, fusiform. racemes few-fld.; fls. about 1¼ in. across, golden yellow, with a deeper blotch on lip; sepals lanceolate, acute, much narrower than the broadly oval petals; lip with the blade about orbicular, emarginate. Burma. B.M 7639. Var **élegans**, Reichb. f Pseudobulbs taller, and base of lip deeper yellow.

72. **chrysotóxum**, Lindl. Pseudobulbs up to 1½ ft. tall, clavate or fusiform. racemes drooping, many-fld.; fls. about 2 in. across, golden yellow, except the reddish streaked orange-yellow disk on lip; sepals oblong-elliptic, about half as broad as the obovate-oblong petals; lip orbicular, fimbriate, pubescent on upper surface. Burma. G. 18:465; 30:275. B.M. 5053. I.H 5:164. C O 11. Var. **suavíssimum**, Hook f. (*D. suavissimum*, Hook f). Differs in its shorter, thicker pseudobulbs, and the large chestnut spot on the lip. Burma. Gn 13:166. C O. 11*a*.

73. **sulcàtum**, Lindl. Pseudobulbs up to 10 in. long, clavate, furrowed: racemes 10–15-fld., short, nodding; fls. yellow, the lip deeper and purple-streaked; sepals oval-oblong, narrower than the ovate petals, lip broadly ovate. Khasia Hills B R 24:65 B M 6962.

74. **densiflòrum**, Wall Pseudobulbs up to 1½ ft. tall, 4-angled, clavate, leafy. racemes pendulous, many-fld; fls about 2 in across, sepals and petals orange-yellow, nearly transparent, the acute sepals oblong-ovate, narrower than the denticulate nearly orbicular petals; lip nearly orbicular, orange-yellow, downy above. Nepal B.R 1828 B M 3418. F.S 14.1397. G.W. 1, p 223 J H III 51:123, 64:94 C O 14. Var **Schrœderi**, Hort (*D densiflòrum Schrœderi*, Hort. *D. densiflòrum álbum*, Hort). Fls larger in looser, longer racemes, the sepals and petals white, the lip deep orange, shading at margin to pale yellow. F M 502. A G 20 5.

75 **Griffithiànum**, Lindl Pseudobulbs up to 1½ ft. tall, furrowed, attenuated below: racemes pendulous, many-fld; fls. about 2 in across; sepals and petals bright yellow, the sepals oblong-oval, narrower than the nearly orbicular petals, lip orbicular, fringed, papillose above Burma Var **Guibértii**, Veitch (*D Guibértii*, Carr) Fls. larger and more intensely colored· pseudobulbs more abruptly narrowed below.

Section XII

76. **crumenàtum**, Sw·itz Pseudobulbs fusiform, thickened above base, then attenuated· fls appearing successively in upper part of st, white, or suffused with pale rose, sepals acute, the petals oblong-lanceolate, acute; lip cuneate, the lateral lobes rounded, the middle lobe nearly orbicular, the disk with 5 keels Malay Archipelago B R 25.22 B M 4013.

D acuminàtum, Rolfe=Sarcopodium acuminatum —*D amplum*, Lindl =Sarcopodium amplum —*D annamense*, Rolfe Fls buff-yellow, rather membranous Annam —*D arcuàtum*, J J. Smith Fls white, with stout spurs curved forward at the tip Java —*D Ashworthæ*, O'Brien Fls cream-white, except a few purple streaks at base of lip, the sepals lanceolate or triangular, the petals clawed New Guinea B M 8141. G C III 29 86 C O 39 —*D atrovioláceum*, Rolfe Racemes many-fld, the fls. about 3 in across, the sepals and petals primrose-yellow, claret-spotted, the lip 3-lobed, the disks violet, white-striped, the middle lobe recurved, dark violet streaked white at base, the upper part yellow, claret-spotted New Guinea B M 7371. C O 12 G W 3 205, 9 152, 16 69 G W 14, p 407 J H III 50 355 —*D bellátulum*, Rolfe Dwarf, tufted fls 1 or 2, axillary, white with a vermilion lip China B M 7985 G C III 36 114 —*D bicaudàtum*, Reinw Sepals and petals whitish, changing to greenish yellow, with faint purple lines, lip elongated, white Java —*C Brándtii*, Kränzl Resembles D Phalænopsis Fls, more fleshy, mauve-purple with silvery crests to the lip, sepals and petals twisted or curled —*D capituliflòrum*, Rolfe Fls in dense axillary heads, greenish white, with column and disk of lip bright green New Guinea —*D ciliátum*, Parish Sepals and petals yellowish green, the lip yellow, purple-lined Moulmein B M 5430, G W 11, p 340 Var *annaménse*, Hort A white-fld form with fringed lip, purple at the base Annam —*D Cælogyne*, Reichb f = Sarcopodium Cœlogyne C O 32 —*D compáctum*, Rolfe A small-growing species sepals and petals pure white, linear, acuminate, lip nearly as long as sepals, light green China —*D convolútum*, Rolfe Sepals and petals light green, with a few small dark brown markings at the base, lip green and dark brown New Guinea —*D criníferum*, Lindl "Fls lasting only a single day, whitish, with a 3-lobed lip which breaks up in front into a fringe of long spreading yellow filaments" Malaya G C III 43 194 —*D cucumérinum*, M'Leay Dwarf lvs oblong, terete, with tubercles arranged in lines fls 3–5, white or yellowish, purple-streaked New S Wales. J F 4 358 B M 4619 —*D delicátulum*, Kränzl=D subacaule —*D delicátum*, Bailey Sepals and petals milky white the lip white, violet-lined, the callus golden, minutely violet-dotted New Guinea G 34 245.—*D epidendróps*, Kränzl Resembling an epidendrum fls greenish or yellow outside, yellow inside, about 1½ in long Philippines —*D Faulhaberiànum*, Schltr Fls violet-rose, lateral sepals forming a mentum scarcely ½in long Hainan —*D fusiformæ*, Bailey=D. speciosum fusiforme —*D glomerátum*, Rolfe. Fls rose-purple, in few-fld fascicles, the lip golden carmine Molucca. Gn. 65, p. 123 —*D Goldschmidtiànum*, Kränzl Over a foot high· racemes short, about 12-fld, fls deep rose-purple Formosa —*D. Hildebrandii*, Rolfe. Racemes axillary, 3-4-fld, sepals and petals white, the lip primrose-yellow, the tube pubescent externally. Burma B M 7453 O R 3 49, 12 153, 16 26 —*D Hóldgkinsonii*, Rolfe Raceme 5–7-fld, terminal, fls pale green, the lip purple-nerved New Guinea B M. 7724 —*D Imthurnii*, Rolfe Probably the most robust of all dendrobiums in cult. racemes axillary, many-fld; fls of medium size, white, with lilac streaks on lateral lobes of lip. New Hebrides B M 8452.—*D inæquále*, Rolfe Flowering pseudobulbs separate from leafy ones, clavate, the fls secund, arising alternately from the margin of the internodes, sepals and petals white, the lip tubular, pale yellow, purple-streaked inside.

New Guinea B M 7745 —*D Jerdonianum*, Wight=D nutans — *D kardineæ*, Schlecht Fls, solitary in axil of lf at apex of the st, small, white A curious species New Guinea —*D Macdonæ*, Rolfe=D rhodostictum —*D monophyllum*, F Muell In habit resembling a bulbophyllum racemes with 9-15 greenish yellow fls. Austral —*D Mórtii*, F Muell Fls solitary, sepals and petals light yellow, lip whitish, marked with lilac with 3 undulate green keels on disk New S Wales —*D muricátum munificum*, Finet = Inobulbon munificum —*D nutans*, Lindl Fls short, in few-fld racemes, golden, sheaths hispidulous Malabar B M 7741 C O 28 (as D Jerdonianum) —*D punctéum*, Rolfe Fls in racemes, light rose-pink, with light yellow tips to the sepals and petals New Guinea —*D quinarium*, Rolfe "Fls light yellow with several light brown nerves in front of lip" New Guinea — *D rhodostictum*, F Muell Fls white, with a few purple spots on margins of lateral lobes of lip New Guinea B M 7900 (as D Madonnæ) G C III 44 162 —*D roxállum*, Ridley Fls rose-colored Borneo —*D rósea-nervátum*, Schlecht Fls pale rose, borne at the summits of the sts Sumatra —*D Sánderæ*, Rolfe Pseudobulbs up to 3 ft long, leafy racemes lateral, 3–4-fld, fls large, white, the lip with purple stripes on the disk and lateral lobes, the middle lobe obovate, truncate, crenulate S E Asia B M 8451 G C III 45 374 G M 52 621 O R 17 209 —*D Schmizii*, Rolfe Fls pale green, very fugacious Sumatra —*D Schwácæ*, Rolfe Fls very large, white A new species of the *Dearei* group —*D sendle*, Pax & Reichb f Pseudobulbs fusiform, hairy as are the lvs fls in pairs or solitary, fleshy, rich yellow, with a few orange streaks on lip Burma, Tenasserim Moulmein B M 5520 G W 9, p 422 —*D sputhaceum*, Lindl A small species with slender pseudobulbs fls white Sikkim —*D speciósum fusiforme*, Bailey Pseudobulbs fusiform fls pale sulfur or straw-color to nearly white, the lip white, marked with violet Austral G 43 361 G C III 41 437 —*D spectábile*, Miq Pseudobulbs up to 2 ft, clavate, grooved fls 3 in across, white, streaked and spotted with dark purple, the sepals and petals undulate, recurved, the former triangular-lanceolate, the petals much narrower, lip undulate, narrowly panduriform, the narrow lanceolate tip recurved New Guinea and Solomon Isls B M 7747 C O 22 A G 21 239 G M 43 53 Var *Simmondsii*, Hort Lip much longer than in the type, white, veined with dark purple —*D speciósum*, J J Smith Fls solitary, sepals and petals white A distinct and singular species Java, Borneo —*D stríctum*, Hort Sepals and petals narrow and nearly equal, labellum as long as petals narrow, with sides folded back, whitish tinged with rose " Philippines —*D subacutum* Reinw Fls fragrant, white speckled with purple on lip lip with very short apiculate middle lobe Queensland. —*D taurinum*, Lindl Pseudobulbs cylindric racemes many-fld, fls large, the sepals white, the petals and lip pale rose, intensely striated Philippines G C III 31 90 B R 29 28 —*D tonkinense* De Wild Lip entire, furnished with crests, the median one very prominent Tonquin —*D Treacherianum*, Reichb f = Sarcopodium Treacherianum —*D triflórum*, Lindl =Sarcopodium cymbidioides —*D undulatum* var *Broómfieldii*, Fitzgerald Fls pale greenish yellow N Austral —*D Victóriæ-reginæ*, Loher Racemes few-fld sepals and petals white at the base, violet-purple above, the lip golden at the base, violet-purple above marked with black-purple lines of papillæ Philippines G M 51 610, 54 556 Gn 75, p 370 C O 21 O R 20 17 —*D Williamsii*, Day & Reichb f Pseudobulbs up to 1 ft tall, hairy, as well as the lvs fls usually in pairs, 2½–3 in across, ivory-white or yellowish, the throat of lip bright orange-red N E India B M 7974 G C III 35 141 —*D Wilsonii*, Rolfe Racemes 2- or 3-fld, fls delicate pink or nearly white, with small yellow blotch on disk of lip W China —*D Wolterianum*, Schltr Racemes many-fld, fls rose-colored New Guinea

The following are some of the hybrid forms *D Ainsworthii*, Moore (D aureum × D nobile) Fls white, more or less suffused with rose, the lip with a feathered purple spot C O 1 Gn 51, p. 38 G C II 16 624 J H III 62 281 —*D Apollo grandiflórum* =D rubens —*D Artemis*=D aureum × D Ainsworthii O R 14 72 —*D Aspasia*=D aureum × D Wardianum O R 1 137 — *D burfordiense*=D aureum × D Linawianum G 29 35 —*D Cassiope*=D monilifórme × D nobile C O 2 —*D chrysodiscus*= D Ainsworthii × D Findlayanum —*D Curtisii*=D aureum × D. Cassiope Gn 60, p 145 O R 14 73 —*D Dalhousie-nobile*= D nobile × D pulchellum G C III 27 379 —*D dominyánum*=D. nobile × D Linawianum —*D dulce*=D aureum × D Linawianum. —*D Edithæ*=D nobile nobilius × D aureum —*D endéchara*= D aureum × D moniliforme G 32 293 G Z 36, p 195 — *D exosmum*=D endocharis × D nobile —*D Leechianum*=D. aureum × D nobile R H 1904 280 C O 1a —*D melanodiscus gloriósa*=D Ainsworthii × D Findlayanum G C III 35 219 —*D. melanodiscus péllens*=D Ainsworthii × D Findlayanum. J H III. 50 25 —*D Rœblingiánum*,=D nobile × D ranosum Gn 59, p. 198, desc —*D Rólfeæ*=D nobile × D primulinum —*D Rólfeæ róseum*=D nobile × D primulinum Gn W 18 541 —*D rúbens grandiflórum*=D Ainsworthii × D nobile. G M 53 206 —*D. Schneideriánum*=D aureum × D Findlayanum —*D splendidissimum grandiflórum*=D nobile × D aureum G M 43 179 Gn 65, p 140 —*D Thwaitesæ*=D Ainsworthii × D. Wigania G M 47 273.—*D. Vénus*=D. nobile × D Falconeri. G M 51 459 C O 3 —*D Wigánia*=D nobile × D signatum —*D Wiganiæ xanthochilum*=D nobile × D. signatum Gn W 20 161 —*D Wiganiánum*=D. Hilde bi andii × D. nobile G M 44 167.—*D xanthoécntron*=D Wardianum × D. Linawianum

GEORGE V. NASH.

DENDROCÁLAMUS: A few large bamboos of the East Indies and China, see *Bamboo*.

DENDROCHÍLUM: *Platycænia*.

DENDROMÈCON (Greek *dendron*, tree; *mecon*, poppy) *Papaveràceæ* An outdoor shrub in California, with bright yellow flowers; sparingly grown elsewhere.

Smooth low branching plant with rigid alternate mostly entire lvs.: fls golden yellow, 1–3 in. across, single on short pedicels, petals 4, large; sepals 2; stamens many, short. fr a linear curved grooved caps 2–4 in. long — Long considered to comprise a single species, but lately redefined by Fedde into 20 species, but only one species-name appears to be in the trade The division into species is largely on foliage characters It is not unlikely that some of the cult material represents one or more of these segregates.

rígida, Benth Rigid, very leafy, 2–10 ft. high: sts up to 2 in. thick. bark whitish: branches stiff, erect lvs. lanceolate or ovate-lanceolate, coriaceous, reticulately veined, very acute and mucronate: fls. on pedicels, 1–4 in. long: seeds black, almost globular. Dry parts of Coast ranges and in the Sierras B M. 5134 F S. 14:1411 Gn 50 292 J H III 29 92 — Spring-flowering In England it is somewhat tender, requiring some protection in winter. Prop from seeds, that take very long to germinate. Considerable variation in size of fls. appears to depend on the conditions in which plants are growing. Evergreen, but in hard winters in Calif., loses most of its lvs by Feb, when, becoming scraggly, it may be cut back to ground for renewal L H B †



1239. Tip of leaf of Dennstædtia punctilobula (×¼)



1240 Fruiting lobe of Dennstædtia punctilobula.

DENDRÓPANAX (Greek, *tree Panax*). *Araliàceæ*. Unarmed trees and shrubs from Trop Amer. and Asia, also China and Japan. Fls. hermaphrodite, rarely polygamous. Species about 20. *D japónicum*, Seem. (*Hédera japónica*, Jungh), may be secured from dealers in Japanese plants The lvs have been compared to *Fatsia japonica*, but are smaller and mostly 3-lobed but simple. The floral parts are in 5's: infl. umbellate, terminal nearly simple and not showy: berry globose. Cult in temperate house.

N. TAYLOR.†

DENDROPHÝLAX: *Polyrrhiza*.

DENNSTÆDTIA (August Wilhelm Dennstedt, early German botanist). *Polypodiàceæ*. Hardy or greenhouse ferns of wide distribution, often referred to Dicksonia but belonging to a different family from the tree ferns of the latter genus from the antarctic or southern hemisphere. Indusium inferior cup-shaped, open at top and adherent on outer side to a reflexed toothlet: lvs 2–3-pinnatifid from erect or creeping rootstocks. Species about 30; of simple cultural requirements.

punctilóbula, Moore (*Dicksònia pilosiúscula*, Willd.). Figs. 1239, 1240. Rootstock slender, creeping, underground: lvs. light green, 1–2½ ft. long, 5–9 in. wide, usually tri-pinnatifid, under surface minutely

glandular, giving the dried lvs a somewhat pleasant fragrance; sori minute, on small, recurved teeth. Canada to Tenn —Sometimes called hay-scented fern, and boulder fern Likes light porous soil and semi-shaded places Variable

Smíthii, Moore Lvs thick, the under surface almost woolly, glandular, tripinnate; lower pinnæ 9–12 in. long, 3–4 in wide; sori 2–8 to each segm. Philippines

dissécta, Moore From the W Indies, often 6–7 ft. high, with broad (2–4 ft) lvs —Sometimes seen in cult. and is well worth a place in the trade.

L M UNDERWOOD.

DENTÀRIA (Latin, *dens,* tooth; referring to the toothed rootstocks) *Cruciferæ* TOOTHWORT Small early-flowering herbs, sometimes offered by dealers in native plants

Hardy herbaceous perennials, usually with pleasant-tasting rootstocks, 2 or 3 lvs , mostly with 3 parts, and corymbs or racemes of large white or purplish fls in spring sts mostly unbranched and not leafy below. lvs. palmately 3-divided or laciniate petals surpassing the sepals, stamens 6, style slender· fr a very narrow flat silique dehiscent from the base —Probably 20 species in Eu , Asia and in N Amer. The European and E American species are readily told from Cardamine by habit and many obvious differences, but the W American representatives of the 2 genera converge so that some botanists have merged Dentaria into Cardamine (See E L Greene, Pittonia, 3:117–124)

Several species are cultivated in Old World rockeries They are of easy culture in light rich soil, and moist shady positions. Usually propagated by division, as seeds are not abundant

A *Rootstock continuous, not tuberous*

diphýlla, Michx PEPPER-ROOT. Fig. 1241. Eight to 16 in . rootstock several inches long, often branched, strongly toothed at the many nodes st -lvs 2, similar to the root-lvs , close together; segms 3, ovate or oblong-ovate, coarsely crenate, the teeth abruptly acute· petals white inside, pale purple or pinkish outside Nova Scotia to S C , west to Minn and Ky B M 1465 —Rootstocks 5–10 in. long, crisp, tasting like water-cress. Pretty spring fl



1241. Dentaria diphylla. (×½)

AA. *Rootstock tuberous or jointed.*

B *Lvs. deeply 3-parted, but not into distinct lfts.*

laciniàta, Muhl Eight to 16 in · the st pubescent above: tubers deep· st -lvs 3, with lateral segms often 2-lobed, all oblong to linear, more or less sharply toothed: petals purplish to white Que. to Minn , south to Fla. and La. Var **íntegra,** Fern , has the lateral segms. entire or nearly so. *D. anómala,* Eames, is perhaps a hybrid with *D diphylla;* Conn

macrocárpa, Nutt. (*C. gemmàta,* Greene) St simple, 4–15 in.: lvs 1–3, palmately or pinnately 3–5-parted, or divided; segms linear to oblong, entire: fls. purple or rose: tubers with joints about 1 in long. N. Calif. to Brit Col.

BB. *Lvs. of st. cut into 3 distinct lfts. (except sometimes in D californica).*

tenélla, Pursh Six to 12 in : tubers small, irregular: basal lvs simple and round-cordate, crenate or sinuate; st -lvs 1 or 2, nearly sessile, sometimes bulbiferous; lfts. linear-oblong or linear, obtuse, entire: petals rose. Ore , Wash

califórnica, Nutt Tubers mostly small: st. ½–2 ft. high lvs very variable; st -lvs. 2–4, mostly short-petiolate, and above the middle of the st. with 3–5 lfts., rarely simple or lobed, lfts mostly short-petiolulate, ovate to lanceolate or linear, entire or toothed· petals white or rose Mountains and streams of Calif. and Ore

máxima, Nutt Ten to 16 in · tubers near the surface, jointed, strongly tubercled. st -lvs 2 or 3, usually alternate; lfts ovate or oblong-ovate, coarsely toothed and somewhat cleft or lobed, with petiolules· fls white or purple-tinged Maine to Mich and Pa

L H B †

DEODAR *Cedrus Deodara*

DEPÀRIA (Greek, *depas,* a beaker or chalice; referring to the form of the involucre) *Polypodiàceæ* A small genus of Hawaiian and South American ferns related to Dennstædtia, rarely seen in cultivation in America The sori are marginal and usually on stalked projections from the margin of the leaf

DÉRRIS (Greek, *a leather covering*). Syn *Deguèlia Leguminòsæ* Tropical, tall woody climbers (sometimes trees), one of which has been offered in S. Calif , but is now apparently out of cult there Lvs alternate, lfts opposite, the odd one distant; stipules none fls violet, purple or white, never yellow, in racemes or panicles or fascicles, papilionaceous, standard broad and rounded; wings oblique pod indehiscent; 1- to several-seeded —About 40 species, of little horticultural significance.

scándens, Benth Climbing: lfts 9–18, 1–2 in long, oblong, obtuse, or acute, glabrous or minutely pilose beneath fls. pale rose, in very long racemes: pod long, lanceolate, acute at both ends, narrowly winged at the base, ovules 6–8 S Asia and Indian Archipelago to Austral —It has been offered in this country, but has not been successfully cult

D alborùbra, Hemsl , from China, has been flowered at Kew in the palm house "where it covered some square yards of the roof " fls. white, fragrant, with red calyx, in long panicles lfts coriaceous, glabrous, ovate-oblong a climbing evergreen shrub once confused with D Fordii, Oliver B M 8008.

L H B

DESCHÁMPSIA (for Deslongchamps, a French botanist, 1774–1849). *Gramíneæ* Tufted perennials with shining spikelets in narrow or loose panicles, sometimes grown for dry bouquets

Spikelets mostly 2-fid , with a hairy prolongation of the rachilla; glumes about as long as the florets; lemmas toothed, bearing a dorsal awn —Species about 20, in the cooler regions of the northern hemisphere

cæspitòsa, Beauv. (*Àira cæspitòsa,* Linn) TUFTED HAIR-GRASS. HASSOCK-GRASS. Growing in tufts 1–3 ft : blades firm, narrow. panicle open, the branches slender. G.M. 54:916 Common in N. U. S., extending

south in the mountains.—In England, it is sometimes used by the farmers to make door-mats.

flexuòsa, Trin (*Aira flexuòsa,* Linn). Wood Hair-Grass Culms slender, 1–2 ft : blades numerous, capillary panicle open, the flexuous branches spikelet-bearing near the ends Dept Agric , Div. Agrost 7 173 Open woods N. E U. S —Of some value for woodland pastures, as it will grow well in the shade Also used for ornament A form with yellow-striped foliage is sold under the name *Aira foliis variegatis*

A S Hitchcock.

DESIGN, FLORAL. An important feature of the work of a retail florist is the making of floral designs or "set pieces" Fig 1242 This work is directly opposed to the informal arrangement of flowers which is so much admired at the present time. See *Bouquets,* Vol I By artistic arrangement, however, these designs are now made less formal than in the earlier history of the retailer's work These designs lend themselves well to the working out of various inscriptions and legends in flowers; therefore, these are most frequently used as tokens of affection sent to friends or relatives at the time of a death These designs are also much in demand by various fraternal orders and other societies, when the emblems of the order or society are worked out in flowers and sent as a tribute to the house of sorrow They therefore have their place in the work of every flower-shop



1242 A floral design.

As has been stated, the present-day tendency in the arrangement of flowers in designs is to get as far away as possible from a stiff, set formality A design must, of necessity, be distinct in outline, but by a careful and free use of ferns and other florists' "green," the effect may be made somewhat informal and pleasing Various forms of the "shower" wreath illustrate this, as well as a loose arrangement of flowers, and even foliage and flowering plants about the base of a standing emblem

The most common forms of floral designs in use at the present time are flat and standing wreaths, pillows, casket-covers, crosses, anchors, and the emblems of various fraternal orders, such as the Masonic square and compass, and the Odd Fellows' three links

. The flowers, of which these designs are made, vary in different stores The price which is to be paid for the design usually governs the species and varieties used Orchids, lilies, lilies-of-the-valley, roses and Farleyense ferns compose the most expensive designs, while carnations, stevia, Roman white hyacinths and other more common flowers, with asparagus fern, comprise the cheaper designs Usually the florist determines the price the customer wishes to pay and selects the flowers in accordance with this Within recent years there has come to be a demand for unusual material in designs, and boxwood, galax, leucothoe and magnolia leaves, ericas and other woody plants have been much used

In making these designs, the arrangement must necessarily be quite formal; therefore, wire frames are used. These are made in large quantities by various wire-working firms and are sold at wholesale at a comparatively low figure. In order to emphasize the particular formal outline and to hold the flowers permanently in place, the flower-stems are usually removed and the flowers then wired with 9- or 12-inch, No 22 or No 24 wire The wire forms are first filled with sphagnum moss, which is moistened so that the flowers will retain their freshness, and the wired stems of the flowers are inserted in this moss The wiring is an art, and the design-worker becomes so proficient in this that many flowers may be wired in a short period of time This is necessary when many designs must be made quickly, as is so frequently the case in a flower-shop at the time of the funeral of a distinguished person

Design work usually brings the retailer a substantial remuneration In many instances, flowers of a lower quality may be used in designs than are demanded by persons buying cut-flowers They must always be fresh, however, but, when roses are used, those having short stems are just as desirable as long-stemmed flowers In carnations, many having a split calyx may be used when they would be salable in no other way. If Roman hyacinths are used, the main truss may be sold as cut-flowers, and the secondary trusses used in designs

The green elements in the design, which are used to emphasize the beauty of the flowers, vary much in different stores Each designer has his own ideas regarding the uses of this material, but often he is compelled to use what is available at the precise moment when it is needed. Because of its excellent keeping qualities, the "dagger," or Christmas fern, is frequently used; but, when this is plainly visible in the finished design, it has a coarse appearance which cheapens the effectiveness of the piece It may, however, be used as a cover for the frame and moss, with excellent effects The "fancy dagger," or spinulose wood fern, is more attractive than the common dagger fern One of the earlier greens used was smilax, but this has inferior keeping qualities to other kinds and is not so popular at the present time It does not lend itself readily to a loose, formal arrangement Both *Asparagus plumosus* and *A. Sprengeri* make excellent backgrounds for all design work For softening effects to be worked among the flowers, nothing adds value to the design so much as a few sprays of *Adiantum Croweanum* or *A Farleyense* Often the foliage of the plants from which the flowers come adds a more pleasing effect than does the green of any other species This is especially true when roses or lilies-of-the-valley are used

Of the many designs made by the retailer of flowers, wreaths are probably the most in demand They exhibit good taste, and many have excellent keeping qualities. One of the earlier forms was made of English ivy, and the effect was pleasing This was especially so when the wreath was enriched with a large bunch of violets, arranged in a loose, artistic manner Because of the difficulty of getting a sufficient quantity of these leaves, the ivy wreath has been largely replaced by that made of galax leaves. These have excellent

keeping qualities and are obtained in large quantities by wholesale dealers from the mountains of North and South Carolina. Both bronze and green galax may be secured, but the green is most satisfactory as it makes a more pleasing contrast with a larger number of colors of flowers It is customary to make these in rather large sizes, a 16-inch frame, or even larger, being used Usually the right-hand side of the wreath is decorated with roses, lilies-of-the-valley, or other flowers A standing galax wreath, with a base of galax leaves, cocos palms, white roses and "valley," and the wreath itself decorated with white roses, lilies-of-the-valley, with shower sprays of "valley" and maidenhair ferns on dainty narrow ribbon, makes an effective design If a single spray of cattleyas is placed among the roses and "valley," the effect is enriched wonderfully. Magnolia and leucothoe leaves are also used extensively for wreaths, but this foliage is heavier and less pleasing than galax However, the buying public is tiring of the galax, and the retailer is searching the continents for something to replace it Boxwood also makes a rich and attractive wreath Wreaths made principally of flowers are often in demand, and when varieties are carefully selected, the results are pleasing. Fig 1242 (redrawn from American Florist).

In selecting the flowers for any design, certain rules must be observed. In the first place, a designer must realize that, as in all other flower-arrangement, a lavish use of material is not essential to good effects. A flower has an individuality of its own, and this should be just as pronounced in a design as in a loose vase arrangement At no time should the material be crowded When an inscription is to be placed over the flowers, as, for example, in a pillow when carnations are to be the background, even then each carnation should show its form and the background should not be a mass of petals without definite shape. As a general thing, it is best to place the flowers in position first, after having covered the mossed frame with green, and then to work the foliage among the flowers where it is needed for the best effects. This method requires fewer flowers, and the effect is more artistic. In making a design, it must be remembered that there may be contrast of forms as well as colors As a rule, there should not be over three contrasts of forms and two contrasts of colors, although there may be variations to this rule in special cases. As regards shapes and forms, it is quite essential that larger, heavier blooms, such as lilies and roses, should be contrasted with sprays of a light and graceful character, like lilies-of-the-valley and Roman hyacinths. The larger flowers are to be placed low in the arrangement, and the finer sprays higher. Often the center of a design is made of one particular species, as, for example, pink roses with their foliage; and the borders of the design are filled with sprays of lighter flowers, like lilies-of-the-valley with their foliage or that of the maidenhair fern If in the arrangement of the larger flowers a few buds of the species used are added, the effectiveness of form is increased.

In selecting colors for designs, the lighter shades are the most desired, although in recent years there has come to be a freer use of darker colors. For example, a large wreath of Richmond or other red roses contrasted with lilies-of-the-valley or white Roman hyacinths, is very effective and is not considered out of place for a funeral design. The amateur should, however, avoid striking contrasts or to endeavor to harmonize unusual forms in flowers The experienced designer may bring these together with pleasing effects, but this ability comes only after years of study and experience. Large designs are more easily arranged than small ones, and in them may be used a wider range of colors. The most striking colors are, however, widely separated, and between these the flowers should be of such tints that they assist in blending.

Flowers with a strong fragrance should not be used in designs if they can be avoided. They are especially objectionable if they are to be used in a dwelling-house where the rooms are often crowded. In a church or other large room, the fragrance is less noticeable. Polyanthus narcissi, tuberoses and freesias are especially objectionable The more delicate odors of violets, lilies-of-the-valley and Roman hyacinths are less so.

The funeral designs most frequently ordered by the immediate family are pillows and casket-covers Both of these demand careful treatment in making, the pillow being especially difficult The smaller the pillow, the harder it is to produce a pleasing result. The flowers should be of a rich character, and it shows better judgment to select a less expensive wreath as a floral tribute than to purchase a pillow made of cheap flowers. Casket-covers should also be made of expensive flowers These covers are not lasting, for they must of necessity be light in character; and moss, which is so necessary to retain moisture and freshness in the flowers, cannot well be used. Light wire of a fine mesh, such as mosquito netting, is cut of the desired size and the flowers which are usually of one species, like Easter lilies or roses, are wired to this with sufficient foliage or other green to cover the wire A flower of some contrasting color may be used for a border, or a rich outline of smilax is effective

The construction of many fraternal emblems in a pleasing, artistic way, demands all the fine points of the professional designer's skill Often all rules of flower-arrangement have to be disregarded Special emblems have to be made of special colors, and when an emblem must be made which calls for definite parts to be blue, others to be yellow, red, white and green, the problem to harmonize these is a serious one. The designer has no choice in such a case, and can meet this demand only with an attempt to reduce to the minimum these clashing contrasts in color

As has been stated, formal designs in the arrangement of cut-flowers are a necessity, and for these there will probably always be a demand The designer should have in mind, however, that it is possible to arrange flowers in a pleasing way and still emphasize the formal lines Artists in this line of work are just as truly "born, not made," as in any other branch of art; and unless one has a genuine love for flowers and the artist's skill in their arrangement, the making of formal designs should not be attempted

E. A. White.



1243. Desmazeria sicula. (×⅓)

DESMÁNTHUS (name refers to flowers being in bundles) Syn. *Acuan. Legumanòsæ* About 10 herbs or shrubs in subtropical N. Amer., and 1 in the tropics of the Old World, a few of the American species reaching well north in the U. S.; probably not regularly cult., but now and then transferred to the garden for the effect of their bipinnate lvs and small greenish white fls., in axillary pedunculed heads or spikes The genus is one of the Mimosa tribe, and the fls. are not papilionaceous. petals 5, distinct or very nearly so, calyx bell-shaped, 5-toothed, stamens 5 or 10, distinct, usually exserted: pod flat, narrow, straight or curved, several-seeded *D illinoénsis*, MacM (*Mimòsa illinoénsis*, Michx *Acuan illinoénsis*, Kuntze), occurs in prairies and river borders from Ind. west and south· 1–5 ft., nearly glabrous, perennial erect

herb· lfts. 20–30 pairs, obtusish. *D. leptólobus*, Torr. & Gray, occurs on prairies from Kans to Texas: lfts. mostly fewer and acute, and peduncles much shorter (1 in. or less long).

DESMAZÈRIA (in honor of Desmazieres, a French botanist). *Graminеæ*. Plants resembling Eragrostis, sometimes grown as ornamental grasses.

Spikelets many-fld, strongly compressed, the lemmas keeled and coriaceous but faintly 3- or rarely 5-nerved, awnless: infl. several closely imbricated spikelets, arranged in a linear, dense, nearly simple spike-like panicle.—Species 4, 1 in Medit. region, and 3 in S. Afr.

sícula, Dum. (*Brizopyrum sículum*, Link). Spike-Grass. Fig 1243 Annual, 8–12 in spikelets ½in., in a nearly simple spike. Eu.—Cult. for ornament and frequently used for edging A. S Hitchcock.

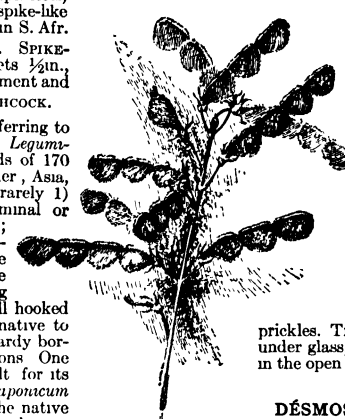
DESMÒDIUM (Greek, a *band* or *chain*, referring to the jointed pods) By some called *Meibòmia. Leguminòsæ* Tick Trefoil Mostly herbs, upwards of 170 species, in temperate and warm regions of Amer, Asia, Afr. and Austral Lvs pinnate, with 3–5 (rarely 1) lfts fls small and papilionaceous, in terminal or axillary racemes in summer, mostly purple; calyx with a short tube, more or less 2-lipped, standard broad, wings joined to the keel pod flat, deeply lobed or jointed, the joints often breaking apart and adhering to clothing and to animals by means of small hooked hairs Fig 1244 A number of species are native to N Amer, and are sometimes grown in the hardy border, where they thrive under ordinary conditions One hothouse species, *D gyrans*, is sometimes cult for its odd moving lfts *D. penduliflorum* and *D. japonicum* will be found under Lespedeza Several of the native species are worthy of cult, but are practically unknown in the trade The following have been offered by collectors *D canadense*, DC (Fig 1244), *D cuspidatum*, Hook, *D Dillenii*, Darl; *D marilandicum*, Boott, *D nudiflorum*, DC.; *D paniculatum*, DC, *D pauciflorum*, DC, *D sessilifolium*, Torr & Gray The Florida beggarweed is *Desmodium tortuosum*, DC, of the W Indies It is coming into prominence in the S as a forage plant (see Cyclo Amer Agric, Vol II, p 214).

Two Chinese shrubby species have recently been intro to Eu. *D amethystinum*, Dunn, growing 3–5 ft: lvs 3-foliolate, the lfts elliptic, 4–7 in long fls amethystine, ½in long, in a terminal panicle *D cinerèscens*, Franch, not Gray broad bush, 3 ft high, densely leafy. lvs large, the lfts lozenge-shaped fls rosy lilac to violet, in many racemes, produced in June and again in Sept

The greenhouse species, *D gyrans*, is of tolerably easy culture It requires stove temperature, and, although a perennial, it is best treated as an annual The best method of propagation is by seeds These should be sown in February in a light, sandy soil, in 4-inch pots, and placed in a warm, close atmosphere, where they will soon germinate. The seedlings should be potted singly into small pots as soon as large enough to handle and grown on as rapidly as possible, using a mixture of good, fibrous loam and leaf soil in about equal proportions By midsummer they will be good bushy plants, and, though not showy, they are very interesting. (Edward J. Canning)

gỳrans, DC Telegraph Plant. Undershrub, 2–4 ft. high, with 3 oblong or elliptic lfts, the small lateral ones (which are almost linear) moving in various directions when the temperature is congenial, and especially in the sunshine: fls purple or violet, in racemes and terminal racemose panicles. Ceylon to the Himalayas and the Philippines —Grown occasionally as a curiosity, particularly in botanical collections. See Darwin's "Power of Movement in Plants," and various botanical treatises, for fuller accounts L. H. B.

DESMÓNCUS (*band* and *hook*, referring to hook-like points on the lvs.) *Palmàceæ* About 25 palms of U S, S. Mex. to Bolivia and Brazil, differing from Bactris in the long slender climbing caudex and technical characters. They are gregarious plants, with spines or hooks by means of which they climb or are elevated on growing trees, the sts. usually thin and flexuose and annular: lvs. scattered along the st., pinnate or pinnatisect, the parts or segms. opposite or alternate, the rachis produced into a long hook-bearing climbing organ: fls greenish, in solitary spadices with 2 spathe-lvs.: fr small, pea-shaped, red. **D. major,** Crueg., st. becoming very long and clinging to supports by the modified retrorse opposite segms on the prolonged rachis: lvs. pinnate, lfts 20 pairs, linear-acuminate and usually clustered, rachis spiny, dark-tomentose· spathe covered with brown prickles. Trinidad Little known under glass, and reported as cult. in the open in S. Fla. and S Calif.



1244 Desmodium canadense pods. (Nearly natural size)

L. H. B

DÉSMOS (Greek, *chain*, on account of the fruit resembling nodes chained together) *Annonàceæ* A genus established in 1790 by Loureiro and based upon *Desmos cochinchinensis* (*Unona Desmos*, Dunal, 1817; *Unona cochinchinensis*, DC, 1824). The flowers are composed of 3 sepals and 6 petals in 2 series, the latter valvate, nearly equal, and flat, stamens numerous, tetragonal-oblong or cuneate, the connective expanded above the dorsal oblong or linear-oblong pollen-sacs into a truncate hood-like process, receptacle, or torus, slightly raised, usually truncate or somewhat concave at the apex; carpels indefinite; ovules several, usually forming a single column, but sometimes sub-biseriate; style ovoid or oblong, recurved, ripe carpels indefinite, either elongate and chain-like from constrictions between the seeds, or baccate and spheroid. *D. cochin-chinénsis*, Lour, is a shrub with an erect or climbing st and weak reclinate branches, lanceolate lvs, fragrant yellowish green pendulous fls, and reddish green moniliform frs *D chinénsis*, Lour (*Unòna discolor*, Vahl), is a small tree of the E Indies, with ovate-oblong lvs glaucous beneath and extra-axillary sweet-scented aromatic fls, for the sake of which it is often cult. The greenish yellow corolla resembles that of *Canangium odoratum*, but the moniliform fr consists of several joints, each containing a pea-like seed It is used when green by the Chinese at Hongkong, who make from it a fine purple dye *D élegans*, Safford (*Unòna élegans*, Thwaites), remarkable for its fr, which resembles strings of beads, and the very closely allied *D. zeylánicus*, Safford (*U. zeylánica*, Hook. f. & Thoms), are endemic in the moist forests of Ceylon. Many species of Desmos have been erroneously referred to the genus Unona, based upon a S. American plant (*Unona discreta*, Linn f) not congeneric with the Asiatic genus above described, but more closely allied, if not to be identified with the genus Xylopia. See Safford, W. E, Bull. Torrey Bot. Club 39:501–8 (1912). W. E Safford.

DEÙTZIA (named by Thunberg in honor of his friend and patron, Johann van der Deutz). *Saxifragàceæ.* Very ornamental shrubs grown for their showy white or blush flowers appearing in spring or early summer

Upright· lvs deciduous, rarely persistent, opposite, petioled, serrate, usually with rough stellate pubescence: fls in panicles, rarely in racemes or in corymbs, white, sometimes purplish, epigynous; calyx-teeth 5; petals 5, stamens 10, rarely more, shorter than the petals, filaments usually winged and toothed at the apex, styles 3–5, distinct caps 3–5-celled, with numerous minute seeds.—About 50 species in E. Asia and Himalayas and 1 in Mex Monograph by Schneider in M.D. 1904.172–188, and a hort monograph by Lemoine in J.H F 1902.298–314; see also Rehder in Sargent, Plant Wilson 1 14–24 for Chinese species

The deutzias belong to our most beautiful and most popular ornamental shrubs; they are very floriferous and of easy cultivation *D parviflora* and *D grandiflora* are the hardiest, and also *D gracilis*, *D. Sieboldiana* and *D scabra* are hardy as far north as Massachusetts; the recently introduced *D longifolia*, *D Schneideriana*, *D discolor*, and *D Wilsonii* have proved fairly hardy with slight protection or in sheltered positions at the Arnold Arboretum One of the most tender is *D. purpurascens* Of the hybrids, *D. Lemoinei* is the hardiest, while *D rosea* has proved about as hardy as *D. gracilis*, *D kalmiæflora*, *D myriantha* and others are tenderer. Most of the deutzias have white flowers, but *D. rosea*, *D. purpurascens*, *D longifolia*, *D. myriantha*, *D kalmiæflora* and some varieties of *D scabra*, have the flowers carmine outside or pinkish They flower most profusely if pruned as little as possible, although an occasional thinning out of the old wood soon after flowering will be of advantage.

The deutzias thrive in almost any well-drained soil, and are well adapted for borders of shrubberies Potted plants forced with a temperature not exceeding 50° develop into beautiful specimens for the decoration of greenhouses and conservatories, especially *D Lemoinei*, *D gracilis* and *D. discolor*. The same plants cannot be forced again Propagate readily by greenwood and hardwood cuttings, also by seeds sown in pans or boxes in spring

INDEX.

albo-marmorata, 1.
albo-plena, 3
albo-punctata, 3
angustifolia, 3, 17.
aurea, 1.
aureo-variegata, 3.
campanulata, 2
candidissima, 3.
carminea, 2
compacta, 17
corymbiflora, 7.
crenata, 3, 5.
dentata, 3
Dippeliana, 6.
discolor, 2, 8, 12.
eburnea, 5
erecta, 5, 7.
exima, 2.
floribunda, 2.
formosa, 5
Fortunei, 3.
gracilis, 1, 2
grandiflora, 2, 15.
kalmiæflora, 11.
latiflora, 5.
laxiflora, 4.
Lemoinei, 17.
longifolia, 9.
magnifica, 5.
major, 12
marmorata, 3.
mitis, 3
multiflora, 2.
Musei, 16
myrianthia, 10.
parviflora, 16.
plena, 3.
punctata, 3.
puncea, 3
purpurascens, 8.
rosea, 2
scabra, 3, 6,
Schneiderana, 4.
setchuenensis, 7.
Sieboldiana, 6.
superba, 5
Veitchii, 9.
venusta, 2
Vilmorinæ, 13.
Watereri, 3.
Wilsii, 3.
Wilsonii, 14.

A. *Petals valvate in the bud.*

B. *Fls. in panicles or racemes, calyx-teeth short (except in the hybrids)*

C. *Lvs glabrous below or nearly so.*

1 **grácilis,** Sieb & Zucc Fig 1245 Shrub, to 3 ft., with slender, often arching branches lvs oblong-lanceolate, acuminate, sharply serrate, with sparse stellate hairs above, nearly glabrous beneath, bright green, 1–2 in long. fls pure white, in racemes, petals erect or somewhat spreading, oblong, stamens much shorter than the petals, calyx-teeth persistent May, June Japan S Z. 8 P F G 2, p 7 F S 6 611. R H 1891, p 203. G M 50.563 Gn 39, p 200 G W. 12, p 534 Gt 1897 384 H F 1 48 J F 1.44 V. 7 217 Var **aùrea,** Schelle Lvs yellow Var. **álbo-marmoràta,** Lemoine Lvs sprinkled with white.

2 **ròsea,** Rehd (*D gracilis* × *D purpurascens D gracilis ròsea* and *D discolor ròsea,* Lemoine) Lvs ovate-oblong, acuminate, bright green, slightly paler below, very sparingly stellate-pubescent on both sides fls pink, campanulate, in panicles, calyx-lobes longer than the tube, filaments slightly toothed or subulate, but strongly toothed in all varieties except in var *venusta* and var *multiflora.* F E 30 423 G 27 274 Var **campanulàta,** Rehd With large white campanulate fls G 28 485 Var **venústa,** Rehd. With white fls G 27 275 Var **multiflòra,** Rehd With white fls Var **exímia,** Rehd With white fls tinted pink outside, in upright panicles Var **carmínea,** Rehd With light pink fls tinted carmine outside Var **floribúnda,** Rehd With white fls tinted pink outside J H F. 1902 312 Var **grandiflòra,** Rehd With fls of the same color, but larger All these varieties were originally described by Lemoine as varieties of *D. gracilis* except the two last ones, which he has under *D discolor.*



1245 Deutzia gracilis. (×½)

CC *Lvs. stellate-pubescent beneath.*

D *Filaments all toothed at the apex.*

E. *Calyx-lobes shorter than the tube, petals upright*

3. **scàbra,** Thunb Shrub, to 6 ft. lvs all petioled, ovate to ovate-lanceolate, rounded at the base, crenate-dentate, with rough pubescence on both sides, dull green, 1–3 in. long· panicles erect, 2–4 in long, fls white or blushed, with erect petals;

calyx-lobes deciduous. June, July. Japan, China. S Z. 6 B M 3838. B R 1718. S B F G II 4·393 Gn. 37, p 315 F E 31.1163. H U. 1, p. 106 Var. **angustifòlia,** Voss Branches reddish brown lvs ovate-lanceolate, rougher Var **crenàta,** Voss (*D crenàta,* Sieb & Zucc. *D dentàta,* Hort *D màius,* Hort). Branches brown: lvs ovate or oblong-ovate, less rough This variety is less common in cult. than the former. Var. **marmoràta,** Rehd (var. *aùreo-variegàta,* Schneid) Lvs. spotted with yellowish white Var. **punctàta,** Arb. Kew (var *álbo-punctàta,* Schneid). Lvs sprinkled with white dots Var. **Fórtunei,** Schneid. Fls. larger F E. 31·1071 Var. **Wâtereri,** Rehd (var. *puníicea,* Schneid *D. crenàta Wâterert,* Lemoine). Fls white, tinted carmine outside G C III 39 340. Var. **plèna,** Rehd (*D crenàta* var. *plèna,* Maxim). Fls double, white, tinged with rose outside. R H 1867· 70 F S 17.1790; 18 1850 G 21:263 F 1863 153. G F 8·112, here belongs also *Prude of Rochester,* with very large fls , faintly tinged with rose outside Gn. 33, p 514. Var **candidíssima,** Rehd (*D scàbra* var. *álbo-plèna,* Schneid *D crenàta candidissima plèna,* Carr *D Wellsii,* Hort) Fls double, pure white.

4 **Schneideriàna,** Rehd. Shrub, to 6 ft lvs elliptic-ovate to elliptic-oblong, short-acuminate, sharply serrulate, stellate-tomentose and whitish below, 1½–3 in. long panicles broadly pyramidal; fls. nearly ½in. long, white, stamens nearly as long as the petals; calyx-lobes deciduous Cent China Var **laxiflòra,** Rehd Lvs oblong-lanceolate, acuminate, remotely denticulate, rough-pubescent above, thinly stellate-pubescent beneath and light green panicles broad and rather loose, 2½–3½ in long, fls about ½in long June W China —Only the var is in cult , similar to *D. scabra,* but the panicles looser and more graceful

EE *Calyx-lobes longer than the tube*

5. **magnífica,** Rehd (*D scàbra* × *D Vilmòrinæ D. crenàta magnífica,* Lemoine) Lvs ovate-oblong, acuminate, appressed-serrulate, rough above, stellate-tomentose and grayish green below, 1½–2½ in long fls in erect panicles, white, double, sepals ovate or ovate-oblong, about as long as calyx, acute June G M 53 108 F E 31.322 Var **latiflòra,** Rehd , with very large single fls 1½ in across Var **supérba,** Rehd , with large single campanulate fls Var **ebúrnea,** with white single campanulate fls in loose panicles, stamens slightly shorter than petals Var **erécta,** Rehd , with white fls in dense panicles Var **formòsa,** Rehd , with double white fls in large panicles. These varieties were originally described as vars of *D crenata*

DD. *Filaments, at least the longer ones, subulate, without teeth*

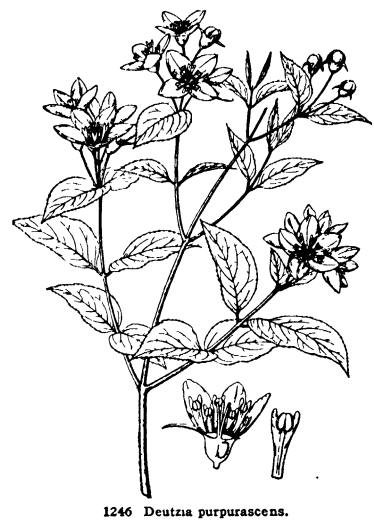
6 **Sieboldiàna,** Maxim (*D scàbra,* Sieb & Zucc , not Thunb) Low shrub, to 2 ft lvs short-petioled, the pair below the panicle nearly sessile, ovate or ovate-elliptic to oblong-ovate, rounded or cordate at the base, rough and rugose above, stellate-pubescent and light green beneath, 1–2 in long panicles erect, loose, 2–3 in. long with appressed stellate pubescence mixed with spreading simple hairs, fls white, rather small, with spreading petals; the shorter filaments usually abruptly contracted or with very short teeth; calyx-lobes persistent. June Japan S Z 7. G C III 36 244. Var **Dippeliàna,** Schneid (*D scàbra vèra,* Hort) Lvs. broader and smaller· panicle only with appressed pubescence, stamens all subulate —Graceful low shrub, but less showy than most other species.

BB. *Fls in corymbs or cymes.*

C *Infl. many- or several-fld.*

D. *Calyx-teeth shorter than tube, anthers attached to the inside of the broad filament*

7. **setchuenénsis,** Franch (*D. corymbiflòra erécta,* Hort.). Shrub, to 6 ft.: lvs. ovate-lanceolate to lanceolate, denticulate, rough-pubescent above, grayish green below and densely covered with stellate and simple hairs, 2–4 in long. corymbs few-fld , fls. less than ½in. across; filaments with large broad teeth about as long as the nearly sessile anther Cent. China. Var **corymbiflòra,** Rehd (*D corymbiflòra,* Lemoine) Lvs elliptic-ovate to ovate-lanceolate, acuminate, sometimes slightly cordate at the base, 2–4 in. long: corymbs many-fld ; fls. with spreading petals, ½in. across;



1246 Deutzia purpurascens.

stamens about one-third as long as the petals, upright and connivent, styles shorter than stamens. June, July Cent China B M 8255 G C III. 24 267. R H 1897, pp 466, 467 (as *D corymbosa*), 1898, p. 402 M D G 1913 9 (lower picture) A F. 14:166. Gng 7 2 —The variety is much handsomer than the type, the fls. are comparatively small, but very numerous Tender.

DD *Calyx-teeth lanceolate, as long or longer than the tube.*

E. *Anthers of the inner stamens borne on the inner side of the petaloid filaments; fls. pink or purplish outside.*

8 **purpurâscens,** Rehd (*D discolor* var. *purpurâscens,* Franch). Fig 1246 Shrub, to 3 ft , with slender arching branches. lvs ovate to ovate-lanceolate, crenately and unequally serrate, usually rounded at the base, green and only sparingly stellate-pubescent on both sides, 1½–2½ in long corymbs 5–10-fld.; fls. with spreading petals, about ¾in across, white, outside purple, the inner filaments with the anther below the apex May, June S W China B M 7708. G C III 2.15, 26:45. G F 7:287 (adapted in Fig. 1246) G. 27.201. R H. 1895 64.—Very handsome, but tender

9 **longifòlia,** Franch Shrub, to 6 ft , with upright branches lvs oblong-lanceolate to narrow-lanceolate, long-acuminate, narrowed at the base, thickish, rough and somewhat rugose above, grayish white and densely tomentose below, 2–4½ in long· corymbs many-fld , loose or dense; fls with spreading petals, more than ¾in across; the shorter filaments lanceolate with the anther inside near the middle. June. W China. G.C. III 51:409. Gn. 76, p. 243. G.M. 55:353 **Var.**

Veitchii, Rehd. (*D. Veitchii,* Veitch) with somewhat larger fls. in dense many-fld. corymbs. G.C. III. 51: suppl. 19. M D.G. 1913:17.—One of the handsomest deutzias, but has proved hardy only under protection at the Arnold Arboretum.

EE. *Anthers borne at the end of the filaments.*

F. *Fls. usually pinkish outside (hybrids of D. purpurascens).*

10. **myriántha,** Lemoine (*D. Lemoinei* × *D. purpurascens*). Lvs. oblong-ovate, acuminate, rounded or broadly cuneate at the base, serrulate with spreading teeth, rough above, slightly stellate-pubescent beneath, 1½–3 in. long fls. in broad corymbs, white, with spreading petals, partly imbricate in bud; filaments strongly toothed; anthers short-stalked; styles shorter than stamens; sepals triangular-ovate, about as long as calyx-tube G C. III. 52·45 F S.R. 3, p. 193. A.F. 31:100, 101. M D G. 1907.376, fig 5; 377, fig. 8. G W. 13, p 614. Var *Boule Rose* and var. *Fleur de Pommier* have the fls pink outside.

11. **kalmiæflòra,** Lemoine (*D parviflòra* × *D. purpurascens*). Lvs oblong to ovate-oblong, short-acuminate, broadly cuneate at the base, serrulate, rough above, slightly stellate pubescent below, 1–2½ in. long. fls. in rather small corymbs, pinkish, white in the center, light carmine outside, cup-shaped, ¾in. across; petals mostly imbricate in bud; stamens half as long as petals; filaments with large teeth, nearly as long as the anthers; styles shorter than stamens M D.G 1913·25. G. 27:199. Gn. W. 17:627.—One of the handsomest hybrids.

FF *Fls white.*

G *Filaments toothed below the apex.*

12. **díscolor,** Hemsl. Upright shrub, to 6 ft.: lvs. oblong-lanceolate, acuminate, cuneate at the base, denticulate, sparingly stellate-hairy above, stellate-tomentose and whitish below, 2–4 in. long . corymbs dense, hemispherical, pedicels usually not exceeding ¼in.; fls. white, with spreading elliptic petals, about ¾in across; stamens about half as long as petals; filaments with large teeth usually as long as the stalk of the anther, the anthers of the inner stamens sometimes inserted inside a little below the apex. June. Cent. China. Var. **màjor,** Veitch Fls. about 1 in across G. 30:307. R.B. 32, p. 174. M.D.G. 1913:9 (upper picture).

13. **Vilmorinæ,** Lemoine. Shrub, to 5 ft.: lvs oblong-lanceolate, acuminate, narrowed at the base, serrulate, thinly stellate-pubescent above, densely so below and grayish white, 2–3 in. long: corymbs loose and large; pedicels ¼–½in. long; fls. more than ½in across; larger stamens only slightly shorter than petals; the teeth of the filaments shorter than the stalks of the anthers; styles as long as stamens. May, June. Cent. China. R.H. 1895, pp. 266, 267. F.V. 126. A very graceful shrub with its large and loose corymbs of white fls.

GG. *Filaments, at least the longer ones, gradually narrowed toward the apex, without teeth.*

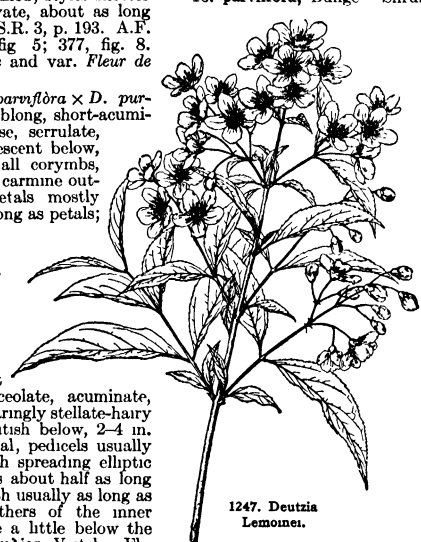
14. **Wilsonii,** Duthie. Shrub, to 6 ft : lvs. elliptic-lanceolate to oblong-lanceolate, short-acuminate, rounded or narrowed at the base, rough-pubescent above, grayish white and tomentose below, 2–4 in. long: corymbs compact, many-fld ; fls white, more than ¾in. across, stamens a third shorter than the petals; the shorter filaments usually abruptly contracted or sometimes with short obtuse teeth; calyx-lobes oblong-ovate, about as long as tube. May, June. Cent. China B M 8083. G. 30:373. G.M. 51:473. M.D.G. 1912:27, 1913:16.

CC. *Infl. 1–3-fld.; filaments with long and slender recurved teeth.*

15 **grandiflòra,** Bunge. Shrub, to 6 ft.: lvs. ovate, acuminate, rounded at the base, unequally and closely denticulate, rough pubescent above, whitish stellate-tomentose below and reticulate, 1–2½ in. long fls. white, nodding, with slightly spreading petals about ¾in. long; stamens about half as long as petals; calyx-lobes lanceolate, twice as long as tube. April, May. N. China —A very distinct species, the earliest of all to bloom, the fls appearing with the lvs ; has proved perfectly hardy at the Arnold Arboretum.

AA. *Petals imbricate in the bud (or partly imbricate in the hybrid); fls white.*

16. **parviflòra,** Bunge Shrub, to 6 ft , with erect branches: lvs ovate or oblong-ovate, usually narrowed at the base, finely serrate, with stellate hairs on both sides, often grayish green beneath, 2–3 in long: fls in many-fld. corymbs, petals roundish obovate, spreading, imbricate in the bud, longer filaments without teeth June. N. China, Mongolia G. F.1 365 Gt 11·370, 43, p 65, 46, p 382. R H 1892, p 223. G C III 14·153 Gn 44, p 181 F S R 3, p 197. A F 15·1297 Gng 8.305, 307. Var **Musæi,** Lemoine Of stronger growth. lvs. larger and more acuminate. fls creamy white in denser corymbs.



1247. Deutzia Lemoinei.

17. **Lemòinei,** Hort. (*D grácilis* × *D. parviflòra D angustifòlia,* Dipp). Fig 1247. Spreading shrub, to 3 ft · lvs elliptic-lanceolate, finely serrate with appressed teeth, with sparse stellate hairs above, nearly glabrous beneath, 1½–3 in long fls in large corymbs or broad panicles, pure white; petals broadly ovate, spreading, partially valvate and partially imbricate in the bud, filaments with large teeth G F. 9 285 (adapted in Fig 1247). A F. 11·457; 15 1296. Gt. 44, p 567; 46, p 383 Gng. 4:135; 8 307 J.H III 34.77 G C III. 18 389 Gn. 48, p. 317. G.M 39·251, 51 962, 963 G 16:223 F E. 24:747; 31·1119. G W. 2, p 173 M D G. 1895.438, 439.—A very desirable shrub, more vigorous and with showier fls than *D. gracilis* Excellent for forcing.

Var **compácta,** Lemoine Dwarfer and of more compact habit *D Boule de Neige,* Lemoine, with creamy white fls. (Gng 8.306) and *D. Avalanche,* Lemoine, with pure white fls , are exceedingly floriferous forms.

D. Brunoniàna, R Br =D. staminea var Brunoniana —*D candelàbrum,* Rehd (D gracilis × D Sieboldiana D gracilis var candelabrum, Lemoine) Shrub with slender branches and large white fls in dense elongated panicles R B 33, p 372 R H 1908, p 174 M D G 1907 378 Var *erécta,* Rehd (D gracilis erecta, Lemoine) Fls smaller and panicles shorter Var *fastuòsa,* Rehd (D gracilis fastuosa, Lemoine) Fls. in elongated rather dense panicles.—*D cándida,* Rehd (D Lemoinei × D Sieboldiana D discolor candida, Lemoine) Upright shrub with large white fls in panicles M D G. 1907 376, fig 6 —*D cárnea,* Rehd (D Sieboldiana × D rosea grandiflora D discolor carnea, Lemoine) Upright shrub with pink rather small fls in upright loose panicles.

\ar *lácteа*, Rehd., with white fls., var *stellàta*, Rehd , with narrow spreading petals, pale pink or carmine-pink, and var *densiflòra*, Rehd , with white fls in dense upright panicles, petals narrow, all these varieties described by Lemoine as varieties of D discolor — *D compácta*, Crab Allied to D parviflora Lvs lanceolate, sparingly pubescent on both sides, ¾–2 in long fls white in dense corymbs, filaments strongly dentate W China —*D corymbósa*, R Br Allied to D parviflora Lvs rounded at the base, crenate-serrate, long-acuminate fls larger, all filaments toothed Himalayas —*D discolor* vars =D candida, D carnea, D elegantissima, D excellens —*D elegantissima*, Rehd (D purpurascens×D Sieboldiana D discolor var elegantissima, Lemoine) Shrub, with slender branches, with numerous corymbs of large white, open fls slightly tinted with rose inside and outside R B 36, p 387. M D G 1907 377, fig 9 Var *arcuata*, Rehd (D. discolor var arcuata, Lemoine), with white fls Var *fasciculàta*, Rehd (D discolor var fasciculata, Lemoine) Flat white fls tinted with pink —*D excéllens*, Rehd (D Vilmorinnana×D rosea grandiflora D discolor var excellens, Lemoine) Shrub, with slender upright branches, with large loose corymbs of pure white fls —*D globósa*, Duthie Similar to D Wilsoni, but smaller in every part: fls creamy white in dense corymbs, filaments abruptly contracted below the apex Cent China —*D glomeruliflòra*, Franch Similar to D discolor Shrub, to 6 ft lvs smaller, grayish white and soft-pubescent below fls white in dense and small, but very numerous corymbs along the slender branches, stamens like those of D. longifolia. W China Handsome and fairly hardy —*D grácilis* vars =D. candelabrum —*D móllis*, Duthie Allied to D parviflora. Shrub, to 6 ft , with upright branches lvs elliptic-ovate to elliptic-lanceolate, soft-pubescent below, 2–4 in long fls small, creamy white or slightly pinkish in dense flat corymbs, filaments subulate Cent. China —*D reflexa*, Duthie Allied to D discolor Lvs oblong-lanceolate, 2–3 in long fls smaller in loose corymbs, petals with reflexed margin, filaments with short teeth or abruptly contracted Cent China —*D staminea*, R Br Shrub, to 3 ft lvs ovate or ovate-lanceolate, with whitish stellate pubescence beneath corymbs many-fld fls white, fragrant, filaments with large teeth Himalayas B R 33 14 Var *Brunoniana*, Hook f & Thoms Lvs less densely pubescent fls larger. B R 26 5 (as D. corymbosa).

ALFRED REHDER.

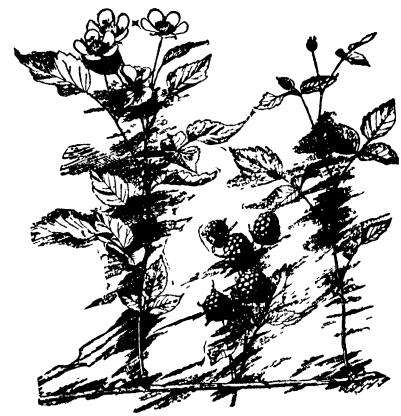
DEVIL-IN-A-BUSH: *Nigella.*

DEWBERRY. A blackberry-like fruit of trailing and climbing habit, now considerably grown in North America

The botanist makes no distinction between dewberries and blackberries But to the fruit-grower, trailing blackberries are dewberries, distinguished further, and probably better separated, by the flower- and fruit-clusters In the true dewberries, the center flowers open first and flowers and fruits are few and scattered, in true blackberries—there are hybrids between the two in which the distinguishing characters are confused—the lower and outer flowers open first and flower- and fruit-clusters are comparatively dense. In the method of propagation there is a further distinction In nature or under cultivation, dewberries are usually propagated from the tips, while blackberries are naturally propagated from suckers and under cultivation from root-cuttings

The dewberry is an American fruit but very recently domesticated—if, indeed, it can be said to be domesticated, for it is the most uncertain and the most unmanageable of the small fruits Its history as a garden plant, according to Card (Card's "Bush-Fruits," page 132) at the most does not go back further than 1863, and dewberries were not generally cultivated until well toward the close of the nineteenth century. Undoubtedly, despite unmanageable habits of growth, uncertainty in fruiting, the necessity of cross-pollination between varieties, capriciousness as to soils and lack of hardiness in northerly climates, the several species and the rapidly increasing number of varieties of dewberries, fill a place not occupied by the better-known and longer domesticated blackberries; for, as a rule, they ripen earlier and, when well grown, give larger, handsomer and better, or at least, differently flavored fruits than the blackberry. Moreover, from the several species of dewberries are being derived greatly improved varieties and hybrids between them and species of blackberries, of which there are now several under cultivation, as Wilson Early and Wilson Junior, which are most promising These qualities make certain the place of the dewberry in home and commercial plantations and presage for it even greater value in the future

Of the thirty or more species of Rubus which all could agree in calling blackberries and dewberries, the fruit-grower would probably distinguish five as dewberries. Between these there are hybrid forms under cultivation, as probably there are in the wild, and since



1248. Lucretia dewberry (×¼)

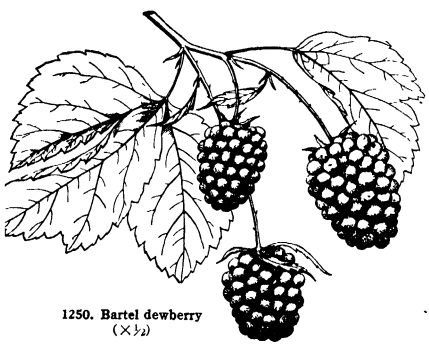
there are also hybrids between blackberries and dewberries, the group is one of great taxonomic difficulty. The five species of dewberries are (1) *Rubus procumbens*, Muhl , found in dry open places from Maine westward and southward. The species is characterized by woody, stoutly armed stems, membranaceous leaves, villous beneath, flowers few to several in leafy racemes, and short cylindrical fruits with few to many large drupelets. Var. *roribaccus*, Bailey, is a well-marked subspecies from West Virginia of more vigor, with larger flowers with elongated pedicels, and larger fruits; much cultivated with the Lucretia as the best representative (Figs 1248, 1249). (2) *Rubus invisus*, Bailey, is similar but stouter, with canes less procumbent, leaves more coarsely toothed, pedicels longer, and with the sepals large and leaf-like The species grows wild from New York to Kansas and southwest and is the parent of several cultivated dewberries of which Bartel (Fig 1250, adapted from G F 4·19) is the type (3) *Rubus trivialis*, Michx , the southern dewberry, is quite distinct from 1 and 2. This species is found near the coast from Virginia to Florida and westward to Texas It is characterized by slender trailing stems armed with recurved prickles, evergreen, smooth, leathery leaves, corymbs 1–3-flowered, and cylindrical fruits with many drupelets Of the few varieties of this species cultivated, Manatee is probably the oldest and best known (4) *Rubus rubrisetus*, Rydb , found in sandy soils in Missouri and Louisiana, is similar to *R. trivialis* but with stems, petioles, and pedicels rough with reddish, purplish hairs, the flowers are smaller but the corymbs are 3–9-flowered. The species is locally cultivated and gives some promise for greater improvement (5) *Rubus ursinus*, Cham. & Schlecht, is the Pacific Coast dewberry characterized by trailing, slender, pubescent canes with weak, straight or recurved prickles, leaves various, flowers staminate or pistillate on different plants,



1249 Lucretia dewberry (Nat size)

fruit of medium size, round-oblong, sweet Several varieties, of which possibly Aughinbaugh and Skagit Chief are the best known, are cultivated in the far West The loganberry is said to be a hybrid between this species and *R Idæus*, and several less well-known hybrids are recorded.

The dewberry should receive under cultivation much the same treatment given the more common blackberry. The culture of the two differs chiefly in the dewberries requiring more care in training and must usually be better protected for the winter The plants are trained on trellises of two or three wires or tied to stakes, the former method giving better results, but the latter being more common. The object in either case is threefold,—namely, to regulate the amount of bearing wood, to keep the vine out of the way of the cultivator and to keep the fruit off the ground The plants should be set 4 by 7 feet apart, these distances varying somewhat in accordance with the variety and



1250. Bartel dewberry (×½)

the soil. Pruning is a simple matter, consisting of shortening back young plants to 4 or 5 feet the first season to keep them from sprawling too much, cutting out old canes at any time after fruiting, and heading-in long shoots and laterals in early summer. From four to six fruiting canes are allowed to the plant In northern climates, the vines must be laid on the ground and protected in winter with straw or other material The plants thrive on a somewhat lighter soil than the blackberry—in fact some sorts require such a soil. Varieties should be intermixed to secure cross-pollination and thereby insure a good set of fruits and avoid the formation of nubbins

Of about thirty named varieties, Lucretia, Bartel, Austin and Premo are the best. Of these four, Lucretia is far most commonly grown, being adapted to the greatest diversity of soils and is in general best suited to varying environments For history and botany, see Bailey, "Evolution of our Native Fruits;" for culture, see Card's "Bush-Fruits," and Cornell Bulletins Nos. 34 and 117. Consult *Blackberry*, *Loganberry* and *Rubus*.

U. P. HEDRICK.

DEYEÚXIA: *Calamagrostis.*

DIACÁTTLEYA (compounded of Diacrium and Cattleya). *Orchidàceæ*. A genus established to include hybrids between the two genera, Diacrium and Cattleya. A hybrid between *Diacrium bicornutum* and *Cattleya Mendelii* is known as *Diacattleya Sanderæ*. It was raised by Sander & Sons. The fls are pure white, the lip with a pale yellow disk and small rose markings. G.C. III. 49:290 *D Còlmaniæ*, Hort (*Diacrocáttleya Còlmaniæ* is a hybrid between *Diacrium bicornutum* and *Cattleya intermedia* var. *nivea*. G.C. III. 43:114. J.H. 56:167. It resembles a slender plant of *Diacrium bicornutum* sepals and petals pure white, lip slightly tinged primrose-yellow. GEORGE V. NASH.

DIÁCRIUM (*through* and *point*, the sts. are surrounded by sheaths) *Orchidàceæ*. Four Trop. Amer. epiphytes, closely allied to Epidendrum, with which they have been included. It differs from that genus in the fact that the column and lip are not united. Fls. showy, in loose racemes: lvs few, sheathing: pseudobulbs slender. Cult. of Epidendrum and Cattleya.

bicornùtum, Benth. (*Epidéndrum bicornùtum*, Hook). Pseudobulbs 1–2 ft. long, hollow, bearing dry sheaths. lvs short and leathery: raceme slender, 3–12-fld ; fls white, with small crimson spots on the 3-lobed lip, fragrant. B.M. 3332 G C III 16 337. J H. III 33 29 O R 12·113, 16·81; 20 361 —A handsome orchid, requiring high temperature.

D bidentàtum, Hemsl (Epidendrum bidentatum, Lindl), of Mex , has been listed in trade catalogues, but it is practically unknown to cult , and is probably not now in the American trade.

L H B

DIALÆLIA (Compounded of the genera Diacrium and Lælia) *Orchidàceæ D. Veitchii*, Hort , is a hybrid between *Diacrium bicornutum* and *Lælia cinnabarina*. Pseudobulbs fleshy fls 9 or 10, the segms white suffused with lilac, also showing a bronze tint derived from the Lælia parent

DIAMOND FLOWER · *Ionopsidium*

DIANDROLÝRA (*two-stamened Olyra*). *Gramíneæ*. A single species raised at Kew some 8 years ago from seed supplied by Sander but native country unknown· differs from Olyra in its twin spikelets and other characters, the upper one being male and the lower one female, the male fls with 2 stamens. The species is *D bicolor*, Stapf, a perennial densely tufted grass with erect culms bearing 1–3 lanceolate or lance-oblong lvs. that are dark green above and violet-purple beneath

DIANÉLLA (diminutive of Diana, goddess of the hunt). *Liliàceæ*. Tender perennial rhizomatous plants, related to Phormium.

Leaves hard, linear, sheathing, grass-like, crowded at base of st , often 2–3 ft long· fls blue, in large loose panicles, on delicate pendent pedicels; perianth withering but not falling, with 6 distinct spreading segms.; stamens 6, with thickened filaments; ovary 3-celled, each cell several-ovuled, the style filiform and stigma very small plant bearing great numbers of pretty blue berries, which remain attractive for several weeks, and are the chief charm of the plant.—There are about a dozen species in Trop. Asia, Austral. and Polynesia. They perhaps succeed best in the open border of a cool greenhouse Prop by division, or by seeds sown in spring in mild heat They are little known in this country. They are spring and summer bloomers.

A. *Lvs radical or nearly so.*

tasmánica, Hook. f. Height 4–5 ft · lvs numerous, in a rosette, broadly ensiform, 2–4 ft long, ¾–1 in wide, margined with small reddish brown spines that cut the hand if the lvs are carelessly grasped: panicle very lax, surpassing the lvs. 1–2 ft , with as many as 60 fls.; fls. pale blue, nodding, ½–¾in across, segms. finally reflexed; anthers 1 line long. berries bright blue, on very slender pedicels. Tasmania and Austral. B M 5551 Var **variegàta,** Bull. Lvs. handsomely striped with light yellow. R B. 29:61.

lævis, R Br Lvs. 1–1½ ft. long, 6–9 lines wide, less leathery and paler than in *D cærulea* and at first slightly glaucous panicle deltoid, the branches more compound than in *D revoluta*, outer segms. of the perianth with 5 distant veins, inner ones densely 3-veined in the middle third, anthers 1½ lines long. Eastern temperate parts of Austral. B.R. 751. L.B.C. 12:1136 (both as *D. strumosa*).

revolûta, R. Br. Height 2–3 ft.: lvs. in a rosette, 1–1½ ft. long, 3–4 lines wide, dark green, purplish at the base and margin, not spiny at the margin: panicle branches short, ascending, fls. later than *D. cærulea;* veins of the perianth-segms. crowded into a central space. W. and E. Austral. in temperate parts. Tasmania. B.R. 734 (as *D. longifolia*); 1120.

AA. *Lvs. more or less scattered on sts. that often branch at base.*

cærùlea, Sims. Sub-shrubby, with a short st. in age, branching: lvs. about 6, clustered at the ends of branches, 9–12 in long, 6–9 lines wide, dark green, rough on the back and margin outer perianth-segms. with 5 distant veins, inner ones with 3 closer veins. E Temp Austral B M. 505.

nemorôsa, Lam. (*C. ensifôlia,* Red.) Caulescent 3–6 ft high, the lvs. never in a rosette, numerous, hard, linear, 1–2 ft. long, 9–12 lines wide, lighter-colored on the keel and margin. fls blue or greenish white Trop. Asia, China, Austral., Hawaiian Isls B M 1404.

WILHELM MILLER.
L. H. B †

DIANTHÈRA (*double anther* referring to the separated anther-cells) *Acanthàceæ* WATER-WILLOW. Herbs, mostly of greenhouses and warmhouses, and sometimes of open planting in mild climates.

Glabrous or pilose perennial herbs or sometimes somewhat woody, mostly of wet places, with opposite, mostly entire lvs. fls mostly purplish or whitish, irregular, usually in axillary spikes, heads or fascicles, or the clusters combined in a terminal thyrse; corolla slender-tubed, 2-lipped, the upper lip erect and more or less concave or arched and entire or 2-toothed, the lower lip 3-lobed or 3-crenate and spreading, and with a palate-like structure, anther-cells separated on a broadened connective, not parallel with each other fr. an oblong or ovoid 2-celled caps., the seeds 4 or less: floral bractlets small or minute.—Probably more than 100 species, mostly in warm and tropical countries Lindau in Engler & Prantl unites it with Justicia as a subgenus, and the number of species is estimated as more than 70 in Trop Amer The diantheras are little known in cult *D Pohliana* is to be found in Jacobinia The treatment given Jacobinia and Justicia applies to these plants.

americàna, Linn St angled, 1–3 ft · lvs narrow-lanceolate, 3–4 in long, nearly sessile: fls several in a close cluster with a peduncle mostly exceeding the lvs, pale violet or whitish, the corolla mostly less than ½in long, the tube shorter than the lips. In water, Quebec to Wis, Ga and Texas.—Sometimes transferred to garden bogs and streams.

secúnda, Griseb (*Justicia secúnda,* Vahl) Nearly glabrous, constricted at the nodes: lvs ovate or ovate-lanceolate, acuminate: fls crimson, short-pedicellate, in a usually 1-sided panicle; lower lip 3-crenate W. Indies B M. 2060.

pectoràlis, Gmel (*Justicia pectoràlis,* Jacq.). GARDEN BALSAM St slender, often woody, 1–3 ft · lvs lanceolate-acuminate or nearly oblong, to 4 in long · fls. rosy or pale blue, with a parti-colored throat, rather distant in elongated branched mostly 1-sided spikes. W. Indies, Mex., Brazil.

D bullàta, N E Br St terete, purplish lvs. elliptic, to 4½ in. long, short-stalked, cordate at base, bullate or puckered between the veins, dark green above and purple-veined beneath fls whitish, small, clustered Borneo I H 33 589.—A handsome foliage subject, with the appearance of a rubiaceous plant.—*D ciliàta,* Benth & Hook (Jacobinia ciliata, Seem.) St obscurely 4-angled, 2 ft lvs ovate-lanceolate, 2–3 in long, short-stalked fls violet with white palate, sessile, many in a short-peduncled fascicle, calyx ciliate, corolla-tube ¾in long, cylindrical, upper lip very small, 2-lobed, concave and recurved, lower lip very large and showy (1¼ in across), flat, with 3 large lobes. Costa Rica Panama(?) B M 5888 (as Beloperone ciliata, Hook. f.).—Described as an annual Perhaps not of this genus.

L. H. B.

DIANTHUS (Greek for *Jove's flower*). *Caryophyllàceæ.* PINK. Small herbs, many of them prized for their rich and showy flowers in the open garden, and one is the carnation. Some of them are deliciously fragrant.

Mostly perennials forming tufts and with grass-like lvs., and jointed sts with terminal fls and opposite lvs. From kindred genera Dianthus is distinguished by the sepal-like bracts at the base of a cylindrical calyx (Figs. 802, 803), petals without a crown; styles 2: caps. opening by 4 valves Mostly temperate-region plants, of S Eu and N. Afr., but occurring elsewhere, one of them (a form of *D alpinus*) being native in N. Amer., about 250 species are recognized The fls are usually pink or red, but in garden forms white and purple are frequent colors Most of the cult. species are hardy in the N and are easy of cult. The perennial species are excellent border plants The chief care required in their cult is to see that the grass does not run them out. Best results in flowering are secured usually from 2-year-old seedling plants The genus abounds in attractive species, and other names than those in this article may be expected to appear in the catalogues Numbers of species are likely to be grown by rock-garden specialists Pinks are among the old-fashioned flowers, particularly *D plumarius,* which was formerly common in edgings and in circle-beds The sweet williams are always popular. All the species described in this article are perennial, but there are a few annuals in the genus but apparently not in cult. Two weedy annual species, *D. prolifer,* Linn., and *D. Armeria,* Linn., are naturalized in the eastern states, and two or three others have run wild more or less. See E T Cook, "Carnations, Picotees, and the Wild and Garden Pinks," London, 1905 See p 3568

Dianthuses like a warm soil, and one that will not become too wet at any time, especially in winter, when the perennial kinds are grown, as they are often killed not so much from cold as from too much ice around them. Snow is the best possible protection, but ice is the reverse.—All dianthuses are readily propagated from seeds sown in rich soil (usually beginning to bloom the second year), but the double kinds are reproduced from cuttings alone to be sure to have them true, and in the fall months cuttings are easily rooted if taken with a "heel" or a part of the old stem adhering to the base of the shoot, so that to make cuttings it is best to strip them off rather than to make them with a knife It will be found, also, that cuttings made from plants growing in the open ground do not root readily but seem to dry up in the cutting-bench, if the plants to be increased are carefully lifted and potted, placed in a temperature of say 50° until young growth shows signs of starting, every cutting taken off at this stage will root easily The transition from outdoors to the propagating-house should not be too abrupt Another method of propagation is by layering, and with the garden pinks, or forms of *D plumarius,* it is the easiest and surest. After hot weather is past, stir the soil round the parent plant, take the branches that have a portion of bare stem, make an incision half way through and along the stem for an inch, and peg this down in the soil without breaking off the shoot (Fig 809) Roots will be formed and good strong plants be the result before winter. The layering method is specially suitable to such species as *D plumarius, D Caryophyllus* and double forms of others, such as sweet william.—Among the species are various pretty little alpine tufted sorts as *D neglectus, D. glacialis* and *D. alpinus,* all of which are of dwarf close habit, not exceeding 3 inches high and having very large single flowers of brightest colors. These are suited only for rock-gardening, as on level ground they often become smothered with weeds or swamped with soil after a heavy rainstorm, and to these two causes are attributable the failures to cultivate them. (E. O. Orpet.)

INDEX.

alpinus, 21
arenarius, 10.
asper, 25
atrococcineus, 5.
atrorubens, 4
attenuatus, 18
barbatus, 3
cæsius, 16.
callizonus, 23.
capitatus, 7
carthusianorum, 4.
Caryophyllus, 19.
caucasicus, 25
chinensis, 25
cinciunatus, 25
cinnabarinus, 1.
collinus, 25
cruentus, 5
deltoides, 20.
dentosus, 25.
dianthus, 25.
fimbriatus, 14.
Freynii, 24
frigidus, 17.
giganteus, 6.
glacialis, 24.
glaucus, 10
grandiflorus, 2
Heddewigii, 25
hybridus, 25
ibericus, 25
imperialis, 25.
lacinatus, 25
latifolius, 26
Laucheanus, 3.
longicaulis, 19.
macrosepalus, 25
monspessulanus, 11.
montanus, 25
neglectus, 24.
orientalis, 14.
Pancicii, 2
petræus, 13
plumarius, 9.
punctatus, 19.
repens, 21
ruthenicus, 25.
scoticus, 9.
Seguieri, 25
semperflorens, 9, 25.
Sinensis, 25
squarrosus, 12.
stellaris, 25
stenopetalus, 2
superbus, 15.
sylvestris, 17.
versicolor, 22.
virgineus, 17.
viscidus, 8.

A. *Fls. mostly in cymes or in heads, often densely aggregated, the cluster often subtended by involucre-like lvs*

B. *Petals not bearing hairs or barbs: bracts dry.*

1. cinnabarinus, Sprun. A foot high, woody at base, many-stemmed, the sts simple and 4-angled, blooming in Aug and Sept.: lvs linear, sharp-pointed and rigid, 7-nerved. fls few in heads, petals fiery red above, paler beneath, glandular, stamens included. Greece.—Handsome little species; useful for hardy border or rockery

2 Pâncicii, Velen. (*D. stenopétalus* var. *Páncicii*, Williams) Cespitose, glabrous, 2–3 ft., the sts. slender and 4-angled: lvs. linear-acuminate, soft, 3-nerved, in a dense grass-like basal tuft: fls. 5–15 in a paniculate cyme or head; calyx green; petals rose or crimson Balkan region. Var **grandiflôrus,** Hort., has very stout sts, large clusters, and large purple-carmine fls.



1251. Sweet William—Dianthus barbatus. (×½)

BB *Petals with hairs or barbs on the lower part of the blade.*

C. *Plant glabrous but usually not glaucous*

3. barbâtus, Linn SWEET WILLIAM. Fig 1251 Readily grown from seed and flowering well the second year: glabrous, the sts. 4-angled, 10-20 in high, simple or branched only above: lvs broad and flat or conduplicate, 5-nerved. fls several to many in a round-topped dense cyme, the petals toothed and bearded, red, rose, purple or white and also varicolored in garden forms, the bracts subtending the calyx 4 and long-pointed Russia to China and south to the Pyrenees. G. 1:372. Gn. M. 2:217; 14:55. F. E 23:219 — The sweet william is one of the oldest garden fls. It is sure to be found in the old-fashioned gardens. The cult. forms run into many colors Sometimes found along roadsides as an escape. There are double-fld forms R H 1894, p 277 Some of the modern improved large-fld. forms are very showy, and produce their bloom over a long season. **D. Laucheânus,** Bolle, is a hybrid of *D. barbatus* and *D. deltoides*. Gt 53 1528.

4. carthusianôrum, Linn. (*D atrórubens*, Willd). Hardy, glabrous, scarcely glaucous, 12–20 in high, the st. angled· lvs linear and pointed, without prominent nerves when fresh. fls. in a dense, 6–20-fld head (sometimes the clusters very few-fld), in shades of red, odorless, the petals sharply but not deeply toothed, the cluster subtended by very narrow or even awl-like lvs ; calyx-bracts 4, coriaceous, yellowish or straw-colored. Denmark to Portugal and Egypt B M 1775, 2039 — Widely variable. Little planted in American gardens.

CC *Plant glabrous and glaucous*

5. cruéntus, Griseb (*D atrococcíneus*, Hort) Cespitose, glaucous, glabrous st 1–2 ft , terete, forking: lvs linear or lance-linear, sharp acuminate, spreading, 7-nerved, the cauline linear-appressed and 5-nerved: fls. deep blood-red, small, about 20 in a subglobose dense head, odorless, petals red-hairy towards the base July. Greece and N.

6. gigantèus, Urv. Cespitose, glabrous, glaucous, 2–3 ft or more, simple· lvs long-linear, 7-nerved, plane, spreading and acuminate . fls 10–12 in a head, red, the petal-blade obovate-cuneate. Balkan region. Gn. 66, p. 122.

CCC. *Plant woolly, glaucous.*

7. capitâtus, Balb Plant glaucous, woolly, 12–16 in , simple, st 4-angled lvs linear, acute, plane, spreading, 7-nerved, those on the st 5-nerved fls 6–8 in a head, the petals purple-spotted Siberia to Servia

CCCC *Plant viscid-pubescent.*

8 víscidus, Bory & Chaub. Cespitose, pubescent and sticky, about 12 in , simple· lvs linear, acuminate, soft, plane, 1–3-nerved fls 3–6 in a fascicle, the petals purple-spotted, the blade obovate-cuneate and few-toothed Bulgaria, Greece, Turkey. —Runs into several marked forms.

AA. *Fls. solitary, or loosely in 2's or 3's.*

B. *Calyx-bracts short and broad, mostly appressed.*

C. *Petals fimbriate.*

D. *Teeth of calyx mucronate*

9. plumârius, Linn (*D scóticus*, Hort). COMMON GRASS OF GARDEN PINK SCOTCH PINK PHEASANT'S-EYE PINK Low, tufty, 1 ft sts simple or forked. plant blooming in spring and early summer, very fragrant· lvs elongate-linear, keeled, spreading or recurved, thickish, 1-nerved, blue-glaucous: fls medium size, rose-colored (varying in cult to purple, white and variegated), the blade of the petal fringed a fourth or fifth of its depth; calyx cylindrical, with short broad-topped mucronate bracts Austria to Siberia Gn. 66, p. 260. F E 23:401 — A universal favorite. Hardy. Much used in old-fashioned gardens as edging for beds. There are double-fld. forms. A more continuous-blooming form is catalogued as var. *semperflôrens*.

10. arenârius, Linn. Cespitose, glabrous, 1 ft. or less, the sts. simple or forked, slender, 1–3-fld.: lvs. elongate-linear, keeled, obtuse, fascicled, spreading: fls. white, fragrant; petals much cut beyond the middle; calyx purplish, the teeth ovate-lanceolate.

Dalmatia to Finland. G 26·433.—Var **glaûcus,** Blocki, connects this species with No 9

DD. *Teeth of calyx acuminate or attenuate*

11. **monspessulânus,** Linn Sts. terete, glabrous, branching, 12–20 in.: lvs. linear, acuminate, plane, spreading but strict, 5-nerved fls solitary or 2 or 3 together, showy, odorless, petals rose, rarely white, cut or fimbriate, calyx attenuated at top, the teeth 7-nerved. Spain to Caucasus.



1252 **Dianthus superbus.** (×½)

12 **squarrôsus,** Bieb. Cespitose. sts terete, slender and squarrosely few-fld, glabrous, more or less branching, 1½–2 ft.· lvs linear, acute, canaliculate, recurved· fls rose; petals oblong, pinnately many-parted Russia, Siberia

13 **petræus,** Waldst & Kit. Cespitose, glabrous, the sts slender and simple, 1 ft or less lvs linear-lanceolate, acute, keeled, spreading, 3-nerved fls white, fragrant; petal-limb obovate, fimbriate but not bearded. Bulgaria, Austria B M 1204

14. **fimbriâtus,** Bieb Suffruticose, glabrous, the sts simple, 1 ft lvs linear, acute, appressed, 3-nerved, plane or keeled fls. variable, rose-colored, much fimbriate, bearded Var **orientâlis,** Williams (*D orientâlis,* Donn), has fls with linear-cuneate petals, strongly imbricate obovate straw-colored bracts. B M 1069 —A very variable species, ranging from Portugal to Thibet.

15 **supérbus,** Linn Fig 1252. Glabrous, light green· sts 10–20 in., dichotomous and branched at top, terete and slender lvs. lance-linear, acute, 3–5-nerved, rather soft, plane fls very fragrant, in a lax forking panicle; petals lilac, dissected below the middle Norway to Japan and Spain. Variable B M 297 —A handsome species, garden forms are sometimes offered.

CC. *Petals only dentate (except perhaps in some garden forms)*

16. **cæsius,** Smith CHEDDAR PINK Cespitose, glabrous, glaucous sts 12 in or less, simple, or forked above, 4-angled, 1–2-fld: lvs. lance-linear, plane, 3-nerved, the cauline acute and keeled· fls showy, fragrant, the petal-limb rose-colored, obovate-cuneate and irregularly toothed. Eu G C. III. 44 214. Gn. 64, p. 236.—Runs into several forms

17. **sylvéstris,** Wulf (*D virgíneus,* Hort.) Cespitose, slender, 1 ft high, the st simple or somewhat branched, angular-compressed and bearing 1–3 odorless fls· lvs tufted, linear and sharp-pointed, scabrous on the margins. fls rather small, red, the petals obovate-cuneate and shallow-toothed. Spain to Greece and Austria —Very variable Pretty perennial border plant Var **frígidus,** Williams (*D frígidus,* Kit.) is a dwarf Hungarian form.

18 **attenuâtus,** Smith. Cespitose, glaucous, woody at base, the sts. diffuse and tortuose, 20 in. lvs. linear, acute, plane, 3-nerved: fls. small, solitary or twin but disposed in a lax panicle, odorless, rose-colored; petal-limb oblong Eu

19 **Caryophýllus,** Linn. CARNATION. CLOVE PINK PICOTEE GRENADINE Figs. 801–818. Plate XXII. Cespitose, glabrous, 1–3 ft., the sts hard or almost woody below, the nodes or joints conspicuous: lvs. thick, long-linear, very glaucous, keeled, 5-nerved, stiffish at the ends. fls. mostly solitary, showy, very fragrant, rose, purple or white; calyx-bracts 4, very broad, abruptly pointed B M 39 (Bizarre Carnation); 1622 (var imbricatus), 2744 (Picotees).—Generally supposed to be native to the Medit. region, but Williams gives its geographical limits as "north and west Normandy" and "south and east Punjaub" (northwestern Hindoostan) In Eu it is largely grown as an outdoor pink, but in this country it is chiefly known as the greenhouse carnation The American forcing type (which may be called var. **longicaûlis**) is distinguished by very long stems and a continuous blooming habit; it is here the carnation of commerce Garden varieties of *D Caryophyllus* are numberless, and they often pass under Latinized names (*D punctatus,* Hort., is one of these names). See *Carnation* The carnation has been long in cult. The bloom is now very variable in size, form and color, originally probably pale lilac. Fragrant.

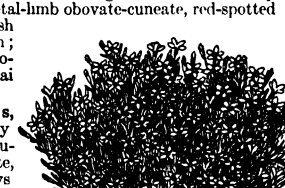
BB. *Calyx-bracts half the length of the calyx, mostly narrow-pointed, more or less spreading at the tips: lvs. short and spreading, the radical ones obtuse or nearly so*

20 **deltoides,** Linn. MAIDEN PINK. Fig 1253. Densely tufted, 6–10 in., blooming in spring and early summer, creeping· sts ascending, forking, with solitary fls. on the branchlets st.-lvs. an inch long, linear-lanceolate, sharp-pointed: fls small (½–¾in across), the petals toothed, deep red with a crimson eye, the petals bearing an inverted V-shaped pocket at their base (whence the name *deltoides*), fragrant Scotland to Norway and Japan Gn 66, p 224 G M 55·28 G.W. 14, p 181.—One of the prettiest border pinks, making neat mats of foliage and bearing profusely of the little bright fls There is a white-fld variety

21 **alpinus,** Linn. More or less cespitose, very dwarf, the 1-fld slender sts. rarely reaching more than 3–4 in high, more or less prostrate foliage dark shining green, the lvs. linear or lance-linear, those on the st. keeled and strict· fl 1 in or more across, odorless, deep rose or purplish and crimson spotted, a darker ring around the eye. Russia to Greece and Swiss Alps. B M 1205. Gn. 26:184, 47, p 292; 45, p 53 Gt 4.110 G.W. 8, p 14 —One of the choicest of alpine and rock-work plants Var. **rèpens,** Regel (*D rèpens,* Willd.), of Siberia and Alaska, has a single root and procumbent sts branched from near base: fls purple; calyx somewhat inflated, ½in. long Apparently not cult. This is kept as a distinct species by some

22 **versícolor,** Fisch. Glabrous, the sts 10–12 in., terete, paniculately branched. lvs narrow-linear, plane, those on the st becoming scale-like fls loosely paniculate, the petal-limb obovate-cuneate, red-spotted above and greenish yellow beneath; calyx-teeth lanceolate, acute Altai Mts., Siberia

23 **callizônus,** Schott & Kotschy Smooth and glaucous, the sts. terete, 1-fld, 12–16 in lvs canaliculate, 3–5-nerved, the radical linear-lanceolate and acute, the cauline lance-linear and acuminate petal-



1253 **Dianthus deltoides.**

limb obovate-cuneate, purple-spotted above, and with a zone at the center, rose-colored beneath; calyx purple, the teeth lanceolate-acuminate. S. E. Eu. Gn. 64, p. 298; 66, p. 54; 70, p 275.

BBB. *Calyx-bracts leafy and spreading.*

24 **glaciàlis,** Haenke Three to 4 in. high, the 4-angled sts tufted and 1-2-fld : lvs. green, linear-lanceolate, pointed, those on the st. linear-acute and strict or recurved, 3-nerved· fls. small and odorless, red-purple, the petals toothed, yellowish beneath, contiguous, bracts 2-4. Mts of S. Eu. G.C. II 21.809.— A pretty species, but difficult to establish Grown among alpine plants Var. **Frèynii,** Williams (*D. Frèynii,* Vandas) Lvs. rather soft, keeled, the lateral nerves obscure sts. usually 1-fld calyx-teeth ciliate Var **negléctus,** Wilhams (*D negléctus,* Loisel). Lvs. plane. fls. rarely twin; bracts 4 petals separate. G C. III 49 415. Gn. 76, p 339 Gn W 20:711.



1254. Dianthus chinensis. (×⅓)

25 **chinénsis,** Linn. (*D. sinénsis,* Hort.). Fig 1254 Cespitose, glabrous, more or less creeping at base. st. forking, angled and more or less grooved, pubescent· lvs. broad and nearly flat or slightly trough-shaped, 3-5-nerved: fls large, solitary or more or less clustered, pink or lilac; the petals (at least in the wild) barbed or hairy toward the base; calyx-bracts 4, in some cult. vars. short China and Japan; but recent authorities consider a European pink to be but a form of it, and thereby extend its range west to Portugal B M 25. The Amoor pink (*D dentòsus,* Fisch.) is a form known as var. **macrosépalus,** Franch.: it is a hardy border plant, 1 ft. high, with bright red fls and a spot at base of each petal Var **àsper,** Koch (*D. Séguieri,* Auth) has fls. in panicles, and the bracts squarrose-spreading: the European form of the species **D. semperflòrens,** Hort., is a hardy perennial form, 12–18 in., with silvery foliage and deep pink, red-eyed, fragrant fls. *D. chinensis* has given rise to a beautiful and variable race of garden pinks, var. **Héddewigii,** Regel (*D. Héddewigii,* Hort.). These are extensively grown from seeds, and are practically annuals, although plants may survive the winter and give a feeble bloom in the spring in mild climates. The fls are scarcely odorous. They are single and double, of many vivid colors; and many of the garden forms have bizarre markings. Gt. 7:328. G. 2:537. In some forms, var **laciniàtus,** Regel (*D. laciniàtus,* Hort.), the petals are slashed and cut. G 2:538. G.Z. 6:1 **D. imperiàlis,** Hort., is a name applied to a strain with strong habit and rather tall growth, mostly double. **D diademàtus,** Hort., is another garden strain. G. 2:538. **D. cincinnàtus,** Lem., is a red form with shredded petals I.H. 11·388 **D. hýbridus,** Hort , is another set This name (*D. hybridus*) is also applied to a *dentosus*-like form, which some regard as a hybrid of *D. dentosus* and some other species. A recent race of the garden pinks, with narrow petals and a star-like effect, is var. **stellàris,** (*D stellàris,* Hort). For portraits of garden pinks, see B M 5536 F S 11 1150, 12 1288–9; 13.1380–1 Gn. 49 82 —The garden pinks are of easy cult. Seeds may be sown in the open where the plants are to stand, but better results are obtained, at least in the N., if plants are started in the house. Plants bloom after the first fall frosts They grow 10–16 in high, and should be planted 6–8 in apart. They are very valuable for borders and flower-gardens. Species-names now referred to *D chinensis* are *D caucasicus,* Sims, *D. ibericus,* Willd , *D. ruthenicus,* Roem , *D montanus,* Bieb , *D. collinus,* Waldst & Kit , representing the European extension of the species

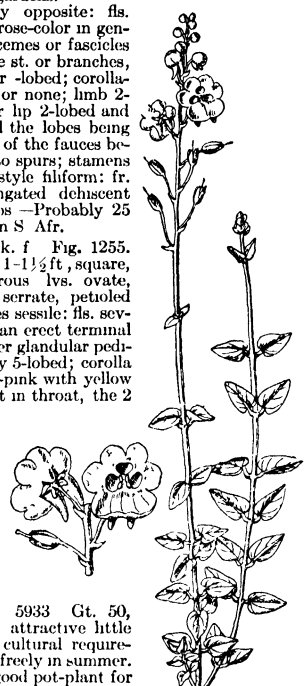
26. **latifòlius,** Hort Plant 6–12 in high, of doubtful origin, but in habit intermediate between *D chinensis* and *D barbatus* Fls large, double, in close clusters or even heads, in good colors. lvs oblong-lanceolate — A good border plant, perhaps a hybrid.

D arbòreus, Linn 3-4 ft , glabrous and glaucous, with a woody trunk, linear-acute canaliculate 3-nerved lvs , and showy rose-colored fragrant fls in a dense corymb S E Eu G C III 44 52 This species is one of the sub-shrubby group of Dianthus, comprising also D fruticosus, Linn (of the Grecian Archipelago), D Bisignani, Tenore (of Tunis and Naples), and othe s D suffruticosus, Willd , probably belongs with the last —*D call-alpinus,* Hort Hybrid of D callizonus and D alpinus G M 47, p 408 — *D diutinus,* Kit Allied to D barbatus glabrous sts. simple, 12–18 in , 4-angled fls pale red, 6-8 together in a head, the petals barbed Hungary, Servia Rockery —*D fragrans,* Bieb Cespitose, glabrous sts 10–16 in , simple, or branched above lvs elongated-linear, acuminate, 3–5-nerved fls fragrant, the limb white suffused with rose, petals beardless Caucasia, Algeria — *D gracilis,* Sibth More or less woody at base, glabrous and glaucous, the sts 14–18 in and simple and slender lvs linear-acute, strict 3-nerved fls rose, paler beneath, 2–3 in a cluster Balkans —*D graniticus,* Jord Sts simple, scabrous below and glabrous above, slender, 4-angled, 6 in lvs linear-acute, 3-nerved fls solitary or in pairs, purple France Rockery —*D japonicus,* Thunb Glabrous perennial, with simple sts 20 in lvs ovate-lanceolate, acute, canaliculate, twisted at base fls 6–8 in a head, red Japan, Manchuria —*D microlepis,* Boiss Very dwarf, cespitose, glabrous lvs scale-like fls rose-colored (varying to white) Balkans A marked little alpine L. H. B.

DIAPÉNSIA (ancient name of obscure application) *Diapensiàceæ* Two alpine-arctic species, one nearly circumpolar and one Himalayan, the former at least sometimes transferred to alpine gardens and rockeries Diapensias are very small compact tufted evergreen more or less woody perennials, with small entire coriaceous crowded lvs · corolla 5-lobed, bell-shaped; calyx inclosing the caps.; stamens 5, affixed in the corolla, the filaments broad; ovary 3-celled; fls solitary on peduncles that project above the dense lf.-rosettes (or the peduncle projected, at least in fr), white or rose-purple. **D. lappónica,** Linn., on mountain summits in New England and N. Y., and distributed northward to the arctic, forms dense cushion-like tufts, 1 or 2 in. high, with white fls on peduncles that become 1 or 2 in. long; a very interesting alpine, but seldom grown. B M. 1108. **D. himalàica,** Hook. f. & Thom Densely tufted: lvs. somewhat acute, very short: fls. white or rose-red, subsessile, the corolla-tube twice the length of the calyx Sikkim, 10,000–14,000 ft L H. B.

DIÁSCIA (*to adorn*, Greek, having regard to the attractive flowers). *Scrophulariàceæ* Low and slender herbs, mostly annual, one of which is recently grown in flower-gardens.

Leaves usually opposite: fls. mostly violet or rose-color in general effect, in racemes or fascicles at the end of the st. or branches, calyx 5-parted or -lobed; corolla-tube very short or none; limb 2-lipped, the upper lip 2-lobed and lower 3-lobed, all the lobes being broad and flat, 2 of the fauces being projected into spurs; stamens 4, didynamous; style filiform: fr. a globose or elongated dehiscent many-seeded caps —Probably 25 or more species in S Afr.



1255. Diascia Barberæ (Plant ×⅓)

Bárberæ, Hook. f Fig. 1255. Annual·st erect, 1–1½ ft, square, green and glabrous lvs. ovate, blunt, obtusely serrate, petioled or the upper ones sessile: fls. several to many in an erect terminal raceme, on slender glandular pedicels, calyx deeply 5-lobed; corolla ⅔in across, rose-pink with yellow green-dotted spot in throat, the 2 upper lobes small and nearly orbicular, the lateral twice larger, and the lower one much larger and obscurely4-angled, the spurs cylindric and about as long as lower lobe, filaments glandular B M 5933 Gt. 50, p 639.—A very attractive little plant, of simple cultural requirements, blooming freely in summer. It also makes a good pot-plant for indoor use Half-hardy annual. Pink and orange shades are advertised. L H. B.

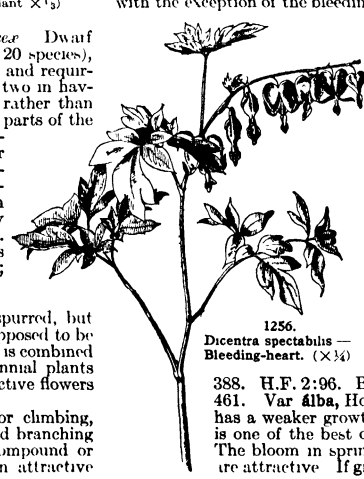
DIASTÈMA (*two stamens*). *Gesneriàceæ* Dwarf warmhouse plants of Trop Amer (about 20 species), allied to Dicyrta, Achimenes and Isoloma, and requiring similar treatment; differs from former two in having 5 distinct glandular parts to the disk rather than annular, and from Isoloma in the narrower parts of the disk, plants weak, fls pale, white or purplish, and in the short or nearly globular anther-cells, and other features summer-flowering. **D. ochroleùcum**, Hook , has yellowish white fls ; corolla somewhat swollen at base: lvs ovate, acute, hairy, coarsely serrate, on hairy purplish erect sts. 1–2 ft. high Colombia B M. 4254 **D. pictum** is offered abroad, but its identity is in doubt; see *Isoloma*. L H B

DICÉNTRA (Greek, *dis*, *kentron*, two-spurred, but originally misprinted *Dielytra*, and then supposed to be *Dielytra*) *Fumariàceæ*, by some this family is combined with *Papaveràceæ* Charming hardy perennial plants with much-cut foliage, and clustered attractive flowers of interesting structure

Herbs of various habit, erect, diffuse or climbing, often stemless, with rhizome horizontal and branching or more or less bulbous. lvs ternately compound or dissected· fls rose-red, yellow or white in attractive racemes, very irregular, with 4 petals cohering into a heart-shaped or 2-spurred apparently gamopetalous corolla (the 2 outer petals oblong with spreading tips and spurred or saccate at base, the inner 2 narrow and clawed and crested or winged and more or less united over the stigma); sepals 2, very small, scale-like, stamens 6, in sets of 3; pistil 1-celled, with a 2-4-crested and sometimes 2-4-horned stigma, ripening into an oblong or linear 2-valved caps bearing crested seeds; pedicels 2-bracted —About 15 species, in N Amer , W. Asia and the Himalayas The names Bikukulla (or Bicuculla) and Capnorchis are older than Dicentra, but are rejected by the "nomina conservanda" list of the Vienna code

The squirrel-corn and dutchman's breeches are two of the daintiest native springtime flowers, and the bleeding-heart is one of the choicest memories of old-fashioned gardens it is also the most widely cultivated of all the plants of this delightful order Though long known to herbaria, plants of bleeding-heart were not introduced to western cultivation from Japan until the late forties of last century. Robert Fortune saw it on the Island of Chusan, where he also got *Dicentra rosea* and the "Chusan daisy," the parent of pompon chrysanthemums. The first live plants seen in England flowered in May, 1847 It rapidly spread into every garden in the land, and is now rich in home associations It is an altogether lovely plant. The species of Dicentra may be classed as caulescent and acaulescent The stemless kinds send up their short scapes directly from the ground, as *D Cucullaria*, *D canadensis*, *D. formosa*, *D eximia*. The species with leaf-bearing stems are such as *D chrysantha* and *D spectabilis*. In the species here described the flowers are nodding except in *D. chrysantha*

Dicentras are easily cultivated in borders and wild gardens. Two or three kinds can be readily secured from the woods in the East Effort should be made to reproduce the natural conditions, especially the degree of shade. They like a rich light soil Propagation is by dividing crowns or roots The forcing of bleeding-hearts, though practically unknown in America, is said to be commoner in England than outdoor culture The forcing must be very gentle and the plants kept as near the glass as possible It is best to have fresh plants each year, and return the forced ones to the border None of the species is much cultivated with the exception of the bleeding-heart (*D spectabilis*).



1256. Dicentra spectabilis — Bleeding-heart. (×¼)

A *Fls. rose-purple.*

B *Racemes simple.*

spectábilis, Lem (*Dielytra spectábilis*, Don) Bleeding-Heart Fig. 1256 Height 1–2 ft.. lvs and lfts broadest of the group, the ultimate segms. obovate or cuneate. fls large, deep rosy red; corolla heart-shaped, inner petals white, protruding. Japan F S 3 258 Gn 40:198, 60, p 375; 70, p 192 Gn.W. 23. suppl July 14 G. 2·375; 26:142, 27:112. G M. 49:718, 51·160 G W. 5, p 388. H.F. 2:96. B M 4458 R H 1847: 461. Var **álba,** Hort., the white-fld. form, has a weaker growth The bleeding-heart is one of the best of flowering perennials. The bloom in spring and also the foliage are attractive If given room and moisture,

the plant will continue to be attractive as a foliage mass till late summer.

BB. *Racemes compound.*

exímia, Torr. Stemless, glabrous and somewhat glaucous, 1–2 ft., from a scaly rootstock: ultimate lf.-segms broadly oblong or ovate, the lvs. being ternately parted: scape about equaling the lvs; fls rose or pink, heart-shaped, tapering to a neck, inner petals protruded. Rocks of W. N. Y and mountains to Ga. Var. **multipinnàta,** Hort, has lvs. more finely cut, making a very handsome foliage plant.



1257. Dicentra formosa. (×⅓)

formòsa, Walp. Fig. 1257. Stemless, with a fleshy and spreading rootstock: lvs. very long-stalked, biternately compound, the segms. cleft or pinnatifid.: scapes about 2 ft., somewhat exceeding the lvs., naked; fls. in a terminal cluster of short and bracted racemes, rose-purple, the corolla ovate-cordate, the petals all united to above the middle, the inner petals scarcely protruding. Cent. Calif. to Brit. Col A.F. 21:459. Mn. 8·17 B M. 1335 (as *Fumaria formosa*).

AA. *Fls. chiefly white.*

canadénsis, Walp (*Dielýtra canadénsis,* Don). SQUIRREL-CORN, from the scattered little tubers resembling grains of maize Fig. 1258. Stemless, fragile: lvs finely cut, glaucous, the segms. linear and abruptly pointed: raceme simple, few-fld; fls white, tipped with rose; corolla merely heart-shaped, the spurs being short and rounded, crest of the inner petals conspicuous, projecting. Nova Scotia to Mich., to N. C and Mo and Neb., but chiefly northward in the vegetable mold of rich woods. B M. 3031.

Cucullària, Bernh. (*Dielýtra Cucullària,* Don). DUTCHMAN'S-BREECHES. Fig. 1259. Easily told from *D. canadensis* by its loose, granular cluster of tubers, forming a bulb-like body: lvs finely cut, little or not at all glaucous: racemes simple, few-fld.; fls. white, tipped creamy yellow; corolla not heart-shaped, the spurs longer and divergent; crest of the inner petals minute Nova Scotia to Ga and Mo., and also along the Columbia River (the western form differing in having shorter and rounded spurs). I.H. 6 215. Mn. 6:41. A.G. 13:516. B.M. 1127 (as *Fumaria Cucullaria*).

AAA. *Fls. yellow.*

chrysántha, Walp. GOLDEN EARDROPS. Pale and glaucous, with leafy sts. 2–3 ft. high. lvs. bipinnate, 1 ft or more long, segms. narrow: infl thyrsoid paniculate; fls. numerous, as many as 50 in a thryse, erect, golden yellow; corolla linear-oblong; outer petals hardly larger than the inner, the tips soon recurving to below the middle, all distinct Dry hills of the inner Coast range Calif. B.M. 7954. F.S. 8:820 (as *Capnorchis chrysantha*) —Rare in cult.

D torulòsa, Hook. f. & Thoms., of the Himalayan region, has been intro abroad. It is an annual climber, 10–16 ft. lvs. attractively cut: fls 6–8 together, yellow: fr. red. L. H. B.†

DICHORISÁNDRA (compounded of Greek words referring to the division of the stamens into two series). *Commelinàceæ.* Tropical perennial herbs, with handsome foliage, often beautifully variegated, and rich blue flowers borne in thyrse-like panicles.

Stems simple or branched, erect or partially scandent, the lvs. sheathing at the nodes. lvs. entire, sessile or petiolate, mostly long sepals 3, distinct, ovate or oblong, green or colored, not equal; petals 3, distinct, wider than the sepals; stamens 6 or 5; ovary sessile, 3-celled: fr an ovate-3-angled 3-valved caps, few-seeded.—About 30 species in the American tropics.

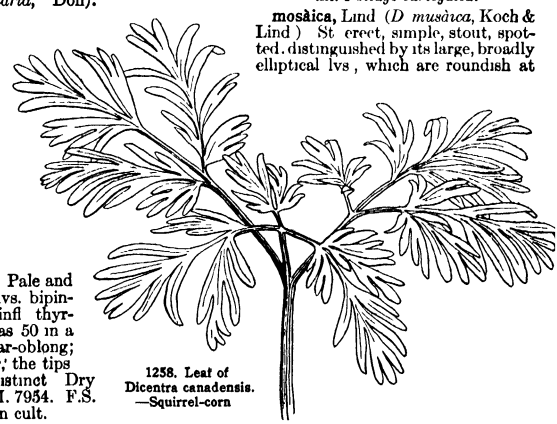
The dichorisandras are usually handled as warmhouse subjects, although some of them may be plunged in the open ground south of Philadelphia *D. thyrsiflora* is a satisfactory plant of unusual and interesting appearance, which requires little attention when once well established, and may be relied upon to flower regularly year after year. It needs careful repotting every year at first until a good-sized pot (say 8-inch) is well filled with roots. It then throws up a strong shoot each year about 5 or 6 feet high, unbranched, and with perhaps 8 or 9 leaves near the top. The handsome thyrse of blue flowers gives a color that is rare in the greenhouse. This plant may be the only representative of its interesting order in a private collection It is willing to be crowded into the background, where its bare stem is hidden, and where the light may be poorest. The stem dies down in the winter time, when water should be gradually withdrawn Water should be given liberally during the growing season Of the foliage plants of this genus, *D. mosaica* is commonest. It is dwarfer, and does not flower so regularly. (Robert Shore.)

A. *Foliage not variegated.*

thyrsiflòra, Mikan Simple or nearly so, stout, 3–6 ft.: distinguished by its large lvs., which are lanceolate, narrowed into a distinct petiole, glabrous, 6–10 in. long, 2 in wide, green on both sides: st about 3 ft. high, scarcely branched, robust, glabrous racemes subpanicled, pubescent; petals dark or light blue; sepals glabrous, blue or somewhat herbaceous Brazil. B R. 682. L B C. 12:1196. P.M. 3.127. G. 27:569. J.H. III. 43:262.

AA. *Foliage variegated.*

mosàica, Lind (*D musàica,* Koch & Lind) St erect, simple, stout, spotted, distinguished by its large, broadly elliptical lvs, which are roundish at



1258. Leaf of Dicentra canadensis. —Squirrel-corn

the base, sessile, glabrous, about 6 in. long, 3–4 in. wide, with a short, sharp, rather abrupt point: st unbranched, robust, spotted. raceme short, densely thyrsoid; sepals white or greenish Gt. 1868 593 F S. 16.1711 —Its chief beauty is the mosaic appearance of the foliage, due to numberless short transverse whitish lines, which do not pass by the longitudinal veins of the lf. The under side of the lvs is a rich purplish color. Var. **gigantèa,** Hort., a large form, has been offered.

Var **undàta,** Miller (*D undàta,* C Koch & Lind). Foliage without any mosaic appearance, the variegation being entirely longitudinal. Each parallel vein



1259 Dicentra Cucullaria —Dutchman's Breeches.

lies in the middle of a long, whitish band extending the full length of the lf. F S 17 1763 G W 3, p 159

D acaulis, Cogn Stemless lvs in a rosette, almost sessile, narrowly oblong, wavy, acutish, short-cuneate at the base, sparsely pilose on both sides panicles terminal, sessile, much shorter than the lvs Brazil I H 41 19 Handsomely variegated with countless short longitudinal lines *D albo-marginata,* Lind St 3 4 ft lvs lanceolate, acuminate, attenuate to base, glabrous raceme peduncled, 2 in long, dense, petals dark blue, white at base sepals white Brazil G W 4, p 307—*D angustifòlia,* Lind & Rod St purple, spotted green lvs oblong-lanceolate, sessile, glabrous, roundish at the base, acute, about 6 in long, 2 in wide at the middle, purple below, marked above with short transverse white lines Ecuador I H 39 158—*D leucophthálmos,* Hook, differs in having radical infl, its fls lying flat on the ground lvs elliptic, acuminate, green on both sides fls blue, with a white eye, stamens 6 Brazil B M 4733 I H 4 428—*D ovatifolia,* Presl lvs oval, sessile, acuminate, glabrous, the upper ones oblong-lanceolate panicle wide-branching Nicaragua to Colombia—*D erypitàta,* Hook, is instantly recognized by its acute petals, which are purple lvs green on both sides Brazil B M 2721—*D pícta,* Lodd, has narrower petals than usual, with a white spot at the base, but is told from all others here described by the irregular blotches of purple on the upper side of the lvs The purple is the same color as that on the under surface Brazil (?) B M 4760 I B C 17 1867—*D Regina,* Hort = Tradescantia Reginæ, Lind & Rod, intro about 20 years ago by a firm of Continental Europe—*D Saúndersii,* Hook, differs from all others here described in the extreme density of its head-like infl Lvs green on both sides, lanceolate sepals white, tinged blue Brazil B M 6165—*D Siébertii,* Hort A little-known plant with white midrib and margins, probably a form of D ovalifolia—*D thysiàna*=Palisota

WILHELM MILLER
L. H B †

DÍCHROA (Greek, *dis,* two, and *chros,* color). Syn *Adàmia. Saxifragàceæ* Rare greenhouse shrub in habit resembling a Hydrangea, with violet-blue fls in a pyramidal panicle a foot across, and handsome blue berries Lvs persistent, opposite, stalked, narrow, tapering both ways, serrate panicles terminal, many-fld.; fls blue, lilac, or violet, petals 5 or 6, valvate, styles 3–5, club-shaped: seeds numerous, small. The genus has only 1 species, in the Himalayas, Malaya, and China. It is sometimes considered to be bitypic, but the other species, *D pubescens,* Miq , is considered by Koorders (Exkursionoflora von Java) to be probably a true Hydrangea

febrífuga, Lour (*Adàmia versícolor,* Fortune *Cyanàtas sylvática,* Remw). Later writers also include *Adàmia cyánea,* Wall , which Lindley distinguished by its smaller lvs and fls , 5 petals, and 10 stamens, while *A versicolor* had 7, or sometimes 6 petals, and 20 stamens Plants may still be cult under the name of *A cyanea,* but it cannot be stated here how distinct they are for horticultural purposes A somewhat virgate shrub 5–9 ft tall, with lanceolate or obovate-lanceolate lvs to 8 in long, glabrous except on the nerves, petals less than ¼in long Clarke states that the Chinese varieties have larger fls. than the Indian forms Occurs in the temperate Himalayas from 5,000–8,000 ft B M 3040 P M. 16 322

WILHELM MILLER
L H B †

DICHROPHÝLLUM *Euphorbia*

DICHRÓSTACHYS (*two-colored spikes*) *Leguminòsæ* Stiff shrubs, with bipinnate lvs and small leathery lfts and very small polygamous fls in spikes, sometimes mentioned as useful for cult in warmhouses The species are few, in Trop Asia, Afr , and Austral. Fls in the upper part of the spike perfect, those of the lower part bearing 10 long filiform staminodia; corolla not papilionaceous, comprising 5 strap-shaped petals that are more or less united at base, stamens 10 in the perfect fls , free, slightly exserted pod narrow, compressed, mostly or nearly indehiscent **D. platycárpa,** Welw , is or has been in cult a slender spiny tree, 10–15 ft high pinnæ 10–18 pairs, the lfts 1–2 lines long and very narrow spikes usually shorter than the lvs pod twisted, 2–4 in long, about 1 in broad Guinea **D nûtans,** Benth (*Cailliea Dichróstachys,* Guill & Perr), has been intro in S Calif spiny, much contorted shrub or small tree. lvs glabrous or pubescent, acacia-like, pinnæ 5–10 pairs, lfts 10–20 or more pairs, sessile, linear or linear-oblong, rarely as long as ½in fls in dense axillary twin or solitary spikes, the upper ones sulfur-yellow and the lower ones rosy lilac pod twisted, ½in or less broad Cent Afr.

L H B.

DICKSÒNIA (named for James Dickson, an English botanist, 1738–1822) *Cyatheàceæ* Tree ferns of greenhouses

Plants with a distinctly 2-valved inferior indusium, the outer valve formed by the apex of the lf-segm —A small genus, mostly of the southern hemisphere For *D pilosiuscula, D punctilobula* and *D Smithii,* see *Dennstædtia* For *D Schiedei* and *D regalis,* see *Cibotium* These are only two of several confusions of species which have been called Dicksonia, but really belong in other genera Modern fern students are now reaching the conclusion that Dicksonia is not only very distinct from the genus Cyathea and its relatives, but belongs in a distinct family

Dicksonias are amongst the most important tree ferns, both for their beauty and because of their relative hardiness In their native countries some of them are occasionally weighted with snow, and *D antarctica* has to endure frosts They can be grown in coolhouses, and should be tried southward outdoors in sheltered places Their trunks are more fibrous than those of most tree ferns, and hence more retentive of moisture, so that they need less care A good trunk produces thirty to forty fronds a year, and retains them until the next set is matured, unless the trees suffer for moisture in winter Although they rest in winter, the fronds soon shrivel up if the trunks are allowed to get too dry. Dicksonias should have their trunks thoroughly watered twice a day during the growing season These waterings

should be gradually decreased until winter, when the trunks should be kept merely moist all the time Only in the hottest summer days is slight shade needed. It is a pity to grow tree ferns in pots, but if this must be done several principles should be observed The lapse of a single day's watering will often cause serious damage As a rule, the pots should be of the smallest size consistent with the size of the trunk Three or 4 inches of soil all around the trunks are enough The above points are taken from Schneider's "Book of Choice Ferns;" see also the discussion of tree ferns, under *Ferns*, Vol. III.

antárctica, Labill Lf -stalks short, the scales dense, dark purplish brown; lvs 5–6 ft. long, the middle pinnæ 12–18 in long, segms oblong, the sterile incised. Austral and Tasmania G C III 9 81 —Trunk sometimes 30–35 ft high A very useful decorative plant

squarrôsa, Swartz Lf -stalks short, the scales hair-like, light colored lvs. 3–4 ft long, the pinnæ 9–15 in long, segms lanceolate, the sterile toothed, the ribs scabrous New Zeal and Chatham Isl

L M Underwood and Wilhelm Miller

DICLÍPTERA (named in allusion to the 2-celled winged caps) *Acanthàceæ*. Pubescent or hirsute annual or perennial herbs or sub-shrubs, with red, violet or blue bracted flowers in terminal or axillary clusters, in the tropical parts of the world, 1 or 2 of which may sometimes occur in the trade Lvs opposite, entire, the plant usually evergreen corolla-tube, slender, often somewhat expanded above, limb 2-lipped, the lips narrow, stamens 2, on the throat **D. Niederleiniàna,** Lind., has been recently intro abroad from Argentina sub-shrub: lvs oval, to 3 in long, petioled, rounded at apex, densely pubescent fls about 1¼ in long, several crowded in a terminal paniculate cyme *D Tweediàna,* Nees, of Uruguay, is a showy perennial with orange-red fls. and oblong-obtuse lvs There are probably 75 species of Dichiptera Very likely the horticultural names are confused as between this genus and others. L. H B

DICLÝTRA: An ancient typographical error for Dielytra See *Dicentra*

DICTÁMNUS (old Greek name, supposed to indicate foliage like the ash: hence Fraxinella, diminutive of the Latin Fraxinus, an ash) *Rutàceæ* Gas-Plant Burning-Bush Fraxinella Dittany. A hardy perennial herb

Stout plants woody at the base: lvs alternate, odd-pinnate, the lfts ovate, serrulate and pellucid-punctate. fls showy, white or rose, on bracted pedicels, petals 5, the lower one declined; disk thickish, annular, stamens 10, declined, ovary deeply 5-lobed, 5-celled, hispid, becoming a hard 5-divided caps, each division or separate part being 2–3-seeded —One variable species, native from S Eu to N. China

This genus includes an old garden favorite which has a strong smell of lemon, and which will give a flash of light on sultry still summer evenings when a lighted match is held under the flower-cluster and near the main stem It is one of the most permanent and beautiful features of the hardy herbaceous border Instances are known in which it has outlived father, son and grandson in the same spot It thrives in the sun

The gas plant makes a sturdy, bold, upright growth, and a clump 3 feet high and as much in thickness makes a brave sight when in flower A strong, rather heavy soil, moderately rich, is best for these plants They are not fastidious as to situation, succeeding as well in partial shade as when fully exposed to the sun, and drought will not affect them when once fairly established. Old strong clumps are good subjects as isolated specimens on a lawn, and a large patch, planted in the border, is not only effective while in full flower, but the dark, persistent foliage is ornamental throughout the season. It is not advisable to disturb the plants very often, as they improve with age, producing taller flower-stems and more of them as they grow older. They are excellent for cutting, especially the white variety. Propagation is accomplished with difficulty by division, but easily by seeds, which are sown in the open ground in fall as soon as ripe, and covered an inch or so. They will germinate the next spring, and, when two years old, the seedlings may be removed to their permanent positions, where they will flower the following year. (J. B Keller)

álbus, Linn (*D. Fraxinélla,* Pers *Fraxinélla álba,* Gaertn *F Dictámnus,* Moench). A vigorous, symmetrical, hardy herb, with glossy leathery foliage surmounted by long showy terminal racemes of good-sized fragrant fls · lvs alternate, odd-pinnate, lfts. ovate, serrulate, dotted with oil-glands fls. white. G.C III 34 409. Gn 35 458, 68, p 73, 75, p 381 G 13 25 A F 5·328 Gng 5 321 Var **purpûreus,** Hort, has large dark-colored fls Var **rûbra,** Hort, has rosy purple fls, the veins deeper colored. Var. **gigantèus,** Hort (*D gigantèus,* Hort.) Plant large Var **caucásicus** (*D caucásicus,* Hort), is a giant form with racemes twice the length of those of the common kind and standing well above the foliage R B. 32, p 253. Perhaps the same as var. *giganteus.*

Wilhelm Miller.
L. H B †

DICTYOGRÁMMA: *Coniogramme*

DICTYOSPÉRMA (Greek, *netted seed*) *Palmàceæ* Areca-like palms, comprising several species of desirable pinnate house and table palms that are becoming deservedly well known

Slender spineless palms, with a ringed trunk lvs equally pinnatisect, segms linear-lanceolate, acuminate or bifid, the apical ones confluent, margins thickened, recurved at the base, midrib and nerves prominent, sparsely clothed with persistent scales beneath, or naked, rachis and petiole slender, scaly, 3-sided, furrowed, sheath elongated, entire spadix on a short glabrous or tomentose peduncle, the branches erect or spreading and flexuose, the lower ones with membranaceous bracts at the base, spathes 2, complete, dorsally compressed, papery, the lower one 2-crested, fl -bearing areas much depressed, bracts and bractlets scaly, pistillate fls rather large, white or yellowish fr scaly, small, olive-shaped or subglobose —There are 6 or 8 species all from Trop Asia but only the following seem to be known in the trade For cult., see *Areca* from which Dictyosperma differs only in having a 1-celled and 1-seeded fr

álba, Wendl & Drude (*Arèca álba,* Bory *Ptychospérma álba,* Scheff) Distinguished by the whitish petioles and the whitish green veins of the lvs caudex about 30 ft high, 8–9 in diam, dilated at the base lvs 8–12 ft long, petiole 6–18 in long, grooved down the face; segms 2½–3 ft long, 2–3 in wide, 7-nerved, veins and margins green or reddish branches of the spadix 6–18 in long, erect or slightly reflexed, zigzag when young —By far the best of the genus and rather widely sold as Areca as is also *D rubra*

aûrea, Wendl & Drude (*Arèca aùrea,* Hort) Distinguished by the yellow or orange petioles and veins of young plants caudex about 30 ft high, smaller and more slender than the preceding. lvs 4–8 ft long, petiole 8 in long; segms 1½–2 ft long, 1 in wide, secondary veins scarcely visible. branches of the spadix rigidly erect, 9–11 in long

furfuràcea, Wendl & Drude (*Arèca furfuràcea,* Hort). Like *D rubra,* but the petiole and lf -sheath of the young plant tomentose.

rûbra, Wendl. & Drude (*Arèca rùbra,* Hort). Resembling *D. alba,* but the lvs of the young plants

darker green, the primary veins and margins dark red, the redness disappearing very much in adult plants branches of the spadix longer and more reflexed. —Young plants of this may be used for table decorations as the plant grows quickly and is attractive in juvenile condition.

JARED G. SMITH.
N. TAYLOR.†

DICÝRTA (*twice curved*, referring to structure of fls.). *Gesneriàceæ*. Very closely related to Achimenes with which some authors unite it, differing in the smaller fls, and diverging anther-cells Low-growing slender villous herbs with creeping roots: lvs opposite, membranaceous fls axillary, small, white or pale lilac, sometimes spotted, corolla-tube declinate, the limb oblique with 5 nearly equal spreading lobes; stamens affixed in the base of the corolla-tube, included, the anther-cells distinct Two species occur in Guatemala **D. cándida,** Hanst & Klotzsch (*Achímenes cándida*, Lindl *Diastèma grácile*, Regel) To 1½ ft. lvs ovate to ovate-lanceolate, acuminate, serrate, short-petioled fl on a bracted pedicel that much exceeds the petiole, white, tubular-campanulate, the lowest lobe projecting Summer The other species is *D. Warscewicziàna*, Regel (*A. misèra*, Lindl), apparently not in cult. fls smaller. L. H. B.

DIDÍSCUS: *Trachymene*

DIDYMOCÁRPUS (*twin fruit*). *Gesneriàceæ* Attractive warmhouse herbs, with few showy flowers

A polymorphous genus, distributed in E India, Malaya, China, and Trop Afr, differently named and defined by different authors Roettlera is an older name, and has been used recently, but it is discarded by the "nomina conservanda" list of the Vienna code The genus includes Chirita and Trachystigma according to Fritsch, and it then numbers more than 100 species Bentham & Hooker omit Chirita, which differs in its 2-parted stigma, always 2 stamens, and other characters, in this work it is kept distinct Didymocarpus comprises plants that are caulescent or nearly acaulescent, sometimes woody, of various habit lvs radical and cauline, those on the st opposite or alternate, crenate, more or less wrinkled and hairy fls violet, blue, white or even yellow, on few-fld scapes or axillary peduncles; corolla with an elongated tube which is widened at the throat or ventricose, the limb spreading and somewhat 2-lobed, stamens 2 or rarely 4, the anthers connivent or coherent and cells divergent; style long or short, the stigma little dilated and entire or nearly so —The species require the treatment given the warmhouse gesneriaceous plants, usually difficult to grow, or are soon lost because seeds may not be produced Several species are mentioned in horticultural literature; but the following are more recently intro and are likely to be cult or perhaps in the trade They are low herbs with few lvs, resembling Streptocarpus Many new species have recently been added to this interesting genus, and a number of them may be expected to appear in cult

cyàneus, Ridley Stemless lvs. in a rosette, ovate, elliptic or obovate, ascending, somewhat obtuse, to 6 in long, crenate-serrate, soft pubescent, petioled· fls, deep blue, trumpet-shaped, about 1½ in long, with rounded spreading lobes, 4 or 5 on a scape. Malaya. B M 8204.—Blooms in autumn; should have warm treatment, such as is given Streptocarpus.

Veitchiàna, W. W. Smith. Eight in or less: lvs 2–4 pairs, ovate, somewhat cordate at base, serrate, 4 in. or less long, stalked fls. lilac with longitudinal lines, tubular, nearly 1¾ in. long, in few-fld axillary cymes. China. L. H. B.

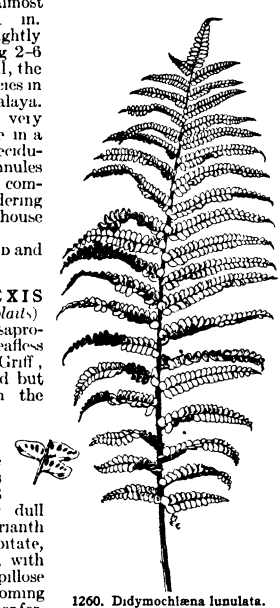
DIDYMOCHLÆNA (Greek, *twin cloak;* alluding to the indusium). *Polypodiàceæ*. Greenhouse ferns of rather coarse foliage.

Indusium elliptical, emarginate at the base, attached along a central vein, free all around the margin —One or 2 species. Large coarse ferns somewhat resembling the shield ferns, Dryopteris, in habit and gross appearance

D. lunulata is a very distinct fern It looks like a tree maidenhair, but the stems are thick and fleshy and the leaves are fleshier than any Adiantum. In cultivation the trunk is only a few inches high, but the fronds are 4 to 6 feet long and densely covered with long, brown chaffy scales and has a metallic luster This is a warmhouse fern, and may be used for subtropical bedding It has a bad trick of dropping its pinnules if allowed to get too dry at the root, but soon rallies under liberal treatment

lunulàta, Desv. (*D. trunculàta*, Hort). Fig. 1260. Lvs clustered from an erect rigid st., bipinnate, 3–6 ft. long, pinnules almost quadrangular, ¾–1 in. broad, entire or slightly sinuate, each bearing 2–6 sori Cuba to Brazil, the same or an allied species in Madagascar and Malaya. —*D. lunulata* is a very attractive fern while in a small state, but its deciduous articulated pinnules are a drawback as a commercial species, rendering it of little value for house decoration

L. M. UNDERWOOD and W. H. TAPLIN.



1260. Didymochlæna lunulata. (×¼)

DIDYMOPLÉXIS (*double* or *twin plaits*) *Orchidàceæ* One saprophytic orchid with leafless sts *D. pállens*, Griff., has been cult abroad but is probably not in the trade root branching and tuberous, bearing a st 4–6 in. high with loose sheaths racemes terminal, with 4–8 small brownish or dull yellow-white fls; perianth ½in diam; lip stipitate, transversely oblong, with 3 nerves and a papillose disk, pedicels becoming greatly elongated after fertilization E India —The genus Didymoplexis comprises 2 or 3 species (Leucorchis is a more recent name), in India, Malaya and the Pacific Isls, characterized by simple flexuous scapes, dorsal sepals and petals connate into a 3-parted upper lip, the lateral connate into an entire or 2-parted lower lip, the regular lip inserted on the foot of the column, very short and broad, entire. caps becoming very long-pedicelled. Apparently of little horticultural interest

DIDYMOSPÉRMA (Greek, *double-seeded*) *Palmàceæ*, tribe *Arèceæ*. Low or almost stemless pinnate oriental palms.

Leaves terminal, unequally pinnatisect, silvery-scaly below; segms opposite, alternate, solitary, or the lower ones in groups, cuneate at the base, obovate-oblong or oblanceolate, sinuate-lobed and erose, the terminal one cuneate; margins recurved at the base, midnerve distinct, nerves flabellate; sheath short, fibrous: spadices with a short, thick peduncle and thick branches; spathes numerous, sheathing the spadix; fls. rather large; calyx 3-lvd., corolla with 3 stiff petals;

ovary 2–3-celled: fr. ovoid or oblong, 2–3-, rarely 1-, seeded.

Didymosperma is a genus of East Indian palms of moderate growth, containing possibly eight species, most of which are stemless or else forming but a short trunk, the pinnate leaves rising from a mass of coarse brownish fibers that surround the base of the plant. The leaflets are of irregular shape, bearing some resemblance to those of Caryota, and the plants frequently throw up suckers from the base The members of this genus are not very common in cultivation The species that is most frequently seen is the plant known to the trade as *D. caryotoides*, an attractive warmhouse palm that has also appeared under the synonym *Hamma caryotoides*, and has lately been referred to Wallichia, which see While young, at least, the didymospermas enjoy a warm house and moist atmosphere with shading from full sunshine, though one species, *D. oblongifolia* (or *Wallichia*), is frequently found in Sikkim at an elevation of 3,000 feet above the sea. Propagated usually by seeds, occasionally by suckers, which are kept rather close for a time after their removal from the parent plant See G C II. 24.362 for description of garden forms

porphyrocárpon, Wendl & Drude (*Wallichia porphyrocárpa,* Mart.) Sts reedy, 3-6 ft · lvs 5–8 ft. long, lfts. 9–15, about 6 in long, distant, narrowly oblong, long-cuneate, blunt, or sinuately 2–3-lobed, truncate, denticulate, glaucous beneath. Java.

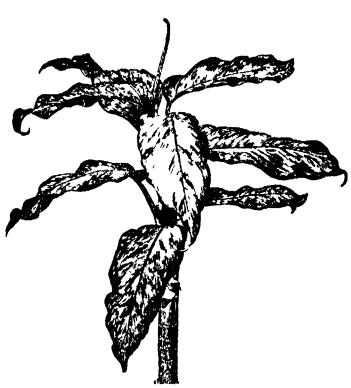
nànum, Hook A dwarf robust palm, 2–3 ft , covered with rusty pubescence lvs 1–2 ft long, glabrous above, glaucous beneath, lfts 1–3 pairs with an odd terminal one, 7–10 in long, 3–5 in broad, wedge-shaped, sharply toothed · Assam. B M 6836 —One of the smallest of all palms

D Hookerùna, Becc Resembles a Caryota, about 3 ft high. Malay Penins Plant scarcely known in cult in Amer but perhaps cult in Eu.

JARED G SMITH.
N TAYLOR †

DIEFFENBÁCHIA (J. F. Dieffenbach, a German botanist, 1794–1847) *Aràceæ* Popular hothouse plants, grown for their handsome and striking foliage.

Low, shrubby perennials sts rather thick, inclined or creeping at the base, then erect, with a leafy top



1261. Dieffenbachia picta var. Bausei.

petioles half-cylindrical, sheathed to above the middle, long, cylindrical at the apex; blade oblong, with a thick midrib at the base, veins very numerous, the first and second parallel, ascending, curving upward at their ends peduncle shorter than the lvs. Differs from Aglaonema in floral characters. Cent. and S. Amer.—Perhaps a dozen species. Engler (in Engler & Prantl, 1889) recognizes many species, with many varieties

For dieffenbachias, similar rooting material to that mentioned for anthuriums, combined with a high and moist atmosphere, will produce a very healthy and luxuriant growth of foliage, especially after the plants have made their first few leaves in ordinary light potting soil Unless it be the very large-leaved kinds, like *D triumphans, D nobilis* and *D Baumannii,* three or four plants may be placed together in large pots, keeping the balls near the surface in potting *D. Jenmanii, D Shuttleworthiana, D Leopoldii* and *D eburnea* are all well suited for massing together in large pots When above a certain height, varying in different species, the plants come to have fewer leaves, and those that remain are small; they should then be topped, retaining a considerable piece of the stem, and placed in the sand-bed, where they will throw out thick roots in a week or two The remaining part of the stems should then be cut up into pieces 2 or 3 inches long, dried for a day or so, and then put into boxes of sand, when, if kept warm and only slightly moist, every piece will send out a shoot, and from the base of this shoot roots will be produced These can be potted up as soon as roots have formed (G W Oliver)

picta, Schott (*D. brasiliénsis,* Veitch *D Shuttleworthiàna,* Regel). Blade oblong, or oblong-elliptical, or oblong-lanceolate, 2½–4 times longer than wide, rounded or acute at the base, gradually narrowing to the long acuminate-cuspidate apex, green, with numerous irregular oblong or linear spots between the veins, veins 15–20 on each side, ascending L B C 7·608 (as, *Caladium maculatum*) J H III 46:165

Var. **Baùsei,** Engler (*D Baùsei,* Regel) Fig 1261 Blade nearly or completely yellowish green, with obscurely green-spotted margins and scattered white spots I H 26 338

Var **Shuttleworthiàna,** Engler (*D Shuttleworthiàna,* Bull). Blade pale green along the midrib

Seguine, Schott Lvs green, with white, more or less confluent stripes and spots, oblong or ovate-oblong, rounded or slightly cordate or subacute at the base, narrowed toward the apex, short cuspidate, primary veins 9–15, the lower spreading, the upper remote and ascending Lowe 14 (as var *maculata*) W Indies — Called "dumb plant" because those who chew it sometimes lose the power of speech for several days

Var **Baraquiniàna,** Engler (*D Baraquiniàna,* Versch & Lem. *D gigantìa,* Versch. *D Verschaffeltii,* Hort Petioles and also midribs almost entirely white, blade with scattered white spots. I H. 11 387, 13 470, 471 G. 2 238.

Var. **nóbilis,** Engler (*D nóbile,* Hort.) Fig 1262 Blade elliptical, acute, dull green with dirty green spots. Brazil.

Var **lituràta,** Engler (*D lituràta,* Schott *D variegàta,* Hort *D Leopoldii,* Bull *D Wallisii,* Lind.) Blade dark green, with a rather broad, yellowish green, ragged-margined stripe along the midrib spathe glaucous-green Province Para, Brazil I H 17 11. S.H 1, p 455. G Z. 25, p. 250

Var **irroràta,** Engler (*D. irroràta,* Schott. *D. Baùmannii,* Hort.) Lvs large and bright green, blotched and sprinkled with white Brazil

The above are the recognized two type species. The following are or have been in the American trade Probably some or all of them belong to the foregoing species.

Chélsonii, Bull. Lvs. deep, satiny green, the middle gray-feathered, and the blade also blotched yellow-green Colombia.

ebúrnea, Hort. Compact: lvs. light green, freely spotted with white, the sts reddish and white-ribbed. Brazil.

Fournièri, Hort. Vigorous: lvs large, leathery, with spots and blotches of white on a blackish green background. Colombia.

illústris, Hort. See *D. latimaculata.*

imperàtor, Hort. Lvs. 16–18 in. long, 5–6 in. wide, olive-green, fantastically blotched, marbled and spotted with pale yellow and white. Colombia.



1262 Dieffenbachia Seguine var. nobilis.

insígnis, Hort Lvs dark green, with irregular, angular blotches of pale yellowish green, 6 or more in wide, ovate and short-acuminate in form and with pale green petiole Colombia,

latimaculàta, Lind & André (*D illústris,* Hort) Lvs glaucous-green, profusely white-barred and white-spotted and blotched with yellow-green, the petioles also glaucous Brazil. I H 23 234

Jénmanii, Veitch Lvs rich, bright, glossy green, relieved by a milk-white band at every lateral nerve, and by a few white spots interspersed between the bands. Guiana G Z 28, p 218.

magnífica, Lind. & Rod Lvs ovate-acuminate, large, dark green, attractively blotched and spotted with white along the veins, sts and petioles also variegated Venezuela I H. 30.482. S.H. 2, p. 383. G. 13.643

marmòrea, Hort. See *D. Parlatorei.*

meleàgris, L Lind & Rod Lvs with the long petioles green, marked with ivory-white, the blades dark green above, paler beneath, marked on both sides with a few white spots Ecuador. I H. 39.559.

memòria-Córsii. A hybrid raised in the garden of the late Marquis Corsi

Parlatòrei, Lind & André, var **marmòrea,** André (*D memòria, D mormòra* and *D Córsii,* Hort) Lvs long-oblong, acuminate, the midrib white and the blades blotched white, the green deep and lustrous. Colombia I H 24·291 —Engler refers this plant to the genus Philodendron

Regìna, Bull. Lvs. oblong-elliptical, rounded at base, short-acuminate at apex, greenish white, profusely mottled and blotched with alternate light and green tints S Amer. G Z. 28, p. 26 —The vari-colored and margined lvs. are very attractive

Rex, Hort. Compact: lvs. oblong-lanceolate, the two sides not equal, deep green, but the white angular blotches and midrib occupying more space than the green S. Amer G Z 28, p. 97

Sánderæ, Hort Lvs very broad-oval, green, mottled with cream-color.

spléndens, Bull. St faintly mottled with dark and light green. lvs have a thick, ivory-white midrib, and the ground-color is of a deep, rich, velvety bottle-green, with a resplendent, lustrous surface, freely marked with whitish striate blotches Colombia. G.Z 25, p 193.

triúmphans, Bull. Lvs dark green, ovate-lanceolate and acuminate, 1 ft long, irregularly marked with angular yellowish blotches Colombia. JARED G. SMITH GEORGE V. NASH †

DIELÝTRA: *Dicentra*

DIERÀMA (a *funnel,* alluding to shape of fls.). *Iridàceæ* S. African cormous plants, related to Sparaxis and Ixia. Fls large, white to purple and red, in panicled spikes lvs long, linear, rigid perianth short-tubed, expanded at throat, with oblong nearly equal segms , stamens 3, inserted on the perianth throat; ovary 3-celled, oblong, with many ovules, the style exserted· fr a 3-valved caps There are 2 or 3 species, of which **D. pulchérrima,** Baker, was intro into S. Calif many years ago. scape 2–6 ft , with remote branches lvs narrow-sword-shaped and with a very slender point fls. 1½ in long, pendulous, blood-red-purple, bell-shaped. B M. 5555 (as *Sparaxis pulcherrima*) Requires the treatment given Ixia

DIERVÍLLA (after Dierville, a French surgeon, who took *D Lonicera* to Europe early in the eighteenth century). *Caprifoliàceæ* WEIGELA Ornamental deciduous shrubs, grown for their showy flowers appearing profusely in spring and early summer.

Leaves opposite, petioled or nearly sessile, serrate fls in 1- to several-fld axillary cymes, often paniced at the end of the branches, yellowish white, pink or crimson, epigynous; calyx 5-toothed or 5-parted, corolla tubular or campanulate, 5-lobed, sometimes slightly 2-lipped, stamens 5, style slender with large capitate stigma, ovary inferior, elongated, 2-celled fr a slender, 2-valved caps with numerous minute seeds —About 10 species in E Asia and N Amer

Diervillas are shrubs of spreading habit, with more or less arching branches, rather large leaves, and, especially the Asiatic species, with very showy flowers from pure white to dark crimson, appearing in spring A very large number of hybrids between the different Asiatic species have been raised and have become great favorites in gardens on account of their profusely produced and delicately tinted flowers The earliest to bloom are *D præcox* and its hybrids and also *D florida* var *venusta,* which begin to flower in Massachusetts about the middle of May, the latest is *D rivularis.* The American species are hardy North and prefer moist and partly shaded positions Of the Asiatic species *D. Middendorffiana* is the hardiest, but rarely does well; it seems to grow best in humid sandy or peaty soil and in positions sheltered from strong winds, it dislikes hot and dry air, *D. florida* also is rather hardy and one of the handsomest species of the genus The other Asiatic species require protection during the winter or sheltered positions They thrive well in any humid garden soil. Propagation is readily effected by greenwood cuttings or hardwood cuttings, the American species usually by suckers and by seeds sown in spring.

INDEX.

alba, 4, 7
amabilis, 4, 6
arborea, 6
arborescens, 8.
canadensis, 1.
Candida, 9
coræensis, 6
Desboisii, 9.
floribunda, 8.
florida, 4
grandiflora, 6, 8.
Gratissima, 9.
Grænewegensii, 9.
Hendersonii, 9.
hortensis, 7.
hybrida, 9
Incarnata, 9
Intermedia, 9.
japonica, 7
Kosteriana variegata, 9
Lavallei, 9
Lonicera, 1
Looymansii aurea, 9.
Lowei, 9
Luteo-marginata, 9
Middendorffiana, 10
multiflora, 8
Nana variegata, 9
nivea, 7
pauciflora, 4
præcox, 5.
rivularis, 3.
rosea, 4
sessilifolia, 2.
Sieboldii argenteo-marginata, 9.
sinica, 7
Stelzneri, 9.
Styriaca, 9
trifida, 1
Van Houttei, 9.
Venosa, 9
venusta, 4
Verschaffeltii, 9
versicolor, 8

A *Fls yellow, slightly 2-lipped, small, about ½in long. (Diervilla proper).*

B. *Lvs. glabrous or nearly so.*

1. **Lonicèra,** Mill. (*D. trífida,* Moench. *D canadénsis,* Willd) Shrub, to 3 ft.: branchlets nearly terete, glabrous: lvs distinctly petioled, ovate-oblong, acuminate, serrate, nearly glabrous, finely ciliate, 1½–4 in. long: cymes usually 3-fld ; limb nearly equal to the tube: caps about ½in long June, July Newfoundland to Sask , south to Ky and N. C. B M. 1796.

2 **sessilifòlia,** Buckl. Shrub, to 5 ft.: branchlets quadrangular: lvs nearly sessile, ovate-lanceolate, serrate, nearly glabrous, of firmer texture, 2–6 in. long: cymes 3–7-fld., often crowded into dense, terminal panicles; limb shorter than the tube caps. about ½in.



1263. Diervilla japonica. (×½)

long June, July N. C and Tenn to Ga. and Ala. G C III. 22 14, 42 127.—Hardy in Canada.

BB *Lvs , branchlets and infl pubescent.*

3. **rivulàris,** Gattinger Shrub, to 6 ft : lvs. short-petioled, ovate to oblong-lanceolate, acuminate, truncate or cordate at the base, doubly serrate, pubescent on both sides, 1½–3½ in long cymes few- to many-fld , crowded into terminal panicles; limb of corolla about as long as tube caps ¼in. long July, Aug. N.C. to Tenn , Ga. and Ala G C. III. 38:339.

AA. *Fls showy, white, pink, or crimson, rarely yellowish.*

B. *Anthers not connected with each other. (Weigela.)*

C *Calyx-lobes lanceolate, connate to or nearly to the middle; stigma 2-lobed. seeds almost wingless.*

4 **flórida,** Sieb. & Zucc. (*Weigèla ròsea,* Lindl. *W. amábilis,* Hort. *D. pauciflòra,* Carr.). Shrub, to 6 ft : branchlets with 2 hairy stripes: lvs. short-petioled or nearly sessile, elliptic or ovate-oblong to obovate, serrate, glabrous above except at the midrib, more or less pubescent or tomentose on the veins beneath, 2–4 in. long: calyx nearly glabrous, with lanceolate teeth; ovary slightly hairy; fls. 1–3, pale or deep rose, 1¼ in. long; corolla broadly funnel-shaped, abruptly narrowed below the middle. May, June. N China. B M 4396. F.S. 3.211. B H 1:577. Gt. 54, p. 86. R.H. 1849:381. H F. 1854:21. V. 18:37 —This is one of the most cult. species, very free-flowering and rather hardy. Var. **álba,** Moore. Fls white, changing to light pink. R H 1861 331 Var **venústa,** Rehd. Lvs smaller, usually obovate, 1½–2½ in long, usually nearly glabrous: fls. in dense clusters with small lvs. at the base; corolla slender, about 1½ in. long, rather gradually narrowed toward the base, lobes oval to oval-oblong, rosy pink. Korea, N. China.— Recently intro.; very floriferous, early and hardy.

5. **prècox,** Lemoine. Shrub, to 6 ft.: branchlets glabrous: lvs short-petioled, elliptic or elliptic-ovate, acuminate, serrate, hairy above, soft-pubescent below, 2–3½ in long. fls clustered, 3–5, nodding; calyx with subulate lobes, ovary hairy; corolla abruptly narrowed below the middle, purplish pink or rose-carmine Japan. May. Gt 46:1441; 53, p 522. R H. 1905:314 —The earliest of all species to bloom; has given rise to a race of early-flowering hybrids as Avalanche, Gracieux, Vestale, Conquerant, Esperance, Seduction, which see under *D. hybrida.*

CC. *Calyx-lobes linear, divided to the base: seeds winged: stigma capitate.*

D. *Plant nearly glabrous.*

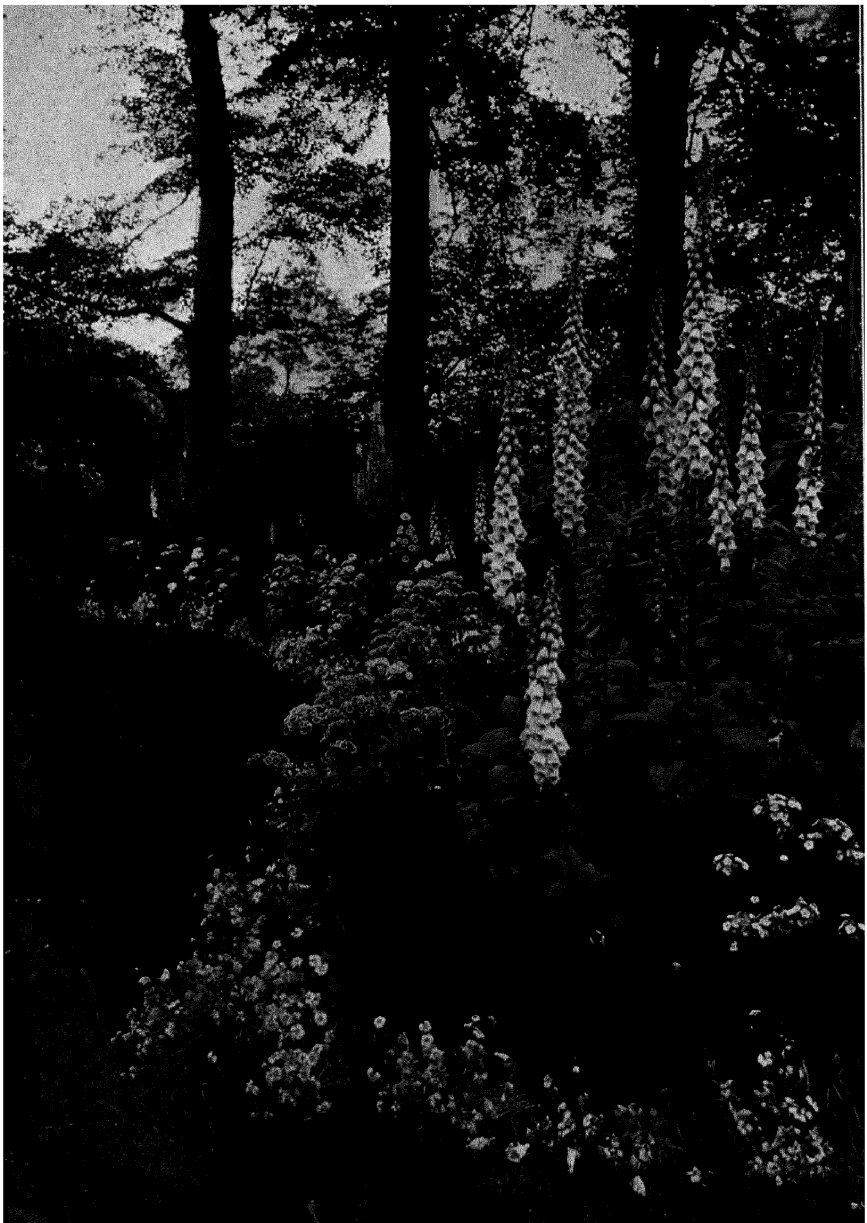
6. **coræénsis,** DC (*D grandiflòra,* Sieb. & Zucc. *D. amábilis,* Carr.). Shrub, 5–10 ft : lvs. rather large, obovate or elliptic, abruptly acuminate, crenately serrate, sparingly hairy on the veins beneath and on the petioles· fls. in 1–3-fld., peduncled cymes, corolla broadly funnelform, abruptly narrowed below the middle, changing from whitish or pale pink to carmine May, June Japan. S Z. 31. F S 8 855 H U 1 19 — Vigorously growing shrub, with large lvs. and fls , but less free-flowering, and the type not common in cult Var **arbòrea,** Rehd. (*W arbòrea grandiflòra.* Hort). Fls yellowish white, changing to pale rose, of vigorous growth.

DD *Plant more or less pubescent corolla finely pubescent outside.*

7. **japónica,** DC Fig 1263 Shrub, to 6 ft lvs. oblong-obovate or elliptic, acuminate-serrate, sparingly pubescent above, tomentose beneath fls usually in 3-fld , short-peduncled cymes, often crowded at the end of short branchlets, corolla broadly funnelform, narrowed below the middle, whitish at first, changing to carmine, slightly pubescent or nearly glabrous outside; style somewhat exserted. May, June Japan, China. G.F. 9:405 (adapted in Fig. 1263). Gn. 21, p. 184. Var **horténsis,** Rehd. (*D. horténsis,* Sieb. & Zucc). Lvs nearly glabrous above, densely grayish tomentose beneath· cymes usually rather long-peduncled; fls. usually carmine. S.Z. 29, 30. More tender and slower-growing than the type. Var. **sínica,** Rehd. Lvs. slender-petioled, soft-pubescent beneath. fls campanulate, abruptly contracted below the middle into a narrow tube, pale pink. Cent. China. Var. **álba,** Makino (*D. horténsis* var. *álba,* Sieb. & Zucc. *D. japónica* var. *nívea,* Rehd) Like var. *hortensis* but fls. white. G C. II. 10:80. Gn. 22, p. 185, 34, p. 352. G. 28:392.

8 **floribúnda,** Sieb & Zucc. (*D. multiflòra,* Lem.). Shrub, to 8 ft.: lvs. oblong-ovate or elliptic, acuminate, serrate, sparingly pubescent above, more densely beneath: fls. 1–3, usually sessile, mostly crowded at the end of short branchlets; corolla rather gradually narrowed toward the base, pubescent outside, brownish crimson in the bud, changing to dark or bright crimson; lobes about 5 times shorter than the tube; style exserted. May, June. Japan S Z. 32. I.H. 10.383.—Vigorously growing shrub, with rather small but abundant fls. Var. **grandiflòra,** Rehd. (*W. arboréscens,* Hort.). Fls. rather large, brownish crimson Var. **versícolor,** Rehd. (*D. versícolor,* Sieb & Zucc) Fls. greenish white at first, changing to crimson S.Z. 33.

9. **hýbrida,** Hort. (Fig. 1264), may be used as a collective name for the different hybrids between *D. florida, D. præcox, D. floribunda, D japonica* and *D. coræensis,* which are now more commonly cult. than the



XXXVI. A border of dianthus and digitalis.

typical species. Some of the best and most distinct are the following, arranged according to the color of the fls The numbers in parenthesis after the name refer to the number of the species and indicate the origin or probable origin of these hybrids.



1264 Diervilla hybrida. (×⅓)

Fls white or nearly white *Avalanche*, Lemoine (5×?) Fls pure white, early *Dame Blanche* (6×7) Fls large, white, slightly pinkish outside, yellowish white and blush in bud *Gracieux*, Lemoine (5×?) Fls white, yellow in throat, buds light salmon-pink, early *Isoline*, Van Houtte (4×?) Fls white or slightly pink outside, yellow in throat *Madame Couturier*, Billiard (4×6) Fls yellowish white changing to pink *Madame Lemoine*, Billiard (4×6) Fls white with delicate blush, changing to pink *Madame Tellier*, Billiard (4×6) Fls large, white, with delicate blush *Vestale*, Lemoine (5×?) Fls pure creamy white *Montblanc*, Lemoine (4×7) Fls pure white, greenish white in bud, fading to pinkish *Papillon Blanc*, Lemoine (4×7) Similar to the preceding *Candida* (4×6) Fls pure white R H 1879 140

Fls pink or carmine *Abel Carriere* (4×7) Fls rose-carmine, purple-carmine in bud, with yellow spot in throat *André Thouin* (4×6) Fls pink, carmine in bud *Conquerant*, Lemoine (5×?) Fls very large, rose-colored, carmine outside and in throat, early *Conquete* (4×7) Fls very large, deep pink *Dr Baillard* (4×7) Fls carmine *Espérance*, Lemoine (5×?) Fls very large, pinkish white tinged with salmon-red, buds pale salmon, early *Gratissima* (4×7) Fls light pink *Grœneveganii* (4×?) Fls red outside, whitish within, slightly striped with yellowish red *Gustave Mallet*, Billiard (4×6) Fls light pink, bordered white *Hendersonii* (4×8) Fls light crimson *Intermedia* (4×7) Fls carmine, buds darker, *Othello* (4×8) Fls carmine, darker outside *Seduction*, Lemoine (5×?) Fls vinous carmine-red, early, very floriferous *Stelzneri*, Van Houtte (4×7) Fls dark red, abundant *Styriaca*, Klenert (4×8) Fls pink, changing to pinkish carmine, very floriferous M D 1912 1 *Van Houttei* (4×7) Fls carmine F S 14 1447 *Venosa* (4×6) Fls carmine-pink, carmine in bud, orange to crimson in throat *Veitchaffitii* (4×6) Fls carmine-pink limb bordered whitish

Fls crimson or dark crimson *Congo* (6×8) Fls large, purplish crimson, abundant *Desbossi* (8×7) Fls small, dark crimson *E André* (8×6) Fls very dark, brownish purple *Eva Rathke* (8×6) Fls deep carmine-red, erect, very free-flowering R B 19 126 G 14 1350 *Hendersonii* (4×8) Fls light crimson, crimson in bud *Incarnata* (6×8). Fls deep red *Lavallei* (6×8) Fls bright crimson H F 1870 5 G W L, p 60 (habit) *Lowei* (8×4). Fls dark purplish crimson H F 1870 8 *P. Ducharthe* (4×8). Fls. deep amaranth, very dark, free-flowering

Lvs. variously colored. *Kosteriana variegata* Lvs. bordered yellow: fls pink, paler in bud, dwarf *Looymansii aurea* Lvs. yellow; of slow growth R B 2 173 *Lutea-marginata* (Weigela amabilis fol var Van Houtte) Lvs bordered yellow F S 12 1189 *Nana variegata* (Weigela rosea nana fol var Van Houtte). Lvs. variegated with white fls. nearly white dwarf *Sieboldii argenteo-marginata* (4×7). Lvs. bordered white fls. rose

BB. *Anthers connected with each other.* (*Calyptrostigma.*)

10 **Middendorffiàna,** Carr. Shrub, to 3 ft · lvs short-petioled, ovate-oblong or oblong-lanceolate, serrate, glabrous at length fls in 2-3-fld axillary and terminal clusters, corolla campanulate-funnelform, yellowish white, spotted orange or purplish inside 1½ in long, calyx-teeth partially connate. May, June E Siberia, N China, Japan Gt 6:183 R H, 1854 261 F S 11 1137 I H 4 115 G C III 7.581 —Hardy, but rarely does well, it demands a cool and moist climate and a position sheltered from strong winds.

D splèndens, Carr (D Lonicera × D sessilifolia) Intermediate between the parents, more similar to L sessilifolia, but lvs short-petioled Garden origin —*D sunnis*, Komarov Allied to D japonica Lvs ovate-lanceolate, ciliate, otherwise glabrous, sparingly serrate, 1-2 in long corolla white, pink outside, style not exserted Manchuria Recently intro, presumably quite hardy — *D Wdigueri*, Kusnezov (D japonica × D Middendorffiana) Lvs ovate-oblong, glabrous except on the veins below fls axillary on short branchlets, sepals lanceolate, distinct or partly connate, pink, tinged yellowish Garden origin Gt 48 1461 —Doubtful whether still in cult

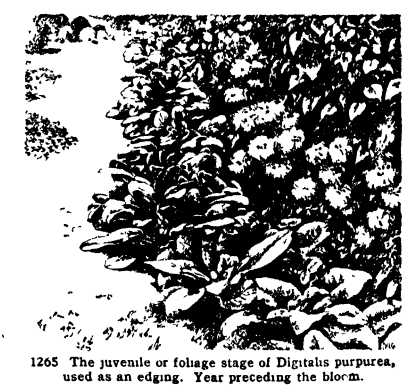
ALFRED REHDER.

DIÈTES: *Moræa.*

DIGITÀLIS (Latin, *digitalis*, finger of a glove, referring to the shape of the flowers) *Scrophulariàceæ*, FOXGLOVE A fine genus, numbering several species, and some hybrids, of hardy or half-hardy herbaceous plants, well known for their long racemes of inflated flowers, which suggest spires or towers of bells Plate XXXVI

Upright herbs, sometimes woody at the base glabrous or tomentose or woolly, mostly simple lvs alternate or scattered or crowded, entire or dentate· fls showy, in a long terminal raceme or spike which is usually 1-sided, purple, ochroleucous or white, corolla declined, more or less campanulate, often constricted above the ovary, the limb erect-spreading and somewhat 2-lipped, spotted and bearded at the throat, stamens 4, didynamous, usually included; style slender, 2-lobed fr an ovate dehiscent caps.—About 25 species, Eu and W and Cent Asia

The foxgloves are old-fashioned and dignified, clean of growth and wholesome company in the choicest garden The strong vertical lines of their flowerstalks, rising from rich and luxuriant masses of cauline leaves, give always an appearance of strength to the rambling outlines of the usual herbaceous border. For a week or two the foxgloves usually dominate the whole border The usual species in cultivation is *D purpurea*, which is one of the commonest English wild flowers The name "foxglove" is so inappropriate that much ingenious speculation has been aroused, but its origin is lost in antiquity The word "fox" is often said to be a corruption of "folk," meaning the "little folk" or fairies Unfortunately, etymologists discredit this pretty suggestion In the drugstores, several preparations of *D. purpurea* are sold They are diuretic, sedative, narcotic. For medicinal purposes, the leaves of the second year's



1265 The juvenile or foliage stage of Digitalis purpurea, used as an edging. Year preceding the bloom.

growth are used.—Foxgloves are of the easiest culture. The common species and hybrids can be grown as biennials from seed. The perennial species are propagated by seeds or by division The common *D purpurea* is best treated as a biennial, although it may sometimes persist longer. Seeds sown one spring (or fall) will give good blooming plants the following season. The large root-leaves before the flower-stems appear are decorative (Fig 1265).

A. *Middle lobe of the lower lip longer than the others.*

ferruginea, Linn. (*D aùrea,* Lindl.) Biennial or perennial, 4–6 ft. high: sts. densely leafy lvs glabrous or ciliate racemes long, dense; fls. rusty red, reticulate-marked, downy outside, lower lip of corolla ovate, entire, bearded, July. S. Eu. B.M. 1828

lanàta, Ehrh. Perennial, or biennial, 2–3 ft lvs oblong or lanceolate, ciliate: fls rather small, 1–1½ in. long, grayish or creamy yellow, sometimes whitish or purplish, downy, in a dense, many-fld raceme, with bracts shorter than the fls July, Aug. Danube River and Greece. B M. 1159 (poor fig.) —A fine species.

sibírica, Lindl Has the habit of *D. ambigua,* with fls like those of *D. lanata* lvs downy, ovate-lanceolate, serrate or the upper entire: fls. ventricose, villose, yellowish, calyx-segms linear, villose Siberia —This is a rare trade name, and it is doubtful whether this little known plant is really in cult

Thápsii, Linn. Plant much like *D. purpurea:* perennial, 2–4 ft. high lvs ovate-lanceolate or oblong, rugose, decurrent: fls purple, throat paler, marked with red dots in a lax raceme, calyx-segms. ovate or oblong. June–Sept Spain B M. 2194 (as *D. tomentosa*).



1266. Digitalis purpurea. (×½)

AA. *Middle lobe of the lower lip shorter or hardly longer than the others.*

ambígua, Murr (*D. grandiflòra,* Lam. *D ochroleùca,* Jacq.). Perennial or biennial, 2–3 ft high: lvs ovate-lanceolate, toothed, sessile or clasping, downy below: fls. large, 2 in. long, yellowish, marked with brown; lower bracts about as long as the fls. Eu., W. Asia B R 64.

purpùrea, Linn. (*D. tomentòsa,* Link & Hoffmgg.). Common Foxglove. Fig. 1266 The species most commonly cult.: mostly biennial, but sometimes perennial: height 2–4 ft.: lvs. rugose, somewhat downy, the radical ones long-stalked and ovate to ovate-lanceolate, the st.-lvs. short-stalked and becoming small toward the top of the st.: fls large 2 in long, ranging from purple and more or less spotted, rather obscurely lobed. On dry hills and roadsides, Great Britain, W. and Cent Eu., to Scandinavia, running into white and modified forms in cult; sometimes escaped in this country. Gn 34.488. Var **gloxiniæflòra,** Hort. (*D. gloxinioides,* Carr *D. gloxiniæflòra,* Hort.). Of more robust habit, longer racemes, larger fls., which open wider, nearly always strongly spotted. Var. **álba,** Hort Fls white. Var **monstrôsa,** Hort., is a double peloric form P.G. 4·151 **D. maculàta supérba** is a trade name for highly improved spotted forms Var. **campanulàta,** Hort., is a monstrous form with the upper fls. united into a bell-shaped large bloom.

D Buxbaùmii is offered as a yellow-fld species —*D dùbia,* Rodr. Perennial, woolly fls slender, hanging, purplish, spotted inside. Balearic Isls G 30 309 —*D lacinàta,* Lindl. Perennial, woody, 2 ft high lvs lanceolate, jagged fls yellow, downy, with ovate, bearded segms., bracts much shorter than the pedicels Spain B R 1201 —*D laevigàta,* Waldst. & Kit. Perennial, 2–3 ft high lvs linear-lanceolate, radical ones obovate-lanceolate fls scattered, glabrous, yellow Danube and Greece —*D lutea,* Linn Perennial, glabrous lvs oblong or lanceolate, denticulate raceme many-fld., secund, corolla yellow to white, glabrous, calyx-segms lanceolate, acute Eu B R 251 —*D marùina,* Boiss Lvs radical, very downy, ovate-oblong fls rose, corolla bearded Spain —*D purpurascens,* Roth Biennial fls yellow or sometimes purplish, pale inside, spotted at the mouth, lower lobe of corolla short Eu —*D purpurea-ambigua* is a hybrid of D purpurea var gloxiniæflora and D ambigua

F. A. Waugh.
L. H. B.†

DILIVÀRIA: *Acanthus.*

DILL (*Anèthum graveòlens,* Linn.), an annual or biennial plant of the *Umbelliferæ,* the seeds of which are used as a seasoning, as are seeds of caraway and coriander It is of the easiest cult from seeds It should have a warm position The plant grows 2–3 ft high the lvs are cut into thread-like divisions the st is very smooth the fls are small and yellowish, the little petals falling early It is a hardy plant The foliage is sometimes used in flavoring, and medicinal preparations are made from the plant The seeds are very flat and bitter-flavored Native of S E Eu

DILLÈNIA (named by Linnæus for J J Dillenius, 1684–1747, botanist and professor at Oxford, author of important botanical works) *Dilleniàceæ* Tall tropical trees from Asia, Indian Archipelago, Philippines, and Australia

Leaves large, with pronounced pinnate parallel venation fls showy, white or yellow, lateral, solitary or clustered; sepals and petals 5, spreading, stamens many, free or somewhat united at base, the anthers linear, opening by 2 slits, the interior ones erect and introrse and the exterior ones recurved and extrorse carpels 5–20, many-ovuled, in fr becoming a fleshy body inclosed in the enlarging calyx —Probably 40 species, allied to the Magnolia family *D indica* is said to be the showiest of the whole family, being attractive in foliage, fl and fr Dillenias may be grown in light sandy loam Prop readily by seeds, but with difficulty from cuttings.

indica, Linn (*D speciósa,* Thunb.) Trunk stout, not high branches numerous, spreading, then ascending: lvs confined to the ends of branches, on short, broad, channelled sheathing petioles, the blade 6–12 in long, oblong, or oblong-lanceolate, acuminate, narrowed at the base, strongly serrate: sepals 5, thick, fleshy, enlarging and inclosing the fr; petals obovate, white, large, making a fl. fully 9 in across, stamens very numerous, forming a large yellow globe crowned by the white, slender, spreading rays of the stigma: fr. edible, acid, the size of an apple, many-celled and many-ovuled Trop Asia Intro in Fla. and S. Calif. B M. 5016 (B M. 449=*Hibbertia volubilis*) H.F. 1867 p. 119.

Wilhelm Miller.

DIMORPHÁNTHUS: *Araha*

DIMORPHOTHÈCA (Greek, *two-formed achenes*). *Compósitæ.* CAPE MARIGOLD. Annual and perennial herbs or sub-shrubs, some of which are excellent flower-garden plants.

Leaves alternate or radical, entire, toothed, or incised, often narrow: heads solitary, long-peduncled; disk-fls. yellow or brown or purple, the rays yellow, purple, or white with purple beneath. The genus is closely allied to Calendula but has straight instead of incurved frs The fls usually close up, like those of Gazania, unless they have sunlight, their backs have as great a variety of coloring as their faces —About 20 species in S Afr

The flowers are often 3 inches across, and their long, slender rays (20 or more) give a distinct and charming effect A dozen kinds are grown abroad, representing a wide range of colors and foliage They are wintered in coolhouses and flowered in spring or else transplanted to the open, where they flower freely during summer. The shrubby kind, *D. Ecklonis*, has been grown as a summer bedding plant, flowering from July to frost, and as a coolhouse plant, making a much-branched subject 3 feet high, and flowering freely all spring.

ánnua, Less (*Calèndula pluvàlis*, Linn). Erect or diffuse, simple or branched annual, rough with jointed and gland-tipped hairs (seen with a small lens): lvs narrowly oblong or obovate-oblong, tapering to the base, with a few distant teeth, pilose, the uppermost smaller and narrower peduncles terminal, nodding in fr ; fls white above, purple or discolored beneath J H III 57 501. Var. **liguldsa,** Voss (*Calèndula Pongei*, Hort.), is a double form (the heads full of rays) with heads white on upper side and yellow or violet beneath

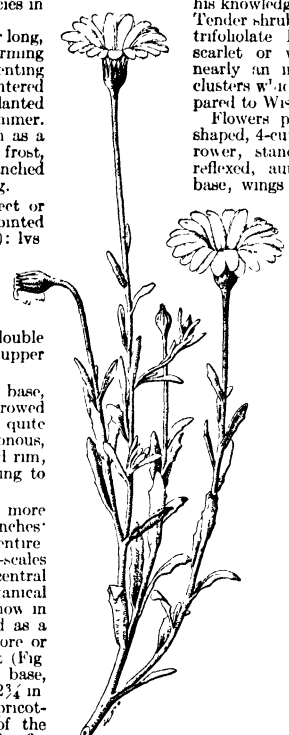
sinuàta, DC Annual, branched from the base, nearly glabrous lvs oblong, obtuse, sinuate, narrowed at base involucre-scales lanceolate-acuminate, quite glabrous, longer than disk achenes of ray trigonous, everywhere tuberculed, of disk flat with thickened rim, rays orange —Grows 12–15 in. high Fls shading to blue in center

aurantiaca, DC. Perennial, the st natively more or less shrubby, erect, glabrous, with rod-like branches' lvs linear-oblong or spatulate, thickish, obtuse, entire fl.-heads large, rays orange-yellow, involucre-scales linear-acuminate, exceeding the disk, with a central line of hairs and paler margins This brief botanical description does not in all ways fit the plant now in common cult as *D aurantiaca*, which is treated as a half-hardy annual, and which is apparently more or less modified by cult , it is a very showy plant (Fig 1267), 12 16 in high, from a short-decumbent base, with notched acute lvs , and terminal heads 2–2¾ in across, and with curving rays of a rich glossy apricot-orange and a disk of brown-black, it is one of the best flower-garden subjects of recent years, the fls. opening in the sun and making a brilliant display in summer and till frost, of simple culture from seeds. Although long described in horticultural literature, it appears not to have come really into cult. until within the past few years, having been offered in Eu in the fall of 1908 Recent forms under the name of *D. aurantiaca hybrida* (hybrids with *D annua*), intro in 1912, range in color from white and blush-white to red, yellow, orange and salmon. B.M 408 (as *Calendula Tragus*). G C III 38 127 G 31 205. J H. III. 57.37 F E 31·308 Winter-flowering in S Calif.

Ecklònis, DC. Shrubby at base, robust and erect, branching at top, 2 ft or more· lvs crowded, linear-lanceolate or lanceolate, entire or somewhat denticulate, acute· fl.-heads terminal, the rays 1½ in long, white above and purplish beneath, involucre-scales long-acuminate. B M. 7535 Gn. 75, p 444 G 24 424, 25.565 —Not hardy north of Washington. It is grown as a summer bedding plant in England

D. Bárberæ, Haw Perennial fls purple above, paler beneath; disk all purple, with corollas of 2 forms. B M 5347. H F II. 5 78 Var. *rósea*, Hort., has rose-colored fls.—*D chrysanthemifólia*, DC Lvs cut like a chrysanthemum fls yellow, reverse reddish. B M 2218 —*D cuneata*, DC Lvs strongly cut fls scarlet-orange. B M 1343 —*D nudicaulis* var *grammifólia*, Harv & Sond Fls white, with a purple ring at the base, and orange-brown on the back, the disk purple B M 5252 —*D Tragus*, DC Perennial lvs narrower than in D Ecklonis, linear fls. white, veined purple, the rays narrower at the base, reverse orange purplish, the disk purplish. B M 1981 (as Calendula) L. H. B †

DIOCLÈA (after Diocles of Carystos, said to be second only to Hippocrates among the ancients for his knowledge of plants). *Leguminósæ.* Tender shrubby twiners, with delicate trifoliolate leaves and blue, violet, scarlet or white flowers, sometimes nearly an inch long, and borne in clusters which have been roughly compared to Wistaria



1267. Dimorphotheca aurantiaca, one of the best of recent flower-garden acquisitions. (×⅓)

Flowers papilionaceous, calyx bell-shaped, 4-cut, 2 lobes shorter and narrower, standard orbicular or ovate, reflexed, auricled or appendaged at base, wings obovate or oblong, free; keel incurved, beaked or obtuse, ovary nearly sessile pod wide, the upper suture thickened or 2-winged — Perhaps 20 species in tropical regions, chiefly in the western hemisphere. What is said to be the following species is cult. in S Calif , where it has a moderate growth, shining foliage, and clusters of 10 or more large fls of a splendid scarlet (to be considered with reference to Camptosema).

glycinoides, Hort. Fls. 1 in long, bright scarlet, in racemes, somewhat like Wistaria will stand some cold Prop by seeds, cuttings, or suckers, freely produced on grown-up plants Rio de la Plata — Imperfectly understood botanically, said to be the same as *Camptosema rubicundum*, Hook & Arn.

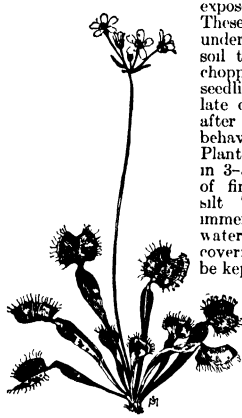
L. H. B.†

DION: *Dioon*

DIONÆA (Greek name for Venus). *Droserâceæ* VENUS FLY-TRAP A remarkable monotypic genus of insectivorous plants, often grown for curiosity and in botanical collections.

Leaves 1–5 in long, 4–8 in number, are arranged in a spreading rosette over the soil, each consisting of a flat expanded petiole, and terminal bilobed blade; midrib of the blade contractile, the margins prolonged into bristles that interlock when the halves close, while each half bears 3 jointed and highly irritable hairs arranged in triangular manner over its upper surface: abundant sessile glands, usually of a crimson color, cover this surface and render it attractive to insects; but when grown in shade the glands and therefore the lvs are quite green a single neat touch of a hair fails to cause closure, but when one of the hairs is touched twice, or when two adjacent hairs are touched once within a short interval apart, the halves close Owing

to continued and repeated stimuli caused by a caught insect, or to chemical stimuli caused by its tissues, the glands exude an acid and peptonizing digestive fluid after a few hours; this starts digestive disintegration of the insect's tissues, and the dissolved products are then absorbed by the lf.-halves: the fl.-stalk lengthens in May to 8–10 in. and bears 4–10 white fls. which expand in June, and which must be cross-pollinated for seed-production. By the end of June the caps. burst, and expose small black shining seeds. These germinate in abundance under a bell-jar on moist sandy soil that is mixed with finely chopped sphagnum moss. Each seedling, after forming 2 lanceolate cotyledons, produces thereafter tiny fly-trapping lvs. that behave like the adult ones. Plants thrive well when grown in 3–5-in. pots amid a mixture of fine silver-sand and black silt. The pots should be kept immersed for about an inch in water, should have a slight top-covering of sphagnum, and must be kept near the glass in a greenhouse with southeastern exposure. Inhabits the edges of moist sandy savannah "bottom" lands, is found wild over a narrow strip of territory about 10 miles in width and 40 miles north, also to an equal distance south of Wilmington, N. C., and grows well only when the tips of its roots reach a moist substratum, and when active transpiration proceeds. The perennial underground part is a bulbous swelling that can readily be dug and distributed from Nov. to March.



1268. The Venus' Fly-trap—Dionæa muscipula.

It is seldom that this wonderful little plant is seen in a good state of cultivation any length of time after removal from its native haunts. Its cultivation in a greenhouse is usually attended with more or less difficulty, owing to unsuitable conditions, such as too much dry air, shade or unfriendly soil. It delights in full sunshine, with a very humid atmosphere. When the plants can be secured and transplanted with considerable of the soil in which they grow attached to the bulb-like rootstalks, they are quite easily dealt with, and may be kept in a healthy growing state for years. I find a round hanging earthenware receptacle most useful to grow them in, the bottom is carefully drained, first with large pieces of broken pots, then smaller pieces, and the upper layer is quite fine. Some chopped fibrous peat is placed above this, when the plants are built in with live sphagnum moss used to fill the spaces between the clumps. Arranged in this way, it is hardly possible to give them too much water, and they revel in abundant supplies. If kept in the sun the leaves take on a reddish tinge, but when grown in the shade they are always green. Flowers will develop about the middle of June, but they should be nipped off as they make their appearance, for they are apt to weaken the plant.—The dionæa has been grown successfully in a dwelling-house by a very different method. The plants were in a wide, shallow dish, without any drainage, and simply placed, not too firmly, in loose live sphagnum moss, with a glass covering. Water was given every other day by filling the space above the plants until the dish was filled, and then it was poured off. In this way the potting material never became sour. From the luxuriant condition in which these plants remained for years, I am inclined to think this was a close imitation of the conditions under which they thrive in a wild state. Some years ago, owing to Asa Gray's endeavor to have the Government purchase a strip of land on which this plant grows, there existed a widespread idea that it was gradually becoming extinct. There seems to be little likelihood of this calamity, however, as Dionæa is found abundantly in some places. (G. W. Oliver, in Garden and Forest, 10:237 [1897]).

muscípula, Ellis. Fig. 1268. St. short, subterranean, coated by the swollen bases of lvs.: lvs. 1–5 in. long in radial rosette, divided into winged petiole and bilobed lamina: infl. umbellate; fls. ¾–1 in.; petals white; stamens usually 15; pistil of 5 united carpels, stigmas 5 penicillate: fr. a caps. B.M. 785. F.S. 3 280. Mn. 1, p. 69.

J. M. MACFARLANE

DIÒON (Greek, *two* and *egg*, each scale covers two ovules and the seeds are in pairs). *Cycadàceæ*. Handsome foliage plants suitable for warm or temperate palm houses and for planting in the open far South.

This genus is said to be the closest to the fossil forms of any living representative of the family. It has the cones and twin seeds of Zamia and Encephalartos, with the flat woolly scales of Cycas, but without the marginal seeds and loose infl. of the latter.—*D. edule* has a flat rigid frond which is more easily kept free from scale insects than *Cycas revoluta*, the commonest species of the family in cult. A specimen at Kew had a trunk 3–4 ft. high and 8–10 in. thick, the crown spreading 8–10 ft. and containing 50 fronds, each 4–5 ft. long and 6–9 in. wide. Specimens of *D. spinulosum* are reported with trunk 24 ft. high. Both sexes make cones frequently, the male cone being 9–12 in. long and the female 7–12 in. The seeds, which are about the size of Spanish chestnuts are eaten by the Mexicans. There are a few species in Mex. Prop. by seeds. Cult. same as Cycas.

edùle, Lindl. Lvs. pilose when young, finally glabrous, 3–5 ft. long, pinnatifid, rigid, narrowly lanceolate segms., about 100 on each side, linear-lanceolate, sharp-pointed, widest at the base, rachis flat above, convex beneath: male cones cylindrical, female cones ovoid. Mex. B.M. 6184. G.C. III. 40. 289. Gn. 55, p. 365. Gt. 48, p. 157. Var. **lanuginòsum,** Hort., is a very woolly kind. Gt. 48, pp. 154, 155. Variable.

spinulòsum, Dyer. Plants 6–50 ft. high, crowned by a noble rosette of spreading lvs.: lvs. 4–5 ft. long, often with 100 lfts. on each side, these bearing 5–8 spines on each margin. This is one of the tallest of all the cycads, and is excelled only by the Australian *Cycas media*. It is very unlike *D. edule*, which has a stocky trunk and straight rigid lvs. Mex. G.W. 4, p. 326, 5, p. 331. A.F. 7:461.

D. Dohènii, Hort. Discovered in mts. of Guatemala and named for Edward L. Doheney of Los Angeles. Pacific Garden, Nov. 1912. 13.—*D. pectinàtum*, Hort. Like *C. spinulosum* foliage described as "very handsome, owing to the very numerous pinnæ and their close and regular arrangement. The texture is also firm and leathery, with a sharp spiny point to each pinna." Gn. W. 24. 5.—*D. Purpusii*, Rose. Trunk short, crowned with numerous stiff and ascending lvs. 3 ft. or more long, pinnæ 2–4 in. long, sharp-pointed, entire on the lower margin but usually with 1, 2, or 3 spine-like teeth on the upper margin: male cones 6–8 in. long, the bracts with recurved ovate tips, female cones ovate, about 18 in. long, the bracts very woolly. S. Mex.

WILHELM MILLER.
L. H. B.†

DIOSCORÈA (Dioscorides, Greek naturalist of the first or second century of the Christian era). *Dioscoreàceæ*. Twining herbs from tuberous or thickened rootstocks, grown as arbor vines or under glass for the foliage, and also for the edible rhizomes and aerial tubers.

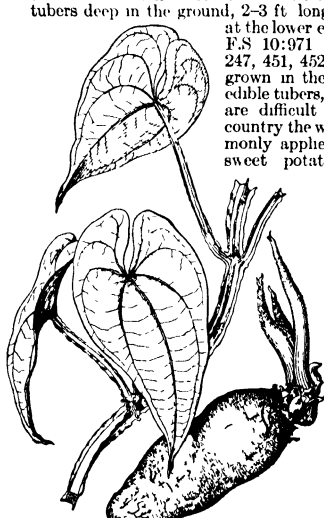
Type genus of a small family (of about 9 genera) allied to Liliaceæ. It contains more than 200 widely dispersed and confused species, most of them native to tropical regions. Sts. herbaceous and twining or long-procumbent, usually from a large tuberous root,

and sometimes bearing tubers in the axils. lvs broad, ribbed and netted-veined, petiolate, alternate or opposite, sometimes compound: fls. dicœcious, small; calyx 6-parted; anthers 6, styles 3; ovary 3-loculed and calyx adherent to it. fr a 3-winged caps; seeds winged.—The great subterranean tubers of some species are eaten in the manner of potatoes Some of the kinds have handsome colored foliage and are good glasshouse subjects. Numbers of species are more or less cult in different warm countries (see, for example, Paillieux & Bois, "Le Potager d'un Curieux," and for Japanese species Georgeson, A G 13:80); but it is not known that many of them have appeared in the U. S. The tuber-bearing species need to be worked over thoroughly from living plants For an inquiry into the prehistoric cult of dioscoreas in Amer, see Gray & Trumbull, Amer Journ Sci 25.250.

All the species are of very easy cultivation from seeds or tubers or cuttings. The tubers keep a long time, like potatoes.

A. *Sts. strongly winged.*

alàta, Linn Fig 1269. St 4-winged or angular: lvs. opposite, cordate-oblong, or cordate-ovate, with a deep, basal sinus, glabrous, devoid of pellucid dots, 7-nerved (sometimes 9-nerved), with the outer pair united staminate spikes compound, special ones whorled, short, flexuose; pistillate spikes simple; fls. distant, anthers subglobose, about as long as the filament caps leathery, elliptical India and the South Sea Isls.—Widely cult in the tropics under many vernacular names Tubers reach a length of 6–8 ft., and sometimes weigh 100 lbs, edible. The roots continue to grow for years Variable

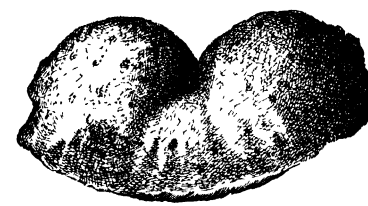


1269. Dioscorea alata, showing foliage (×⅛) and a small tuber

AA. *Sts. terete (cylindrical).*

B. *Lvs. plain green.*

Batatas, Decne (*D. dvaricàta,* Auth., not Blanco). YAM. CHINESE YAM. CHINESE POTATO CINNAMON-VINE. Tall climbing (10–30 ft), the lvs. 7–9-ribbed, cordate-ovate and shining, short-petioled, bearing small clusters of cinnamon-scented white fls in the axils root-tubers deep in the ground, 2–3 ft long, usually larger at the lower end. Philippines. F.S 10:971 R H 1854, pp. 247, 451, 452.—This is often grown in the tropics for its edible tubers, which, however, are difficult to dig. In this country the word yam is commonly applied to a tribe of sweet potatoes (see *Sweet Potato*) The yam is hardy The root will remain in the ground over winter in New York, and send up handsome tall twining shoots in the spring The plant bears little tubers in the lf-axils, and these are usually planted to produce the cinnamon vine; but it is not until the second year that plants grown from these tubercles produce the large or full-grown yams. A form with short and potato-like tubers is *D. Decaisneàna,* Carr (R H. 1865·110).—A vine widely cult since 1910 under the name "air potato" or "giant yam vine" has large potato-shaped bitter tubers Its identity is in doubt It is not *D dwaricata,* under which name it was intro. from Hawaii, nor *D bulbifera,* which has angular and edible aerial tubers In order to distinguish it from the latter, it has recently been called the "Hawaiian bitter yam." The yampi is apparently a form of *D. alata* This and other forms of this species are grown in Fla. and La, for the excellent edible tubers, which compare favorably with the potato.



1270 Air potato.—Aerial tuber of Dioscorea bulbifera. (×¼)

bulbifera, Linn. AIR POTATO Fig 1270 Tall-climbing. lvs. alternate, cordate-ovate and cuspidate, 7–9-nerved, the stalks longer than the blade fls in long, lax, drooping, axillary racemes. Trop. Asia G.C. III 52:313.—Somewhat cult S. as an oddity and for the very large angular axillary tubers (which vary greatly in size and shape) These tubers sometimes weigh several pounds They are palatable and potato-like in flavor The root-tubers are usually small or even none.

BB *Lvs. variously marked and colored, at least beneath (greenhouse "foliage plants").*

discolor, Hort Lvs large, cordate-ovate, cuspidate, with several shades of green, white-banded along the midrib and purplish beneath: fls greenish and inconspicuous: root tuberous. S. Amer. Lowe 54. F W 1877:353.—Useful for the conservatory. Suggestive of *Cissus discolor.*

multicolor, Lind. & André Probably only a form of the last. lvs. variously marked and blotched and veined with silvery white, red, green and salmon. S Amer I H. 18·53.—Very decorative glasshouse plant of several well-marked forms (some of them under Latin names).

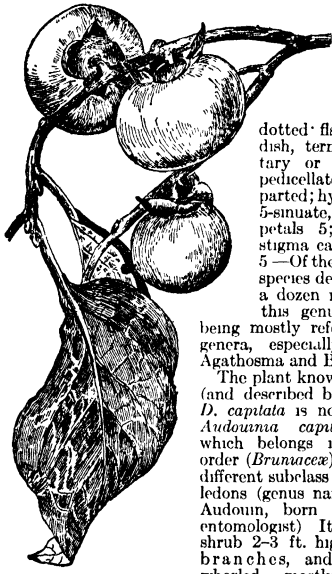
D villòsa, Linn, a native dioscorea, is offered. Bartlett has recently worked over the species native to the U S (Bull 189, Bur Pl Ind, U S Dept of Agric, 1910) and has recognized 5 species in the material formerly passing as D villosa, and the name villosa itself he finds to be untenable because of the confusion attending it (a similar case lies with D sativa, Linn, a name applied to oriental species) The 5 species are as follows *D quaternàta,* Gmel Rhizomes stout, ⅛in diam, straight or forked, with few or no lateral branches sts 3–8 ft long, rigid and erect at base but requiring support above lvs mostly 3 and 6 at a node, alternate above, cordate, repand, green on both sides, glabrous staminate fls paniculed, the clusters solitary in the axils, pistillate fls few in the cluster fr variable, ¾–1½in long Woods and banks, N C to Fla, La, Mo and Ark.—*D glauca,* Muhl Rhizomes ⅔in or more diam, often forked and with many short lateral branches (the source of the drug "dioscorea") sts 3–10 ft long, rigid and erect at base but requiring support above. lvs in whorls of 3–7, the upper ones alternate, larger than in D quaternata and less or not at all repand glabrous or hirtellous, glaucous at maturity staminate infl solitary in all axils, paniculate, pistillate infl few-fld fr to 1¼ in long Pa southward along the mts to S C and west to E Mo.—*D paniculata,* Michx Rhizomes long and slender, simple or rarely forked, less than ⅔in diam, with a few short thinner laterals sts 4–14 ft, flexuose, glabrous lvs all alternate or nearly so, pubescent beneath staminate infl solitary in the upper axils, pistillate infl densely many-fruited fr less than 1 in Var *glabrifòlia,* Bartlett, has glabrous lvs Mass to Minn, south to Texas in the middle region.—*D hirtiuvidis,* Bartlett Rhizome less than ⅔in diam, simple or rarely forked, nearly

straight, with short thn laterals st 3–10 ft , weak and flexuose, pubescent lvs all alternate (except perhaps at lowest node), grayish pubescent staminate infl solitary in upper axils, the upper ones paniculate, pistillate infl with 1–4 frs , which are nearly 1 in. long Carolinas and Ga —*D floridana*, Bartlett Rhizomes undescribed st flexuose and twining lvs alternate, wholly glabrous, green above and paler beneath staminate infl paniculate, in the upper axils and also terminal, pistillate infl solitary, 5–7-fld fr. similar to those of D paniculata, nearly 1 in long, S C to Fla

Of the many names appearing in horticultural literature, the following are recent *D argyræa*, Hort Lvs with silver-gray angular patches along the main nerves Colombia Probably one of the D discolor-multicolor group —*D bicolor*, Hort Greenhouse climber, with ovate and cordate lvs , variegated above and deep purple beneath G.W. 13, p 254 Perhaps a garden form of some species, although there is a D bicolor, Prain & Burkill described in a Bengal journal ——*D Fargesii*, Franch Twining, with spherical aerial tubers lvs of 3–5 parts or lfts , ternate or digitate, the parts oval or oval-lanceolate, more or less acuminate female fls in a very long cluster, sessile, subtended by lanceolate bracts, female fl oblong, with 6 short segms subterranean tuber globular, said to be edible, plant produces aerial tubers W China R H 1900, p 685 —*D globòsa*, Roxbg Cult by Hindoos tubers large, round and white sts 6-winged, prickly toward the root lvs sagittate-cordate, ensiform, 5–7-nerved, the long petiole 5-winged staminate infl long-pendulous and compound, and verticillate, pistillate infl simple and erect in the axils, few-fld India This name is listed in Eu —*D illustrata*, Hort , appears in European lists lvs satiny green with a central band of gray, transverse lines of white, and gray patches, under surface purple Brazil Probably one of the D discolor group —*D japonica*, Thunb St slender, climbing 10–12 ft lvs ovate with tapering apex and deeply cordate base, with some of the axils bearing small oblong tubers or bulbels pistillate fls small, white, racemose near the top of the plant fr triangular, winged root 3–4 ft long, 1–2 in diam , often branched Japan Cult forms have thicker and more condensed roots, and are eaten after the manner of potatoes Offered abroad —*D macroura*, Harms, Lvs simple, alternate, glabrous, stalked, cordate-orbicular, 1 ft. each way, undulate, with an apical cusp 1½–2 in long male fls in a large panicle, the racemes reaching 2 ft , the fertile stamens 6 and very short Upper Guinea (Trop Afr) —*D retùsa*, Mast. Sts slender, much twining, finely pubescent lvs alternate, compound, lfts 3, stalked obovate, retuse, to 2 in long, green and glabrous male fls few, in short-peduncled racemes, perianth-segms oblong and connivent, fertile stamens 3 and staminodes 3. S. Afr. G C 1870 1119 G Z 22, p 242

L. H. B.

DIÓSMA (Greek, *divine odor*). *Rutàceæ*. Small tender heath-like shrubs from southwestern Africa.



1271. Native persimmon, Diospyros virginiana. (×¾)

Leaves alternate or opposite, linear-acute, channeled, serrulate or sometimes ciliate, glandular-dotted· fls white or reddish, terminal, subsolitary or corymbose, pedicellate; calyx 5-parted; hypogynous disk 5-sinuate, 5-plaited; petals 5; style short; stigma capitate carpels 5 —Of the more than 200 species described, barely a dozen now remain in this genus, the others being mostly referred to allied genera, especially Adenandra, Agathosma and Barosma.

The plant known to gardeners (and described by Linnæus) as *D. capitata* is now referred to *Audouinia capitata*, Brongn , which belongs in a different order (*Brunìaceæ*) and even in a different subclass of the Dicotyledons (genus named for J. V. Audouin, born 1797, famous entomologist) It is a heath-like shrub 2–3 ft. high, with erect branches, and somewhat whorled, mostly clustered branchlets. lvs spirally arranged, stalkless, overlapping, linear, 3-angled, roughish, with 2 grooves beneath· fls crimson (according to Flora Capensis), crowded into oblong spike-like, terminal heads. Generic characters are: calyx adhering to the ovary, 5-cleft, segms large, overlapping; petals with a long, 2-keeled claw, and a spreading, roundish limb; stamens included; ovary half inferior, 3-celled, cells 2-ovuled, style 3-angled, with 3 small, papilla-like stigmas —One species.

In America, *D. ericoides* is more or less well known, and is put to various uses in floral decorations, in sprays, or branchlets cut to the required length, and stuck in formal designs as a setting for other flowers in the same manner and for the same purpose as Stevia is used, to give that necessary grace and artistic effect to the whole. This species, like most of the genus, has an agreeable aromatic fragrance in the foliage It is a strong grower, loose and heath-like in habit and foliage, as the specific name indicates, flowers white and small, one or more on the points of tiny branchlets While diosmas undoubtedly do best in soil suitable for heaths, that is, soil composed largely of fibrous peat, they are not nearly so exacting in their requirements in this respect, and can be grown in good fibrous loam and leaf-mold in equal parts, with considerable clean sharp sand added thereto The plants should be cut back rather severely after flowering to keep them low and bushy; this refers more particularly to the above species, other members of the genus being of more compact growth and needing very little corrective cutting to keep them in shape *D capitata* (properly *Audouinia capitata*) is a fine example of the latter class, and is much better than *D ericoides* for exhibition and show purposes; flowers pinkish lilac, in corymbs The propagation of diosmas by cuttings is similar to that of heaths, but much easier The best material for cuttings is young wood (Kenneth Finlayson)

ericoides, Linn Much-branched, 1–2 ft , leafy: branches and twigs quite glabrous. lvs alternate, crowded, recurved-spreading, oblong, obtuse, keeled, pointless, glabrous fls terminal, 2–3 together, with very short pedicels, calyx-lobes ovate, obtuse, petals reddish, elliptic-oblong or obovate, obtuse, narrowed to a short claw, twice as long as the calyx; disk free and 5-lobed. B.M 2332 under this name is in reality *D. vulgaris* var *longifolia*. G 33·501

The plant cult in Calif as *Diosma purpurea* belongs to Agathosma (Greek, *good odor*), differing from Diosma chiefly in the presence of 5 staminodes and in the 3 or 4 carpels, it is *D. villòsa* Willd , a shrub about 1 ft high with upright branches, spirally arranged upright and imbricate lvs oblong-lanceolate, ciliate, pubescent beneath, ⅛–¼in long fls light purple, in dense terminal heads, pedicels unequal, at least the outer ones not exceeding the lvs S Afr R B 5 369 (as Diosma hirta), H I 1 4 Another species sometimes cult as D purpurea is *Agathosma Ventenatiana*, Bartl & Wendl differing from the preceding species chiefly in the spreading lvs and in nearly equal pedicels exceeding the lvs L B C 12 1122 (as Diosma hirta)

D frágrans, Sims=Adenandra fragrans —*D vulgàris*, Schlecht , has narrower lvs than D ericoides, and they are acute branchlets minutely pubescent lvs scattered, rarely opposite, linear, convex-carinate, subulate-acuminate fls corymbose, the petals white, or red on the outside plant 1–2 or more ft There are well-marked botanical varieties.

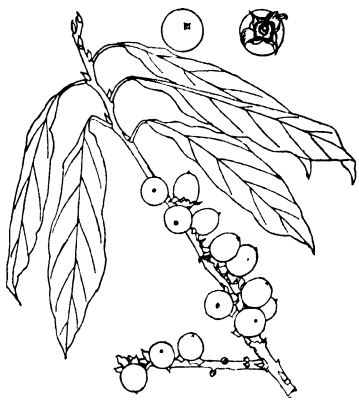
WILHELM MILLER.
L H B.†

DIOSPŸROS (*Dios*, Jove's, *pyros*, grain; alluding to its edible fruit). *Ebenàceæ*. PERSIMMON. EBONY. Woody plants grown partly for the handsome foliage and partly for their edible fruits; some species are valuable timber trees.

Deciduous or evergreen trees or shrubs, with alternate, rarely opposite, entire lvs., without stipules: fls. dioecious or polygamous in few- or many-fld , axillary cymes, the pistillate often solitary, yellowish or whitish; calyx and corolla 3–7-, usually 4-lobed; stamens usually 8–16, included, styles 2–6, ovary 4–12-celled: fr. a large, juicy berry, 1–10-seeded, bearing usually the enlarged calyx at the base; seed flat, rather large.— About 190 species in the tropics, few in colder climates.

The few cultivated species are ornamental trees,

with handsome lustrous foliage, rarely attacked by insects and with decorative and edible fruit. The only species which is tolerably hardy North is *D virginiana*, while *D. Kaki*, much cultivated in Japan for its large edible fruits, is hardy only in the southern states. Most species have valuable hard and close-grained wood,



1272. Diospyros Lotus. (×⅜)

and that of some tropical species is known as ebony They thrive in almost any soil, but require, in cooler climates, sheltered and sunny positions Propagated by seeds to be sown after maturity or stratified and sown in spring, and by cuttings of half-ripened wood or by layers, the tropical species by cuttings of mature wood in spring, with bottom heat, the fruit-bearing varieties are usually grafted or budded on seedling stock of *D. virginiana* See *Persimmon.*

A *Lvs acuminate.*

B *Fr ½–1½ in across, not ribbed: branches usually glabrous*

virginiàna, Linn COMMON PERSIMMON. Fig 1271 Tree, to 50 ft., rarely to 100 ft , with round-topped head and spreading, often pendulous branches lvs ovate or elliptic, acuminate, shining above, glabrous at length or pubescent beneath, 3–6 in long: fls short-stalked, greenish yellow, staminate in 3's, ½in long, with 16 stamens; pistillate solitary, larger, with 4 2-lobed styles, connate at the base fr globose or obovate, plum-like, with the enlarged calyx at the base, 1–1½ in diam., pale orange, often with red cheek, edible, varying in size, color and flavor June. Conn to Fla , west to Kans. and Texas. S S. 6·252, 253. G F 8:265. Mn. 4:21. Gn 57, p 146. A G 11·651. V. 4 20. G W 16:230.

Lòtus, Linn Fig 1272 Round-headed tree, to 40 ft · lvs elliptic or oblong, acuminate, pubescent, often glabrous above at length, 3–5 in. long: fls. reddish white, staminate in 3's, with 16 stamens, pistillate solitary fr yellow at first, black when fully ripe, globular, ½–¾in. diam., edible. June. W. Asia to China. A.G. 12:460. Gn. 32, p. 68. S I.F. 1·79.

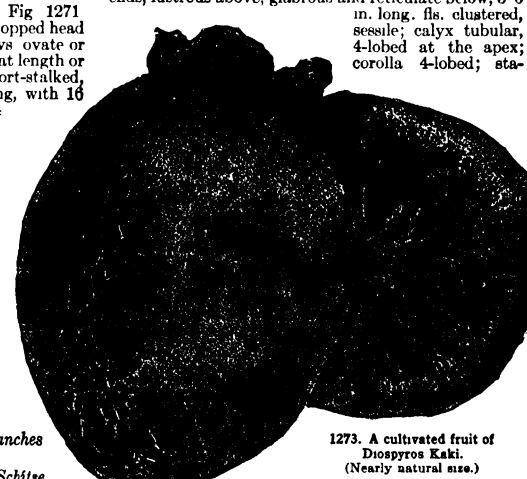
BB. *Fr. 1½–3 in. across, usually ribbed: branches with appressed brownish pubescence.*

Kàki, Linn. f. (*D. chinénsis*, Blume. *D. Schitse*, Bunge. *D Róxburghii*, Carr) Fig 1273. Tree, to 40 ft., with round head: lvs. ovate-elliptic, oblong-ovate or obovate, acuminate, subcoriaceous, glabrous and shining above, more or less pubescent beneath, 3–7 in. long. fls yellowish white, staminate with 16–24 stamens, pistillate to ¾in. long, styles divided to the base, pubescent: fr. large, 1½–3 in. across, very variable in shape and size, mostly resembling a tomato, orange or reddish. June. Japan, China. R H 1870, pp 412, 413; 1872, pp 254, 255 B M 8127 G C III. 41.22 Gn 27, pp 168, 169, 49, p 171 M.D G. 1909. 409. Var. **costàta,** André Fr large, depressed, globular, orange-red, with 4 furrows R H. 1870:410, and p. 133. I H. 18.78. G C. II. 4·777; III 9:171; 13:51. Gn 49, p 171 Var. **Mazélii,** Mouillef Fr. orange-yellow, with 8 furrows R H 1874 70 Other varieties are figured in R H 1872, p 254, 1878 470; 1887:348; 1888.60. A G. 12 331–8, 459–462.—A very desirable and beautiful fruit-bearing tree for the southern states, where a number of different varieties intro from Japan are cult , but the harder varieties from the north of Japan and China, which are likely to be hardy north to New England, seem hitherto not to have been intro. Fig 1273 is from Georgeson's articles in A. G 1891. —The plant cult in Eu. as *D. chinensis*, which is apparently the same as *D Roxburghii*, differs from the Japanese forms of Kaki, which usually have elliptic and glabrescent lvs , in the narrower usually oblong lvs densely pubescent beneath, less so above, and in the greenish yellow subglobose fr., it is tenderer than the common Kaki It must not be confused with *D sinensis*, Hemsl , an entirely different species from Cent. China, not in cult

AA *Lvs. obtuse or emarginate.*

texàna, Scheele (*D. mexicàna*, Scheele *Brayodéndron texànum*, Small). Small tree, intricately branched, rarely to 40 ft : lvs cuneate, oblong or obovate, pubescent below, 1–2 in long fls with the lvs , pubescent, on branches of the previous year; calyx and corolla 5-lobed, staminate fls with 16 stamens, pistillate with 4 pubescent styles connate at the base: fr. black, ¾–1 in. diam. Spring Texas, New Mex. S.S. 6:254

tessellària, POIR (*D. reticulàta*, Willd.). Tree or shrub lvs coriaceous, oval or oblong, rounded at both ends, lustrous above, glabrous and reticulate below, 3–6 in. long. fls. clustered, sessile; calyx tubular, 4-lobed at the apex; corolla 4-lobed; sta-



1273. A cultivated fruit of Diospyros Kaki. (Nearly natural size.)

mens 12–13, glabrous: fr. ovoid, sericeous or glabrate, 1¼–1½ in. long, edible. Mauritius.—Yields the ebony of Mauritius. Cult. in S Calif.

D armàta, Hemsl. Spiny tree, to 20 ft lvs persistent, oval-oblong, obtuse, 1–2 in long staminate fls in short panicles, creamy white, fragrant fr usually solitary, ¾ in across Cent China. Tender.—*D Ebenaster*, Retz The "guayabota" and "zapote negro," from Mex and W Indies, has been catalogued in S Calif It is a tall tree, with very sweet frs the size of an orange, green outside and almost black inside lvs elliptic or oblong, usually obtuse, 3–12 in long fls white, fragrant.—*D Ébenum*, Koenig Tree, to 50 ft lvs elliptic-oblong, bluntly acuminate, glabrous. fls white, staminate, in short racemes E Indies, Ceylon For cult in hothouses or tropical climates This species is said to yield the best ebony.—*D Morrisiàna*, Hance Evergreen shrub or small tree, glabrous lvs oval, obtusely acuminate, 2–3½ in long fls whitish, drooping, on hairy stalks fr yellow, subglobose, ½–¾ in across Hongkong, Formosa The edible fr ripens in Dec.—*D ùtilis*, Hemsl Evergreen large tree branchlets silky-pubescent lvs oblong, short-petioled, glabrous above, whitish and silky-pubescent beneath, 5–8 in long fr depressed-globose, pubescent, nearly 2 in across. Formosa. The edible fr is called Mao-shih

ALFRED REHDER.

DIOSTÈA (probably *two stones* or *seeds*). *Verbenàceæ*. Once referred to Baillonia, but now kept distinct, closely allied to Lippia, but differing widely in habit, in the slender green branches, in the branchlets having very long internodes and being cylindric and hollow. *D. júncea*, Miers, of the Andes of Chile and Argentina, is a bush or small tree, with the long branches constricted when dry lvs opposite, 1 in or less long, sessile, oblong or ovate-oblong, obtuse, crenate, rather fleshy. fls small, pale lilac, in peduncled axillary or terminal spikes; corolla tubular, inflated above the middle, hairy inside, with 5 very short rounded spreading lobes; stamens 4, didynamous B M 7695.

DIÒTIS (*two-eared*, denoting the structure) *Compósitæ* One cottony perennial on sea sands of Eu, sometimes planted in rock-gardens and for edgings **D. candidíssima,** Desf (*D maritima*, Smith). COTTON-WEED Usually less than 1 ft. high, has hard sts. almost woody at base, arising from a creeping rootstock. lvs alternate, oblong, entire or slightly toothed, about ½ in. long fl -heads nearly globular, ½ in across, in dense terminal clusters, in Aug and Sept It is readily prop by seeds or cuttings Diotis is closely allied to Achillea, being distinguished by the florets being all tubular and having 2 ears at the base of the corolla which persist and inclose the achene

DIPCÀDI (meaning uncertain) Including *Tricharis* and *Uropétalum Liliàceæ*. Tender bulbous scapose plants of minor importance, allied to Galtonia.

Leaves radical, thickish, narrowly linear: scape simple and leafless, bearing loose racemes of odd-colored fls, perianth with a cylindrical tube, the lobes mostly equaling or exceeding the tube, the 3 exterior ones spreading or flaring and the 3 interior usually shorter and erect; stamens 6, on the throat of the perianth, the anthers linear and attached by the back; ovary sessile, ovoid or oblong, becoming a 3-sided dehiscent caps. bulb tunicated.—About 50 species in S. Eu., Trop and S Afr and India. During the winter, their resting time, the bulbs should be kept dry. A compost of light, sandy loam and leaf-mold has been recommended. Many species have been described in recent years from Trop. and S. Afr, and some of them may be expected to appear in the trade, and in lists of novelties.

A. *All perianth-segms equally long.* (*Tricharis.*)

serótinum, Medikus Lvs 5–6, fleshy-herbaceous, glabrous, narrowly linear, 6–12 in long, 2–3 lines wide near the base, channeled on the face. scape 4–12 in long; raceme loose, 4–12-fld; bracts lanceolate, 4–6 lines long, longer than the pedicels, perianth greenish brown, 5–6 lines long; ovary sessile or subsessile. S. Eu, N. Afr. B M 859 (as *Scilla serotina*)

AA. *Outer perianth-segms longer than the inner and tailed.* (*Uropetalum.*)

filamentòsum, Medikus (*D virde*, Moench). Lvs 5–6, fleshy-herbaceous, narrowly linear, glabrous, 1 ft. long, 1½–3 lines wide near the base. scape 1–2 ft. high, raceme loose, 6–15-fld.; bracts linear-acuminate, 4–6 lines long, perianth green, 12–15 lines long, outer segms 4–6 lines longer than the inner: caps sessile or nearly so. S. Afr.

WILHELM MILLER
L. H. B †

DIPÉLTA (Greek *dis*, twice, and *pelte*, shield, two of the floral bracts are shield-like). *Caprifoliàceæ*. Ornamental deciduous shrubs, grown for their handsome pinkish or purple flowers.

Leaves opposite, short-petioled, entire or denticulate, without stipules fls solitary or in leafy few-fld racemes, with 4 unequal conspicuous bracts at the base, calyx-lobes linear or lanceolate, 5, corolla tubular-campanulate, 2-lipped, stamens 4, inclosed, style slender, shorter than corolla, ovary inferior, elongated, 4-celled, 2 of the cells with 1 fertile ovule each and 2 cells with several sterile ovules: fr. a caps inclosed by the enlarged, usually shield-like, bracts.—Four species in Cent. and W. Asia.

Dipeltas resemble diervillas in habit, with handsome pinkish or purple flowers in clusters along last year's branches, the flowers in shape are like those of a large-flowered abelia *D floribunda* has proved hardy at the Arnold Arboretum, while *D ventricosa* seems to be somewhat tenderer They are apparently not particular as to the soil Propagation is by seeds sown in spring and probably, like Abelia and Diervilla, by greenwood and hardwood cuttings

floribúnda, Maxim. Shrub, to 15 ft lvs ovate to lanceolate, acute or acuminate, rounded or narrowed at the base, entire, puberulous at first, soon glabrous, 2–4 in long fls. 1–6, on slender nodding pedicels, tubular-campanulate, pale rose, lower lip with orange marks, 1½ in long, ovary inclosed by the 2 upper large shield-like bracts persisting on the fr and ¾–1 in across May Cent China B M 8310 G C III 42 3 M D G 1912.27.

ventricòsa, Hemsl. Shrub, to 18 ft · lvs ovate-lanceolate to lanceolate, long-acuminate, usually rounded at the base, remotely glandular-denticulate, sparingly hairy above and villous along the veins beneath, 2–6 in long· fls 1–4 on drooping slender pedicels, campanulate, ventricose and scarcely tubular at the base, outside purple, whitish inside and marked with orange, 1¼ in long, ovary hidden by 2 large unequal auriculate bracts on the fr about ¾ in across May, June. W. China B M 8294 G C III 44.101.

D yunnanénsis, Franch Allied to D ventricosa Lvs entire· corolla distinctly tubular at the base W China R H 1891, p 246 Not yet intro.—*D elegans*, Batal, is another handsome species not yet in cult.

ALFRED REHDER

DIPHYLLÈIA (Greek, *double leaf*). *Berberidàceæ*. UMBRELLA-LEAF. An interesting hardy perennial herb, sometimes transferred to the wild-garden

Plant with thick creeping jointed knotty rootstocks, sending up a huge peltate cut-lobed umbrella-like radical lf on a stout stalk, and a flowering st. bearing 2 similar (but smaller and more 2-cleft) alternate lvs, which are peltate near one margin, and a terminal cyme of white fls: sepals 6, fugacious; petals and stamens 6; ovules 5 or 6. berries globose, few-seeded This is one of the genera having only 2 species, one of which is found in N. E N Amer, the other in E. Asia or Japan, of which there are two others in this family.

cymòsa, Michx Root-lvs 1–2 ft across, 2-cleft, each division 5–7-lobed; lobes toothed: st. 1–4 ft tall: berries blue May Wet or springy places in mountains from Va to Ga. B M. 1666.—Grows readily in dry soil under cult. but is dwarf

DIPHÝSA (*two bladders*, because of the structure of the pod). *Legumnòsæ*. Shrubs or trees, usually glandular, with odd-pinnate lvs. and papilionaceous fls., of about 10 or 12 species in Mex., Cent. Amer., to Venezuela, rarely seen in cult. abroad in warmhouses: calyx with 5 unlike teeth, the 2 upper short; standard of the corolla orbicular, clawed, with 2 callosities inside; wings obovate or oblong or nearly lanceolate; keel as long as the wings or somewhat longer fr. a stipitate more or less inflated pod. fls. yellow, in short racemes or fascicles. *D. carthagenénsis*, Jacq., is a shrub or small unarmed tree, with 2–3-fld. axillary peduncles, and about 5 pairs of lfts. **D. floribúnda**, Peyr., has been offered in S. Calif. much-branching shrub: lvs. alternate; lfts. 7–13, elliptic or broad-oblong, the mid-nerve ending in a mucro; fls. yellow, in short secund racemes; standard strongly reflexed, ½in. broad. S. Mex. L. H. B.

DÍPIDAX (*double fountain*, from the pair of nectaries at the base of the perianth-segms.). *Liliàceæ*. Two species in S. Afr., with tunicated corms, simple sts. and small whitish more or less tinted fls. in spikes, of little horticultural importance; perianth deciduous, polyphyllous; stamens 6, included; ovary sessile, 3-celled and 3-lobed, many-ovuled, styles 3, awl-shaped; fr. a turbinate 3-valved caps. *D. ciliàta*, Baker. St. 6–12 in.; lvs. usually 3, ciliate, the lower 4–6 in. long and lanceolate-acuminate and the upper much shorter and amplexicaul; spike 2–6 in. long, densely many-fld.; fls. whitish more or less tinged red; there are several botanical vars., differing in lvs., number and color of fls. *D. triquètra*, Baker. St. 12–18 in.; lvs. 3, ciliate, the lowest at base of st. and the upper near the spike (which is 1–6 in. long); fls. with numerous brown veins and 2 purple nectar-spots. B.M. 558 (as *Melanthium triquetrum*). The species are treated as greenhouse perennials.

DÍPLACUS. *Mimulus*.

DIPLADÈNIA (Greek, *double gland*, referring to the two glands at base of ovary, which distinguish this genus from Echites). *Apocynàceæ*. A charming genus of greenhouse twiners (sometimes erect), mostly from Brazil.

Flowers large, showy, more or less funnel-shaped, having a remarkable range of color, rarely white or dark red, but especially rich in rosy shades and with throats often brilliantly colored with yellow, the buds, also, are charming; calyx 5-parted, the lobes lanceolate, with glands or scales in the inside; corolla without scales at the throat, the 5 lobes spreading, twisted in the bud; stamens 5, affixed in the top of the tube, included, the acuminate anthers connivent around the 5-lobed stigma; disk of 2 fleshy scales, alternating with the 2 distinct ovaries: fr. of 2 terete more or less spreading follicles.—Species 30–40, in Trop. S. Amer., woody (rarely herbaceous) and mostly at first erect but becoming scandent, the lvs. mostly opposite and entire and usually with bristles or glands at base, fls. usually in terminal or axillary racemes. The genus is fully as interesting as Allamanda, which belongs to another tribe of the same family. Other allied genera of garden interest are Echites, Odontadenia, Mandevilla and Urechites. Some species are naturally erect bushes, at least when young, and many can be trained to the bush form. The group is a most tempting one to the hybridizer. Many names appear in European catalogues, but they are confused. Very many pictures are found in the European horticultural periodicals.



1274. Dipladenia atropurpurea. (×⅓)

Of the twining glasshouse flowering subjects, dipladenias are amongst the best and ought to be in all collections of greenhouse plants. An erroneous idea is held by many that it is necessary to have a very high temperature to grow these plants successfully. This, however, is not the case. Except when started into active growth in the early spring, they do better in an intermediate temperature. Dipladenias have been known to live, and thrive well, after having been subjected to 7° of frost. A good time of the year to secure cuttings of dipladenias is about February 1. At that time they show signs of starting into growth and the weak wood should all be pruned back to the normal thickness of the stem. The thickest part of these prunings make good cuttings. Take a piece with two leaves attached, with about an inch of the stem under the leaves. Pot them singly in small pots, half filled with equal parts osmundine, broken up rather fine, sand, and charcoal. Fill the upper part of the pot with sand. Place the pots in a tight propagating bed, in a night-temperature of 70°. Allow the temperature to run up to 80° or more by day, but be sure and admit air several times during the day by opening up the case the plants are in for a few minutes. The cuttings will have the small pots filled with roots in about a month, when they may be shifted into larger pots. From now on, use for potting equal parts of osmundine, the fiber of loam out of which all the fine part has been shaken, sphagnum moss, sand and charcoal. When the plants reach a 6-inch pot, a sixth part of sheep-manure may be added and a sprinkling of chicken-bone. It is a good plan, provided one has a good sheltered border with a southern aspect, to plant small plants of dipladenia outdoors from June until the middle of September. It is astonishing how vigorously they start into growth and flower when potted after this treatment. Fifty-five degrees is a good night temperature to grow dipladenias in when possible. During the summer, if grown indoors, admit all the air that can be admitted day and night. They will stand the full sun under glass, but they do slightly better under a very light shade during the hotter part of the day, when the sun is shining. When the pots are filled with roots, and it is desired that they should remain in that pot for the rest of the season, feed with manure-water, a handful of cow-manure to a two-and-a-half-gallon watering-pot. The same amount to an equal quantity of water if a fertilizer such as "Clays" is used, is sufficient. Horse urine may also be used for a change, a 3-inch potful to two and one-half gallons of water. Be sure to water three times in between with clean water. Dipladenias show signs of completing their growth toward the end of November, at which time water should be gradually withheld, but never so as to allow the wood to shrivel. They may be treated in this manner until the end of January, when, as stated above, they will show signs of starting the season's growth. At this season they should have a general overhauling. Large plants should be turned out of their pots, and the loose dirt all washed out of them with a hose with a gentle pressure on it; and if possible repot in the same size of pot. After disturbing the roots in this manner, they are better to be placed for a few weeks in a temperature of not less than 65°. When they have gripped the new soil, they do better in 55° night temperature. Give each break a piece of thread attached from the plant to the roof to climb on until they set flower. A few breaks, near the highest part of the plant, will

start climbing ahead of the others, and after they show a flower-stem pinch the shoot immediately ahead of the flower This will encourage the belated breaks to start and catch up to these leaders. When they have all set flower, they may be trained evenly over a globe trellis if they are desired for a specimen plant. By the above treatment ninety-five open flowers, all at one time, have been secured on a plant in a 12-inch pot. Dipladenias are subject to mealy-bug, scale, thrips, and red-spider Fumigate with hydrocyanic gas during the cold months, and syringe regularly and thoroughly during the summer, and these pests will give no trouble (George F. Stewart.)

A. *Fls. white, throat yellow inside.*

boliviénsis, Hook. Plant everywhere glabrous: sts. slender: lvs. petioled, 2-3½ in. long, oblong, acuminate, acute at base, bright green and glossy above, pale beneath, stipules none: racemes axillary, 3-4-fld ; peduncles much shorter than the lvs, about as long as petioles and pedicels, bracts minute at the base of the twisted pedicels; calyx-lobes ovate, acuminate, 3 lines long, corolla almost salver-shaped, tube and throat slender and cylindrical, the former ½ in long, the latter twice as long and half as broad again, limb 1½ in. across, lobes broadly ovate, more acuminate than in *D atropurpurea* Bolivia B. M 5783 Gn. 44: 140. Gng 7 342.



1275. Dipladenia splendens. (×⅓)

AA. *Fls dark purple.*

atropurpùrea, DC. (*D. Marie Henriette*, Hort.) Fig. 1274. Glabrous lvs ovate-acute, about 2 in. long, acute at the very base racemes axillary, 2-fld , peduncles a little longer than the lvs ; pedicels twisted, bracted, calyx-lobes lanceolate-acuminate, a little shorter than the pedicel, and a third as long as the cylindrical part of the corolla (of which the tube is about 2 in long), corolla dark purple inside and out, tube funnel-shaped above the middle, lobes triangular, wavy, spreading, shorter than the dilated part of the tube Brazil B R 29 27 (as Echites). Gn 44·488. I H 42.33 Gt 43, p 548 Var **Clárkei,** Hort. Lvs rather small fl deep crimson shaded velvet-black, about 2½ in across, the tube paler Gn W. 8.661 —*D atropurpurea* is a handsome species, but considered to be a shy bloomer.

AAA *Fls. rose; throat deep rose or purple within, whitish outside*

spléndens, DC. (*Echites spléndens*, Hook). Fig. 1275 St glabrous, the branches terete. lvs subsessile, 4-8 in. long, elliptic-acuminate, cordate at the base, wavy, pubescent, especially beneath. veins elevated, numerous: racemes axillary, longer than the lvs, 4-6-fld ; calyx-lobes red-tipped, awl-shaped, as long as the cylindrical part of the corolla-tube, which is half the length of the funnel-shaped portion; limb flat, 4 in across, the lobes rotund, subacute, almost as long as the tube; corolla-tube 1½ in long, white outside, lobes rosy, throat deeper, almost purple. Brazil. B M. 3976 F S 1.34 shows a yellow-throated form. Var **profùsa,** Rod. (*D profùsa*, Hort), has larger and brighter rosy fls , lined with yellow inside, the outside of the tube rosy except at the base, which is yellow. J H III 57·277. I H 30 491 —Intro. by B S. Williams *D amábilis*, Hort , is said to be a hybrid of *D. crassinoda* and *D. splendens* Lvs short-stalked, oblong, acute· fls. rosy crimson, 4–5 in across; corolla-lobes very round and stiff. Gn 51, p. 227. G. 12 89; 14·461. I H 27·396, shows a 12-fld raceme with exceptionally bright red fls

AAAA *Fls. salmon-colored; throat yellow inside and out.*

uroph̆lla, Hook Glabrous erect bush, not a vine: branches numerous, swollen at the joints: lvs ovate-oblong, obtuse at the base, suddenly narrowed at the apex into a narrow point ¾in long: peduncles long, drooping, flexuose; racemes axillary, 4–6-fld ; calyx-segms awl-shaped, corolla dull yellow outside, deeper and brighter yellow within, tube cylindrical in lower third, then swelling into an almost bell-shaped throat; lobes of the limb salmon inclined to purple, acute. Brazil. B M 4414 P M 16 66 F S 5 425

D amœna, Moore Free-flowering, with good foliage lvs oblong-acuminate fls pink tinted with rose, corolla-lobes rounded and not reflexed Of garden origin (D splendens ×D amabilis), offered abroad F 1868 73 G 6 491, 11 43 —*D Brearleyana*, Hort Lvs. oblong, acute, dark green fls pink at first, changing to rich crimson, very large Gn 51, p 226 F W 1875 161 G 8 92, 12 703. Probably a form of Odontadenia speciosa —*D carissima*, Hort. Fls very large (about 5 in diam), delicate pink lined with bright rose Garden origin G Z 27, p 19 —*D crassinódula*, DC Glabrous: st. much branched, with many nodes lvs lanceolate, acute or almost acuminate, acute at the base, shining and leathery on both sides racemes axillary, about 6-fld , calyx-lobes lanceolate, acuminate, a little shorter than the cylindrical part of the corolla-tube, 2 or 3 times shorter than the pedicel, corolla-tube bell-shaped above the middle, lobes obovate-orbicular Brazil The above is the original description by De Candolle, who adds that the lvs are 3-3½ in long, ½–1 in wide, petiole 2–3 lines long stipules interpetiolar, with 4 short cuspidate teeth The plant pictured in B R 30 64 was renamed D Lindleyi by Lemaire chiefly for its pilose st and stellate-lobed stipules Later authorities refer B R 30 64 to D Martiana F S 22 2310 may be the same plant as B R 30 64, but with variable lvs and stipules The plant was prized for its delicate colors, being white at first, then shot with soft rose like a flame tulip, and finally a deep rose Only 1 fl in a raceme was open at a time, and each lasted 8 or 9 days, throat orange inside — *D exima*, Hemsl Nearly glabrous, twining, nearly glabrous, the st. rose-red lvs opposite, very short-stalked, 1–1½ in long, orbicular-ovate to elliptic fls 6–8 in a cyme, 2½–3 in across, rose-colored, the tube nearly 2 in long, corolla-lobes orbicular and obtusely cuspidate Probably Brazil B M 7720 —*D flávа*, Hook Fls size and color of common yellow allamanda, climbing lvs opposite, short-stalked, ovate to elliptic fls 4–6 in a lax cyme, yellow, the tube very hairy on the outside and suddenly enlarged above Colombia B M 4702 J F 4 373 Sc L rechites, to which this is properly referred —*D Hárrisii*, Hook =Odontadenia speciosa —*D hybrida* Lvs large, stout, bright green fls flaming crimson-red. Garden form G 32 647 —*D illustris*, DC Glabrous or pubescent lvs oblong or rotund, obtuse or nearly acute, rounded or subcordate at the base, many-nerved, stipules none, petiole short racemes terminal, 4–8-fld , fls rosy, throat yellow inside, purple at the mouth, corolla-tube cylindrical to the middle, then funnel-shaped, limb 3–3½in across, lobes rosy, orbicular-ovate, obtuse Brazil F S 3 256 Var *glábra*, Muell Arg B M 7156 —*D insignis*, Hort Stout-growing foliage strong fls rosy purple Of garden origin R H 1904, p 419 G Z 16 145 —*D pastórium*, Hort , var *tenuifólia*, Hook f A very slender tuberous-rooted glabrous twining herb with very narrow (⅛in. or less broad) lvs 2–3 in long, and rose-colored fls 1½ in across and bearing a golden 5-cleft ring at the throat Brazil B M 7725 —*D Sánderi*, Hemsl , has fleshy-colored, fls with throat yellow inside, and outside at the base, has smaller lvs than D illustris, and no circle of purple at the mouth of the fl. Gn. 51 226.

WILHELM MILLER.
L. H. B †

DIPLARRHÈNA (Greek, *two anthers*, the third being imperfect). *Iridàceæ*. Tender rhizomatous plants from Australia and Tasmania, with white and variegated flowers Herbs rhizome short. sts. erect, simple or somewhat branched· lvs mostly radical, narrow, rigid, acuminate, equitant: spathe terminal, rigid, acuminate; perianth without any tube above the ovary; segms unequal, inner ones shorter, connivent; upper stamen imperfect; fls. usually more than 1 to a spathe, not lasting

Morǽa, Labill. Sts. 1½–2 ft. long, with a single terminal cluster, and several sheathing bracts lvs. 6–8 in a tuft, 1–1½ ft long, ¼–½in wide. spathes cylindrical, 2–3-fld , 2 in. long; fls whitish. caps. 1 in. long New S Wales, Victoria, and Tasmania. This species has been offered. The only other species is *D. latifòlia,* Benth. (*D Morœa* var *latifòlia,* Baker), from Tasmania, with longer and broader lvs (nearly 1 in. wide), longer spathes which are 5–6-fld., and fls variegated with lilac and yellow. L. H. B.

DIPLÀZIUM (Greek, *doubled*). *Polypodiàceæ.* Rather large, coarse ferns, of greenhouse culture

Allied to Asplenium, but with the indusia often double, extending along both sides of some of the free veins The dividing line between Diplazium and Asplenium is technical In general appearance and in cultural requirements, the two genera are practically identical —Eighty or more species are found, mostly in the warmer portions of the world

A. *Lvs. simple.*

lánceum, Presl Lvs 6–9 in long, ¾–1 in wide, narrowed upward and downward, the margin mostly entire, sori reaching nearer to the edge than the midrib India, China Japan

AA *Lvs pinnate, with the pinna deeply lobed: rootstock not rising to form a trunk*

arbòreum, Presl (*Asplenium arbòreum,* Linn) Lvs. 12–18 in long, 6–8 in wide, with a distinct auricle or lobe at the base The habit is not arboreous, as originally supposed, and as the name would indicate; quite near the next, but less deeply cut W Indies and Venezuela

Shépherdii, Link (*Asplènium Shépherdii,* Spreng). Lvs 12 18 in long, 6–9 in broad, deeply lobed, the lobes at the base sometimes reaching down to the rachis, somewhat toothed and often ¼in broad; sori long-linear Cuba and Mex to Brazil

AAA *Lvs bipinnate trunk somewhat arborescent*

máximum, C Chr (*D latifòlium,* Moore *Asplènium latifòlium,* Don) St erect, somewhat arborescent: lvs 3–4 ft long, 12–18 in wide, with about 12 pinnæ on either side. India, China and the Philippines

L M Underwood

DIPLOGLÓTTIS (*double-tongued,* referring to the divided scale inside the petals) *Sapindàceæ* Australian tree, one species· *D australis,* Radlk (*D Cunninghamii,* Hook f), mentioned in recent horticultural literature Lvs large (1–2 ft or more), pinnate, more or less villous, lfts 8–12, oblong-elliptic to ovate-lanceolate, sometimes more than 1 ft long· fls greenish, many, in a large panicle, calyx deeply 5-lobed, small, petals about twice as long as calyx (¼in), 4, thin, orbicular, ciliate, about equaled by the 2 inner scales; stamens 8, exserted or included, ovary 3-celled, the style short and incurved, stigma entire or somewhat 3-lobed fr. a nearly globular 3-valved caps., tomentose, about ½in. diam. B.M. 4470 (as *Cupania Cunninghamii*).

DIPLOLÆNA (*double cloak,* in allusion to the double involucre) *Rutàceæ* W. Australian tomentose shrubs, sometimes cult , but apparently not in American trade Lvs simple and entire, stalked, alternate. fls. red from the appearance of the many stamens in the terminal heads which are flower-like and short-peduncled or sessile and surrounded by an involucre of broad bracts in 3 or 4 series of which the inner ones are large and petal-like, calyx wanting; petals 5, small and narrow; disk small; stamens 10, much exserted, the filaments bearded, ovary 5-lobed, the styles united into 1: fr. 2-valved cocci, resulting from the division of the ovary. —About 4 species *D. grandiflòra,* Desf , 5–6 ft , with rigid spreading branches, the ovate or broad-oblong very obtuse lvs. tomentose or hoary on both sides. *D Dampièri,* Desf , distinguished chiefly by the lvs being green and smooth on the upper surface. B.M 4059 B.R 27 64. H.U. 5:42. L. H. B.

DIPLOPÁPPUS: *Aster.*

DIPLOSTÈPHIUM (*double crown* or *pappus*). *Compósitæ* This genus as now defined comprises upward of a dozen species in Venezuela, Colombia and to Peru, probably not in cult , the *D amygdálinum,* Cass , of gardens is *Aster umbellàtus,* Mill , under Gray's treatment, and *Dœllingèria umbellàta,* Nees, of some other authors Dœllingeria differs from Aster proper in its double pappus, the inner bristles long and capillary and the outer short and rigid, involucre-bracts short and lacking herbaceous tips; heads corymbose or solitary, rays rather few, white or rose-tinged. lvs veiny, not stiff (Named for Th. Dœllinger, botanical explorer)

Aster umbellatus is a stout plant (2–7 ft.) of low grounds from Newfoundland to Ga and Ark , variable, and lower forms occurring very leafy, with numerous crowded heads. lvs lanceolate to oblong-lanceolate (to 6 in long), tapering to both ends involucre short, rays white A good plant for the wild garden

L H B

DIPLOTHÈMIUM (Greek, *double sheathed*). *Palmàceæ,* tribe *Cocoíneæ* Spineless pinnate palms, low or stemless, or often with ringed, stout, solitary or fascicled trunks

Leaves terminal, pinnatisect, segms crowded, lanceolate or ensiform, acuminate, glaucous or silvery beneath, margins recurved at the base, midnerve prominent; rachis 2-faced, strongly laterally compressed, petiole concave above, sheath fibrous, open spadices erect, long or short-peduncled, strict, thickish; spathes 2, the lower coriaceous, the upper cymbiform, beaked, ventrally dehiscent, bracts short, coriaceous; fls rather large, cream-colored or yellow, more showy than almost any other palm fr. ovoid or obovoid, small —Species 5 Brazil

Diplothemium is a group of very handsome palms In size the members of this genus seem to vary as much as those included in the Cocos group *D maritimum,* which is found along the coast of Brazil, is but 10 feet in height when fully developed This genus is without spines, the leaves being pinnate, very dark green on the upper side and usually covered with white tomentum on the under side, the pinnæ being clustered along the midrib in most instances In a very young plant of this genus the ultimate character is not at all apparent from the fact that the seedling plants have undivided or simple leaves, this characteristic frequently obtaining in the case of *D caudescens* until the plant is strong enough to produce leaves 4 or 5 feet long or about one and one-half years from germination. Frequently the plant bears both sorts of leaves while young A warm greenhouse, rich soil and a plentiful supply of water are among the chief requisites for the successful culture of diplothemiums. *D caudescens* is the best known of the genus, and when space may be had for its free development it is one of the handsomest palms in cultivation See G C II 24 394 for horticultural account of the group

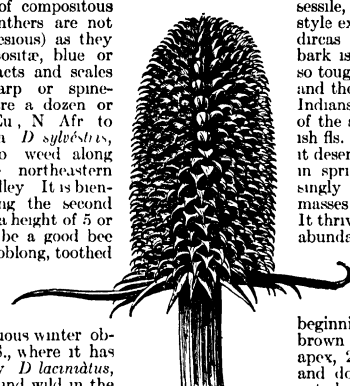
caudéscens, Mart (*Ceróxylon nivèum,* Hort). Wax-Palm. St. 12–20 ft high, 10–12 in thick, remotely ringed, often swollen at the middle. lvs 9–12 ft , short-petioled; segms 70–90 on each side, ensiform, densely waxy white below, the middle ones 24–28 in long, 1¾ in wide, the upper and lower ones shorter and narrower, all obtuse at the apex. Brazil R H 1876, p 235

D littorale, Mart A small graceful palm with finely dissected lvs and very bright yellow fl -clusters making it attractive during the spring months B M 4861 —Hardly in cult in Amer.

Jared G Smith
N. Taylor †

DÍPSACUS (*to thirst*, from the Greek, because the [illegible] of the connate lvs in some species hold water). *Dipsacàceæ*. TEASEL Stout tall biennial or perennial herbs of the Old World, two or three of which are weeds; and one of them is cultivated for fuller's teasels.

The plants are prickly or rough-hairy: lvs opposite, entire, toothed or pinnatifid: fls. small and in dense heads, like those of compositous plants, but the anthers are not united (or syngenesious) as they are in the Compositæ, blue or lilac, involucre-bracts and scales of receptacle sharp or spine-pointed There are a dozen or more species in Eu, N Afr to Abyssinia, and Asia *D sylvéstris*, Huds, is an intro weed along roadsides in the northeastern states and Ohio Valley It is biennial, the st arising the second year and reaching a height of 5 or 6 ft It is said to be a good bee plant Lvs lance-oblong, toothed and more or less prickly on the margin The dead stiff stalks of this teasel are conspicuous winter objects in the E U S., where it has run wild extensively *D lacinàtus*, Linn, has been found wild in the U. S: lvs pinnatifid or bipinnatifid, ciliate The fuller's teasel, *D fullònum*, Linn (Fig 1276), is probably derived from the first, and differs from it chiefly in the very strong and hooked floral scales These scales give the head its value for the teasing or raising the nap on woollen cloth, for which no machinery is so efficient This plant is grown commercially in a limited area in Cent N Y, see Cyclo. Amer Agric, Vol II, p 636 L H B.



1276 Fuller's teasel—Dipsacus fullonum (×½)

DIPTERÒNIA (Greek *dis*, twice and *pteron* wing. the fruit consists of two winged carpels) *Aceràceæ* Ornamental deciduous tree with handsome large pinnate foliage.

Leaves opposite, petioled, odd-pinnate, with 9–15 serrate lfts fls polygamous, small, in large terminal panicles; sepals 5, longer than the short and broad petals; staminate fls with usually 8 stamens and a rudimentary ovary in the center, pistillate fls with a 2-celled compressed ovary, style cylindric with 2 slender recurved stigmas fr consisting of 2 1-seeded compressed nutlets connate only at the base and with the wing extending all around —Two species in Cent. and S. W. China

The species in cultivation is a small tree with handsome foliage, insignificant flowers, but conspicuous winged fruits in large panicles It is apparently not hardy North It grows well in any good soil Propagation is by seeds.

sinénsis, Oliver Tree, to 30 ft · lvs ¾–1½ ft long; lfts 9–15, short-petioled, the upper nearly sessile, the lowest pair sometimes 3-parted, ovate-lanceolate to lanceolate, long-acuminate, coarsely serrate, glabrous or sparingly hairy, 2–4 in. long panicles loose, 6–12 in. long; fls whitish, minute, slender-pedicelled each carpel (samara) of the fr broadly obovate or nearly orbicular, light brown, about 1 in long, with the seed near the middle June, fr in Sept Cent China J H S 28·60. H I 19 1898 ALFRED REHDER.

DÍRCA (*Dirke*, mythological name; also a spring near Thebes). *Thymelæàceæ* LEATHERWOOD. Two North American small early-blooming shrubs, sometimes planted.

Bushes with tough fibrous bark, alternate, thin short entire petiolate deciduous lvs, apetalous perfect fls. in peduncled fascicles of the previous season's growth, the branches developing subsequently from the same nodes calyx corolla-like, yellowish, campanulate, undulately obscurely 4-toothed, bearing twice as many exserted stamens as its lobes (usually 8), ovary nearly sessile, free, 1-loculed, with a single hanging ovule; style exserted, filiform. fr berry-like, oval-oblong. The dircas often have the habit of miniature trees. The bark is of interlaced strong fibers, and branches are so tough and flexible that they may be bent into hoops and thongs without breaking, and were so used by the Indians and early settlers The leatherwood is not one of the showiest of hardy shrubs, but its small yellowish fls. are abundant enough to make it attractive, and it deserves cult especially for the earliness of its bloom in spring It is of slow growth, and when planted singly makes a very shapely specimen, planted in masses or under shade it assumes a straggling habit. It thrives in any moist loam Prop by seeds, which are abundant and germinate readily, also by layers

palústris, Linn LEATHERWOOD MOOSEWOOD WICOPY Fig 1277 Two to 6 ft high, with numerous branches having scars which make them appear as if jointed, at the beginning of each annual growth, and with yellow-brown glabrous twigs lvs oval or obovate, with obtuse apex, 2–3 in long, green and smooth above, whitish and downy below, becoming smooth, the base of the petiole covering buds of the next season fls yellowish, abundant enough to be attractive, nearly sessile, ¼in long, falling as the lvs expand fr hidden by the abundant foliage, egg- or top-shaped, ½in long, reddish, or pale green Woods and thickets, mostly in wet soil Canada to Fla and Mo B R 292 —Common.

D occidentàlis, Gray A similar species found on northerly slopes of cañons in Calif., differs mainly in the deeper calyx-lobes, lower insertion of the stamens, sessile fls, and white involucre, blooms Nov–Feb Not in the trade, but worthy of cult

A. PHELPS WYMAN.

DÌSA (origin of name unknown) *Orchidàceæ* Terrestrial orchids, mostly South African, of which several are known to fanciers, but only one of which is in the American trade

Sepals free, spreading, upper one galeate, produced in a horn or spur at the base, petals inconspicuous, small, adnate to the base of the column —Sixty or more species *D grandiflora* is undoubtedly one of the most beautiful of known orchids, but as yet difficult to manage under artificial conditions

grandiflòra, Linn FLOWER OF THE GODS Root-stock tuberous. sts 1 ft or more high, unbranched: lvs dark green: fls. several, upper sepal hood-like or galeate, 3 in long, rose-color, with branching crimson veins; lateral sepals slightly shorter, brilliant carmine-red; petals and labellum orange, inconspicuous S Afr B M. 4073 G C. II 18·521; III 9 365; 33:37. G M. 54.608 Gt. 59, p. 374 J.H III. 52.339. O R. 6.241; 9 273, 20·336

D crassicórnis, Lindl. Spike few-fld, lateral sepals oblong, the dorsal smaller, reflexed petals, and lip lan-



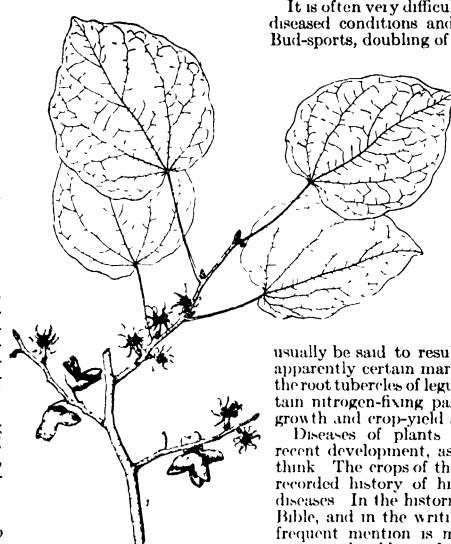
1277 Leatherwood—Dirca palustris. (×½)

ecolate S. Afr. Gn. 73, p 187.—*D. Élwesii*, Hort. A garden hy rid, probably between D kewensis and D Veitchii.—*D equitris*, Reichb f Dorsal sepal funnel-shaped, pale blue, petals white Rhodesia.—*D erubescens*, Rendle Fls large and handsome, somewhat resembling D grandiflora in color Trop Afr.—*D kewénsis*, Hort Hybrid between D grandiflora and D tripetaloides Spike few-fld, fls 1½ in across, lateral sepals rosy pink, the dorsal paler, red-spotted, lip yellowish, crimson-spotted Gt 52 1510 O R 6 24, 9 273, 20 336.—*D longicornu*, Linn f Plant ½-1 ft high, producing a single fl about 2 in long resembling a light blue delphinium S Afr.—*D lugens*, Bolus Spike 10-15-fld, fls dull purple, the lip green, lacerated S Afr B M 8415.—*D Luna*, Hort A garden hybrid between D racemosa and D Veitchii.—*D pulchra*, Sond Spike 6-12 in long, fls rose S Afr G 28 201.—*D racemòsa*, Linn f Racemes 4-9-fld, fls deep rose-red, about 1½ in across S Afr B M 7021 J H III 47 213.—*D sagittàlis*, Swartz Fls in a short raceme, about ¾ in long, pale lilac, the petals and lip red-streaked S Afr B M 7403 G C III 51 312.—*D Veitchii*, Hort Hybrid between D racemosa and D grandiflora Fls about 2½ in across, rose-lilac J H III 43 145 C O 1 O R 6 241, 9 273, 20 336.—*D. venusta*, Bolus A slender species with grass-like lvs. S. Afr

GEORGE V. NASH †

DISÁNTHUS (Greek, *dis*, twice, and *anthos*, flower; the fls being in 2-fld. heads). *Hamamelidàceæ* Ornamental shrub, grown for its handsome foliage, assuming beautiful autumnal tints

Deciduous, glabrous lvs alternate, long-petioled, entire, palmately veined fls perfect, axillary, in pairs on erect peduncles and connate back to back, calyx 5-parted, petals 5, spreading, stamens 5, shorter than sepals, ovary superior, with 2 short styles fr a dehiscent caps with several black glossy seeds in each cell.—One species in Japan Hardy ornamental shrub of elegant habit, with distinct, handsome foliage, turning to a beautiful claret-red or red and orange in fall Prop by seeds, germinating the second or third year, and by layers, possibly also by grafting on Hamamelis.



1278. Disanthus cercidifolius. (×⅓)

cercidifòlius, Maxim Fig 1278 Shrub, to 10 ft., with slender branches lvs roundish-ovate, obtuse or acutish, truncate or cordate at the base, leathery at maturity, dark bluish green above, paler below, 2–4 in long fls. dark purple, about ¾ in across, with linear-lanceolate petals Oct fr ripens the following Oct High Mountains of Cent Japan G F. 6 215 (adapted in Fig 1278). R H 1910.363 Demands a light peaty soil.

ALFRED REHDER

DISEASES AND INSECTS. Under one head it is thought best to bring together the discussions of the so-called enemies of plants,—the parasitic fungi and the depredating insects, together with the means of control. This composite article therefore comprises

	Page
Diseases due to parasitic fungi	1021
Fungicides, or remedies for these diseases	1027
Catalogue of diseases, with advice	1029
Insects and their depredations on plants	1034
Insecticides and fumigation	1042
Catalogue of insect depredators, with advice	1047
Spraying.	1057

The reader now has before him a comprehensive survey of the subject It is impossible, of course, to list all the plant diseases and all the insect pests in a compilation of this kind, but it is desired that the catalogues shall comprise the most important depredators of the leading horticultural plants The reader should keep himself informed of the new knowledge and new practice by consulting current publications of the government and the experiment stations

Diseases of plants.

Disease in plants may be defined as any derangement or disorganization of the normal structure or physiological functions of the plant, as for example the formation of galls, cankers or distortions, rotting of plant parts, or disturbances in the sap system resulting in wilting, or in the nutritive processes resulting in such symptoms as dwarfing, chlorosis, and the like. Forms of plant diseases are shown in Figs 1279–1292.

It is often very difficult to distinguish clearly between diseased conditions and abnormalities of other types Bud-sports, doubling of blossoms, fasciations and many other similar abnormalities, while often the result of reaction to some pathogen, are not apparently always so and they are often spoken of as teratological phenomena. While the reaction of plants to insect attacks in the formation of galls, cankers, and so on, is to be regarded as symptom of disease, the injuries produced by the mere eating away of parts of leaf, stem or fruit are not usually so to be regarded Even here, however, it is often difficult to draw a sharp line of demarkation While disease may usually be said to result in ultimate injury, there are apparently certain marked exceptions, as in the case of the root tubercles of legumes caused by the attacks of certain nitrogen-fixing parasitic bacteria Here increased growth and crop-yield are generally held to result

Diseases of plants are not something new or of recent development, as the grower is often inclined to think The crops of the husbandman, from the earliest recorded history of his art, have been afflicted with diseases In the historical writings of the Hebrews, the Bible, and in the writings of the Greeks and Romans, frequent mention is made of such diseases as rusts, smuts and mildews of grain and canker of trees To be sure, the extensive and intensive crop-cultivation of modern times, together with the extraordinary world-wide transportation and exchange of crop-products, have greatly favored the distribution of plant pathogens (insects, fungi and bacteria), and afford them exceptional opportunities for destructive development Nor are cultivated plants alone subject to disease Disease epidemics among weeds and the wild flowers of the woods may be observed any season in localities in which weather conditions especially favor the causal organisms

The study of the nature and control of plant diseases, however, is of recent development The first man really to study plant diseases from the true modern economic point of view, that is, with the object of helping the grower to understand and combat or control diseases in his crops, was Julius Kuhn This German, the son of a German land-owner and for many years himself the manager of a large agricultural estate, was the founder of an early German agricultural college He interested himself, among other phases of agriculture, in plant diseases and their control and his

book, "Die Krankheit der Kulturgewachse," published in 1858, is to be regarded as the first book of real economic importance on the subject of diseases in plants. In this remarkable volume is given a concise statement of the thoroughly digested and personally tested knowledge of his time, on the nature and control of plant diseases. He also describes a number of new methods, especially for seed treatment of cereals against smuts, which have become the foundation for many of our present-day practices.

Since Kuhn's day there have been remarkable developments in the control of plant diseases. The discovery of bordeaux mixture by the Frenchman Millardet in 1882; the discovery of the formaldehyde treatment of seed for smut by the American plant pathologist, Arthur, in 1896; and the recent development of the use of lime-sulfur solutions and mixtures as a substitute for bordeaux in the spraying of apples and peaches, are but the most noteworthy of the many discoveries and developments in the remarkable growth of this economic science within the last half century.

The economic importance of plant diseases can scarcely be overestimated, as they constitute one of the chief losses in our agricultural resources. The loss from 5 to 25 per cent of many crops from diseases alone each year is so common as to be the general rule. The loss from potato diseases each season in the United States has been carefully estimated at not less than $36,000,000. Yet, it has been conclusively demonstrated by extensive experiments among potato-growers during a continuous period of ten years, that an annual average increase of over forty bushels per acre may be expected from spraying the crop with bordeaux mixture, from three to five times in the season at a total average cost of about $5 per acre. The loss from oat-smut commonly averages from 5 to 25 per cent of the crop, yet it may be absolutely prevented by seed treatment at almost insignificant cost. The loss from scab in the apple crop of New York State often totals not less than $3,000,000 and for the United States a corresponding loss of over $40,000,000. In 1900, the peach-growers of Georgia lost $5,000,000 by brown rot, while the average annual loss from the same disease in the entire United States is never less. Yet in each case here mentioned, as well as in most of the other of our common and destructive diseases, cheap and effective means of control are within the reach of every grower.

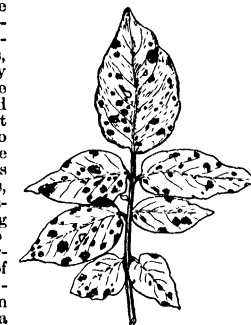


1279 Effects of the leaf-curl fungus on peach foliage. (×½)

The value and efficiency of these means have been established beyond doubt. Their profitable application requires only intelligence and practice on the part of the grower.

Symptoms of disease in plants are so varied in character as to make an attempt at wholly satisfactory grouping for practical purposes of doubtful value. Mention of some of the more common types, however, may be useful. The grower must learn by study and experience the more striking symptoms characteristic of those diseases peculiar to the crops that he grows.

Disease may be exhibited in malformations of the leaf, stem, root or fruit, as for example, knots, galls, tubercles, curling, wrinkling or other distortions. There are such symptoms in crown-gall of trees, black-knot of plums and cherries and leaf-curl of the peach (Fig. 1279). Another type are cankers, dead sunken or roughened areas in the bark of trees or the outer rind of herbaceous stems, as for example in the New York apple-tree canker, the brown-rot canker of peaches, frost cankers of many trees, and anthracnose of beans, melons, and others. The blight type of lesion is also very common. Here are the more or less sudden death of leaves, stems, shoots or blossoms, usually turning dark and drying up. Such symptoms characterize fire-blight of fruit trees, potato-blight (Fig. 1280, from Vt. Sta.), alternaria blight of ginseng and similar diseases, especially in their last stages. The leaf- or fruit-spot type is also very common. Brown or black spots appear in foliage or fruit. They may be brown dead or rotted areas, or spots due to the growth of the parasite on or under the surface. Bordeaux-injury spots on apple foliage, shot-hole leaf injury of stone fruits, leaf-spot of the currant (Fig. 1281), celery or alfalfa, the tar-spot of the maple, the black-spot of the rose and the apple-scab are of this type. Another not uncommon type is that exhibited in certain bacterial and fungous diseases, where the pathogen infests the sap-tube regions of the stems or petioles, resulting in a sudden wilting of leaves and shoots. The wilt diseases of cotton, cucumber, ginseng, watermelon and cowpeas are characterized by this symptom. The yellowing of the foliage, either suffused or localized as spots, rings, and blotches and often accompanied by dwarfing and wrinkling of the affected organs is a common symptom of certain so-called physiological diseases like the peach yellows (Figs. 1282, 1283), little-peach, mosaic disease of tobacco, infectious chlorosis and nitrogen-poisoning of greenhouse cucumbers (Fig. 1284) and other plants.



1280 Early blight of potato.

The causes of disease in plants.

Etiology, or the cause of disease, has been more generally and carefully investigated than any other phase of the subject, so that we now know much regarding the agents primarily responsible for most plant diseases. These agents may be grouped as follows.

Slime molds, lowly organisms having characters of both plants and animals (see article *Fungi*). The club-root of cabbage, cauliflower and other crucifers, is the best known slime-mold disease.

Bacteria, microscopic unicellular plants which multiply very rapidly by simple fusion (see article *Fungi*). While most species are harmless scavengers of dead organic matter, and a few are known to cause diseases of men and animals, not less than 150 different diseases of plants are now known to be due to the attacks of parasitic bacteria. Some of the commonest bacterial diseases of plants are, fire-blight, crown-gall, olive-knot, soft-rot of vegetables, potato-scab, cucumber-wilt and black-leg of potatoes.

Fungi (see Vol. III) are perhaps responsible for far the greater number of the diseases of plants. They are the causal agents in such well-known diseases as apple-scab, brown-rot of plums and peaches (Fig. 1285), black-rot of grapes, (Fig. 1286) bitter-rot of apples, brown-rot of lemons, late blight of potatoes, peach-

leaf-curl, heart-rot and canker of trees, mildew of many plants, rusts and smuts of cereals (Figs. 1287, 1288, Kansas Experiment Station); in fact the mere enumeration of the more common fungous diseases of plants would fill many columns in this volume

Algæ, low forms of green plants, most of them living in water or very damp places. Few are known to pro-



1281 Currant foliage attacked by the leaf-spot fungus. (×½)

duce disease in plants The red rust of tea is one of the best known algal diseases

Parasitic angiosperms,—flowering plants, of which there is no inconsiderable number, causing more or less injury to the plants upon which they live These parasites are usually markedly degenerate in one or more respects, as a result of their parasitism, being often without true roots, or without leaves and frequently without chlorophyl green As examples we may mention the mistletoes, dodders and broom rapes

Insects (see page 1034) cause such diseases as galls and similar malformations

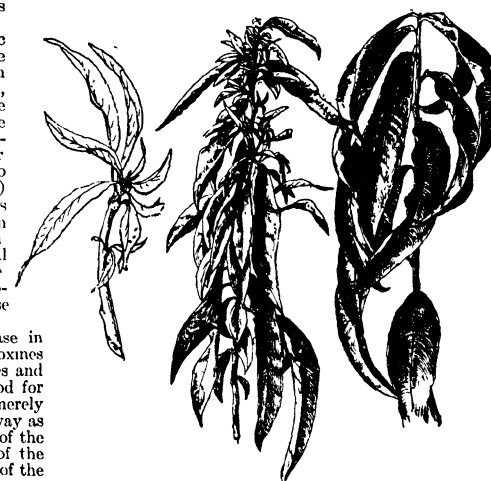
Nematode worms,—minute all but microscopic in size and multiplying rapidly, they constitute one of the greatest crop pests, especially in warm or tropical countries They usually infest the roots, causing galls or swellings Some species injure the plants by destroying the fine feeding roots as in the case of the nematode parasites of oats so destructive in certain countries of northern Europe. Over 400 different plants are known to be subject to the nematode root-gall disease (See pp 1041–2)

Physiological disease is a term under which is included all those diseases the cause of which cannot be attributed to some parasitic organism Their origin is variously attributed to abnormal enzymic activity, disturbed nutrition, and the like The best-known of these are peach-yellows, chlorosis of the vine, tip-burn (Fig. 1291), mosaic disease of tobacco and leaf-roll disease of potatoes.

The various parasitic organisms cause disease in one of two ways, either by the secretion of toxines and enzymes which at once kill the plant tissues and change them into forms readily available as food for the invader; or the toxins and enzymes secreted merely stimulate or irritate the plant tissues in such a way as to result in abnormal tissue growth or diversion of the food substances of the host to the advantage of the parasite making its home between or in the cells of the host Both types of disease-production have the same ultimate result, the serious injury or destruction of the infested plant, although the former is usually the more rapid and destructive Of the first type, rots, blights and leaf-spots are the best examples, and are characterized by the rapid death and destruction of the affected tissues, of the second type, galls, leaf-curls, rusts and smuts are good examples and are characterized by a rather long period of association of the parasite with the living tissues of its host before marked injury or death of the plant results

The causal agent is usually associated with the tissues of the host, either the dead or living, during its entire cycle of development The apple-scab pathogen, *Venturia inæqualis*, will serve admirably to illustrate. It passes the summer on the surface of leaf and fruit. In the autumn when the infested leaves fall to the ground, the fungus, which as a parasite has invaded only the cuticle of the leaf or fruit, now penetrates the dead tissues and develops there during the autumn the winter form of fruit bodies, the minute globose black perithecia, in which during the warm days of early spring the ascospores are rapidly developed These ascospores (Fig 1292), eight in a sac, ripen and are discharged by the spring rains that come during the blossoming period The old leaves on the ground are filled with millions of these minute perithecia with many sacs of ascospores in each perithecium. The spores are shot into the air during the rain and being exceedingly light are carried to the opening leaves and forming fruits, where they germinate, sending out mycelial threads into the cuticle of leaf or fruit forming the characteristic dense dark green or black mats or crusts, the scab-spots The leaves become crumpled and injured, the young fruits grow one-sided, or if the stem be attacked, soon drop from the tree, thus giving no set of fruit On the scab-spots the conidia or summer spores cut off from the tips of upright branches in great numbers, are carried by the wind to other leaves and fruits where, with the next rain, they germinate and give rise to new scab-spots and more conidia

The life-cycle as given for the apple-scab fungus is typical of many of the fungous pathogens of our crops. It must be remembered, however, that each pathogen has habits peculiar to itself; hence the necessity for the most careful study of each that we may know its habits and peculiarities and thus be able successfully to



1282. "Tip growth" of yellows

Left-hand specimen shows two small-leaved tips appearing in October, two or three of the normal leaves still remaining near the top The middle specimen shows numerous tips appearing in August. Right-hand specimen is a healthy twig, for comparison

combat it. The following illustrations will serve to explain and impress this point

Plowrightia morbosa, the fungus causing black-knot of plums and cherries, requires two seasons to complete its life-cycle. The first season there appears on the knots only conidia, followed the second season by a crop of ascospores, produced in perithecia, which form a black crust on the surface where the conidia were earlier produced Other pathogens like *Exoascus cerasi*, the "witches broom" pathogen of the cherry, lives from year to year as mycelium in the branch and twigs of the broom-like growths it excites, producing each season a crop of spores on the under sides of the leaves. The blister-rust fungus of the white pine, *Cronartium ribicolum*, also lives from season to season



1283. The tufted shoots of peach yellows.

in the tissues of the pine, producing each spring a new crop of spores This pathogen exhibits another habit peculiar chiefly to certain of the rust fungi, namely that it has another stage or spore form on an entirely different host plant, in this case, the currant, especially the European black currant The apple-rust pathogen, *Gymnosporangium macropus*, exhibits the same habit, passing the winter in galls formed on the twigs of the red cedar. In the spring spores appear on these galls, which germinating in situ give rise to other minute spore bodies, the sporidia. These sporidia are carried by the wind to the young apple leaves and fruit, giving rise there to the rust disease so destructive to certain varieties like the McIntosh and York Imperial. The spores formed on the rusted leaves and fruit of the apple are carried to the cedar, originating a new crop of galls and thus completing the life-cycle.

While some pathogens may develop in both living and dead tissues of their host, as we have seen in the case of the apple-scab fungus, other pathogens like the rust organism just described or the potato-blight pathogen, *Phytophthora infestans*, require to be constantly associated with the living tissues of their host The last-mentioned fungus passes the winter as mycelium in the tissues of diseased tubers, grows from thence up through the new shoots, slowly killing them and forming thereon the first crop of conidia, which, carried by the wind to nearby healthy plants, produce the primary infections of the season. The successive crops of conidia produced during the season on the blighted tops are washed into the soil by the rains, find their way to the newly formed tubers, and, infecting them, complete the seasonal cycle of the parasite

Many fungous pathogens are now known to pass from one generation of the host plant to the next through the seed The smut parasites of cereals afford remarkable examples of this habit In the case of the oat-smut fungus, *Ustilago avenæ*, the spores ripen as dusty black masses in the panicles of affected plants just as the healthy plants are in blossom At this time the two hulls inclosing the grain are open The wind-scattered spores lodge in the open flowers against the young kernel where they are soon safely housed by the closing hulls They lie dormant along with the ripened seeds until they are planted. Then as the oat kernels germinate, the smut spores do likewise, sending forth their germ tubes which penetrate the young oat sprouts before they emerge from the hull The mycelium grows along up through the growing oat straw, finally giving rise to the black spore masses in the unfolding panicle. In the case of stinking smut of wheat the seasonal life-cycle of the pathogen, *Tilletia tritici*, is much the same, except that the spores are disseminated at threshing time. Some very important differences in the habits of the loose smut pathogens of wheat, *Ustilago tritici* and of barley, *Ustilago nuda*, have recently been discovered (1902). The spores of these pathogens are also ripened and disseminated at blossoming time, but on falling within the open blossom they germinate at once, sending their germ-tubes into the tender young kernels The affected kernels are apparently not injured but continue to develop and ripen The mycelium of the pathogen within remains dormant until the seeds are planted and begin to grow, at which time the mycelium also becomes active It grows out into the young shoots and up through the lengthening culms eventually to give rise to the black spore masses of the smutted heads The bean anthracnose fungus, *Colletotrichum lindemuthianum*, is also carried over in the seed Here the fungus in the black spots or cankers on the pods penetrates into the tender cotyledons of the seed within, goes into a dormant condition as the seed ripens, to become active again when the germinating seed lifts these cotyledons from the soil. A new crop of spores is produced, which, if the season be rainy, are splattered on to the stems and leaves of nearby healthy plants and the pathogen becomes established for another season.

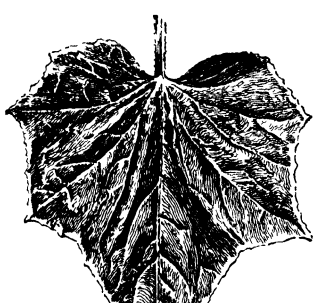
While the wind is the most common disseminating agent of fungus spores, often carrying them for great distances, such agents as rain, flowing water, insects and even man himself, are frequently responsible. It is in the dissemination of bacterial pathogens, however, that insects most generally function. The dreaded fire-blight bacteria are disseminated only by insects or man They pass the winter in a semi-active state in the half-living tissues along the margins of cankers on limbs or twigs, multiply rapidly with the rise of sap and the heat of spring They ooze from the affected bark in sticky, milky drops. This ooze is visited by bees and flies, which with besmeared legs and mouthparts fly away to visit the opening apple or pear blossoms Here they leave some of the bacteria in the nectar where they rapidly multiply, to be more widely distributed by each succeeding visitor They soon pene-

trate into the tender tissues of the blossom, causing the blossom blight. From these blighted blossoms, sucking insects like the aphids carry the bacteria to the tips of the rapidly growing shoots when in sucking sap they introduce the organisms and twig blight follows. The striped cucumber beetle is probably the chief disseminator of *Bacillus tracheiphilus*, which causes the cucumber-wilt.

Ecological conditions as affecting disease.

By ecology is meant the influence of such environmental factors as climate, weather, soil and fertilizers, on the disease, its severity, epidemic occurrence, and the like. These factors may influence the severity of the disease by their effect on either the pathogen or the host, or both For example, most fungous parasites require the presence of water on the host plant in which their spores may germinate, hence severe epidemics of such diseases as potato-blight, apple-scab, brown-rot of stone fruits and black-rot of grapes usually appear in wet seasons. Moreover, the attacking pathogen is especially favored by wet weather at certain seasons or periods in its development, especially the infection period Continued spring rains about blossoming time favor apple-scab and peach leaf-curl. Late summer rains bring with them epidemics of late blight of potatoes, brown-rot of peaches or late infections of apple-scab. Frequent or continuous rains during June and July in grape regions are usually accompanied by severe attacks of the black-rot pathogen The relation of rainfall to the pathogen explains why, when there has been a severe epidemic the previous season, the crop may escape if the following season be dry. There is ever a critical period in the development of the pathogen, usually when it is passing from its resting or winter stage to the active vegetative period of the growing season Moisture and temperature conditions at such periods largely determine whether the disease will be epidemic or not Of course the necessary abundance of spores to be disseminated is an evident necessity. Favorable weather alone cannot bring on disease as the grower too often believes

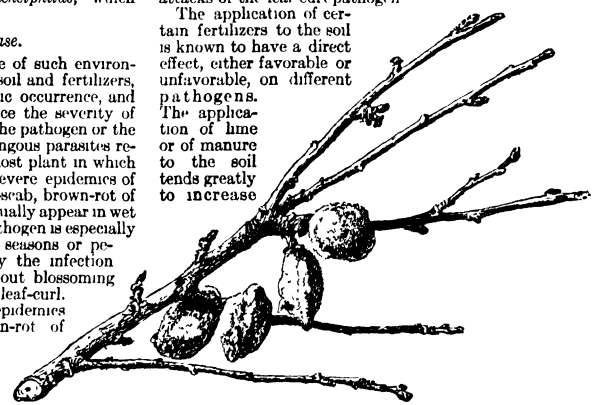
The absence of rains at certain stages in their development is for other pathogens equally essential The loose smuts of cereals afford good examples Their spores are powdery and wind-borne and if rains fall when they are being disseminated, they are washed to the ground and perish instead of finding their way into the open blossoms of their host. Thus, clear sunny weather during the blossoming period of wheat and oats one season usually means a more or less severe epidemic of smuts the next, while rains at this time, even though there be an abundance of the disease, may mean a clean crop the following year



1284. Disease of cucumber leaf. The dying margin indicates that the trouble is due to some interference with the food supply. (×½)

On the other hand, weather conditions may determine the severity or absence of certain diseases by its effect on the host Long-continued cold rainy weather in the spring, especially following a warm spell, results in a slow succulent growth of the developing peach leaves, rendering them especially susceptible to the attacks of the leaf-curl pathogen

The application of certain fertilizers to the soil is known to have a direct effect, either favorable or unfavorable, on different pathogens. The application of lime or of manure to the soil tends greatly to increase the scab of potatoes planted thereon; while, on the other hand, liming the soil prevents infection of cabbage and cauliflower by the club-root pathogen Lime likewise favors the development of the root-rot of tobacco and ginseng caused by *Thielavia basicola*, while applications of acid phosphate tend to prevent infection by this pathogen The effect of fertilizers on the susceptibility of the host has also been shown to be marked in certain cases Barley, when fertilized with nitrogenous manures, becomes very susceptible to attacks of the mildew *Erysiphe graminis*. Certain varieties of wheat have been observed in Denmark to suffer severely from attacks of the rust *Puccinia glumarum* only when nitrogenous manures are applied. Excessive applications of barnyard manure to greenhouse cucumbers often cause a physiological disease, the symptoms of which are a curling, and dying of the margins of the leaves, accompanied by marked chlorosis or yellowing Fertilizers or late continued cultivation of pear trees, by lengthening the period of active twig-growth, favor fire-blight, the bacteria of which infect only tender actively growing tissues.



1285. Peaches of last year's crop still hanging on the tree, attacked by monilia. The branch is dead from the effects of the fungus. (×½)

Control of diseases

By the term control is meant the profitable reduction of the losses ordinarily sustained from a given disease The absolute prevention of many plant diseases is either impossible or unprofitable.

There are four fundamental principles upon which all methods of plant-disease control are based, viz.: (1) *exclusion*, (2) *eradication*, (3) *protection* and (4) *immunization* Upon the first two are based those measures which are directed primarily against the pathogen, upon the last two those which are directed merely toward the protection of the host from pathogens commonly present in the environment The order in which these principles are here presented represent the logical, though unfortunately not the historical or usual order of their development and application. We will consider briefly under each some of the more important methods now employed for the control of plant diseases

1. *Exclusion* measures are directed toward keeping disease organisms, usually insects, fungi and bacteria, out of areas, regions or countries in which they do not occur. This is commonly attempted by the passing of laws forbidding the importation of plants affected with such parasites As means of enforcing such regulations, some sort of inspection, either at port of entry or at point of destination, is provided. Inspection in the country from which they are exported is also often required. Absolute quarantine against all importation of certain plants from those countries in which dangerous diseases are known to occur is also being practised in some countries, as, for example, prohibiting the importation of potatoes into the United States from those countries in which the black-scab is now known to occur Exclusion measures, often undertaken when it is too late, are at best under present conditions of doubtful efficiency Those interested in these methods of control should consult the various pest and disease acts of the different countries of the world See *Inspection*, in Vol. III.



1286 Grapes ruined by black-rot.

2 *Eradication* —On the principle of eradication are based those measures which are directed to the elimination of pathogens already established While absolute eradication is seldom to be effected, the pathogen may often be eliminated to such an extent as to reduce losses therefrom to a profitable minimum In Denmark, the destruction of all barberry bushes, the alternate host of the grain-rust fungus, *Puccinia graminis*, has decidedly reduced the severity of this disease in recent years The careful eradication of all diseased plants is often quite effective even in a small area, like a raspberry or blackberry plantation suffering from the red rust Here the mycelium of the pathogen lives from year to year in the roots of diseased plants, which each spring send up diseased shoots On the under side of the leaves of these shoots, the orange-red spores are produced in great abundance, and serve to spread the pathogen to healthy plants As diseased plants are readily detected in early spring by the pale clustered shoots, they may be removed before spores appear and the pathogen thus eradicated. The black-knot of plums and cherries is most readily and profitably controlled in a similar manner, the knot-affected limbs and twigs being cut out and burned early in the spring before spores appear. The fire-blight of pears is to be controlled only by systematic eradication, first of all cankers in autumn or early spring, then of all blossom blight as fast as it appears and later of the affected twigs when twig-blight comes on. To be effective, the trees must be inspected two or three times each week throughout the growing season and all diseased parts removed *at once* as soon as discovered



1287. Smut of oats.

Another method of eradication especially applicable to seeds, tubers or bulbs, on which spores of the pathogen pass the dormant period, is disinfection. This is accomplished by the application of chemical poisons, either in solution, as powder or as gas, at a strength and for a period of time sufficient to destroy the pathogen without injury to the host When the pathogen lives over as mycelium in the seed or tuber, the application of heat is sometimes effective Formaldehyde, as a gas or in solution in water, is now generally employed for the eradication of the smut of oats, the stinking smut of wheat and the potato-scab (For details of method, see *Formaldehyde*, p 1028). The spraying of peach trees with copper-sulfate solution, lime-sulfur solution or bordeaux, just before the buds start in the spring, disinfects the trees by destroying the spores of the leaf-curl fungus which pass the winter on the buds



1288. Loose smut of barley.

Pathogens which attack the underground parts of plants may sometimes be eradicated by disinfection of the soil before planting Drenching the soil with a formaldehyde solution of a strength sufficient to distribute one gallon of the strong 10 per cent solution to each 100 square feet of surface, wetting the soil to a depth of 6 to 8 inches, has been found to be very effective against damping-off, root-rot and similar diseases in forest tree seed-beds, ginseng seed-beds and in the benches in greenhouses. It is also often effective in the eradication of nematodes in greenhouses. Steaming of the soil is also very effective, destroying insects and weed seeds as well as pathogenic fungi. It is not always conveniently applied.

3. *Protection* measures are to be employed in those regions in which the pathogen is very generally and very thoroughly established, or in which for one reason or another eradication is impossible or unprofitable. They aim to protect the crop against attacks of the parasite by means of some external barrier Spraying is the most commonly employed protective measure. In spraying, the susceptible surfaces of the plant are coated with some slowly soluble poison, known as a fungicide. Fungicides are of various types They are applied in suspension in water, in solution or dry, *i e*, in the form of a fine impalpable powder The fungicide most generally applied in liquid spraying is bordeaux, a colloidal compound formed by the union of lime-milk and copper-sulfate solution Minute blue gelatinous

membranes are formed which remain for a time suspended in the liquid. When sprayed upon the plants the water soon evaporates, leaving a coating of these dried membranes. The active fungicidal principal in these bordeaux membranes is the copper. When leaves or fruit are rewetted by rains enough of the copper in these membranes comes into solution to prevent the germination of the spores of the parasite that may have been deposited thereon. (See under *Bordeaux*, p. 1028.)

Bordeaux, however, is sometimes injurious to such plants as peaches, plums and apples, and has, within the last few years, been largely replaced as a summer spray, especially for apples. Lime-sulfur, unlike bordeaux, is a solution. It is made by boiling together in water, lime and sulfur. A concentrated solution of certain poly-sulfides of calcium, chiefly penta- and tetra-sulfide, is thus obtained which, when properly diluted is applied in the same way as the bordeaux. (For method of preparation, see *Lime-sulfur*, p. 1028). When this solution dries on the leaves and fruit, it is rapidly converted by the action of the atmosphere into other calcium compounds and free sulfur. The sulfur is in a very finely divided state and is the active principal of lime-sulfur. It becomes oxidized in the presence of moisture probably as sulfuric or sulfurous acid, which prevents the germination of the spores of the pathogen. Flowers of sulfur and sulfur-flour, when very finely ground and applied dry by dusting or sprayed on in suspension in water, alone or with lime-milk (the so-called self-boiled lime-sulfur) are also quite effective against certain diseases. Dusting with sulfur is employed in combating powdery mildews of grapes, hops, roses and the rust of asparagus.

Lime-sulfur may not be used on potatoes and grapes, as it dwarfs the plants and reduces the yield, while bordeaux has just the opposite effect on these crops. Bordeaux, as already pointed out, is, however, injurious to leaves and fruit of the apple and to the foliage of peaches and certain varieties of plums. It will thus be seen that there is no universal fungicide and also that both the effect on the host and on the parasite must be considered. It is now known for example that while lime-sulfur is very effective against the apple-scab fungus, it has little fungicidal effect on the spores of the bitter-rot pathogen.

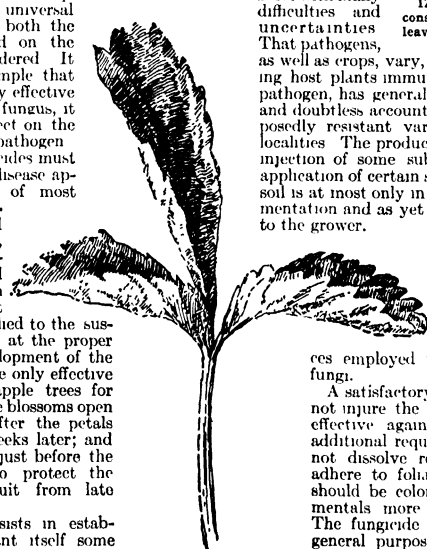
To be effective, fungicides must be applied before the disease appears. As the spores of most parasitic fungi germinate during the period of rainy cloudy weather, the fungicide, to be effective, must be applied *before* and not after such periods. They must not only be thoroughly applied to the susceptible parts but also at the proper stage of growth or development of the plant. To illustrate: the only effective periods for spraying apple trees for scab are just before the blossoms open (not dormant); just after the petals fall; ten days or two weeks later; and again in late summer just before the late summer rains, to protect the rapidly developing fruit from late infection.

4 *Immunization* consists in establishing within the plant itself some condition which renders it immune or resistant to the attacks of the pathogens. Immune crops may be developed by selection and propagation of individuals naturally immune, whose immunity has been evidenced by their coming through an epidemic unscathed. Immune varieties may be crossed with susceptible ones having other especially desirable qualities and then by segregation and propagation strains of the crop may be developed combining the resistance or immunity of the one parent with the desirable qualities of the other. Some striking results have been obtained in this line of disease control as witness the wilt-resistant cotton, cowpeas and watermelon, the nematode-free Iron cowpea, rust-resistant wheat, barley, and asparagus, and the anthracnose-resistant clover. Nevertheless, this method of control, while the most ideal, is beset with many difficulties and uncertainties. That pathogens, as well as crops, vary, giving strains capable of attacking host plants immune to other strains of the same pathogen, has generally been overlooked by breeders, and doubtless accounts for the frequent failure of supposedly resistant varieties when transferred to new localities. The production of artificial immunity by the injection of some substance into the plant or by the application of certain substances (fertilizers, etc.) to the soil is at most only in the preliminary stages of experimentation and as yet offers but little of practical value to the grower.

H. H. WHETZEL.



1290. A blight of grapes due to some constitutional disorder. Notice that the leaves die first at the edges. (×⅓)



1289. Strawberry leaf rolled up from the attack of the mildew

Fungicides.

A fungicide is any material or substance that kills fungi or their spores. The word is used particularly for those substances employed in the warfare against parasitic fungi.

A satisfactory fungicide must be one that does not injure the plants and at the same time is effective against the parasite. For spraying, additional requirements are imposed. It should not dissolve readily in rain-water; it should adhere to foliage and fruit, in some cases it should be colorless in order not to make ornamentals more unsightly than when diseased. The fungicide which has been used most for general purposes is bordeaux mixture. Lately some other preparations, particularly lime-sulfur combinations, have come into use, and in many cases are supplanting bordeaux. There are in

addition a large number of other substances which have fungicidal value and are in more limited use for specific cases. The following directions are taken, with modifications, from the author's part in Bailey's "Farm and Garden Rule-Book."



1291. Tip-burn of potato leaf.—A physiological difficulty or disease, due to some so-called "constitutional" disorder or obstruction (Vermont Experiment Station).

Practices.

Destroying affected parts.—It is important that all affected parts should be removed and burned, if possible. In the fall all leaves and fruit that have been attacked by fungi should be raked up and burned. Diseased branches should be severed at some distance below the lowest visible point of attack. Fungous diseases often spread rapidly, and prompt action is usually necessary. Practise clean and tidy culture.

Rotation of crops.—This is one of the most effective and practical means of heading off fungous diseases. It is especially applicable to diseases of roots or root-crops, but also to many other diseases of annual plants.

Sterilizing by steam.—This is an effective fungicidal practice for several soil-inhabiting organisms which attack roots and stems. This includes nematode worms. It is especially applicable in the greenhouse, where it may be applied (*a*) through sub-irrigation tile or through specially laid perforated steam pipes in the bottom of the bed. Cover the beds with blankets, introduce steam under pressure of forty to eighty pounds for two hours. Insert thermometers at various places to see that the soil is being uniformly heated. (*b*) A large galvanized iron tight box may be constructed with finely perforated trays 4 to 6 inches in depth. Soil placed in these trays and steamed for two hours as above will be freed from parasitic organisms. In this case the frames should be sprayed with a solution of formaldehyde, one pint in twelve gallons of water. Steam sterilization of soil may be used on intensively cultivated areas or extensive seed-beds. A portable boiler is necessary. The beds are sterilized after they have been prepared for seed, and just before the seed is sown. A galvanized pan of convenient dimensions and 6 to 8 inches deep is inverted, and the edges are pushed down into the soil 1 or 2 inches. The pan is connected with the steam boiler by means of a steam hose and live steam is run into the pan from twenty to forty minutes under a pressure of eighty pounds and up. The higher the pressure the deeper the soil will be sterilized. The pan must be weighted. Paths should be disinfected by spraying with copper sulfate one pound to fifty gallons of water or with formaldehyde solution one pint to twelve gallons of water. The cost of sterilizing is approximately three-fourths of a cent the square foot. It should be noted that soil-sterilization has an invigorating effect on many plants, and it will be necessary to run greenhouses at a lower temperature (6° to 10°) both night and day. Field-sterilization also kills weed seeds, and with the reduction of the cost of weeding makes the process practicable.

Substances

Bordeaux mixture.—A bluish green copper compound that settles out when freshly slaked lime and a solution of copper sulfate (blue-stone) are mixed. Many formulas have been recommended and used. The 5-5-50 formula may be regarded as standard. In such a formula the first figure refers to the number of pounds of copper sulfate, the second to the stone or hydrated lime, and the third to the number of gallons of water. Bordeaux must often be used as weak as 2-2-50, on account of injury to some plants.

To make fifty gallons of bordeaux mixture, proceed as follows:

(1) Pulverize five pounds of copper sulfate (blue vitriol), place in a glass, wooden, or brass vessel, and add two or three gallons of hot water. In another vessel slake five pounds of quicklime in a small amount of water. When the copper sulfate is all dissolved, pour into a barrel and add water to make forty or forty-five gallons. Now strain the lime into this, using a sieve fifty meshes to the inch or a piece of cheese-cloth supported by ordinary screening. Stir thoroughly, and add water to the fifty-gallon mark. The flocculent substance which settles is the effective fungicide. Always stir vigorously before filling the sprayer. Never add the strong lime to strong vitriol. Always add a large amount of water to one or the other first. Blue vitriol used alone would not only wash off quickly in a rain, but cause a severe burning of fruit and foliage. Lime is added to neutralize this burning effect of the copper. If the lime were absolutely pure, only slightly more than one pound would be required to neutralize this burning effect. For many purposes an excess of lime is not objectionable and may be desirable. For nearly ripe fruit and ornamentals an excess of lime augments spotting. In such cases the least amount of lime possible should be used. Determine this by applying the cyanide test. (2)

(2) Secure from the druggist 10 cents' worth of potassium ferrocyanide (yellow prussiate of potash) and dissolve it in water in an eight-ounce bottle. Cut a V-shaped slit in one side of the cork, so that a few drops of the liquid can be obtained. Now proceed as before. Add lime with constant stirring until a drop of the ferrocyanide ceases to give a reddish-brown color.

(3) When bordeaux mixture is desired in large quantities, stock solutions should be made. Place one hundred pounds of copper sulfate in a bag of coffee-sacking, and suspend in the top of a fifty-gallon barrel, and add water to the fifty-gallon mark. In twelve to fifteen hours the vitriol will be dissolved and each gallon of solution will contain two pounds of copper sulfate. Slake a barrel of lime, and store in a tight barrel, keeping it covered with water. Lime so treated will keep all summer. It is really hydrated lime. This is often dried, pulverized, and offered on the market in paper bags of forty pounds each, under such names as ground lime, prepared lime, hydrated lime, and the like. If the paper is not broken, the lime does not air-slake for a long time. One and one-third pounds of hydrated lime equals in value one pound of quicklime. Air-slaked lime cannot be used in preparing bordeaux mixture.

Arsenical poisons can be combined with bordeaux mixture.

Ammoniacal copper carbonate.—For use on nearly mature fruit and on ornamentals. Does not discolor. Weigh out three ounces of copper carbonate, and make a thick paste with water in a wooden pail. Measure five pints of strong ammonia (26° Baumé) and dilute with three or four parts of water. Add ammonia to the paste, and stir. This makes a deep blue solution. Add water to make fifty gallons.

Copper carbonate.—For use in the above formula, it may be secured as a green powder, or may be prepared as follows. Dissolve twelve pounds of copper sulfate in twelve gallons of water in a barrel. Dissolve fifteen pounds of sal-soda in fifteen gallons of water (preferably hot). Allow the solution to cool, then add the sal-soda solution to the copper-sulfate solution, pouring slowly in order to prevent the mixture from working up and running over. A fine precipitate is formed which will settle to the bottom if allowed to stand over night. Siphon off the clear liquid. Wash the precipitate by adding clear water, stirring, and allowing to settle. Siphon off the clear water, strain the precipitate through mushn, and allow it to dry. This is copper carbonate. The above amounts will make about six pounds.

Copper sulfate.—See *Sulfate of copper*.

Corrosive sublimate (mercuric chloride).—Used for disinfecting pruned stubs and cleaned-out cankers, at the rate of one part in 1,000 parts of water. Can be secured from the druggist in tablet form in vials of twenty-five each, and costing 25 cents. One tablet makes a pint of solution. Make and store solution in glass and label "poison."

Formaldehyde (10 per cent solution of formaldehyde gas in water).—A pungent, clear liquid, very irritating to eyes and nose. Obtained at any drugstore at about 40 cents a pint. Used for potato-scab, oat smut, bunt in wheat, soil disinfection, and so on.

Lime.—Often on sale in the following forms: (*a*) Ground rock or ground limestone, air-slaked lime is of the same composition, i.e. a carbonate of calcium. (*b*) Lump, barrel, stone, or quicklime, this is burned limestone, and should test at least 90 per cent oxid of calcium. (*c*) Prepared, ground, or hydrated lime, this is water- or steam-slaked quicklime, dried and pulverized. Used as an applicant to the soil to correct acidity, for club-root of cabbage, and for preparing spray mixtures.

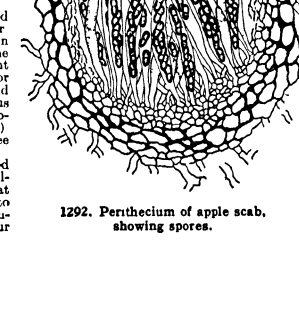
Lime-sulfur.—In the many possible combinations, lime-sulfur is coming to be equally as important as bordeaux mixture, in the control of many plant diseases.

(1) Flowers of sulfur or very finely powdered sulfur is often dusted on plants for surface mildews.

(2) A paste of equal parts of lime, sulfur, and water. This is painted on the heating-pipes in the greenhouse, and is valuable for keeping off surface mildews.

(3) Home-boiled dilute lime-sulfur. This solution has been widely used in the past as a dormant spray, particularly for San José scale and peach leaf-curl. It is likely to be supplanted by (4) or (5). For preparation see page 1043.

(4) Home-boiled concentrated lime-sulfur.—When a great deal of spraying is to be done, a concentrated lime-sulfur



1292. Perithecium of apple scab, showing spores.

DISEASES AND INSECTS

solution may be boiled at home and stored in barrels to be used as needed For method of preparation see page 1043

Test with a Baumé hydrometer, which has a scale reading from 25° to 35° Dilutions are reckoned from a standard solution testing 32° If the solution tests only 28°, it is not so strong as standard, and cannot be diluted so much as a solution testing 32° The table shows the proper dilution for solutions testing 25° to 35° Baumé

	1-10	1-15	1-20	1-25	1-30	1-40	1-50	1-60	1-75	1-100
25°	7 4	11	14 7	18 4	22 1	29 5	36 8	44 2	55	73
26°	7 7	11 6	15 4	19 3	23 2	30 9	38 6	46 3	58	77 2
27°	8 1	12 1	16 1	20 2	24 3	32 4	40 5	48 5	60 6	80 7
28°	8 4	12 7	16 9	21 1	25 4	33 8	42 3	50 7	63 5	84 5
29°	8 8	13 2	17 6	22 1	26 5	35 3	44 2	53	66 3	88 2
30°	9 2	13 9	18 4	23	27 6	36 9	46 1	55 3	69	92
31°	9 6	14 4	19 3	24	28 8	38 4	48	58	72	96
32°	10	15	20	25	30	40	50	60	75	100
33°	10 4	15 6	20 8	26	31 2	41 5	52	62 4	78	104
34°	10 8	16 2	21 6	26 8	32 4	43 2	54	64 7	80 8	108
35°	11 2	16 8	22 4	28	33 4	44 9	56	67 4	84 2	112

Decimals are given in all cases, but for practical purposes the nearest even gallon or half gallon can be used, unless appliances for more accurate measurement are at hand It is understood in making all dilutions that water is added to one gallon of the concentrate to make the stated amount Do not measure out the stated amount of water and add the concentrated solution to it

(5) Commercial concentrated lime-sulfur —As manufactured and placed on the market is a clear amber liquid, and should test 32° to 35° Baumé It costs about 20 cents a gallon retail, and comes ready to pour into the spray tank For apple and pear diseases Arsenate of lead can be used with this solution, and increases its fungicidal value

(6) Scott's self-boiled lime-sulfur —This is a mechanical mixture of the two substances, and is really not boiled, the heat being supplied by the slaking lime In a small barrel or keg place eight pounds of good quicklime Add water from time to time in just sufficient amounts to prevent burning As soon as the lime begins to slake well, add slowly (preferably through a sieve) eight pounds of sulfur flour Stir constantly, and add water as needed As soon as all bubbling has ceased, check further action by adding a quantity of cold water, or pour into a barrel or tank and make up to fifty gallons Keep well agitated Very effective against peach scab and brown rot Several other formulas have been used 10-10-50 and 5-5-50 Arsenate of lead can be used with this mixture

By using boiling water and allowing the hot mixture to stand for half an hour, a stronger spray mixture than the above can be secured It cannot be used safely on peaches, but has been used successfully on grapes for surface mildew The addition of sulfate of iron or sulfate of copper, one or two pounds to fifty gallons, has been used for apple rust

Potassium sulfid (liver of sulfur) —Simple solution, three ounces in ten gallons of water For mildew in greenhouses, on rose bushes and other ornamentals

Resin-sal-soda sticker —Resin, two pounds sal-soda (crystals), one pound, water, one gallon Boil until of a clear brown color, or from one to one and a half hours Cook in an iron kettle in the open Add this amount to fifty gallons of bordeaux Useful for onions, cabbage, and other plants to which spray does not adhere well

Sulfate of copper (blue vitriol) —Dissolve one pound of pure sulfate of copper in twenty-five gallons of water A specific for peach leaf-curl Apply once before buds swell in the spring Cover every bud For use in preparing bordeaux mixture Costs from 5 to 7 cents a pound, in quantity

Sulfate of iron (copperas) —A greenish granular crystalline substance Dissolve one hundred pounds in fifty gallons of water For mustard in oats, wheat and the like, apply at the rate of fifty gallons an acre Also for anthracnose of grapes as a dormant spray

Sulfur (ground brimstone, sulfur flour, flowers of sulfur) —Should be 99 per cent pure Valuable for surface mildews Dust on dry or in the greenhouse used in fumes Evaporate it over a steady heat, as an oil-stove, until the house is filled with vapor Do not heat to the burning point, as burning sulfur destroys most plants To prevent burning, place the sulfur and pan in a larger pan of sand and set the whole upon the oil-stove

DONALD REDDICK.

Catalogue of diseases.

Abies. WITCHES' BROOM (*Æcidium elatinum. Melampsorella elatina*) —On fir causing swellings, cankers, and witches' brooms.
Control —Prune off all affected parts

Abutilon RUST —See under *Hollyhock*
CONTAGIOUS CHLOROSIS —Variegated leaves
Control —Remove variegated leaves and their shoots, keep in dark and remove any further variegated leaves, then the plant should remain green

Acacia RUSTS (*Æcidium sp*) —Distorts branches and twigs
Control —Prune off diseased parts

CATALOGUE OF DISEASES, continued

Acer. TAR-SPOT (*Rhytisma acerinum*) —Black tar-like spots on upper side of the leaves
Control —Burn all old leaves in fall or winter
SUN SCALD OR SCORCH —Maples suffer commonly from a drying up of the foliage, due to over-transpiration of water at times when hot winds occur

Actinidia MILDEW (*Uncinula necator*) —See under *Ampelopsis.*

Æsculus LEAF-SPOT (*Phyllosticta pavæ*) —Irregular spots develop rapidly, the larger part of the leaf being involved Leaves fall prematurely
Control —Spray with bordeaux mixture, beginning when the leaves are about half-grown and repeating the process every three weeks

Agave. LEAF-BLOTCH (*Coniothyrium concentricum*) —Grayish, more or less circular dead patches, ranging from ½ to 1 inch in diameter
Control —Remove and burn diseased leaves

Allium —See under *Onion*

Almond BLIGHT (*Coryneum beyerinkii*) —See *Peach Blight*
YELLOWS —See under *Peach.*

Alnus ROOT-TUBERCLES —Clumps of small tubercles on the roots Not important
WITCHES' BROOMS AND BLADDERY DEFORMATIONS OF FLOWERS (*Exoascus sp*) —Broom-like tufts of branches and irregular deforming and contortion of fruits
Control —See under *Peach Leaf-Curl*

Alyssum MILDEW (*Erysiphe polygoni*) —See under *Verbena* Disease very similar

Amarantus WHITE "RUST" OR MILDEW (*Albugo bliti*) —See similar disease under *Radish*

Amelanchier RUST (*Gymnosporangium sp*) —Orange rust spots on leaves
Control —Keep junipers at a considerable distance
WITCHES' BROOM (*Dimerosporium collinsii*) —Thick twisted broom-like growth of branches
Control —Cut out the brooms

Ampelopsis BLACK-ROT —See under *Grape*
MILDEW (*Uncinula necator*) —Powdery mildew growths on upper side of leaf
Control —Dust with sulfur

Anemone ROOT-DECAY (*Sclerotinia tuberosa*) —Rhizomes decayed and large lumps form on the outside
Control —Eradicate affected rhizomes and the cup-like fungous bodies near such plants
RUST —Several rusts attack species of Anemone

Anthurium BLIGHT (*Glomerella cincta*) —See under *Orchids*

Apple BLIGHT —The same disease as *Pear Blight*, which see
CANKER —Smooth cankers in bark of trunk or limbs usually indicate blight (*Bacillus amylivorus*), rough ones, New York apple-tree canker (*Sphæropsis malorum*), or the nail-head canker (*Armularia disenta*)
Control —As soon as noticed, cut away dead bark and wood to the living tissue and paint over with lead paint or coal-tar.
SCAB (*Venturia inæqualis*) —Olive-green, brownish or blackish scab-like spots on leaves and fruit
Control —Rake and burn or plow under old leaves very early in spring Spray with lime-sulfur 32° Baumé, 1 40, or bordeaux, 3-3-50 (1) when blossom buds show pink, (2) when majority of petals have fallen (3) three weeks after 2, depending upon the weather, (4) if a late attack is feared, spray before fall rains begin

Apricot YELLOWS —See under *Peach*
BLACK-SPOT OR SCAB —See under *Peach*

Aquilegia MILDEW (*Erysiphe polygoni*) —See under *Verbena* Disease very similar
BLACK-SPOT (*Bacillus delphini*) —Sunken black spots on leaves and stems
Control —Remove and burn diseased parts

Artemisia RUST (*Puccinia asteris*) —Same rust as on *Asters*, which see

Artichoke SOFT-ROT —See under *Carrot*

Arum LEAF-SPOT (*Protomyces ari*) —Irregular bleached patches on leaves and leaf-stalks of *A maculatum*
Control —Burn diseased plants

Asparagus RUST (*Puccinia asparagi*) —A rust of the tops which is often so severe as to kill them, thus interfering with root-development
Control —Dust with flowers of sulfur about every three weeks while dew is still on in the morning Use dusting-machines

Aspidistra LEAF-BLOTCH (*Ascochyta aspidistræ*) —Large, irregular, bleached spots with black streaks running across
Control —Remove diseased leaves

Aster. RUST (*Puccinia asteris*) —Brown rust of leaves
Control —Eradicate the affected leaves

Aucuba. FREEZING —Young leaves suffer from spring frosts

Auricula LEAF-BLOTCH (*Heterosporium auriculæ*) —Three or four olive-green spots on each leaf Spots become brown and fall out
Control —Do not have excessive moisture Spray with potassium sulfid and ventilate well

Avocado, or Persea ANTHRACNOSE (*Colletotrichum gloeosporioides*). —See under *Pomelo*

DISEASES AND INSECTS

CATALOGUE OF DISEASES, continued.

Bamboo. SMUT (*Ustilago shirvana*).—Internodes and tips of young shoots attacked. Wild and cultivated bamboo attacked in Japan
Control —Bordeaux mixture and sprinkling soil with lime before the shoots appear.

Banana. ROT (*Bacillus musæ*) —Leaf-blades droop, turn yellow; petioles decay, letting leaves drop, and finally whole plant rots to the ground
Control —Practise sanitation.

Bean. ANTHRACNOSE, or POD-SPOT (*Colletotrichum lindemuthianum*). —Reddish brown, scab-like spots on stems, pods, and veins of leaves, particularly on yellow-podded snap beans. Fungus enters the beans
Control —Use seed only from pods without spots. Spray plants, from beneath and above, every ten days.
BLIGHT (*Bacterium phaseoli*) —Large papery spots on leaves and watery spots on pods
Control —As for *Anthracnose*

Beet. HEART-ROT (*Phoma betæ*) —Leaves appear spotted late in July, then wilt, and finally a dry heart-rot appears
Control —Destroy affected plants Practise long rotations. Treat seed with formalin, one pint in thirty gallons of water.
SCAB.—The same disease as *Potato Scab*, which see

Begonia. ROOT-ROT (*Thielavia basicola*) —See under *Nicotiana*.

Berberis RUST (*Puccinia graminis*) —Orange-colored rust spots on under side of leaf

Betula LEAF-SPOT (*Gloeosporium betularum*) —Round spots with blackish margin
HEART-ROT (*Fomes igniarius*).—See under *Fagus*

Blackberry CROWN-GALL, or ROOT-GALL (*Bacterium tumefaciens*). —Swellings, hard or soft, on roots and stem below ground
Treatment —Plow up and burn all bushes in a diseased patch Plant clean roots in a new place.
ANTHRACNOSE —See under *Raspberry*
RED OR ORANGE RUST —See under *Raspberry*
LEAF-SPOT —See under *Dewberry* Same disease

Blueberry RUST (*Calyptospora goeppertiana*) —Stem attacked, swollen, spongy, at first pink, changing to brown and blackish. Plants taller than healthy and leaves dwarfed
Control —Segregate from species of fir and spruce.

Brassica. See under *Cabbage*.

Brussels Sprouts. CLUB-ROOT —See under *Cabbage*

Buxus STEM-BLIGHT (*Nectria rousseliana*) —Twigs killed, reddish pustules appearing on stems and leaves
Control —Remove all diseased parts and burn

Cabbage CLUB-ROOT, or CLUB-FOOT (*Plasmodiophora brassicæ*) — A contorted swelling of roots and sickly wilted tops
Control —Destroy affected seedlings Lime the soil at least eighteen months before planting cabbage, using at the rate of two tons of quicklime to the acre
BLACK-ROT (*Bacillus campestre*) —Sap-tubes in leaves and stem turn black and the leaves drop, thus preventing heading
Control —Praise crop-rotation Soak the seed for fifteen minutes in a solution of mercuric chloride, one tablet in a pint of water

Cactus SPOT (*Diplodia opuntiæ*) —Sometimes a serious disease

Calathea LEAF-BLIGHT (*Cephalurus parasiticus*) —The epidermal cells contain the alga, which spreads over the leaf, blackening and killing it
Control —Remove diseased leaves.

Calceolaria LEAF-BLIGHT (Ascribed to a Micrococcus).—Brownish patches on lower leaves, many times bordered by the small veins of the leaf
Control —Burn affected plants

Campanula RUST (*Coleosporium campanulæ*).—Red and brown rust spots on leaves
Control —Segregate from *Pinus rigida*.

Capsicum. ANTHRACNOSE —Same as on *Piper*, which see.

Carnation RUST (*Uromyces caryophyllinus*) —Brown, powdery pustules on stems and leaves
Control —Spray once in two weeks with a solution of copper sulfate, one pound to twenty gallons of water. Pick off diseased leaves Keep temperature low

Carpinus BLACK-MOLD (*Dimerosporium pulchrum*) —On leaves.
Control —Spray with any good fungicide
HEART-ROT (*Fomes fulvus*) —Red-brown decay, crumbles when crushed
Control —Surgery methods

Carrot. SOFT-ROT (*Bacillus carotovorus*) —A soft-rotting of the root identical with the soft rots of other root crops
Control —Good drainage of soil Steam sterilization of soil.
LEAF-SPOT or EARLY LEAF-BLIGHT (*Cercospora apii*) —See under *Celery*.

Carya —See under *Hickory-Nut*.

Castanea —See under *Chestnut*

Catalpa LEAF-BLIGHT —Sudden blackening and dying of leaves in early summer
HEART-ROT (*Polystictus versicolor*) —Heart-wood becomes straw-colored and finally soft
Control —Surgery
ROOT-ROT of seedlings (*Thielavia basicola*) —See under *Nicotiana*

Cauliflower —See under *Cabbage*

CATALOGUE OF DISEASES, continued

Celastrus. MILDEW (*Phyllactinia corylea*).—Powdery mildew of leaves.
Control —Dust with sulfur.

Celery. EARLY LEAF-BLIGHT (*Cercospora apii*) —A spotting and eventual blighting of leaves
Control —Spray with ammoniacal copper carbonate, 5-3-50, beginning in seed-bed and keeping new growth covered throughout the season
LATE BLIGHT (*Septoria petroselini* var *apii*) —Blight of foliage appearing late in season and in storage
Control —As above Grow under half shade

Celtis. MILDEW (*Peronoplasmopara celtidis*) —Definite spots on veins, water-soaked dark green becoming gray.
Control —Spray with bordeaux mixture

Cercis. LEAF-SPOT (*Ascochyta pisi*) —Spots round, yellowish with brown margin on leaves and stem
Control —Spray with dilute bordeaux mixture on first appearance

Chamæcyparis TWIG DISEASE (*Pestalozzia funerea*) —Bark of young branches killed, needles die
Control —Prune off affected parts and clean up litter and burn
HEART-ROT (*Stereum ballouii*) —Kills tops of trees

Chard (Beta) LEAF-SPOT (*Cercospora beticola*) —Brown, purplish bordered spots on leaves
Control —Pick off and destroy diseased leaves

Cherry. BROWN-ROT (*Sclerotinia fructigena*) —The flowers decay, the leaves become discolored with irregular brown spots, and the fruit rots on the tree
Control —Spray with bordeaux mixture, 4-4-50, or lime-sulfur, 1-40 (1) just before the blossom buds open, (2) just after the blossoms fall, (3) one or two more applications at intervals of ten days
POWDERY MILDEW (*Podosphæra oxyacanthæ*) —Leaves and twigs affected, often causing defoliation
Control —Spray with lime-sulfur, 1-40, or dust heavily with powdered sulfur
BLACK-KNOT —See under *Plum* Same disease

Chestnut. CANKER, or BARK DISEASE (*Endothia parasitica*) — Sunken or swollen cankers on limbs or trunk Limbs die and leaves and burs cling in winter
Control —Remove diseased parts and burn Paint all wounds Little chance of saving trees in infested locality

Chicory STEM-SPOT (*Phospora albicans*) —Yellowish-gray spots on lower portion of the stem Later on smaller branches and leaves Plant destroyed
Control —Eradicate diseased plants

Chrysanthemum LEAF-SPOT (*Septoria chrysanthemi*) —Small dark brown spots, which increase in size until leaf is killed
Control —Pick and burn affected leaves Spray with bordeaux mixture, 4-4-50
RUST (*Puccinia chrysanthemi*) —Reddish brown rust pustules on leaves
Control —As for *Leaf-Spot*

Cineraria MILDEW (*Bremia lactucæ*) —Plants stunted and of a pale color, finally wilting Same disease on lettuce.
Control —Remove diseased plants Do not use same soil again
RUST —See under *Senecio*

Citrus —See under *Orange, Lemon, Grapefruit*, etc The "wither tip" disease described under *Pomelo* is common to species of citrus

Clematis. LEAF-SPOT (*Cylindrosporium clematidis* var *jackmanii*) —Causing loss of lower leaves at times Not serious

Cocoanut. BUD-ROT (*Bacillus coli*) —Rot of soft tissues of cocoanut plant and is perhaps responsible for cocoanut bud-rot
Control —Not given

Coffea. LEAF-DISEASE (*Hemileia vastatrix* and *H. woodii*) — Circular discolored areas, turning pale yellow and becoming studded with orange-yellow spots
Control —Burn all diseased leaves

Colchicum RUST (*Uromyces colchici*) —Black spots on leaves Looks like a smut disease
Control —Diseased leaves should be burned

Colocasia ROOT-ROT (*Peronospora trichomata*) —Sap-tubes turn yellow and finally entire tuber becomes black
Control —Dry tubers thoroughly before storing Do not plant in soil in which the disease has occurred

Convolvulus MILDEW (*Albugo ipomœæ-panduranæ*) —Distortions and white or yellow blisters
Control —Remove diseased plants and spray with bordeaux mixture frequently

Cordyline. BLIGHT —See under *Orchids*.

Coreopsis MILDEW (*Sphærotheca humuli* var *fuliginea*).—Powdery mildew of the leaves
Control —Dust with sulfur

Corn SMUT (*Ustilago zeæ*) —Boils on stalks, ears or tassels, at first white, then black, and, when burst open, containing black powder, the spores
Control —Cut out developing smut boils and burn
WILT (*Pseudomonas stewartii*) —Sap-tubes turn yellow and plant wilts and drys up
Control —Burn affected plants Grow varieties not affected

CATALOGUE OF DISEASES, continued

Cornus. TWIG-BLIGHT (*Diaporthe albocarnis*) —Twigs die, bark turns yellow and is covered with numerous small pimples.
Control —Prune off and destroy affected parts.

Corylus.—See under *Filbert*

Cosmos STEM-BLIGHT (*Phomopsis stewartii*) —Brown spots rapidly enlarging on stems of mature plants Parts above wilt and die
Control —Difficult and no certain methods known. Remove diseased stems and burn

Cotoneaster RHUS (*Gymnosporangium clavariæforme*).—Orange rust pustules on leaves
Control —Keep at a distance from junipers

Cranberry BLAST, or SCALD (*Guignardia vaccinii*) —Young flower and fruits blasted, older fruits appear scalded or watery
Control —Spray five or six times with bordeaux mixture, 5–5–50, to which has been added four pounds of resin fish-oil soap. Begin just before the blossoms open

Crataegus RUST (*Gymnosporangium sp*).—Orange rust pustules on leaves and petioles
Control —Keep at a distance from junipers.

Cress. WHITE MOLD —See under *Horse-Radish*

Crocus ROOT-ROT (*Rhizoctonia sp*) —Important in France and likely occurring here
Control —Sanitation, new soil frequently or soil sterilization.

Cucumber BLIGHT, or MILDEW (*Pseudoperonospora cubensis*) — A blighting and premature yellowing of the leaves.
Control —Spray with bordeaux mixture, 5–5–50, every ten to fourteen days after plants begin to run
WILT —See under *Cucurbita*

Cucurbita WILT (*Bacillus tracheiphilus*) —Sap-tubes are clogged and destroyed, causing the plant to wilt
Control —Eradicate the striped beetle Gather and destroy all wilted leaves and plants

Cupressus ROOT-ROT —See under *Pine* Same disease.
TWIG DISEASE —See under *Chamaecyparis*
WITCHES' BROOM (*Gymnosporangium ellisii*) —Fasciation of branches
Control —Prune off affected parts

Currant WILT, or CANE-BLIGHT (*Botryosphæria ribis*) —Canes die suddenly, the leaves wilting
Control —No satisfactory method known Cut out and burn affected plants
RUST (*Cronartium ribicola*) -Brown rust pustules and brown felt-like growth on under side of leaf Black currants especially susceptible
Control —Grow at least 500 feet from white pine trees

Cycas LEAF-SPOT (*Mycosphærella tulasnei*=*Cladosporium herbarum*) —Gray spots and final death of leaves
Control —Remove and burn affected parts

Cyclamen LEAF-SPOT (*Glomerella rufomaculans* var *cyclaminis*). —Spots circular, slightly water-logged, with sharply defined outlines
Control —Destroy affected leaves by burning
BLIGHT —Similar to *Lilium Leaf-Spot*, which see

Dahlia WILT (*Sclerotinia sclerotiorum*) —White mold on stem, later yellowing and wilting of plant, and finally stem collapses
Control —Remove and burn affected plants Green stable manure favors the disease

Daphne LEAF-SPOT (*Mycosphærella laureolæ*) —Similar to *Strawberry Leaf-Spot*, which see

Date See under *Palms*

Delphinium BLACK-SPOT (*Bacillus delphini*) —Sunken black spots on stem and leaves
Control —Remove and burn diseased parts

Dewberry LEAF-SPOT (*Septoria rubi*) —Small pale spots of dead leaf-tissue finally becoming dotted with black specks
Control —No successful method of treatment is known.

Dianthus —See under *Carnation*

Digitalis MILDEW (*Peronospora sordida*) —Broadly effused, dingy lilac patches of mildew on under surface of leaves
Control —Spray with bordeaux mixture

Diospyros MILDEW (*Podosphæra oxyacanthæ*) —Powdery mildew of the leaves
Control —Dust with sulfur

Dracæna. BLIGHT —See under *Orchids*

Eggplant ANTHRACNOSE (*Glœosporium melongenæ*).—Spots on fruit Same as on *Piper*, which see
STEM ROT (*Nectria ipomœ*) -Spreading spots on the stem.
Control —Spray mixtures may be of avail

Elæagnus. ROOT-TUBERCLES —See under *Alnus* Not destructive

Endive RUST (*Puccinia endiviæ*) —Rust spots on leaves
STEM-ROT —See under *Chicory*

Eucalyptus TUMOR (*Ustilago vrieseana*) —Woody tumors at collar of tree Production of black soot-like mass of spores between wood and bark
Control —Surgery methods

Euphorbia BLIGHT (*Gloeosporium euphorbiæ*) —Causes death of floral portion just before flowering time and the parts below are soon blighted
Control —Burn affected plants Spray with bordeaux mixture

CATALOGUE OF DISEASES, continued

Fagus. HEART-ROT (*Fomes ignarius*) —White, dry, and somewhat solid decay of heart-wood bordered by fine black lines
Control —See under *Arboriculture, Diseases of Trees*

Ferns TIP BLIGHT (*Phyllosticta pteridis*) —Brown spots at or near tips of the fronds covered with minute black dots
Control —Remove and burn the blighted leaves and then spray with bordeaux mixture

Ficus LEAF-SPOT (*Leptostromella elasticæ*) —Causes spots on leaves See also under *Fig*

Fig LEAF-SPOT (*Cercospora bolleana*) —Brown spots on leaves Leaves turn yellow and drop off
Control —Spray with bordeaux mixture while leaves are young

Filbert BLACK-KNOT (*Cryptosporella anomala*) —Serious stem disease, canker girdles the stems and kills parts above
Control —Prune off affected parts and burn

Forsythia LEAF-SPOT (*Alternaria forsythiæ*) —Forms subcircular spots
Control —Spray with bordeaux mixture

Fraxinus RUST (*Puccinia fraxinata*) —Swellings of midribs of leaves and petioles with orange rust spots on them
Control —Keep the common grass *Spartina cynosuroides* away from the trees

Freesia LEAF-SPOT and WILT (*Heterosporium gracile*) —Large brown spots with darker margin, numerous, soon the leaves wilt and die
Control —Spray with ammoniacal copper sulfate

Galanthus DECAY (*Sclerotinia galanthi*) —In place of the flower a shapeless mass is produced covered with brown mildew Tubers decay also
Control —Remove all affected parts and burn Use new soil thereafter

Gardenia RUST —See under *Coffea* Same disease

Genista ROOT-TUBERCLES —Beneficial

Gentiana RUST (*Puccinia gentianæ*) —Lower leaves first attacked, become yellow and die. Disease gradually works upward
Control —Destroy affected plants

Geranium MILDEW (*Plasmopara geranii*) —Downy mildew of leaves
Control —Spray with bordeaux mixture

Gladiolus SMUT (*Urocystis gladioli*) —Black smut pustules on corms
Control —Destroy affected corms Use new soil

Gleditsia LEAF-SPOT (*Leptostroma hypophylla*) —Leaflets become covered with small black specks, causing some of them to turn yellow and fall

Gooseberry MILDEW (*Sphærotheca mors-uvæ*) —A powdery mildew of the fruit and young growth of English varieties
Control Spray with potassium sulfid, one ounce to two gallons of water, at intervals after leaves begin to unfold

Grape BLACK-ROT (*Guignardia bidwellii*) —Brown circular spots on leaves, black, elongated, sunken pits on petioles, canes, etc , and on the berry a brown rot with shriveling and wrinkling
Control —Spray with bordeaux mixture, 4–4–50, before rains Spray (1) when the third or fourth leaf unfolds, (2) as soon as the blossoms have fallen, (3) when berries are size of a pea, (4) about two weeks later Two more applications if wet season
DOWNY MILDEW, or LEAF-BLIGHT (*Plasmopara viticola*) —White frost-like patches on under side of the leaf
Control —Same as *Black-Rot*

Grapefruit LEAF-SPOT (*Pestatozzia guepini*) —Large spots with dark margins Leaves fall prematurely On other species of Citrus also
Control —Destroy affected leaves

Guava. ANTHRACNOSE (*Glomerella psidii*) —Circular brown, decayed areas on fruit Like apple bitter-rot
Control —None given

Hedera. LEAF-SPOT and LEAF BLIGHT (*Vermicularia trichella*).— Rapid blackening of the etiolated portion of the leaf
Control —Remove and burn affected leaves and spray with bordeaux mixture

Helianthus. RUST (*Puccinia helianthi*) —Red rust pustules on leaves of most species of Helianthus
Control —No specific control measures worked out.

Helleborus LEAF-BLOTCH (*Coniothyrium hellebori*) —Large circular brownish blotches of scorched appearance, covered with minute black dots.
Control —Cut off and burn affected leaves.

Hemerocallis. LEAF-SPOT —See under *Freesia.*

Hibiscus LEAF-SPOT (*Phyllosticta sidicola*) —Indistinct brown spots with whitish centers
Control —Burn affected leaves
MILDEW (*Microsphæra euphorbiæ*) —Powdery mildew of leaves.
Control —Dust with sulfur

Hickory-nut. LEAF-SPOT (*Marsonia juglandis*) —Large leaf-spot, causing premature dying of leaves
Control —Spraying with bordeaux mixture may be of value

DISEASES AND INSECTS

CATALOGUE OF DISEASES, continued.

Hollyhock RUST (*Puccinia malvacearum*) —All parts of plant show reddish brown pustules
Control —Eradicate mallow Pick off diseased leaves and burn Spray every week with bordeaux mixture, 4–3–50

Horse-Radish WHITE MOLD (*Cystopus candidus*) —Deforming and swelling of leaves and stems, with white powdery surface growth
Control —Hardly important enough on the radish to necessitate control

Hyacinthus. BLIGHT (*Pseudomonas hyacinthi*) —Serious pest in the Netherlands Sap-tubes filled with yellow slime.
Control —Destroy all affected plants

Hydrangea. LEAF-BLIGHT (*Phyllosticta hydrangeæ*).—Leaf-spot disease which becomes serious at times
Control —Destroy diseased leaves as soon as noticed.

Iberis CLUB-ROOT.—See under *Cabbage*

Impatiens MILDEW (*Plasmopara obducens*) —Downy mildew of the leaves
Control —Remove affected leaves and spray with bordeaux mixture

Ipomœa. RUST (*Coleosporium ipomœæ*).—Common rust spotting of leaves.
Control —Destroy affected leaves.
MILDEW —See under *Convolvulus*

Iris. LEAF-BLIGHT (*Botrytis galanthina*) —First the leaves and flowers are much distorted and covered with black mold growth, later the bulb may be destroyed
Control —Eradicate diseased plants and grow in new soil.

Juglans LEAF-SPOT (*Gnomonia leptostyla*) —Brown leaf-spot, causing defoliation
Control —Collect and burn fallen leaves. Spray with bordeaux mixture while leaves are young

Juniperus. CEDAR APPLES (*Gymnosporangium spp*.) —Large or small red and woody growth at tips of branches. Gelatinous in wet weather.
Control —Prune off affected parts. Keep apples, pears, and hawthorns at a distance

Kale. BLACK-ROT —See under *Cabbage*

Kohlrabi CLUB-ROOT —See under *Cabbage*

Laburnum LEAF-SPOT (*Peronospora cystisi*) —Leaves become brown-spotted Seedlings killed
Control —Spray with bordeaux mixture.
CONTAGIOUS CHLOROSIS —See under *Abutilon.*

Larix. CANKER (*Dasyscypha willkommii*) —Canker of trunk and branches, usually around base of trunk
Control —Eradicate diseased parts, using tree surgery methods

Laurus. WITCHES' BROOM (*Exobasidium laurii*).—Branched out growths, antler-like, 2 or 3 feet in length, springing from the leaves
Control —Prune off affected parts

Lemon BROWN-ROT (*Pythacystis citrophthora*) —White mold on surface of fruit.
Control —Not destructive in orchard Add copper sulfate to water when washing lemons to prevent infection of healthy ones
LEAF-DISEASES —Not well understood Probably controllable by spraying

Lespedeza MILDEW (*Microsphæra diffusa*) —Powdery mildew of leaves
Control —Dust with sulfur

Lettuce. DROP, or ROT (*Sclerotinia libertiana*) —Base of stems or leaves rots off, allowing leaves to drop
Control —Sterilize soil with steam before planting.
MILDEW —See under *Cineraria*

Ligustrum ANTHRACNOSE (*Gloæosporium cingulatum*) —Affected areas light brown either oblong on one side of the stem or completely girdling it
Control —Destroy by burning affected plants.

Lilium. LEAF-SPOT (*Botrytis sp*.) —Orange-brown or buff blotches on leaves, stem and flowers of *L. candidum* May be same as *Tulipa Mold*, which see
Control —Eradicate diseased plants.

Lily-of-the-Valley. STEM-ROT —See under *Pæonia.*

Leiodendron. TWIG BLIGHT (*Myxosporium longisporium*).—Killing twigs
Control —Prune off diseased twigs

Lobelia. CANKER (*Phoma dewastatrix*) —Portions of the stems covered with minute black dots
Control —Remove diseased plants They never bloom.

Lonicera CANKER (*Nectria cinnabarina*) —Rough canker on limbs covered with flesh-colored or red bodies.
Control —Prune off or cut out all affected parts and cover wounds with tar

Lupinus.—See under *Pea*

Lychnis. SMUT (*Ustilago violacea*) —Pollen-sacs filled with black dust which escapes and discolors the flower
Control —Destroy the affected plants and use new soil.

Lycopersicum —See under *Tomato.*

Magnolia LEAF-SPOT —See under *Grapefruit*

Malva RUST —See under *Hollyhock* Same disease.

CATALOGUE OF DISEASES, continued

Mangifera. BLACK BLIGHT (*Dimerosporium mangiferum*).—An intense black velvety patches on both surfaces of the leaves.
Control —Spray with any good spray mixture

Matthiola. CLUB-ROOT —See under *Cabbage*

Mentha. RUST (*Puccinia menthæ*) —A most destructive rust disease
Control —None given

Mignonette LEAF-SPOT (*Cercospora resedæ*) —First reddish discoloration of leaves Later small depressed spots with brownish or yellowish margin
Control —Spraying with bordeaux mixture gives good results

Morus LEAF-SPOT (*Cercospora moricola*) —Not serious
LEAF-BLIGHT (*Pseudomonas mori*) —Wilting and death of leaves. Cankers girdle the twigs
Control —Prune off diseased parts and burn.

Muscari SMUT (*Urocystis colchici*) —Long black powdery streaks on leaves
Control —Destroy affected plants by burning. Use new soil

Mushroom MOLD (*Mycogone perniciosa*) —Mushrooms develop abnormally as monstrous soft growths These develop into a moldy mass and putrify
Control —Affected beds should be thoroughly cleaned and sprayed with copper sulfate, one pound to fifty gallons of water

Muskmelon DOWNY MILDEW —See under *Cucumber*
WILT —See under *Cucurbita*

Narcissus LEAF-SPOT (*Ramularia narcissi*) —Spots on leaves and stem
Control —Burn diseased parts and spray with bordeaux mixture

Nasturtium WHITE "RUST" (*Cystopus candidus*) —See under *Horse-Radish*

Nectarine YELLOWS, etc —See under *Peach*

Nerium BLACK MOLD (*Capnodium fædum*) —Black velvety-like growth on leaves
Control —Spray with bordeaux mixture

Nicotiana ROOT-ROT (*Thielavia basicola*) —Blackening and rotting of the roots of seedling plants
Control —Steam sterilization of seed-beds
MOSAIC OR CALICO DISEASE —Enzymic disease Mottling of leaf Spread by touch

Oak. ANTHRACNOSE (*Gnomonia veneta*) —Brown spotting on under side of leaves, along veins Brown pustules on spots Death of leaves and twigs See under *Arboriculture, Diseases of Trees*
Control —Collect and burn all diseased twigs and leaves Spray with bordeaux mixture frequently from time buds swell

Œnothera LEAF-GALLS (*Synchytrium fulgens*) —Yellow swellings on the leaves
Control —Destroy affected leaves

Okra.—See under *Hibiscus*

Olive LIMB-GALL, or KNOT (*Pseudomonas olea*) —Knots or galls on the twigs and limbs
Control —Remove and burn affected limbs

Onion. MILDEW (*Peronospora schleideniana*) —Causes a wilt or blight of the leaves
Control —Spray with bordeaux mixture, 5–5–50, to which has been added one gallon of resin sal-soda sticker First application when third leaf has developed, repeating every ten days until harvest time
SMUT (*Urocystis cepulæ*) —Black pustules on leaves and bulbs Seedlings may be killed outright
Control —Grow seed in new soil Drill in with the seed one hundred pounds of sulfur and fifty pounds of air-slaked lime to the acre

Opuntia. SPOT (*Diplodia opuntiæ*) —Sometimes a serious pest of cactus

Orach. GALLS (*Urophlyctis pulposa*) —Glassy swellings on leaves, stems and flowers of Chenopodium and Atriplex
Control —Burn affected plants

Orange. BLACK-MOLD (*Capnodium citri*) —Black mold-like growth on leaves and fruit
Control —Spray with any good fungicide

Orchids LEAF-BLIGHT (*Glomerella cincta*) —Leaf dies back from the tip, turning brown
Control —Burn affected leaves Spray frequently then with bordeaux mixture

Ornithogalum WARTS (*Synchytrium niesii*) —Dirty white warts on leaves, bounded by a dark line
Control —Burn diseased leaves

Pæonia STEM-ROT and WILT (*Sclerotinia pæoniæ*) —Gradual wilting and dying of leaves caused by decay of stem at or near surface of soil
Control —Spray the stems frequently with a strong fungicide Burn affected plants

Palms LEAF-SPOT (*Gloæosporium alleschери*) —May cause ultimate death of leaves
Control —Frequent spraying with bordeaux mixture and eradication of diseased leaves may prove beneficial

CATALOGUE OF DISEASES, continued.

Pandanus BLACK CANKER (*Nectria pandani*) —Kills branches and entire plants Black pustules on bark oozing black tendrils.
Control —Cut out diseased portions as soon as noticed.

Pansy LEAF-SPOT (*Peronospora violæ*).—Discolored spots with pale violet growth on them
Control —Spray with bordeaux mixture.

Papaver MILDEW (*Peronospora arborescens*) —Downy mildew of wild and cultivated poppies Especially injurious to seedlings of garden species
Control —Spray with bordeaux mixture.

Parsley. LEAF-SCORCH (*Septoria petroselini*).—Small scattered brown patches, which increase in size until whole leaf is covered
Control —Spray early with dilute bordeaux. Pick off and burn affected leaves

Parsnip LEAF-BLIGHT —See under *Celery, Early Leaf-Blight.*

Pea MILDEW (*Erysiphe polygoni*) —A powdery mildew on pods and leaves
Control —Dust dry sulfur over the plants

Peach. BLIGHT (*Corymeum beyerinkii*) —A spotting, gumming and death of the buds and twigs, particularly in the lower parts of the tree The fruit drops
Control —For California conditions, two applications bordeaux mixture, 5-5-50, or lime-sulfur, 1-10, (1) in November or December, and (2) in February or March
LEAF-CURL (*Exoascus deformans*) —Leaves curl and wrinkle
Control —Spray with lime-sulfur, 1-11, before buds swell
BROWN-ROT (*Sclerotinia fructigena*) —Rot on fruit and cankers on limbs
Control —Spray with self-boiled lime-sulfur, 8-8-50, adding two pounds arsenate of lead Spray (1) about time shucks are shedding from young fruit, (2) two or three weeks later; (3) one month before fruit ripens
SCAB, or BLACK-SPOT (*Cladosporium carpophilum*) —Black scab-like spots on fruit
Control —Self-boiled lime-sulfur applied as under *Brown-Rot.*
YELLOWS —A fatal disease Red spots in fruit. Tuft-like growth of new shoots and finally yellow foliage.
Control —Burn affected trees

Pear BLIGHT (*Bacillus amylovorus*) —Flowers, young fruit, twigs, and leaves turn black and die Limbs die back and sunken cankers form in bark
Control —Eradicate all wild hawthorns, pears and apples Inspect and remove all blighted parts of tree. Paint wounds with coal tar
SCAB —Very similar disease to *Apple Scab*, which see.

Pecan LEAF-BLOTCH (*Mycosphærella convexula*) —Dark-colored blotches covered with minute black dots on leaves in mid-summer
Control —None given

Pelargonium DROPSY —Translucent spotting of leaf. Spots finally die
Control —Withhold water until absolutely necessary.

Persimmon ANTHRACNOSE (*Glomerella rufomaculans*) —Similar if not identical to *Piper Anthracnose*, which see

Petunia WILT —See under *Dahlia*

Phlox. STEM-CANKER (*Pyrenochæta phlogidis*).—Canker just above the ground on the stem Plant dies, first turning yellow and then falls over
Control —Diseased stems should be removed and burned.

Physalis WILT (*Bacillus solonacearum*) —Pith of stem turns brown, sap-tubes filled with viscid ooze
Control —Get rid of insects such as potato beetle and burn all affected plants

Picea LEAF-SPOT and LEAF-CAST (*Phoma sp*) —Causes discoloration and dropping of needles Black dots on affected needles.
Control —Clean up all fallen needles and burn
DROUGHT INJURY —Drying up of needles Water in dry weather.

Pine. ROOT-ROT (*Armillaria mellea*).—Tops turn yellow and die, swelling of trunk at surface of ground Decay of roots with black threads abundantly present Toadstools around base of tree
Control —Dig up and burn and destroy all toadstools near the affected trees

Pineapple. HEART-ROT —Browning of the axis of the fruit, due to excessive moisture at time of ripening
Control —Keep down humidity in greenhouses.

Piper. ANTHRACNOSE (*Glæosporium piperatum*) —Spots on leaves of plants Also apple bitter-rot fungus (*Glomerella rufomaculans*) causes similar spots on the fruits
Control —Frequent spraying with bordeaux mixture.

Platanus. ANTHRACNOSE —See under *Oak.* Same disease

Plum BLACK-KNOT (*Plowrightia morbosa*) —Black tumorous swellings from 1 to several inches in length, on limbs and twigs.
Control —Burn all affected parts in the fall. Burn whole tree if badly affected
BROWN-ROT —See under *Peach.*

Polygonum TAR-SPOT (*Rhytisma bistortæ*).—Black tar-like spots on leaves
Control —Burn affected leaves

Pomegranate. INTERNAL ROT (*Sterigmatocystis castanea*) —Central cavity of fruit occupied by a black sporulating fungus
Control —None known

CATALOGUE OF DISEASES, continued.

Pomelo. WITHER-TIP (*Colletotrichum glæosporioides*).—Anthracnose cankers of stem, spots on leaves and flowers and general wilting of tips of branches
Control.—Prune off affected parts and spray with bordeaux mixture.

Populus. HEART-ROT (*Polyporus sulphureus*).—Red rot of the wood, which finally breaks up into cubes
Control —Surgery methods

Potato. EARLY BLIGHT (*Alternaria solani*) —Circular spots, usually in July and final blighting of whole leaf.
Control —Spray with bordeaux mixture, every ten days, beginning when plants are 6 to 8 inches high
LATE BLIGHT and POTATO-ROT (*Phytophthora infestans*) —Quick-spreading watery appearing spots in leaves. Mildew on under side Plants appear as scalded by hot water. Tubers rot in soil or soon after digging
Control —Spray with bordeaux mixture, 5-5-50, at least three applications and in wet seasons, six or more may be necessary Use from forty to one hundred gallons per acre
SCAB (*Oospora scabies*) —A scabby and pitted roughness of the tubers
Control —Keep lime or ashes off the land Soak uncut seed tubers in a solution of formalin, one pint to thirty gallons of water for two hours Avoid land that has grown scabby potatoes

Potentilla. LEAF-SPOT —See under *Strawberry.*

Primula. ROT (*Botrytis sp*)—Similar to rot of *Pæonia*, which see.

Prune.—See under *Plum*

Prunus.—See under *Cherry, Plum* and *Peach.*

Pseudotsuga. BLIGHT (*Sclerotinia fuckeliana*).—Gray mold of seedlings and younger shoots of older trees in moist situations
Control —Spray with bordeaux mixture.

Psidium —See under *Guava.*

Pyrus —See under *Apple* and *Pear.*

Quince. BLIGHT —See under *Pear*
RUST (*Gymnosporangium globosum*) —Orange rust of fruit
Control —Destroy red cedars in the neighborhood, also wild apples and hawthorns Spray as for *Apple Scab*

Radish WHITE "RUST" or MILDEW (*Albugo candidus*) —A whitish powdery growth on the leaves and petioles, often causing distortion
Control —Steam sterilize the soil before planting.
CLUB-ROOT —See under *Cabbage*
BLACK-ROT —See under *Cabbage*

Ranunculus MILDEW (*Plasmopara pygmæa*).—Downy mildew of leaves
Control —Spray with bordeaux mixture

Raspberry ANTHRACNOSE (*Gloeosporium venetum*) —Circular or elliptical, gray scab-like spots on the canes
Control —Remove diseased canes as soon as fruit is picked. Avoid taking young plants from diseased plantings.
CROWN-GALL —See under *Blackberry*
RED, or ORANGE RUST (*Gymnoconia interstitialis*) —Dense red powdery growth on under side of leaves of black varieties and blackberries
Control —Dig up and destroy affected plants
LEAF-SPOT —See under *Dewberry* Same disease

Retinospora GALL (*Gymnosporangium sp*) —Swellings on limbs and twigs with red-brown pustules covering them
Control —Prune off affected parts and keep at a distance from species of Pomeæ

Rhamnus RUST (*Puccinia coronata*) —Irregular yellow blotches, with yellow pustules on under side of leaf Also on fruit and flowers
Control —Keep at a distance from "rusted" cereals and other grasses

Rheum. SOFT-ROT —See under *Carrot.*

Rhododendron. GALLS (*Exobasidium rhododendri*) —Galls of the size of a pea or larger, at first pale green, then red and brownish covered with white bloom
Control —Leaves bearing galls should be removed and burned

Rhubarb. SOFT-ROT.—See under *Carrot.*

Rhus CANKER and TWIG BLIGHT (*Endothia parasitica*) —See under *Chestnut* Causes death of twigs

Ribes —See under *Currant* and *Gooseberry*

Richardia SOFT-ROT (*Bacillus aroideæ*) —Soft rotting of corms (bulbs) and leaves
Control —Change soil every three or four years Reject corms which show the disease

Robinia HEART-ROT (*Trametes robiniophila* and *Fomes rimosus*). —Heart-wood converted into punk Shelf-like bodies grow from wounds
Control —Surgery methods.

Rose. MILDEW (*Sphærotheca pannosa*) —A white powdery mildew on new growth
Control —In greenhouses, keep steam-pipes painted with a paste of equal parts lime and sulfur mixed in water Out-of-doors roses should be dusted with sulfur flower or sprayed with potassium sulfid, one ounce to three gallons of water
STEM-BLIGHT —Similar to *Raspberry Anthracnose*, which see

CATALOGUE OF DISEASES, continued.

Rubus.—See under *Raspberry.*

Salix RUST —Numerous species of the rust fungi produce red rust spots on the leaves
Control —Keep at a distance from species of conifers.
HEART-ROT (*Trametes suaveolens*) —Enters through wounds.
Control —Surgery methods

Salsify. MILDEW (*Albugo tragopogonis*). —Distortion and white blisters on host
Control —Eradicate affected plants and grow on new soil apart from wild and cultivated species of the Compositæ

Sambucus CANKERS —See under *Lonicera*

Sarracenia. BLIGHT —See under *Orchids*

Saxifraga. RUST (*Puccinia pazschkei* and *P saxifragæ*) —Dark brown concentric circles of rust pustules on upper surface of the leaves
Control —Burn affected leaves

Scilla BULB-ROT (*Sclerotinia bulborum*) —Yellow stripes and blotches on leaves in early summer, with olive-brown mold on them Rots the bulb later
Control —Destroy affected plants. Spray with potassium sulfid Use new soil thereafter

Sedum. LEAF-SPOT (*Septoria sedi*) —Dark circular blotches appear on the leaves and defoliation occurs
Control —Destroy affected parts by burning

Sempervivum. RUST (*Endophyllum sempervivi*) —Brown rust pustules rupturing epidermis of leaf.
Control —Destroy affected plants as the fungus lives over from year to year in the same plant.

Senecio RUST (*Coleosporium senecionis*).—Orange patches on under surface of leaf
Control —Keep at a distance from species of Pinus Burn affected plants to protect neighboring pines

Sequoia. BLIGHT —See under *Pseudotsuga*

Silene. SMUT —See under *Lychnis*

Solanum.—See under *Potato, Eggplant,* etc

Sorbus. BLIGHT —See under *Pear*

Spinach. ANTHRACNOSE (*Colletotrichum spinaceæ*) —Spots on leaves, at first minute and watery, gradually increasing in size and becoming gray and dry
Control —Gather and destroy all diseased leaves
MILDEW (*Peronospora effusa*) —Gray, slightly violet, patches of a velvety texture on under side of leaves
Control —As for *Anthracnose,* which see

Spiræa. RUST (*Triphragmium ulmariæ*) —Reddish yellow and dark brown rust pustules on leaves
Control —Burn affected parts

Squash. WILT —See under *Cucurbita.*

Strawberry LEAF-SPOT, or LEAF-BLIGHT (*Mycosphærella fragariæ*) —Small purple or red spots appearing on leaves Leaf appears blotched
Control —Spray with bordeaux mixture, 4-4-50, soon after growth begins and make three or four additional sprayings during season

Sweet Pea MILDEW —See under *Pea*

Sweet Potato BLACK-ROT (*Ceratocystis fimbriata*) —Black shank and a black rot of tuber
Control —Never use sprouts from affected potatoes Steam sterilize hotbeds
ROTS —The sweet potato is susceptible to a large number of rots, soft, dry, hard, white, etc
Control —Use soil which has not grown diseased sweet potatoes heretofore

Syringa MILDEW (*Microsphæra alni*) —White powdery mildew on upper surface of leaves
Control —Dust with sulfur
TWIG and BUD DISEASE (*Phytophthora syringæ*) —Tips of twigs killed
Control —Prune off twigs.

Thalictrum RED-SPOT (*Synchytrium anemones*) —Red eruptions on stem, leaf and flower Causing at times swelling and crumpling of the organ
Control —Burn affected parts.

Thuja. ROOT-ROT (*Polyporus schweinitzii*) —Diseased wood yellowish, cheesy, brittle when dry
HEART-ROT (*Fomes carneus*) —Causes pockets in the affected wood
Control —Remove all affected wood, using surgery methods

Tilia LEAF-SPOT (*Cercospora microsora*) —Causes spotting and defoliation
Control —Two sprayings in Massachusetts resulted in longer retention of the leaves

Tomato. LEAF-SPOT (*Septoria lycopersica*) —At first small spots appear, which spread until the whole leaf is consumed. Fruit may be attacked
Control —Spray with bordeaux mixture 4-4-50, making the first application two weeks after the plants are set out and repeating every two weeks throughout the season.
DOWNY MILDEW —See under *Potato Late Blight*
END-ROT —Due to lack of sufficient soil moisture
Control.—Water soil in dry periods

Toxylon (Maclura). RUST (*Physopella fici*) —Pale cinnamon-brown rust pustules on under side of leaf
Control —Destroy by burning the affected leaves

CATALOGUE OF DISEASES, continued

Tropæolum —See under *Horse-Radish.*

Tsuga HEART-ROT (*Trametes pini*) —Light brown decay pitted with small oblong cavities, which are white-lined
SAP-ROT (*Fomes pinicola*) —Soft decay of sap-wood.
Control —Surgery methods

Tulipa. MOLD (*Sclerotinia parasitica*) —Olive-brown, velvety patches formed on leaves, stem, and flowers, also, later, small black lumps at base of stems
Control —Burn affected plants

Turnip CLUB-ROOT —See under *Cabbage* Same disease.
SOFT-ROT —See under *Carrot* Same disease

Ulmus TAR-SPOT (*Gnomonia ulmea*) —Black spots on upper surface of leaves
Control —Burn old leaves in fall or winter.
HEART-ROT (*Pleurotus ulmarius*) —Soft rotting of wood.
Control —Surgery methods

Vaccinium. LEAF-BLISTER (*Exobasidium vaccinii*) —Large blisters on leaves, petioles and stems, of a red or purple color White bloom beneath
Control —Remove and burn diseased parts

Verbena. MILDEW (*Erysiphe cichoracearum* and others) —Powdery mildew growths on leaves
Control —Spray with any good fungicide or dust with powdered sulfur

Veronica. LEAF-SPOT (*Septoria veronicæ*) —Well-defined spots on leaves
Control —Pick off and burn affected leaves

Vinca. LEAF-SPOT (*Sphæropsis vincæ*) —Leaves disfigured by spots which occur on the stem at times as well
Control —Destroy diseased parts of plants

Violet ROOT-ROT (*Thielavia basicola*) —Plants make poor growth, roots rotted off
Control —Start in steam-sterilized soil, and transfer to sterilized beds

Vitis —See under *Grape*

Walnut BLIGHT (*Pseudomonas juglandis*) —Black spotting of fruit and black cankers on the stems Twigs and fruit-spurs killed
Control —None known except such as mentioned under *Pear Blight* Grow immune varieties
ANTHRACNOSE, or LEAF-BLIGHT (*Marsonia juglandis*) —See under *Hickory-Nut* Same disease

Watermelon MILDEW —See under *Cucumber*
WILT (*Fusarium vasinfectu*) —Wilting of leaves and plant dries up
Control —None recommended Resistant varieties should be grown

Yucca LEAF-BLOTCH —See under *Agave*

Zea —See under *Corn*

Zinnia. WILT —See under *Dahlia.*

DONALD REDDICK.

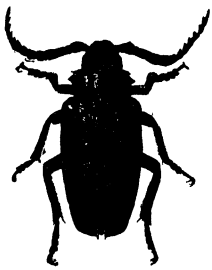
Insect enemies of plants.

The animals which constitute the insect world play an important part in most horticultural operations The busy bee is an indispensable aid in the production of many fruits, but the equally busy jaws of canker-worms or other insects oftentimes seriously interfere with man's plans for profitable crops Horticulturists should become more intimately acquainted with their little friends and foes in the insect world Not only from the economic standpoint is this knowledge necessary in the business of growing plants, but the striking peculiarities of form, coloring, structure, habits, and the wonderful transformations of insects afford one of the most interesting fields in nature. The life-stories of many insects, if told in detail, would rival in variety and interest many a famous fairy tale The science that treats of insects, or entomology, has now reached the stage at which its devotees are no longer looked upon with ridicule in most communities At the present time more than 350 trained men are officially employed in entomological work in the United States and Canada

What they are —An insect is an animal which, in the adult stage, has its body divided into three distinct regions the head, the thorax and the abdomen (Fig 1293) The head bears one pair of antennæ, and there are always three pairs of legs and usually either one or two pairs of wings attached to the thorax. By these characteristics one can usually readily distinguish an adult insect from any other animal Among the near relatives of insects in the animal world are the cray-

DISEASES AND INSECTS

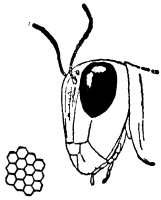
fish, sow-bugs, and crabs, but these are mostly aquatic animals, breathing by true gills, they have two pairs of antennæ, and at least five pairs of legs Centipedes, or "hundred-legged worms," and millipedes, or "thousand-legged worms," are also nearly related to insects, but they have the thorax and abdomen forming a continuous region, and with six to 200 segments, each bearing one or two pairs of legs, they have one pair of antennæ The layman usually classes such animals as the spiders, mites and daddy-long-legs among the insects, but they form a distinct class, as they have the head and thorax grown together, no antennæ, and have four pairs of legs.



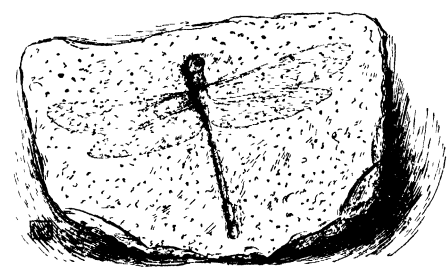
1293. A beetle, showing the different parts.

How they are constructed.—Insects are constructed on an entirely different plan from the higher animals Their supporting skeleton is outside, it being simply the skin hardened more or less by a horny substance, known as chitin This firm outer wall, or skeleton, supports and protects the muscles, blood-vessels, nerves, and other organs within The mouth-parts, antennæ and eyes of an insect are attached to its head, and all are exceedingly useful organs, as will be shown later in discussing the feeling and the other sensations of an insect An insect's wings and legs are always borne by the thorax The wings are primarily organs of flight, but are used as musical organs by some of the grasshoppers and crickets Female canker-worm moths, bed-bugs, and some other insects have practically no wings, and the house-flies, mosquitos, male bark lice, and similar insects have but one pair of wings Insects use their legs primarily for locomotion, some have their front legs modified for catching other insects for food, others have hind legs fitted for jumping, while the honey-bee has little "pockets" on its hind legs for carrying pollen to feed its young

The arrangement of the internal organs in insects is interesting and somewhat peculiar The alimentary or food canal in larvæ is a nearly straight tube, occupying the central portion of the body, in adult insects it is usually much longer than the body and is more or less folded, from the mouth the food passes through a pharynx, an esophagus, sometimes a crop and a gizzard, a stomach, and a small and large intestine The nervous system of an insect is similar to that in the higher animals, but it extends along the venter instead of the back. There is a little brain in the upper part of the head, and two nerve cords extend from this around the food-canal to another ganglion or nerve center in the lower part of the head; two nerve cords then extend longitudinally along the venter and connect a series of nerve centers or ganglia, typically one for each segment of the body From each of these ganglia or little brains nerves arise, which supply the adjacent organs and ramify throughout the body In insects, all parts of the body cavity that are not occupied by the internal organs are filled with a rich, colorless or slightly greenish blood There is no system of tubes like our arteries and veins, in which the blood is confined and through which it flows There is a so-called "heart" above the food-canal, along the middle line of the back, it is a tube consisting of several chambers communicating with each other and with the body cavity by valvular openings The blood is forced through this heart into the head, where it escapes into the body cavity. It then flows to all parts of the body, even out into the appendages, in regular streams which have definite directions, but which are not confined in tubes They, like the ocean currents, are definite streams with liquid shores Insects do not breathe through the mouth, as many suppose, but through a series of holes along the sides of the body These openings, or spiracles, lead into a system of air-tubes, called tracheæ These tracheæ branch and finally ramify all through the insect. Insects have no lungs, but the tracheæ sometimes connect with air-sacs or bladders in the body, which help to buoy up the insect when flying Thus the relation between the circulation of the blood and respiration is not nearly so intimate in insects as in man In insects the air is carried to all the tissues of the body in the tracheæ and the blood simply bathes these tissues Just how the blood is purified and how the waste matter is disposed of in insects are not yet clearly understood Aquatic insects breathe by either carrying down bubbles of air from the surface entangled under their wings, or they may be provided with organs known as tracheal gills, these



1294
Head of grasshopper.
Showing the great eye A detail of a part of the surface of the compound eye is also shown

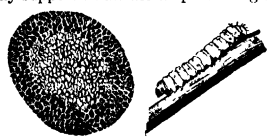


1295 Fossil dragon-fly, Petalia longialata (×½.)

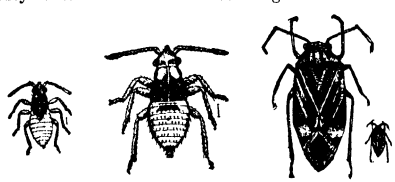
are usually plate-like expansions of the body that are abundantly supplied with tracheæ, in which the air is brought practically in contact with the air in water, and may thus be purified More than 4,000 different muscles have been found in a single caterpillar Notwithstanding their delicate appearance, these muscles are really very strong and their rapidity of action is wonderful, in certain gnats the muscles move or vibrate the wings 15,000 times a second

Their sensations—Insects can see, feel, hear, taste and smell, and they may also possess other senses, as a sense of direction Many insects have two kinds of eyes On each side of the head the large compound eye is easily recognized (Fig 1294), each compound eye is composed of many small eyes, from fifty in some ants to many thousands in a butterfly or dragon-fly Between these compound eyes, from one to four simple eyes are to be found in many adult insects. Caterpillars and other larvæ possess only simple eyes It is thought that each facet of the compound eye sees a part of an object, thus the whole eye would form a mosaic picture on the insect's brain The simple eyes doubtless see as our eyes do, and seem to be best adapted for use in dark places and for near vision. Insects do not see the form of objects distinctly, but their eyes are doubtless superior to ours in distinguishing the smallest movements of an object It is now supposed that no insects can distinctly see objects at a greater distance than 6 feet. It must be a sixth

sense, a sense of direction, which enables the bee to find its way for a mile or more back to its home. Insects are doubtless able to distinguish the color of objects, and some insects seem to prefer certain colors. Blue is said to be the favorite color of the honey-bee, and violet that of ants; ants are also apparently sensitive to the ultra-violet rays of light, which man cannot perceive. It is generally supposed that the shape and high colors of flowers attract insects; but recent experiments seem to show that insects are guided to flowers by the sense of smell rather than by sight. The hard outer skin of an insect has no nerves distributed in it, hence it is not sensitive; but it is pierced with holes, in which grow hairs that are in connection with nerves at their base. It is by means of these sensory hairs that insects feel, and are sensitive to touch on most parts of the body. Doubtless insects are not deaf, for we know that many of them make sounds, and it must naturally follow that they have ears to hear, for there is every reason to suppose that they make these sounds as love-songs to attract the sexes, as a means of communication, or possibly to express their emotions. Some think that bees and ants hear sounds too shrill for our ears. Insects have no true voice, but produce various noises mechanically, either by rapid movements of their wings, which causes the humming of bees and flies, or by friction between roughened surfaces on the body or its appendages, thus producing the rasping sounds or shrill cries of some crickets and grasshoppers. The house-fly hums on F, thus vibrating its wings 335 times in a second, while the wing tone of the honey-bee is A. Usually the males are the musicians of the insect world, but it is the female of the familiar mosquito which does the singing, and the "biting" also. The male mosquito doubtless hears the song of his mate by means of his antennæ, as the song causes the antennal hairs to vibrate rapidly. Organs which are structurally ear-like have been found in various parts of the body of insects. The common brown grasshoppers of the fields have a large ear on each side of the first segment of the abdomen; one can easily distinguish with the naked eye the membrane or tympanum stretched over a cavity. Many of the long-horned green grasshoppers, katydids and crickets have two similar ears on the tibia of each front leg. Some think that mosquitos have the faculty of the perception of the direction of sound more highly developed than in any other class of animals. Insects undoubtedly possess the sense of taste. When morphine or strychnine was mixed with honey, ants perceived the fraud the moment they began to feed. The substitution of alum for sugar was soon detected by wasps. Bees and wasps seem to have a more delicate gustatory sense than flies. Taste organs have been found in many insects, and are usually situated either in the mouth or on the organs immediately surrounding it. Many experiments have shown that the antennæ are the principal organs of smell in insects. Blow-flies and cockroaches which have had their antennæ removed are not attracted by their favorite food, and male insects find their mates with difficulty when deprived of their antennæ. The familiar world which surrounds us may be a totally different place to insects. To them it may be full of music which we cannot hear, of color which we cannot see, of sensations which we cannot perceive. Do insects think or reason? Why not? Their actions are said to be the result of inherited habit or instinct. But some of them have been seen to do things which require the exercise of instinctive powers so acute and so closely akin to reason that one can hardly escape the conclusion that some insects are endowed with reasoning powers.



1296. The four stages in an insect's life—egg, larva, pupa, imago.—The codlin-moth. (Egg much enlarged, others ×1½)



1297. Nymphs of the four-lined leaf-bug, and adult of the tarnished plant-bug

The smaller one at the left is the nymph recently hatched. The next is the nymph after the first moult. The imago is shown at the right. Hair lines at the right of nymphs, and small figure near imago indicate the natural size



1298. Larva of a sphinx moth.

Their number, size and age.—Experts guess that there are from 2,000,000 to 10,000,000 different kinds of insects in the world. Only about 400,000 of these have yet been described and named by man. Between 30,000 and 40,000 are now known in North America. Four-fifths of all the kinds of animals are insects, some single families of insects are said to contain more species than one can see stars in a clear sky at night; and there are as many butterflies as birds in North America. The larger part of the land animals are insects, and it is asserted that the larger proportion of the animal matter existing on the lands of the globe is probably locked up in the forms of insects. Insects vary in size from little beetles, of which it would take 100, placed end to end, to measure an inch, up to tropical species 6 or 8 inches in length, or of equal bulk to a mouse. Insects have a very long, but, as yet, very imperfect pedigree extending through the geological ages to Silurian times. Fossil remains of many different kinds of insects have been found in the rocks (Fig. 1295); even such delicate insects as plant-lice left their impress on the rocks ages ago. In the carboniferous or coal age, the insect world was evidently quite different from that of today, for fossils of veritable insect mammoths have been found; dragon-flies with a wing-expanse of 2 to 3 feet then existed. Insect fossils found in the tertiary rocks



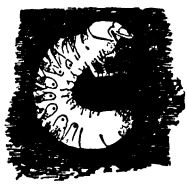
1299 Tent-caterpillar.

indicate that there were even more kinds of insects then than now.

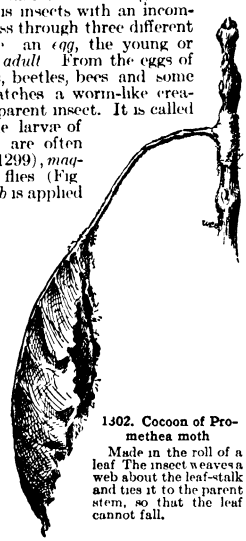
Their growth and transformations. Fig 1296 —Insects begin life as an egg, in some cases the egg stage is passed within the body of the mother, which then gives birth to living young The eggs of insects exhibit a wonderful variety of forms, sizes, colors and characteristic markings A single scale insect may lay thousands of eggs, while some plant-lice produce only one Remarkable instinct is often shown by the mother insect in placing her eggs where her young will find proper food From their birth the young of some of the lowest or most generalized insects closely resemble their parents, and they undergo no striking change during their life, hence are said to have no metamorphosis In the case of grasshoppers, stinkbugs, dragon-flies, and many othe insects, the young at birth resemble their parents, but have no wings As they grow, wings gradually develop and often changes in markings occur, until the adult stage is reached The growth, however, is gradual, and no striking or complete change occurs, and these insects are said to undergo an incomplete metamorphosis The young insects in all stages are called *nymphs* (Fig 1297), thus insects with an incomplete metamorphosis pass through three different forms during their life an *egg*, the young or *nymph* stage, and the *adult* From the eggs of butterflies, moths, flies, beetles, bees and some other insects, there hatches a worm-like creature, much unlike the parent insect. It is called a *larva* (Fig 1298); the larvæ of butterflies and moths are often called *caterpillars* (Fig 1299), *maggots* are the larvæ of flies (Fig 1300), and the term *grub* is applied to the larvæ of beetles and bees (Fig 1301) When these larvæ get their full growth, some of them go into the ground where they form an earthen cell, while others proceed to spin around themselves a silken home or *cocoon* (Figs 1302–1304). In these retreats the larvæ change to a quiescent or lifeless-appearing creature which has little resemblance to either the larva or the parent insect It is call a *pupa* (Fig 1305) The pupæ of butterflies are often called *chrysalids* Flies change to pupæ in the hardened skin of the maggot. Some pupæ, like those of mosquitos, are very active Wonderful changes take place within the skin of the pupa Nearly all the larval tissues break down and the insect is practically made over, from a crawling larva to a beautiful, flying adult insect. When the adult is fully formed, it breaks its pupal shroud and emerges to spend a comparatively brief existence as a winged creature Such insects are said to undergo a complete metamorphosis, and pass through four strikingly different stages during their life: the egg, the worm-like larva, the quiescent pupa, and the adult insect. Such remarkable changes or transformations make the story of an insect's life one of intense interest to one who reads it from nature's book Various kinds of adult insects, or imagoes, are shown in Figs. 1306–1311. No two kinds of insects have the same life-story to tell. Some pass their whole life on a single host; some partake of only a certain kind of food, while others thrive on many kinds of plants; some are cannibals at times, and others, like the parasites, are boarders within their host, while many prey openly on their brethren in the insect world. Usually the life of the adult insect is brief, but ants have been kept for thirteen years, and the periodical cicada has to spend seventeen years as a nymph underground before it is fitted to become a denizen of the air The winter months may be passed in any of the different stages of the insect's life. Two very closely allied insects may have very different life habits



1300 A maggot Larva of a dipterous insect



1301 A grub Larva of a beetle



1302. Cocoon of Promethea moth

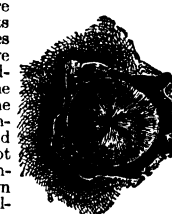
Made in the roll of a leaf The insect weaves a web about the leaf-stalk and ties it to the parent stem, so that the leaf cannot fall.



1303 Lengthwise section of the Promethea cocoon.

Showing at apex the valve-like opening through which the moth escaped.

How they grow —Many persons think that the small house-flies grow to be the large ones While most insects feed after they become adults, they get little or none of their growth during their adult life. Insects grow mostly while they are larvæ, or nymphs The maggots from which the little house-flies develop doubtless do not have as luxuriant or favorable feeding-grounds as do those of the larger flies. In thirty days some leaf-feeding caterpillars will increase in size 10,000 times; and a certain flesh-feeding maggot will in twenty-four hours consume two hundred times its own weight, which would be paralleled in the human race if a one-day-old baby ate 1,500 pounds the first day of its existence! The skin of insects is so hard and inelastic that it cannot stretch to accommodate such rapid growth. But nature obviates this difficulty by teaching these creatures how to grow a new suit of clothes or a new skin underneath the old one, and then to shed or molt the latter The old skin is shed in its entirety, even from all the appendages, and sometimes remains in such a natural position where the insect left it as to easily deceive one into thinking that he is looking at the insect rather than at its cast-off clothes Some insects are so neat and economical that they devour their old suits or skins soon after molting them Larvæ, or nymphs, may molt from two or three to ten or more times, the larvæ do not often change strikingly in appear-

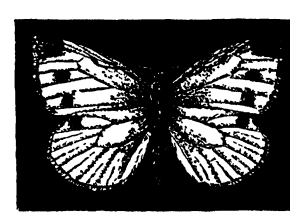


1304. End of cocoon of Cecropia moth.

Inside view, showing where the moth gets out.



1305 Pupa of tomato worm.



1306. The cabbage butterfly.

ance, but the nymphs gradually acquire the characters and structures of the adult

How they eat.—To the horticulturist, the mouth-parts of an insect are its most important organs or appendages. The mouth-parts are built on two very different plans. Grasshoppers, beetles, caterpillars and grubs have two pairs of horny jaws, working from side to side, with which they bite or chew off pieces of their food, that then pass into the food-canal for digestion (Fig 1312) The scale insects (Fig 1313), plant-lice, true bugs (Fig 1314), mosquitos and others have these jaws drawn out into thread-like organs, which are worked along a groove in a stiff beak or extended under-lip Such insects can eat only liquid food, which they suck with their beak-like mouth-parts. The insect places its beak on the surface of the plant, forces the thread-like jaws into the tissues, and then begins a sucking operation, which draws the juices of the plant up along the jaws, and the groove in the beak into the food-canal of the insect. Thus a sucking insect could not partake of particles of poison sprayed on the surface of a plant Its mouth-parts are not built for such feeding, and as it is impracticable to poison the juice of the plant, one is forced to fight such insects with a deadly gas, or each individual insect must be actually hit with some insecticide A knowledge of these fundamental facts about the eating habits of insects would have saved much time and money that have been wasted in trying to check the ravages of sucking insects with paris green and similar poisons. Some insects, like the fruit flies, have mouth-parts fitted for lapping up liquids.



1307. Imago of a tent-caterpillar.



1308. A beetle. The adult of a borer larva.

Beneficial insects

The horticulturist has many staunch and true friends among the insects The honey-bee, the many wild bees, and other insects, as they visit the blossoms to get food for themselves, for their young, and honey for man, leave an insurance policy in the shape of tiny grains of pollen, which often insures a crop of fruit that otherwise might be extremely uncertain The honey-bee is often accused of biting into ripe fruits, especially grapes. They have not yet been proved guilty, and careful, exhaustive experiments have shown that they will not do it under the most favorable circumstances. Wasps and other strong-jawed insects are responsible for most of this injury, the bees only sipping the juice from the wound See *Bees*, Vol I.



1309. One of the weevil beetles. With a long and strong proboscis

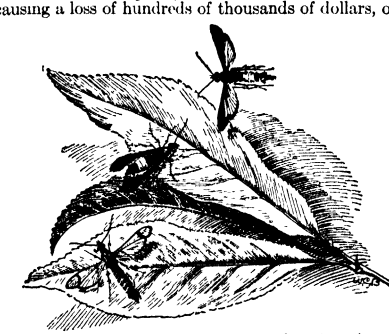
Most of the pretty little beetles known to every child as "lady-bugs" eat nothing but injurious insects; many other beetles are also predaceous Man is also often deeply indebted to many of the two-winged insects or true flies whose larvæ live as parasites inside the body of insect pests or feed upon them predaceously Were it not for the ravenous larvæ of the "lady-bugs" and of the syrphus flies, plant-lice of all kinds would soon get beyond control While man must recognize these little friends as valuable aids in his warfare against the hordes of insect pests, it will rarely be safe to wait for the pests to be controlled by their enemies Fig 1315 shows a tomato worm bearing the cocoons of a parasite Fig. 1310 shows one of the predaceous beetles destroying a cutworm.

Injurious insects.

There are now several thousand different kinds of insects that may be classed as injurious in the United States and Canada Over 600 kinds were exhibited at the Columbian Exposition in 1893 All of these may not be injurious every year, as most insect pests have periods of subsidence, when certain factors, possibly their enemies or perhaps climate conditions, hold them in check The outlook for American horticulturists, so far as injurious insects are concerned, is not encouraging. Nowhere else in the world are insects being fought as intelligently, successfully and scientifically as in America, yet we never have exterminated, and it is very doubtful if we ever will, a single insect pest. This means that American horticulturists will never have any fewer kinds of insects to fight On the contrary, there are many more insect pests now than in our grandfather's early days, and new pests are appearing every year. This alarming state of affairs is largely due to two causes, for both of which man is responsible. Man is continually encroaching upon and thereby disturbing nature's primitive domain and the equilibrium which has there become established between animals and plants In consequence, insects like the Colorado potato beetle, the apple-tree or the peach-tree borers have been attracted from their original wild food-plants to man's cultivated crops, which often offer practically unlimited feeding-grounds Most of the new insect pests, however, are now coming to America from foreign shores American horticulturists are continually importing plants from the ends of the earth, and oftentimes the plants are accompanied by one or more of their insect pests Some comparatively recent introductions of this kind are the smaller pear-borer, the pear midge, the gypsy moth, the brown-tail moth, the horn-fly and the elm leaf-beetle, such standard pests as the Hessian fly, the cabbage butterfly, the currant-worm, the codlin-moth (Fig 1296) came in many years ago Of the seventy-three insects which rank as first-class pests, each of them almost annually causing a loss of hundreds of thousands of dollars, over



1310. Ground beetle One of the commonest predaceous insects



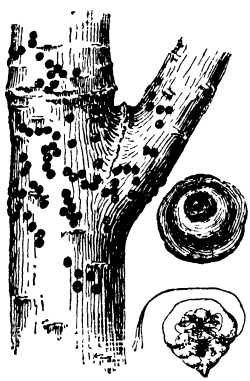
1311 Moths of the peach-tree borer. The lowest one is male.

DISEASES AND INSECTS

one-half have been introduced from foreign countries, mostly from Europe. It is a significant fact that usually these imported insects become much more serious pests here than in their native home; this is doubtless largely due to the absence of their native enemies, to more favorable climatic conditions here, and to a less intense system of agriculture in this country. Most of our worst insect pests of the fruits, of the garden crops, of the granary, of the household, of the greenhouse, and practically all of our most dangerous scale insects, are of foreign origin. Man will continue to encroach on and disturb nature's primitive domain, and commercial operations will never cease, nor is there much hope of ever effectually quarantining our shores against these little foes, hence there seems to be no practicable way to stop this increase of the insect enemies of the horticulturist. The one who is the best fitted by nature, and who best fits himself with a knowledge of these pests and how to fight them, will usually be the one to survive and reap the reward of profitable crops. No part of a plant, from its roots to the fruit it produces, escapes the tiny jaws or the sucking beaks of insects.

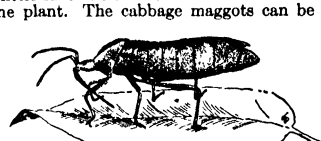


1312. Mouth-parts of a biting insect.



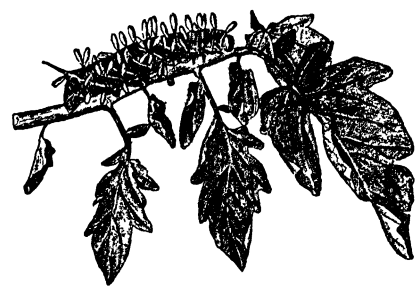
1313. San José Scale.
Showing the mature winter scale, also the insect itself, with its thread-like feeding organs

Root-feeding insects.—Many of the small fruits and vegetables are often seriously injured by insects feeding on the roots. The grape-vine fidia (the grub of a small beetle) and the grape phylloxera plant-louse live on grape roots. Strawberries often succumb to the attacks of the grubs of several small beetles known as strawberry-root worms, and to the large white grubs of the May beetles. The roots of cabbages, radishes and other cruciferous plants are often devoured by hordes of hungry maggots. These underground root-feeding insects are difficult pests to control, like any other unseen foe. Sometimes they can be reached successfully by injecting a little carbon bisulfide into the soil around the base of the plant. The cabbage maggots can be prevented largely by the use of tarred paper pads placed around the plants, or by pouring a carbolic acid emulsion at the base of the infested plants. The strawberry root-feeders are best controlled by frequent cultivation and a short rotation of crops.



1314. Hemipterous insect. Known to entomologists as a true bug.

Borers.—These are the larvæ of several different kinds of insects, which burrow into and feed upon the inner bark, the solid wood, or the interior pith of the larger roots, trunks, branches, and stems or stalks of many horticultural plants. Nearly every kind of fruit trees is attacked by its special kind of borer, as are also many of the smaller vine and bush-fruits and garden crops. Borers are often the most destructive of insect pests. The two apple-tree borers, the round-headed (Fig. 1316) and the flat-headed species, and the peach-tree borer (Fig. 1311) doubtless cause the death of as many apple and peach trees in America as all other enemies combined. The fruit-bark beetles, or "shot-hole" borers, usually attack only unthrifty or sickly fruit trees, and a tree once infested by them is usually doomed. Two borers, one the grub of a beetle



1315. Tomato worm attacked by parasitic insects.

and the other the caterpillar of a moth, sometimes tunnel down the stems of currants and gooseberries. Raspberries and blackberries (Fig. 1317) also suffer from two or three kinds of borers, one working in the root, one in the stem, and a maggot bores down and kills the new shoots. A caterpillar closely allied to the peach-tree borer lives in squash vines, often ruining the crop. The potato-stalk weevil sometimes does much damage in potato fields. Sometimes one can prevent borers from getting into a fruit tree with a paper bandage closely wrapped around the part liable to be attacked, or by the application of some "wash." Most of the washes recommended will prove ineffectual or dangerous to use. Gas-tar has given good results, but some report injury to peach trees from its use; hence one should first experiment with it on a few trees. No way has been found to keep borers out of the small fruits or garden crops; usually if infested canes, stems or plants are cut out and burned early in the fall or whenever noticed, most of the borers will be killed. When borers once get into fruit trees, the "digging-out" process is usually the only resort, although some report that they readily kill the depredator by simply injecting a little carbon bisulfide into the entrance of his burrow and quickly closing it with putty.



1316. Burrows of an apple-tree borer.
The holes at *a* show where the imago or beetle emerged

Bud- and leaf-feeding insects.—The buds and leaves of horticultural crops often swarm with legions of biting and sucking insects. A mere enumeration of the different kinds of these pests would weary the reader. Some insects, like the rose chafer, work on several different kinds of plants, while many others attack only one or two kinds. In apple orchards, the opening buds are seized upon by the the hungry bud-moth and case-bearing caterpillars, by

the newly hatched canker-worms, and by tent-caterpillars, whose tents or "sign-boards" are familiar objects in many orchards. These pests continue their destructive work on the leaves. The pear slug often needs to be checked in its work of skeletonizing the leaves of the pear and cherry. The pear psylla, one of the jumping plant-lice, is a very serious menace to pear-growing in many localities, the fruit is either dwarfed or drops from badly infested trees, and sometimes so many little pumps sucking out its life finally cause the death of the tree. The little blue grape-vine flea-beetle often literally nips the prospective crop of fruit in the bud, or the rose-chafer may swarm over the vines and eat the foliage or blossoms Currant and gooseberry growers realize that eternal vigilance against the familiar green currant worms is the price of a crop of fruit The asparagus beetles would soon appropriate every asparagus shoot that appears in many localities It is a continual struggle against insect pests to get a paying crop of almost any vegetable. The several kinds of cabbage caterpillars would soon riddle the leaves The hungry striped cucumber beetles can hardly wait for the melon, squash, or cucumber vines to come up Two sucking insects, the harlequin cabbage bug and the squash stink-bug, are equally as destructive as their biting relatives The bud- and leaf-feeding insects are usually readily controlled by spraying some poison on their food, or by hitting them with some oil or soap spray As the female moths of canker-worms are wingless, a wire trap or sticky bandage placed around the trunk of the tree in the late fall and early spring, to capture the moths as they crawl up the tree to lay their eggs, will greatly help to check these serious pests The collection and burning of the conspicuous egg-rings of the tent-caterpillars at any time between August and the following April will greatly reduce the vast numbers of tents or signboards of shiftlessness in apple orchards Hand-picking or collecting is the most successful method of controlling the rose-chafer, harlequin cabbage bug, and the squash stink-bug in many cases Prompt action, guided by a knowledge of the insect's habits and life-history, and any intelligent use of materials and apparatus, are essential in any successful effort to control these bud- and leaf-feeding pests of the horticulturist.

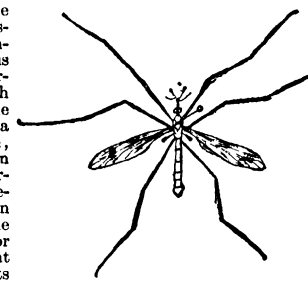


1317. A beetle borer and its work.
The larva bores in the young wood of raspberry and blackberry canes, causing the swellings seen in the picture.



1318. Grasshopper. (Mounted)

Fruit-eating insects.—"Wormy" apples, pears, quinces, plums, peaches, cherries, apricots, grapes, currants and nuts are often the rule rather than the exception. The codlin-moth or apple-worm often ruins from one-third to one-half of the crop each year in many localities, it also infests pears seriously The apple maggot tunnels its way through and through the flesh of a large percentage of the apples in the northern sections of the country Most of the wormy plums, peaches, cherries and apricots are the work of the grub of that worst insect enemy of the stone fruits—the plum curculio; the plum gouger, a similar insect, whose grub works in the pit of plums, is equally destructive to this fruit in some states "Knotty" quinces are largely the work of the adults of the quince curculio, while its grub often ruins the fruit with its disgusting worm-hole There is also a grape curculio that, with the aid of the caterpillar of a little moth, works havoc in grapes Currants and gooseberries are often wormy from the work of two or three different kinds of maggots and caterpillars Two kinds of fruit flies attack the cherry· infested cherries may show no external signs of the presence of the maggot reveling in the juices within Various small beetles known as weevils, are responsible for most wormy nuts Most of the fruit-eating insects are out of the reach of the ordinary insecticides The codlin-moth is a noted exception, however, for the peculiar habit that the little caterpillar has of usually entering the blossom end of the fruit and feeding therein for a few days, gives the man with a poison spray a very vulnerable point of attack. It is only necessary to spray a bit of poison into the open calyx cup within a few days after the petals fall, and let nature soon close the calices and keep the poison therein until the newly-hatched caterpillar includes it in its first menu Often 95 per cent of the apples that would otherwise be ruined by the worms are saved by an application of paris green at this critical time



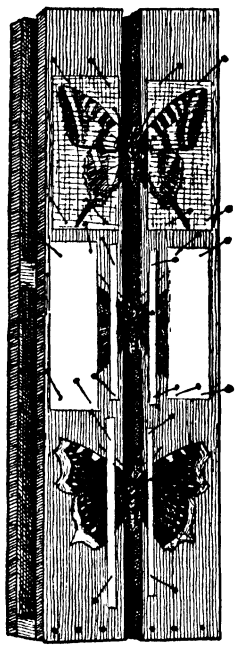
1319 A crane fly (Mounted)

Plant-lice —Scarcely a plant escapes the little suction pump or beak of some kind of a plant-louse or aphis. More than 300 different kinds of plant-lice have been identified in the United States, and nearly every kind of fruit, flower, farm or garden crop has its special plant-louse enemy, which is often a serious factor in the production of a crop These little creatures are so small, so variable, so hard to perceive, present so many different forms in the same species, and have such varied and interesting life-stories to tell, that what is known about them is but a mere beginning as compared to what is yet to be learned. It would take a large volume to include the interesting stories which might be told of the lives and of the relations with ants of some of the commonest of these plant-lice No other group of insects presents so many curious, varied, interesting, and wonderful problems of life as do the aphids In the aggregate, the damage done by plant-lice is very great



1320 A snapping beetle (Mounted)

At times hundreds of acres of peas have been ruined by an aphid. Nursery stock often suffers severely and bearing fruit trees are often seriously injured by them About forty different kinds of aphides live in greenhouses where a perpetual warfare has to be waged against them. In four years nearly 100 generations of a common aphis have been reared in greenhouses, and there were no indications of any egg-stage or of male forms during this time, so that they may thus breed indefinitely in houses, their young being born alive and no males appearing. The standard remedies for plant-lice are whale-oil soap, kerosene emulsion, and tobacco in various ways (as a decoction, dry as a dust, or in the form of similar extracts), and these are successfully used to kill the aphides in all situations.



1321. A spreading board for drying soft-winged insects.

Scale insects —Since the advent of San José scale into the eastern United States, scale insects of all kinds have attracted world-wide attention They are all small insects, and derive their name from the fact that their tender bodies are protected by hard, scale-like coverings secreted by the insects Thus protected, they are difficult insects to kill, and as they are easily transported on nursery stock, buds or cions, and also multiply rapidly, the scale insects are justly to be considered as among the most dangerous and destructive of injurious insects A single female San José scale may rear a brood of from 100 to 600 young, and there may be four or five generations a year; and more than 2,000 eggs have been laid by a single Lecanium scale. The scale insects, the dreaded San José species included, can be controlled successfully by judicious, intelligent and timely work with sprays of lime-sulfur, crude petroleum, or hydrocyanic acid gas, which should be used in the case of nursery stock Since 1889 fumigation with hydrocyanic acid gas has been extensively practised in the citrus orchards of California, and now Florida and South African fruit-growers are also using it in their orchards. Large gas-tight tents or boxes are placed over the trees and the gas then generated within. Much nursery stock is now treated with the gas in tight boxes or houses; this is required by law in many states, and it should be practised in other regions. Recently greenhouses, railway coaches, rooms in private houses, and whole flouring mills have been effectively fumigated with this gas.

Insects are preserved in collections by securing them in tight cases by means of a pin inserted through the thorax, or through the right wing if the subject is a beetle Moths and butterflies are pinned in position on a spreading-board until thoroughly dried See Figs. 1318–1322. Every horticulturist should make a collection of injurious insects

Insect literature for horticulturists.—Horticulturists should keep in close touch with the experiment stations and state entomologists of their own and of other states, and also with the Department of Agriculture at Washington, for it is from these sources that the best and latest advice regarding injurious insects is now being disseminated free, either by personal correspondence or by means of bulletins. Among the books, one or more of which may well find a place in a horticulturist's library are the following: Weed's "Insects and Insecticides," Lodeman's "The Spraying of Plants," Saunders' "Insects Injurious to Fruits," Sanderson's "Insect Pests of Orchard, Farm and Garden," and Slingerland and Crosby's "Fruit Insects"

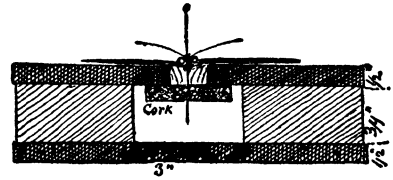
M. V. Slingerland.
C. R. Crosby†

Other invertebrate animals.

Mites.—Mites belong to the class of animals known as Arachnida, which are closely related to insects. Spiders and scorpions also belong in this group Mites are small creatures, usually possessing four pairs of legs when mature, and the body is not divided into three divisions as in the case of insects The greenhouse red-spider (*Tetranychus bimaculatus*) is one of the most common and injurious species It occurs on a wide variety of plants grown under glass and also out-of-doors on the foliage of many wild and cultivated plants It is about $\frac{1}{50}$in long and varies in color from yellow through orange to brown and dark green, often with a darker spot on each side of the body It spins a very delicate silken web-like nest over its breeding-ground It can be killed on the foliage of plants grown in the open with soap solution, dusting with sulfur, and hydrated lime, or by using a flour-paste spray In greenhouses, it is best controlled by repeated spraying with water, using much force and little water to avoid drenching the beds

The clover mite (*Bryobia pratensis*) is a minute, spider-like, oval, reddish brown mite about $\frac{1}{100}$inch in length with long front legs. It attacks the foliage of many fruit and forest trees as well as clover and grasses The tiny, round, reddish eggs often occur in great numbers on the bark of trees in winter giving the branches a reddish color. It may be controlled by the same treatment as for red-spider. In addition, the eggs may be killed with a lime-sulfur solution while the trees are dormant.

The pear-leaf blister-mite (*Eriophyes pyri*) differs from most other mites in having only two pairs of legs and in its elongate body The mite is only $\frac{1}{150}$inch in length; it burrows in the tissue of the leaf, causing blister-like galls. The eggs are laid within the gall,



1322. A cross-section of spreading board in front of the cleat "*d*," in Fig. 1321.

and some of the mites when mature leave through a small opening and migrate to new leaves. The mature mites hibernate under the bud-scales. This pest is controlled by applications of lime-sulfur or miscible oils while the trees are dormant.

Nematodes —A species of nematode worm (*Heterodera radicicola*) lives parasitically in the roots of a wide variety of wild and cultivated plants producing enlarged knots or swellings This disease is known as

root-knot and is more prevalent in light soils. It is especially troublesome in greenhouses. The adult female worm is flask-shaped, .5 to 1 mm. in length, pearly white in color, and is found within the knots on the roots. Each female lays several hundred eggs. The young worms may continue within the same root or migrate through the soil to others. Nematode root-galls have been found on nearly 500 different species of plants. It is especially destructive to okra, hollyhock, *Amarantus tricolor*, peach, snapdragon, celery, heart-leaved basil, wax gourd, beet, rape, red pepper, balloon vine, melon papaw, catalpa, endive, watermelon, coffee, muskmelon, cucumber, squash, pumpkin, carrot, deutzia, California poppy, fig, soybean, pecan, morning-glory, lettuce, gourd, sweet pea, flax, tomato, tobacco, peony, ginseng, passiflora, petunia, tuberose, cherry, pomegranate, eggplant, potato, salsify, clovers, violet, Old World grape. See page 1023.

This pest may be controlled in greenhouses by the use of live steam to sterilize the soil or by a weak solution of formaldehyde, one part, 36 to 40 per cent formaldehyde, to one hundred parts water, applied at the rate of one to one and one-half gallons to every square yard of soil surface of shallow beds After the application, the soil should be thoroughly stirred and planting should not be done till at least ten days later. Under field conditions, the problem is more difficult. The most feasible method is a system of crop-rotation in which an immune crop is grown for at least two years between susceptible crops. One of the most resistant crops is the Iron variety of cowpea Clean cultivation should be practised so as to destroy all susceptible plants.

Insecticides.

Insecticides are substances used to kill insects, as poisons, washes and gases Insects are subject to many natural checks, such as wind, rains, sudden changes of temperature, the attacks of parasites and predaceous enemies, and are often destroyed in great numbers by bacterial and fungous diseases In spite of these natural checks it is, however, usually necessary to resort to a spray or some other artificial insecticide for the protection of our crops.

The essential requirements for a satisfactory insecticide are efficient killing power, safety to the foliage, cheapness and ease of application The choice of an insecticide for any particular case will depend upon a number of factors upon the structure, habits, and life-history of the insect to be killed; and upon the susceptibility of the host plant to injury, its mode of growth and the conditions under which it is cultivated Some insects, as the plant-lice, are soft-bodied and provided with a thin and delicate integument, others, like the beetles and wireworms, have hard, horny shells impervious to ordinary spray liquids; some insects bite off and swallow portions of the plant, while others merely suck out the sap by means of a slender tube; some are injurious in the larval stage, others as adults; some attack the roots, some the foliage and fruit, while others burrow in the trunk and branches. Plants vary greatly in their susceptibility to injury from the use of insecticides; the peach and Japan plum have especially tender foliage, while the apple is not so easily injured All these points and many more must be considered in selecting an insecticide which will be adapted to the control of any injurious insect Our methods of fighting insects are constantly changing as new facts are discovered, new methods devised and new insecticides invented Our present methods are the results of a more or less unconscious cooperation extending over many years between the practical grower, the student of insect life and the progressive manufacturers of spraying materials and spray machinery.

Insecticides may be classed into those which are eaten with the food and kill by poisoning; those that kill by contact with the insect's body; and fumes of gases used for fumigation. The poisons are effective against the biting or chewing and lapping (fruit flies) insects; the contact insecticides are used as a rule against sucking insects; and fumes and gases are employed principally in greenhouses and for the fumigation of nursery stock, stored seeds, and citrus trees.

Poisoning insecticides.

The most widely used substance for the poisoning of insects is arsenic in its various compounds For this purpose only compounds insoluble in water can be used, as soluble arsenic is very injurious to foliage

White arsenic —This is the cheapest form in which arsenic can be obtained It is a white powder, soluble in water and very injurious to foliage A cheap and efficient insecticide may be prepared from it as follows

For use with bordeaux mixture only Sal-soda, two pounds, water, one gallon, arsenic, one pound Mix the white arsenic into a paste and then add the sal-soda and water, and boil until dissolved. Add water to replace any that has boiled away, so that one gallon of stock solution is the result Use one quart of this stock solution to fifty gallons of bordeaux mixture for fruit trees Make sure that there is enough lime in the mixture to prevent the caustic action of the arsenic

For use without bordeaux mixture Sal-soda, one pound, water, one gallon, white arsenic, one pound, quicklime, two pounds Dissolve the white arsenic with the water and sal-soda as above, and use this solution while hot to slake the two pounds of lime Add enough water to make two gallons Use two quarts of this stock solution in fifty gallons of water

As there is always some danger of foliage injury from the use of these home-made arsenic compounds, and as they cannot be safely combined with the dilute lime-sulfur when used as a summer spray, they are now rarely employed in commercial orchard spraying

Paris green —Paris green is composed of copper oxid, acetic acid and arsenious oxid chemically combined as copper-aceto-arsenite By the National Insecticide Law of 1910, paris green must contain at least 50 per cent arsenious oxid and must not contain arsenic in water-soluble form equivalent to more than 3½ per cent arsenious oxid For many years paris green has been the standard insecticide for orchard use, but is now largely replaced by the safer and more adhesive arsenate of lead In spraying apples, paris green is used at the rate of one-half pound to one hundred gallons of water or bordeaux mixture When used with water, lime twice the bulk of the paris green should be added to lessen the danger of foliage injury Paris green cannot safely be used with either the dilute lime-sulfur as used for summer spraying or with the self-boiled lime-sulfur

London purple —London purple is an arsenite of lime and is a by-product in the manufacture of aniline dyes Its composition is variable, the arsenic content varying from 30 to 50 per cent Owing to the presence of much soluble arsenic it is likely to cause foliage injury, and it is now little used in commercial spraying

Arsenate of lead —Arsenate of lead was first used as an insecticide in 1893, in Massachusetts It has now almost entirely replaced paris green for orchard work throughout the country It adheres better to the leaves, may be used at considerably greater strength without injuring the foliage and may be combined with a dilute lime-sulfur solution or with the self-boiled lime-sulfur Chemically, arsenate of lead may be either triplumbic arsenate or plumbic-hydrogen arsenate The commercial product usually consists of a mixture of these two forms, the proportion depending on the method of manufacture employed It is usually sold in the form of a thick paste, but for some purposes the powdered form is preferred Under the National Insecticide Law of 1910, arsenate of lead paste must not contain more than 50 per cent water and must contain the arsenic equivalent of at least 12½ per cent arsenious oxid The water-soluble arsenic must not exceed an equivalent of three-fourths of 1 per cent of arsenic oxid In the best grades of arsenate of lead paste the chemical is in a finely divided condition, and thus when diluted for use remains in suspension for a considerable time Arsenate of lead is used at various strengths, depending upon the insect to be killed and on the susceptibility of the foliage to injury Four pounds in one hundred gallons can be used on the peach if combined with the self-boiled lime-sulfur, on apple, four or five pounds in one hundred gallons is usually sufficient, on grapes for killing the grape root-worm beetles and the rose-chafer, eight to ten pounds in one hundred gallons have been found necessary The poison is more readily eaten by these beetles if sweetened by two gallons of molasses in one hundred gallons, but, unfortunately, the addition of molasses greatly decreases the adhesiveness of the poison Some species of fruit flies may be controlled by the use of sweetened arsenate of lead sprayed on the foliage of the plants at the first appearance of the flies They lap up the poison with their fleshy tongue-like mouth-parts and succumb before ovipositing.

Arsenite of zinc.—Arsenite of zinc is a light fluffy powder and contains the equivalent of about 40 per cent arsenious oxid It has been used extensively on the Pacific slope as a substitute for arsenate of lead It kills somewhat more quickly and is fairly safe on apple foliage when used with bordeaux mixture or with lime. When sweetened with molasses, it is injurious to foliage One pound of zinc arsenate is equivalent to about three pounds of arsenate of lead In orchard experiments, as a rule, it has not shown that it is superior to the latter

Hellebore —Hellebore is a light brown powder made from the roots of the white hellebore plant (*Veratrum album*), one of the lily family It is applied both dry and in water In the dry state, it is usually applied without dilution, although the addition of a little flour will render it more adhesive In water, four ounces of the poison is mixed with two or three gallons, and an ounce of glue, or thin flour paste, is sometimes added to make it adhere A decoction is made by using boiling water in the same proportions Hellebore soon loses its strength, and a fresh article should always be demanded It is much less poisonous than the arsenicals, and should be used in place of them upon ripening fruit It is used for various leaf-eating insects, particularly for the currant-worm and rose-slug.

Contact insecticides.

The most important contact insecticides are soaps, sulfur, sulfur compound, and oily or resinous emulsions

Soaps —The most commonly used soap solution is that prepared from fish-oil soap The commercial brands of this soap are usually by-products and contain many impurities, further, many of them contain an excess of free or uncombined alkali and are thus likely to injure young and tender foliage A good fish-oil soap may be prepared by the following formula. Caustic soda, six pounds, water, one-half gallon, fish-oil, twenty-two pounds Dissolve the caustic soda in the water and then add the fish-oil gradually under constant and vigorous stirring The combination occurs readily at ordinary summer temperatures, and boiling is unnecessary Stir briskly for about twenty minutes after the last of the oil has been added There is now on the market a good brand of insecticide soap prepared from cotton-seed oil soap stock or from an impure grade known as paneoline

Sulfur —Sulfur may be obtained in two forms,—flowers of sulfur and flour of sulfur In the form of a powder or dust, sulfur is especially valuable against red-spider In California, flowers of sulfur mixed with equal parts of hydrated lime is blown on the trees for the control of red-spider and mite It may also be used for the same purpose mixed with water at the rate of one pound in three gallons of water, to which has been added a little soap to keep the sulfur in suspension The mixture should be agitated constantly during spraying The sulfur remains longer in suspension if it is first made into a paste with water containing one-half of 1 per cent of glue Page 1028

Lime sulfur solution —A solution of lime-sulfur was first used as an insecticide in California in 1886 It is now the standard remedy for blister mite, San José scale and similar scales, as well as an efficient fungicide The lime-sulfur solution may be purchased in the concentrated form or may be prepared as follows Lump lime (95 per cent calcium oxid), thirty-eight pounds lump lime (90 per cent calcium oxid), forty pounds, sulfur, eighty pounds, water, fifty gallons Make a paste of the sulfur with about ten gallons of hot water Add the lime As the lime slakes, add hot water as necessary to prevent caking When the lime has slaked, add hot water to make fifty gallons and boil one hour, stirring constantly Water should be added from time to time to keep the liquid up to fifty gallons Store in air-tight hardwood barrels Test the strength of the solution with a Baumé hydrometer and dilute for use according to the following table (see also p 1029)

DILUTIONS FOR DORMANT AND SUMMER SPRAYING WITH LIME-SULFUR MIXTURES

Reading on hydrometer	Amount of dilution Number of gallons of water to one gallon of lime-sulfur solution		
	For San José scale	For blister mite	For summer spraying of apples
Degrees Baumé			
36	9	12½	45
34	8¾	12	43¼
33	8¼	11½	41½
32	8	11	40
31	7½	10½	37¾
30	7¼	10	36¼
29	6¾	9½	34¾
28	6½	9	32¾
27	6	8½	31
26	5¾	8	29½
25	5¼	7½	27¾
24	5	7	26
23	4½	6½	24¼
22	4¼	6	22¾
21	3¾	5½	21¼
20	3½	5	19¾
19	3¼	4¾	18¾
18	3	4¼	17
17	2¾	4	16
16	2½	3¾	15
15	2¼	3¼	14
14	2	3	12¾

Emulsions —Emulsions are oily or resinous sprays in which these substances are suspended in water in the form of minute globules, a condition brought about by the addition of soap They form an important class of contact insecticides, useful particularly against scale insects and plant-lice

Kerosene emulsion —Kerosene emulsion is the oldest of our contact insecticides It is especially valuable for use against plant-lice and other small, soft-bodied insects It is prepared by the following formula Soap, one-half pound; water, one gallon, kerosene, two gallons Dissolve the soap in hot water, remove from the fire and, while still hot, add the kerosene. Pump the liquid back into itself for five or ten minutes or until it becomes a creamy mass If properly made, the oil will not separate on cooling For use on dormant trees, dilute with five to seven parts of water For killing plant-lice on foliage, dilute with ten to fifteen parts of water —Crude-oil emulsion is made in the same way by substituting crude oil in place of kerosene The strength of oil emulsions is frequently indicated by the percentage of oil in the diluted liquid for a 10 per cent emulsion, add seventeen gallons of water to three gallons of stock emulsion, for a 15 per cent emulsion, add ten and one-half gallons of water to three gallons of stock emulsion, for a 20 per cent emulsion, add seven gallons of water to three gallons of stock emulsion, for a 25 per cent emulsion, add five gallons of water to three gallons of stock emulsion

Distillate emulsion —Distillate emulsion is widely used in California Distillate (28° Baumé), twenty gallons, whale-oil soap, thirty pounds, water, twelve gallons Dissolve the whale-oil soap in the water which should be heated to the boiling point, add the distillate and agitate thoroughly while the solution is hot For use, add twenty gallons of water to each gallon of the stock solution

Carbolic acid emulsion —This spray is used in California for mealy-bugs, plant-lice, and the soft brown scale Whale-oil soap, forty pounds, crude carbolic acid, five gallons, water, forty gallons Dissolve the soap completely in hot water, add the carbolic acid, and heat to the boiling point for twenty minutes For use, add twenty gallons of water to each gallon of stock solution

Miscible oils —There are now on the market a number of concentrated oil emulsions, known as soluble or miscible oils, intended primarily for use against the San José scale For this purpose they are fairly effective when diluted with not more than fifteen parts of water To lessen danger of injury to the trees, applications should not be made when the temperature is below freezing, nor when the trees are wet with snow or rain Methods have been devised for preparing these concentrated emulsions at home, but as there is considerable danger attending the process, it is better to buy them ready-made

Tobacco —Tobacco is one of our most useful insecticides The poisonous principle in tobacco is an alkaloid nicotine, which in the pure state is a colorless fluid, slightly heavier than water, of little smell when cold and with an exceedingly acrid burning taste even when largely diluted It is soluble in water and entirely volatile It is one of the most virulent poisons known, a single drop is sufficient to kill a dog Commercial tobacco preparations have been on the market for many years The most important of these are black leaf, "black leaf 40," and nicofume

Black Leaf —Black leaf was formerly the most widely used tobacco extract It contains only 2 7 per cent nicotine and has now been replaced by the more concentrated extracts It is used for plant-lice at the rate of one gallon to sixty-five gallons of water

"Black leaf 40" —"Black leaf 40" is a concentrated tobacco extract containing 40 per cent nicotine sulfate Its specific gravity is about 1 25 In this preparation the nicotine is in a non-volatile form, it having been treated with sulfuric acid to form the sulfate "Black leaf 40" is used at strengths varying from one part in 800 parts of water to one part in 1,600 parts It can be satisfactorily combined with other sprays, as for example, lime-sulfur solution, arsenate of lead, and the various soap solutions When used with water, about four pounds of soap should be added to make the mixture spread and stick better

Nicofume is a tobacco extract containing 40 per cent of nicotine in the volatile form It is intended primarily for use in greenhouses Strips of paper soaked in this preparation are smudged in greenhouses to destroy aphids

Tobacco is also used in the form of dust for the same purpose It is especially valuable against root-lice on asters and other plants Tobacco extracts can be made at home by steeping tobacco stems in water, but as they vary greatly in nicotine content and are sometimes likely to injure tender foliage, it is better to buy the standardized extracts

Pyrethrum —A very fine, light brown powder, made from the flower-heads of species of pyrethrum It is scarcely injurious to man Three brands are on the market·

Persian insect-powder, made from the heads of *Pyrethrum roseum*, a species also cultivated as an ornamental plant. The plant is native to the Caucasus region.

Dalmation insect-powder, made from *Pyrethrum cinerariæfolium*

Buhach, made in California from cultivated plants of *Pyrethrum cinerariæfolium*

When fresh and pure, all these brands appear to be equally valuable, but the home-grown product is usually considered most reliable Pyrethrum soon loses its value when exposed to the air. It is used in various ways

(1) In solution in water, one ounce to three gallons. Should be mixed up twenty-four hours before using

(2) Dry, without dilution. In this form it is excellent for thrips and lice on roses and other bushes Apply when the bush is wet Useful for aphis on house plants

(3) Dry, diluted with flour or any light and fine powder. The poison may be used in the proportion of one part to from six to thirty of the dilutent

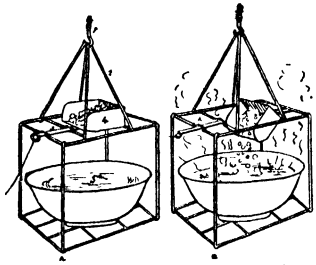
(4) In fumigation It may be scattered directly upon coals, or made into small balls by wetting and molding with the hands and

then set upon coals. This is a desirable way of dealing with mosquitos and flies

(5) In alcohol. (a) Put a part of pyrethrum (buhach) and four parts alcohol, by weight, in any tight vessel. Shake occasionally, and after eight days filter. Apply with an atomizer Excellent for greenhouse pests For some plants it needs to be diluted a little. (b) Dissolve about four ounces of powder in one gill of alcohol, and add twelve gallons of water.

(6) Decoction. Whole flower-heads are treated to boiling water, and the liquid is covered to prevent evaporation. Boiling the liquid destroys its value.

Good insect-powder can be made from *Pyrethrum roseum*, and probably also from *P cinerariæfolium*, grown in the home garden.



1323 Device for discharging the cyanide into the acid.

Bait, vegetable ban —Spray a patch of clover or some other plant that the insects will eat with paris green or some other arsenical, mow it close to the ground, and while fresh place it in small piles round the infested plants To avoid wilting of the bait, cover the heaps with a shingle or piece of board

Bran-arsenic mash —White arsenic, one-half pound, or paris green, one pound, bran, fifty pounds Mix thoroughly and then add enough water to make a wet mash Sugar or molasses may be added, but is unnecessary Poisoned baits are used against cutworms and grasshoppers

Kansas grasshopper bait —This bait is the most efficient means of controlling grasshoppers yet devised It is prepared as follows Bran, twenty pounds, paris green, one pound, syrup, two quarts, oranges or lemons, three fruits, water, three and one-half gallons Mix the bran and paris green thoroughly in a wash-tub while dry Squeeze the juice of the oranges or lemons into the water, chop the pulp and peel fine and add them also Dissolve the syrup in the water and wet the bran and poison with the mixture, stirring at the same time so as to dampen the mash thoroughly Sow the bait broadcast in the infested area early in the morning

Cradille mixture —Mix one pound of paris green with one-half barrel of horse droppings, and add one pound of salt if the material is not fresh For use against grasshoppers

Gas tar is used extensively for painting wounds to keep out the moisture and prevent the entrance of insects It is also sometimes used on peach trees to keep out the borers In this case it should be applied in the spring only, as there is danger of injuring the trees in the fall.

Asphalt —Certain grades of asphalt have been used successfully on peach in California to keep out the Pacific peach tree-borer Experiments in the eastern states indicate that it may be used to advantage against the common peach tree-borer.

Hot-water.—Submerge affected plants or branches in water at a temperature of about 125°. For aphis It will also kill rose-bugs at a temperature of 125° to 135°.

Gasolene torch —The gasolene torch has been successfully used for the control of scale insects on date palms in Arizona The trees are first pruned closely, drenched with gasolene and fired. They are then scorched with a gasolene blast torch

Flour paste —Mix a cheap grade of wheat flour with cold water, making a thin batter, without lumps, or wash the flour through a wire screen with a stream of cold water Dilute until there is one pound of flour in each gallon of mixture Cook until a paste is formed, stirring constantly to prevent caking or burning Add sufficient water to make up for evaporation For use, add eight gallons of this stock solution to one hundred gallons of water. Used for red spider in California.

General practices.

Cleanliness —Much can be done to check the ravages of insects by destroying their breeding-places and hiding-places Weeds, rubbish, and refuse should be eliminated

Hand-picking is often still the best means of destroying insects despite all the perfection of machinery and of materials This is, particularly true about the home grounds and in the garden. The cultivator should not scorn this method

Promoting growth —Any course that tends to promote vigor will be helpful in enabling plants to withstand the attacks of plant-lice and other insects.

Burning —Larvæ which live or feed in webs, like the tent-caterpillar and fall web-worm may be burned with a torch The lamp or torch used in campaign parades finds its most efficient use here

Banding —To prevent the ascent of canker-worm moths and gypsy-moth caterpillars, various forms of sticky bands are in use For this purpose there is no better substance than "tree tanglefoot " It may be applied directly to the tree-trunk, but when so used leaves an unsightly mark and requires more material than when the following method is used First place a strip of cotton batting 3 inches wide around the trunk, cover this with a strip of tarred paper 5 inches wide, draw the paper tight and fasten at the lap only with three or four tacks Spread the tanglefoot on the upper two-thirds of the paper, and comb it from time to time to keep the surface sticky Burlap bands are made by tying or tacking a strip of burlap around the trunk and letting the edges hang down The larvæ will hide under the loose edge, where they may be killed Banding is now little used for codlin-moth, since spraying with poison has been found so much more effective.

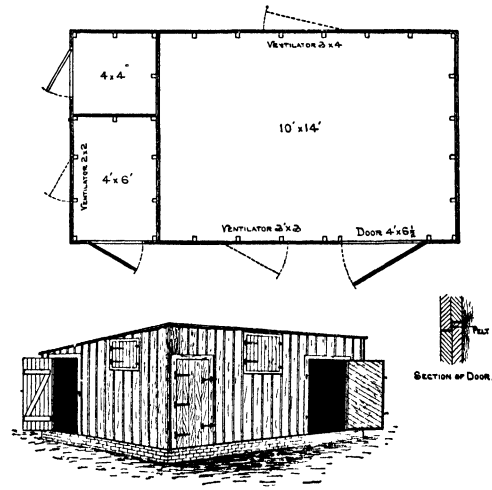
Fumigation.

Poisonous gases are widely used in killing insects under certain conditions Hydrocyanic acid gas is employed in the fumigation of greenhouses and citrus trees It is a most deadly and effective material In Europe, fumigation with this gas is known as cyaniding and cyanization Nicotine preparations are used extensively in greenhouse fumigation. Carbon bisulfid is employed almost exclusively for the treatment of stored grains and seeds.

Hydrocyanic acid gas —This gas is generated by adding potassium or sodium cyanide to dilute sulfuric acid The gas is a deadly poison, and great care should be taken not to inhale it. One breath is fatal!

Potassium cyanide is a white amorphous salt that readily absorbs moisture when exposed to the air. Pure potassium cyanide contains 40 per cent of cyanogen (CN) by weight. When potassium cyanide (KCN) is placed in dilute sulfuric acid the cyanogen (CN) unites with the hydrogen (H) of the acid (H_2SO_4) to form hydrocyanic acid gas (HCN) In the preparation of this gas for fumigation purposes use a potassium cyanide which is at least 98 per cent pure The chemicals should always be combined in the following proportions Potassium cyanide, one ounce, sulfuric acid, one fluid ounce; water, three fluid ounces.

Always use an earthen dish, *pour in the water first*, and add the sulfuric acid When all is ready, drop in the proper quantity of potassium cyanide and retire



1324. Shed for the fumigation of nursery stock.

immediately, before the gas arises. Fig. 1323 shows a device used abroad (from the "Gardening World") for dumping the cyanide (at 4) into the acid by means of a cord that extends outside the house.

White-fly —The quantity of chemicals used for a given space will depend on the nature of the insects to be killed and the susceptibility of the plants to injury. This quantity is usually indicated by amount of potassium cyanide required for each 100 cubic feet of space. For treating white-fly on tomatoes in greenhouses, use one ounce to 3,000 cubic feet, letting the fumigation continue all night The same treatment applies for cucumber Fumigate on dry, dark nights when there is no wind The house should be as dry as practicable and the temperature not above 60° F.

Greenhouses —No one formula can be given for fumigating with hydrocyanic acid gas the different kinds of plants grown in greenhouses, as the species and varieties differ greatly in their ability to withstand the effects of the gas For the general run of greenhouse subjects, the practice is to use one ounce of potassium cyanide, one ounce of sulfuric acid, two ounces water, to each 2,000 cubic feet of space The cyanide should be 98 per cent pure Fumigate at night when there is no wind and when the plants are dry and the house cool; leave the house closed till morning, and open it up and let it air out before entering it This applies to chrysanthemums, cinerarias, azaleas, bulbs, carnations and other common plants.

Ferns and roses are very susceptible to injury, and fumigation, if attempted at all, should be performed with great care. In cases of doubt, or when there is reason to suspect that the plants are particularly susceptible, and when one does not have definite instructions, it is well to fumigate with the weakest strength in use, and increase it in subsequent fumigations if the insects are not killed and if the plants are not injured.

Violets are very susceptible to injury from tobacco fumigation, and commercial growers therefore regularly use hydrocyanic acid gas for the control of "green-fly" and "black-fly," two species of plant-lice. The latter is much more difficult to kill. For over-night fumigation from one-fourth to one-half ounce potassium cyanide to each 1,000 cubic feet is generally used. Sometimes one ounce potassium cyanide to each 1,000 cubic feet is used, the fumigation continuing only from twenty-five to thirty-five minutes This treatment is more likely to injure the plants. Violets may be injured severely by the gas without the leaves being burned. This injury consists in a weakening of the plants which defers blooming for several weeks.

Dormant nursery stock may be fumigated with hydrocyanic acid gas in a tight box or fumigating-house made especially for the purpose Fumigating-houses are built of two thicknesses of matched boards with building-paper between, and are provided with a tight-fitting door and ventilators The stock should be reasonably dry to avoid injury, and should be piled loosely in the house to permit a free circulation of the gas Use one ounce of potassium cyanide for each 100 cubic feet of space, and let the fumigation continue forty minutes to one hour.

A fumigating-house is shown in Fig. 1324 (from a bulletin on "The San José Scale," by A. E Stene, of the Rhode Island State Board of Agriculture and College of Agriculture). It is a house or box as nearly air-tight as possible The floor should have a movable slat grating on which the plants may be laid, some distance from the ground, to allow of circulation of the gas. The house shown in the cut is 8 feet high in front and 6 feet in rear, and the larger room contains 980 cubic feet, requiring approximately ten ounces of cyanide. The other rooms allow of smaller quantities to be fumigated The doors opening from the outside provide quick discharge of the air when fumigation is completed.

Fumigation of citrus trees.—In this case, the tree to be fumigated with the hydrocyanic acid gas is covered with an octagonal sheet tent (Fig 1325) made of six and one-half ounce special drill or eight-ounce special army duck, and the gas is generated in the ordinary way beneath it. The tent is so marked that when in position it is an easy matter to determine the distance over the tent and the circumference at the ground. When these figures are known, the proper dosage may be obtained from the following chart, which has been prepared for a strength of one ounce of cyanide for each 100 cubic feet of space.

DISTANCE AROUND, IN FEET

DISTANCE OVER, IN FEET	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
10	2	2	2	2	2																							10
12	2	2	3	3	3	3																						12
14	3	3	3	3	3	3	4	4	4	4	4	5																14
16	3	3	3	3	4	4	4	4	4	5	5	5	5	5														16
18	3	3	3	4	4	4	5	5	5	5	5	5	6															18
			20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
20			3	4	4	5	5	5	5	5	6	6	6	6	7	7	8	8										20
22					5	5	5	5	5	6	6	6	7	7	8	8	8	8										22
24						5	5	5	6	6	6	7	8	8	8	8	9	9										24
26							5	6	6	7	7	8	8	8	8	9	10	10	10	11	11	11						26
28								6	7	8	8	8	8	9	9	10	11	11	11	11	12	12						28
								30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
30								7	8	8	8	9	9	10	10	11	11	11	11	12	13	14	14	14	15	16	16	30
32											9	10	10	11	11	12	12	12	13	13	14	14	14	15	16	16	17	32
34												10	11	11	12	13	13	14	14	14	14	15	16	16	17	17	17	34
36												11	11	12	13	13	14	14	15	15	16	17	17	17	17	18	19	36
38													12	12	13	14	14	15	16	16	17	17	17	18	18	19	20	38
													40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
40													12	13	14	14	15	15	16	17	17	18	18	19	20	20	20	40
41														14	14	15	15	16	17	17	18	18	19	20	20	20	21	41
42															15	15	16	17	17	18	19	19	20	20	20	21	21	42
43																16	17	17	18	19	19	20	20	20	21	22	43
44																		17	18	19	19	20	20	21	22	22	44
																		50	52	54	56	58	60	62	64	66	68	
45																		17	18	19	20	20	20	21	22	23	23	45
46																		18	19	20	20	20	21	22	22	23	23	46
47																		18	19	20	20	21	22	22	23	23	24	47
48																		19	20	20	21	22	22	23	23	24	24	48
49																		19	20	21	21	22	23	23	23	24	25	49

Dosage chart for fumigating citrus trees with high-grade sodium cyanide (Bureau of Entomology, United States Department of Agriculture)

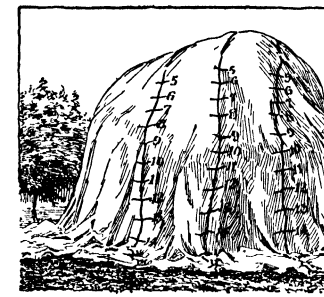
The top line of numbers, beginning at 16 and continuing to 68, represents the distance in feet around the bottom of the tent. The outer vertical columns of larger numbers running from 10 to 49 represent the distance in feet over the top of the tent. The number of ounces of cyanide to use for a tree of known dimensions is found in that square where the vertical column

headed by the distance around the tree intersects the horizontal line of figures corresponding to the distance over For certain insects it is not advisable to use the full dosage schedule

Sodium cyanide (NaCN) is coming into use as a substitute for potassium cyanide. When pure, this compound contains 53 per cent of cyanogen, that is, about 33 per cent more of cyanogen than is present in potassium cyanide It is customary to indicate the strength of sodium cyanide in terms of potassium cyanide; that is, pure sodium cyanide is said to be 133 per cent pure This means that 100 pounds of sodium cyanide will yield as much cyanogen as 133 pounds of potassium cyanide. For fumigation purposes, sodium cyanide should be at least 124 per cent pure and should not contain more than 1 per cent of common salt

Because of the greater content of cyanogen of sodium cyanide, a smaller quantity is required The chemicals should be combined in the following proportions: Sodium cyanide, one ounce; sulfuric acid, one and one-half fluid ounces; water, two ounces

The following dosage schedule corresponds to the one given above for potassium cyanide:



1325. A fumigating tent (Morrill system)

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
10	1	1	1	1½	1¾																												10
12	1⅜	1¾	1¾	1½	2	2½																											12
14	1⅜	2	2	2½	2½	3	3	3½	4	4½	5																						14
16	2	2½	2⅝	3	3	3¼	3¼	3½	4	4½	5	5½	6	7																			16
18			3	3	3½	3¾	4	4½	4½	5¼	5½	6	7	7½	8																			18
			20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
20				3	4	4½	5	5½	5½	6	6½	7	7	8	8½	9	9½																	20
22					4½	5	5½	6	6½	7	7½	7½	8	8½	8½	9½	10	10½																22
24						5½	6½	7	7½	8	8½	9½	9½	10	10½	11	11½	12																24
26							7	8	8½	9	9½	10	10½	10½	11	11	11½	12	13	14	14½	15											26
28								8½	9½	10	10½	11	11½	11½	12½	12½	13	13½	14	14½	15½	16											28
								30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
30									10	11	11½	12	12½	13	13½	14	14½	14½	15	15½	16½	17½	18	19	20	20½	21½							30
32											12	12½	13	14	15	15½	16	16½	17	17½	18	18½	19	19½	20½	21½	22½							32
34												13	14	15	16	17	17½	18	18½	19	19½	20	20½	21	21½	22½	23							34
36												14	15	16	17	17½	18	19½	20	20½	21½	22	22½	23	23½	24½							36
38													16	16½	17½	18½	19	20½	21	21½	22	23	23½	24	24½	25	25½							38
													40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
40													17	18	19	20	21	21	22	22½	23	23	24	24½	25	25½	26	26½	27	27½	28				40
41													18	19	20	21	22	22½	23	23½	24	24½	25	25½	26	26½	27	27½	28	28½	29				41
42														20	20½	22	22½	23	23½	24	25	25½	26	26½	27	27½	28	28½	29	29	30	30½			42
43															21½	22½	23	23½	24	25	25½	26	26½	27	27½	28	28½	29	29½	30	30½	31			43
44																23	23½	24	25	25	26	26½	27	27½	28	28½	29	29½	30	31	31½	32			44
																		50	52	54	56	58	60	62	64	66	68	70	72	74	76	78		
45																		24	25	26	26½	27	27½	28	29	29½	30	30½	31	31½	32	33	45	
46																		24½	25½	26½	27	27½	28	28½	29½	30	30½	31	31½	32½	33	34	46	
47																		25	26	27	27½	28	28½	29	30	30½	31½	32	32½	33	34	35	47	
48																		25½	26½	27½	28	28½	29	29½	30½	31	32	32½	33	34	35	36	48	
49																		26½	27	28	28½	29	29½	30	31	31½	32½	33	34	35	36	37	49	
																		50	52	54	56	58	60	62	64	66	68	70	72	74	76	78		
50																							30	31	31½	32½	33	33½	35	36	37	38	50	
51																							31	31½	32	33	33½	34	36	37	38	39	51	
52																							31½	32	33	33½	34	35	37	38	39	41	52	
53																							32	32½	33½	34	35	36	38	39	40	41	53	
54																							32½	33	34	35	36	37	39	40	41	42	54	
																							60	62	64	66	68	70	72	74	76	78		
55																							33	34	35	36	37	37½	40	41	42	43	55	
56																							34	35	36	37	37½	38	40½	42	43	44	56	
57																							34½	35½	36½	37½	38½	39	41	42½	43½	45	57	
58																							35	36	37	38	39	40	42	43	44	46	58	
59																							36	36½	38	39	40	40½	42½	43½	45	47	59	

Dosage chart for fumigating citrus trees with potassium cyanide (Bureau of Entomology, United States Department of Agriculture).

Nicotine preparations.—Tobacco is used in various ways in fumigating greenhouses For smoking or smudging greenhouses, tobacco-stems are burned slowly. Best results are secured when a sheet-iron vessel made for the purpose is used, having holes in the bottom to supply draft. A quart of live coals is placed in the bottom of the vessel, and about a pailful of tobacco-stems is laid on them. The stems should not blaze, but burn with a slow smudge. If they are slightly damp, better results are obtained. Some plants are injured by a very heavy smoke, and in order to avoid this injury, and also more effectually to destroy the insects, it is better to smoke rather lightly and often It is always well to smoke through two consecutive days, for the insects which persist through the first treatment, being weak, will be killed by the second If the plants are wet, the smoke is more likely to scorch them The smudge often injures flowers, as those of roses and chrysanthemums In order to avoid this injury, the flowers should be covered with paper bags Violet plants are very liable to injury

Tobacco fumes can be more conveniently generated by burning strips of prepared nicotine paper, or by vaporizing a concentrated aqueous solution of nicotine over alcohol or special kerosene lamps.

Bisulfid of carbon is a thin liquid that volatilizes at a very low temperature, the vapor being very destructive to animal life It is exceedingly inflammable, and should never be used near a lamp or fire. It is sometimes used for the control of certain root insects It is poured into holes made around the infested plants, and these are then immediately closed up causing the fumes to permeate the soil in all directions.

Against weevils infesting stored grain and seeds, carbon bisulfid is effective at the rate of five to eight pounds for each 1,000 cubic feet, provided the application is made while the temperature is not below 65° F. Make the bins as tight as possible If bins are only single sheathed with common flooring use twenty to twenty-five pounds carbon bisulfid. Let the fumigation continue for at least twenty-four hours. Care should be taken not to apply carbon bisulfied when there is indication of heating in the grain.

C. R. CROSBY.
ROBERT MATHESON.

Catalogue of insects.

Abutilon. ABUTILON MOTH (*Cosmophila erosa*) —A pale pea-green caterpillar striped with lemon-yellow often defoliates the plants in the southern states.

Treatment —The young caterpillar may be killed by spraying with "Black Leaf 40" tobacco extract, one part in 650 parts water, adding soap to make the liquid spread and stick better

Acacia. COTTONY CUSHION SCALE.—See *Citrus.*

OLEANDER SCALE —See *Hedera.*

RED SCALE.—See *Citrus.*

Acer BOX-ELDER BUG (*Leptocoris trivittatus*) is about ½ inch in length, dark gray in color marked with red. They congregate about box elder in great numbers, on the sap of which they feed The young nymphs may be killed by spraying with ordinary contact insecticides

COTTONY MAPLE SCALE (*Pulvinaria vitis*) is a brown, soft-bodied, scale insect, ⅛ inch in length. The eggs are laid beneath a conspicuous cottony mass which protrudes from under the scale The eggs hatch during June and July, and the fertilized females hibernate on the smaller branches There is one generation annually

Treatment —A stiff stream of water will dislodge many of the mature scales in June or July The young scales may be killed with tobacco extract The most effective treatment on maples is 15 per cent kerosene emulsion applied during the dormant season to kill the hibernating females.

GREEN-STRIPED MAPLE WORM (*Anisota rubicunda*) is a large, pale yellowish green caterpillar, striped with dark green, that occasionally defoliates the maple

Treatment —The young caterpillars may be controlled by spraying with arsenate of lead, four to eight pounds to one hundred gallons of water

PIGEON TREMEX (*Tremex columba*) is a large four-winged fly having a wing expanse of 2½ inches The abdomen ends in a prominent ovipositor The larva, over 2 inches long when full-grown, burrows in the wood, seriously injuring the tree when abundant Vigorous trees usually overcome the attack.

PLANT-LICE —Several species are occasionally injurious

Treatment —"Black Leaf 40" tobacco extract, three-fourths of a pint to one hundred gallons of water, adding four pounds of soap, is an efficient remedy

SUGAR-MAPLE BORER (*Plagionotus speciosus*) is very destructive to hard maples The parent beetle is about an inch long, black, brilliantly marked and banded with yellow The larva is a large borer about 2 inches in length when mature They burrow mostly in the sapwood, several often girdling and killing a tree It is a difficult matter to prevent this injury

Treatment —Digging out the borers is the only remedy known

WOOLLY MAPLE-LEAF SCALE (*Phenacoccus acericola*) is a soft-bodied woolly-covered insect about ¼ inch long, found on the under side of the leaves There are two or three generations a year They hibernate as young on the bark of the trunk and branches

Treatment —Winter applications of whale-oil soap, one pound in one gallon of water, have given the best results.

Æsculus TUSSOCK-MOTH —See *Apple.*

Agave OLEANDER SCALE —See *Hedera.*

RED SCALE —See *Citrus.*

Alder ALDER BLIGHT APHIS (*Pemphigus tessellata*) occurs in colonies on the branches and appears as conspicuous white, woolly masses

Treatment —They may be dislodged by a stiff stream of water or may be killed by spraying with kerosene emulsion.

SAW-FLY LEAF-MINER (*Kaliosysphinga dohrnii*) feeds between the upper and lower layers of the leaves, causing large blotch mines

No remedy known.

Allamanda. CITRUS WHITE FLY.—See *Citrus.*

Almond BLACK SCALE —See *Citrus.*

CLOVER MITE —See *Peach.*

COTTONY CUSHION SCALE —See *Citrus.*

PEAR THRIPS —See *Pear.*

SAN JOSÉ SCALE —See *Apple.*

Aloe OLEANDER SCALE.—See *Hedera.*

Amaryllis. NARCISSUS BULB-FLY.—See *Narcissus.*

Ampelopsis. MYRON SPHINX (*Ampelophaga myron*).—Large, green or brown, smooth caterpillars occasionally defoliate the vines.

Treatment —Hand-picking.

Annona. FLORIDA WAX SCALE.—See *Citrus.*

Anthurium. FLORIDA WAX SCALE.—See *Citrus.*

Apple. APHIDS OR PLANT-LICE —There are three species which commonly attack the opening buds and leaves of apple,—the leaf aphis (*Aphis pomi*), rosy aphis (*Aphis sorbi*) and bud aphis (*Siphocoryne avenæ*).

Treatment.—These small, soft-bodied insects may be controlled by thorough spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint, in one-hundred gallons of water, adding four pounds of soap. Make the application before the leaves curl

APPLE-CURCULIO (*Anthonomus quadrigibbus*).—A soft, white grub, about ½ inch long, living in the fruit

Treatment —Clean cultivation Rake the small apples that drop early out into the sun where they will dry up.

Catalogue of Insects, continued

APPLE FLEA-BEETLE (*Graptodera foliacea*).—Brassy, green beetle, ⅛ inch or less long, feeding upon leaves

Treatment —Arsenicals. Lime-sulfur or bordeaux mixture as a repellent.

APPLE LEAF-HOPPER (*Empoasca mali*).—A slender pale yellowish green bug, the nymphs are pale greenish and usually found on the under side of the leaves. The winter eggs are laid in blisters under the bark of the smaller branches, summer eggs, in the leaf veins and petioles Four generations annually The insect feeds by extracting the juices from the leaves, causing them to turn pale and curl. It is most injurious to nursery stock.

Treatment.—The young nymphs may be killed by spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint in one hundred gallons of water, adding three to four pounds of soap Nurserymen often catch the adults by the use of sticky shields

APPLE LEAF-ROLLER (*Archips argyrospila*).—A green caterpillar with a black head, 1 inch or less in length when mature, attacks the opening buds rolling and webbing together the leaves, flowers and young fruit into a nest Holes are eaten in the young apples, deforming them. Eggs are laid in June in small, flat masses on the bark and are covered with a smooth varnish-like coating They do not hatch till the following spring

Treatment —To kill eggs spray with miscible oil, one gallon in fifteen gallons of water, making the application as late as possible before the buds open If the eggs have been neglected, recourse must be had to arsenate of lead, six pounds in one hundred gallons water Apply before the blossoms open

APPLE MAGGOT (*Rhagoletis pomnella*) —A white maggot that tunnels apples through and through, causing decay and falling of the fruit The parent flies appear the latter part of June and early July and insert the eggs under the skin of the fruit Hibernation takes place in small puparia just below the surface of the soil Sweet and subacid varieties are most susceptible, but others are sometimes attacked

Treatment —Clean cultivation Spray when flies appear with arsenate of lead, four pounds in one hundred gallons of water The addition of two or three gallons of molasses is supposed to render the poison more attractive to the flies

BROWN-TAIL MOTH (*Euproctis chrysorrhœa*).—This highly destructive European insect was introduced near Boston a number of years ago, and is now rapidly spreading over New England The snow-white moths, with a large tuft of brown hairs at the tip of the abdomen, appear in July and deposit eggs on the leaves in elongate masses covered with brown hairs from the body of the female The caterpillars become only partly grown the first season, and hibernate in conspicuous nests, 3 or 4 inches long, at the tips of the branches The black-bodied caterpillars, clothed with rather long, brownish, stinging hairs, complete their growth the next spring, feeding ravenously on the tender foliage and causing great damage in orchards, parks, and forests

Treatment —Cut out and burn all winter nests before the buds start In the spring, spray with arsenate of lead, as recommended for the gipsy-moth Prevent the ascent of caterpillars from other trees by banding the trunks with tanglefoot Keep the bands fresh by combing the surface every few days

BUD-MOTH (*Tmetocera ocellana*) —The small brown caterpillars with black heads burrow into the buds, feeding on the opening leaves and flowers and web them together

Treatment.—Spray with arsenate of lead, four pounds in one hundred gallons of water, just as the blossoms show pink, and again as the last of the petals are falling

CANKER-WORM, FALL (*Alsophila pometaria*) —Wingless female moths usually emerge from the ground in late autumn, crawl up the trees and deposit their eggs on the smaller branches The eggs hatch in April or May and the blackish yellow-striped, looping caterpillars defoliate the trees

Treatment —Band tree trunks in the fall with tanglefoot or cotton batting to prevent ascent of moths The young canker-worms may be killed by spraying with arsenate of lead, six pounds to one hundred gallons of water

CANKER-WORM, SPRING (*Paleacrita vernata*) —Habits similar to the fall canker-worm, but the moths emerge in March and April. Caterpillars are distinguished by having only two pairs of prolegs

Treatment —Same as for fall canker-worm except the bands should be applied in early spring

CASE-BEARERS —The pistol-case-bearer (*Coleophora malivorella*) and the cigar-case-bearer (*C fletcherella*) —The small caterpillars live in pistol or cigar-shaped cases, about ¼ inch long, that they carry around with them. They appear in spring on the opening buds at the same time as the bud-moth, and may be controlled by the same means

CODLIN-MOTH (*Carpocapsa pomonella*) —This is the pinkish caterpillar which causes a large proportion of wormy apples The eggs are laid by a small moth on the leaves and the skin of the fruit Most of the caterpillars enter the apple at the blossom end When the petals fall, the calyx is open, and this is the time to spray. The calyx soon closes, and keeps the poison inside ready for the young caterpillars' first meal After the calyx has closed, it is too late to spray effectively. The caterpillars become full-grown in July and August, leave the fruit, crawl down on the trunk, and there most of them spin cocoons under the loose bark In most parts of the country there are two broods annually

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued

Treatment —As the last of the petals are falling, spray with four pounds arsenate of lead in one hundred gallons of water, using a stiff spray to force it into the blossom end of the apple. Repeat the application three weeks later

FALL WEB-WORM (*Hyphantria cunea*) —Hairy larva, about an inch long, varying from gray to pale yellow or bluish black, feeding upon the leaves of many trees, in tents or webs.

Treatment —Destroy by burning the webs, or removing them and crushing the larvæ Spray with arsenicals.

FLAT-HEADED BORER (*Chrysobothris femorata*) —Larva about an inch long, flesh-colored, the second segment ("head") greatly enlarged, boring under the bark and sometimes into the wood They are readily located in late summer or fall by the dead and sunken patches of bark

Preventive —Soap and carbolic acid washes applied from May to July Keep trees vigorous

GREEN FRUIT-WORMS (*Xylina sp.*) —Yellowish or apple-green caterpillars, striped with cream-color, 1 to 1½ inches in length when mature, attack the opening leaves and blossoms and eat holes in the developing fruit The parent moths emerge from hibernation in early spring and lay their eggs on the smaller branches One brood annually

Treatment —Thorough and repeated spraying with arsenate of lead, six pounds in one hundred gallons of water, will kill many of the young caterpillars Make the application when blossom clusters appear

GYPSY MOTH (*Porthetria dispar*) —The full-grown caterpillar is about 2 inches long, dark gray in ground-color with eleven pairs of prominent tubercles on the back, the first five pairs blue, the last six dark red They become full-grown about the first of July They pupate in slight cocoons The moths emerge in seven to seventeen days The male has a light brown body, wings yellowish brown, and each front wing is crossed by four wavy dark brown lines The female the body is light buff and the wings grayish white The dark markings on the front wings are similar to those of the male. The females do not fly, but each lays its eggs in a mass about an inch in length covered with hairs from its body Hibernation takes place in the egg stage The eggs hatch just as the buds are bursting.

Treatment —Kill the eggs by saturating the masses with crude coal-tar creosote, to which a little lamp-black has been added as a marker When the young caterpillars hatch, spray the trees with arsenate of lead, ten pounds in one-hundred gallons of water When the caterpillars are half-grown, use thirteen to fifteen pounds of lead arsenate Full-grown caterpillars are very resistant to poisons Band the tree trunks with tanglefoot to prevent the ascent of wandering caterpillars.

LEAF-BLISTER MITE —See *Pear*

LEAF-CRUMPLER (*Mineola indigenella*) —Reddish brown caterpillars that live in slender, horn-shaped cases and feed on the tender leaves They hibernate as partly grown larvæ and attack the opening buds the following spring They usually live in a nest of several leaves fastened together with silk

Treatment —Gather the nests and burn them. Arsenicals when the buds open

LESSER APPLE-WORM (*Enarmonia prunivora*) —Similar to the codlin-moth, but larvæ often feed just under the skin of the fruit, causing blotched areas

Treatment —As for codlin-moth

OYSTER-SHELL SCALE (*Lepidosaphes ulmi*) —This is an elongate scale (sometimes called bark-louse), ⅛ inch in length, resembling an oyster-shell in shape and often incrusting the bark It hibernates as minute white eggs under the old scales The eggs hatch during the latter part of May or in June, the date depending on the season After they hatch, the young may be seen as tiny whitish lice crawling about on the bark When these young appear, spray with kerosene emulsion, diluted with six parts of water, or whale-oil, or any good soap, one pound in four or five gallons of water Where trees are regularly sprayed with lime-sulfur, as for the San José scale or blister mite, the oyster-shell scale is usually controlled

PALMER WORM (*Ypsolophus pometellus*) —The brownish green, white-striped caterpillars, ½ inch in length when mature, skeletonize the tender foliage in June and eat holes in the young apples There is only one brood a year

Treatment —Spray with arsenate of lead, four pounds in one hundred gallons of water when the caterpillars first appear.

PLUM-CURCULIO (*Conotrachelus nenuphar*) —A snout-beetle that deforms the fruit by its characteristic feeding and egg-laying punctures The grubs develop in the fruit and cause it to fall.

Treatment —Spraying with arsenate of lead, as for codlin-moth, whenever it can be applied with a fungicide so as not to increase expense, will help to control the trouble Thorough superficial tillage of the surface of soil during July and August will kill many of the pupæ, and is recommended For treatment on plum, see under *Plum*

RED BUGS (*Heterocordylus malinus* and *Lygidea mendax*).—The winter is passed as eggs inserted in the smaller branches. The brilliant red nymphs appear as the buds open and feed on the foliage for a time Then they puncture the newly set apples causing one of three things some drop, some dry up and remain on trees till next spring, and others mature as knotty, misshapen, worthless fruit One generation a year

Treatment —The young nymphs may be killed by thorough spraying with "Black Leaf 40" tobacco extract, one pint in one hundred gallons water, adding four pounds of soap, (1) when blossoms show pink, (2) when the last of the petals are falling

CATALOGUE OF INSECTS, continued

RED-HUMPED APPLE CATERPILLAR (*Schizeura concinna*) —These red-headed, black-and-yellow-striped caterpillars with a red hump on the fourth segment often attract attention in August and September by feeding in colonies on the ends of the branches

Treatment —Spray for the young caterpillars with arsenate of lead, four pounds in one hundred gallons of water As they are most troublesome on newly planted trees the older caterpillars may be shaken to the ground and crushed under foot.

RIBBED COCOON-MAKER (*Bucculatrix pomifoliella* —A minute yellow or green larva feeding upon the upper surface of the leaves, causing the lower surface to turn brown The cocoons are white and slender, and are laid side by side upon the under side of twigs, where they are conspicuous in winter

Treatment —Lime-sulfur while tree is dormant. Arsenicals for the larvæ in summer.

ROSE-CHAFER —See *Grape.*

ROUND-HEADED BORER (*Saperda candida*) —A yellowish white grub with dark brown head, about 1 inch long when mature It is said to remain in the larval state three years The parent beetle is silvery white on the head and beneath, the thorax and wing-covers are light brown two silvery white stripes extend from the head to the tip of the wing-covers The eggs are laid in slits in the bark, mostly in June

Preventive —Keep the beetles from laying eggs by spraying the trunks several times during the spring and summer with kerosene emulsion or by coating them with an alkaline wash made from soap, caustic potash, and carbolic acid Tarred paper tree-protectors well tied at the top, or wire mosquito-netting protectors closed at the top and encircling the trunk so loosely that the beetles cannot reach the bark, are effective in preventing egg-laying Practise clean cultivation, and do not let water sprouts or other rank vegetation encircle the base of the tree

Remedial —Dig out the borers whenever they can be located by discolored bark or by the sawdust thrown out of the burrow

SAN JOSÉ SCALE (*Aspidiotus perniciosus*) —This scale is nearly circular in outline and about the size of a pinhead When abundant it forms a crust on the branches, and causes small red spots on the fruit It multiplies with marvelous rapidity, there being three or four broods annually, and each mother scale may give birth to several hundred young The young are born alive, and breeding continues until late autumn, when all stages are killed by the cold weather, except the tiny, half-grown, black scales, many of which hibernate safely

Treatment —Spray thoroughly in the fall after the leaves drop, or early in the spring before growth begins, with lime-sulfur wash, one gallon in eight gallons of water, or miscible oil, one gallon in fifteen gallons of water When badly infested, make two applications, one in the fall and another in the spring In case of large, old trees, 25 per cent crude-oil emulsion should be applied just as the buds are swelling

SCURFY SCALE (*Chionaspis furfurus*) —This whitish, pear-shaped scale, about ⅛ inch in length, often incrusts the bark, giving it a scurfy appearance It hibernates as purplish eggs under the old scales

Treatment —Spray as recommended for oyster-shell scale.

TENT-CATERPILLARS (*Malacosoma americana* and *M. disstria*) — Larvæ nearly 2 inches long, spotted and striped with yellow, white, and black, feeding upon the leaves They congregate in tents or in clusters on the bark at night and in cool weather, and forage out upon the branches during the day

Treatment —Arsenicals, as for codlin-moth Burn out nests with torch, or cut them out and crush the larvæ Pick off egg masses from twigs during winter and spring

TUSSOCK-MOTH (*Hemerocampa leucostigma*) —A handsome, red-headed, yellow and black tufted caterpillar, about an inch long, which devours the leaves and sometimes eats into the fruit

Remedial —Collect the frothy egg-masses in fall and winter and band the trees to prevent a reinfestation by migrating caterpillars Spray with arsenicals as for codlin-moth, taking care to cover the under side of the leaves

TWIG-BORER (*Schistoceros hamatus*) —Beetle, ¾ inch long, cylindrical and dark brown, boring into twigs of apple, pear, and other trees The beetle enters just above a bud

Treatment —Burn the twigs The early stages are passed in dying wood, such as prunings, diseased canes, and in upturned roots Burn such rubbish, and thus destroy their breeding-places This is also a grape pest

TWIG-GIRDLER (*Oncideres cingulatus*) —Small branches are often girdled by a handsome ash-sprinkled reddish brown beetle, about ½ inch in length The girdled twigs soon fall and the grubs develop in the fallen branches

Treatment —Collect and burn all fallen branches

WOOLLY APHIS (*Schizoneura lanigera*) —Small reddish brown plant-lice covered with a conspicuous mass of white, waxy fibers, found on the branches, sprouts, trunks and roots

Treatment —For the form above ground drench the infested parts with 15 per cent kerosene emulsion, for the underground form remove the earth beneath the tree to a depth of 3 inches, and apply 10 per cent kerosene emulsion liberally, and replace the earth In the case of nursery stock the emulsion may be applied in a shallow furrow close to the row Do not set infested trees

YELLOW-NECKED APPLE CATERPILLARS (*Datana ministra*) — Apple branches are often defoliated in late summer by colonies of black- and yellow-striped caterpillars about 2 inches in length when mature

Treatment —Same as for *Red-humped Caterpillar*, which see.

CATALOGUE OF INSECTS, continued.

Apricot. BARK BEETLE —See *Peach.*
BLACK SCALE—See *Citrus*
CANKER-WORMS —See *Apple.*
CLOVER MITE —See *Peach*
COTTONY CUSHION SCALE —See *Citrus.*
EUROPEAN FRUIT LECANIUM —See *Plum*
FROSTED SCALE (*Eulecanium prunosum*) —A large soft-bodied scale, ½ inch in length, hemispherical in shape with a frost-like covering of wax
Treatment —Kerosene or distillate emulsion while the trees are dormant
PEACH TREE-BORERS —See *Peach*
PEAR THRIPS —See *Pear*
PLUM-CURCULIO.—See *Plum.*

Aquilegia. COLUMBINE BORER (*Papaipema purpurifascia*) —The full-grown caterpillar measures 1⅜ inches in length, salmon-pink in color with three narrow stripes visible from above, the two lateral ones broadly interrupted in the middle It bores in the stems near the base
Treatment—Dig out and destroy caterpillars

Artichoke STEM MAGGOT (*Strauxia longipennis*) —A small yellowish maggot boring in the pith of the stems The adult are two-winged yellowish flies with banded wings
Treatment —Encourage growth, vigorous plants outlive injury

Asparagus COMMON ASPARAGUS-BEETLE (*Crioceris asparagi*) —Beetle, less than ¼ inch in length, yellow, red, and shining black, with conspicuous ornamentation, feeding upon the tender shoots Larva feeds upon the leaves and tender bark
Treatment —Freshly slaked lime dusted on before the dew has disappeared in the morning Poultry Cut down all plants in early spring to force the beetles to deposit their eggs upon the new shoots, which are then cut every few days before the eggs hatch, or leave a row or so around the field as a lure for the beetles where they may be killed with arsenicals
TWELVE-SPOTTED ASPARAGUS-BEETLE (*Crioceris 12-punctata*) —Similar to the last, but with twelve spots on the wing-covers
Treatment —Similar to that used above, except that the grubs cannot be destroyed by lime, since they live within the berry
ASPARAGUS MINER (*Agromyza simplex*) —A maggot mining under the skin near the base of the plant
Treatment —Leave a few volunteer plants as a trap in which the fly will deposit her eggs Pull and burn these plants in late June and early July The flies may be killed before ovipositing with sweetened arsenate of lead

Aspidistra FLORIDA RED SCALE —See *Citrus*

Aster BLISTER BEETLES —Large, black, grayish or striped beetles that feed on the flowers The larvæ in general feed on grasshopper eggs
Treatment —Hand-picking
TARNISHED PLANT-BUG (*Lygus pratensis*) —An active bronzy brown sucking bug ⅛ inch long, mottled with various shades of yellowish, that stunts the terminal buds by its feeding punctures and also injures the flower-buds so that they either do not open or produce imperfect flowers Injured plants are dwarfed and stunted
Treatment —No satisfactory control measures are known Plants grown in shade are less liable to injury
ROOT-LOUSE (*Aphis maidiradicis*) —Small bluish green plant-lice infesting the roots, causing the plants to turn yellow and sickly
Treatment —Mix tobacco dust into the soil around the plants when transplanting
WHITE GRUBS —See *Corn*

Aucuba. THE YELLOW SCALE —See *Citrus*

Avocado LEAF-ROLLER (*Amorbia emigratella*) —A yellowish green caterpillar striped with pinkish brown, about 1 inch long when mature, rolls the leaves and eats small holes in the fruit, rendering it unfit for sale
Treatment —Arsenate of lead when the caterpillars appear
MEALY-BUG (*Dactylopius nipæ*) —A small unarmored scale with white mealy covering
Treatment —Kerosene emulsion, one part to ten parts water

Bamboo COTTONY BAMBOO SCALE (*Antonina crawi*) —Small purplish red scales ⅛ to ¼ inch in length, covered with a dense cottony coating, often ½ inch in diameter They collect in large numbers in the crotches and leaf-axils
Treatment —Repeated applications of kerosene emulsion
PLANT LOUSE (*Myzocallis arundicolens*) —Small yellowish lice which collect in large numbers on the under surface of the leaves
Treatment —Contact sprays

Banana BANANA WEEVIL (*Sphenophorus sordidus*).—A small grub boring in the stems
FLORIDA RED SCALE —See *Citrus*
MEALY-BUG (*Ceroputo yuccæ*) —Soft scales closely resembling the common mealy-bug (Pseudococcus)
Treatment —Kerosene emulsion

Bean. BEAN LADY-BIRD (*Epilachna corrupta*) —A light yellowish brown lady-bird beetle, with four black spots on each wing-cover, attacks and devours all parts of the bean plant The larva, which is yellow and covered with stout branched spines, also feeds on the bean
Treatment —Arsenate of lead or kerosene emulsion.

CATALOGUE OF INSECTS, continued

BEAN LEAF-BEETLE (*Cerotoma trifurcata*) —A pale yellow beetle ⅛ inch in length, with black markings on the wing-covers, often eats round holes in the leaves The larvæ feed on the roots and main stems of the plants
Treatment —Arsenate of lead as soon as the beetles appear
BEAN-WEEVIL (*Bruchus obtectus*) —Closely resembles the pea-weevil, which see for description and remedies Holding over the seed will be of no value with this insect.
CORN-EAR WORM —See *Corn*
CUTWORM —See *Corn*
PEA APHIS —See *Pea*
SEED-CORN MAGGOT (*Pegomya fusciceps*) —A maggot attacking germinating seeds and roots of young plants
Treatment —Avoid stable manure, practise crop-rotation In the garden, use sand moistened with kerosene around the plants to keep the flies from laying the eggs

Beet BEET APHIS (*Pemphigus betæ*) —A root-infesting plant-louse locally abundant in certain western states
Treatment —Rotation of crops
BEET LEAF-HOPPER (*Eutettix tenella*) —A small, pale yellowish green leaf-hopper punctures the leaves, causing the disease, curly top Present in the western states
Treatment —No satisfactory treatment known
BLISTER BEETLES —See *Aster*
CUTWORMS —See *Corn*
FALSE CHINCH BUG (*Nysius angustatus* var *minutus*) —Small grayish brown bugs, ⅛ inch in length Destructive to sugar beets grown for seed
Control —Contact insecticides, clean cultivation
GRASSHOPPERS —See *Corn*
LEAF-MINER —See *Spinach*
LARGER BEET LEAF-BEETLE (*Monoxia punctricollis*) —A dull brown beetle with striped wing-covers Both larvæ and adults feed on the sugar beet, often in immense numbers
Treatment —Same as for *Flea-Beetles* See *Potato*
FLEA-BEETLE —See *Potato*
WESTERN BEET BEETLE (*Monoxia consputa*) —A beetle closely allied to the larger beet leaf-beetle, feeding on the leaves, leaving only the veins
Treatment —Same as for *Flea-Beetles* See *Potato*
BEET ARMY WORM (*Laphygma exigua*) —A large caterpillar about 1¼ inches long when mature, olivaceous to greenish in color, broadly striped with lighter green, defoliates the plants
Treatment —See *Army Worm, Corn*
BEET WEB-WORM (*Loxostege sticticalis*) —Pale yellowish green caterpillars striped with lighter green, about ¾ inch long, frequently defoliate the plants in certain regions
Treatment —Destroy all weeds Spray with arsenate of lead

Begonia GREENHOUSE THRIPS —See *Citrus*
GREENHOUSE WHITE-FLY —See *Tomato*
MEALY-BUGS —See *Citrus*
WHITE-FLY —See *Citrus*

Berberis BARBERRY PLANT-LOUSE (*Rhopalosiphum berberidis*) —Small, greenish yellow lice attacking the leaves and young growth
Treatment —Tobacco extract or kerosene emulsion

Betula BIRCH APHIS (*Callipterus betulæcoleus*) —A small, yellowish plant-louse occasionally abundant on the under side of birch foliage (cut-leaf varieties)
Treatment —"Black Leaf 40" tobacco extract three-fourths of a pint to one hundred gallons of water
BIRCH LEAF BUCCULATRIX (*Bucculatrix canadensisella*) —Small, whitish larvæ skeletonizing the leaves
Treatment —Arsenate of lead, six pounds in one hundred gallons water
BRONZE BIRCH BORER (*Agrilus anxius*) —Slender, flattened yellowish white grubs, ¾ inch long when full-grown, burrow under the bark on all parts of the tree The top branch usually dies first and is the first indication that the tree is infested
Treatment —Cut down and burn all infested trees immediately to prevent spread to other trees
FROSTED SCALE —See *Apricot* Occurs in California on birch
OYSTER-SHELL SCALE —See *Apple*

Bignonia HEMISPHERICAL SCALE —See *Citrus*
MEALY-BUGS —See *Citrus*

Billbergia PINEAPPLE SCALE —See *Pineapple*

Blackberry —See *Bramble Fruits*

Bramble Fruits BLACKBERRY LEAF-MINER (*Metellus rubi*) —A greenish white larva with brown markings, ⅛ inch in length when full-grown, causing blotch mines in the leaves
Treatment —No satisfactory treatment known
CANE-BORER (*Oberea bimaculata*) —Beetle, black, small, and slim, making two girdles about an inch apart near the tip of the cane, in June, and laying an egg just above the lower girdle, the larva, attaining the length of nearly an inch, bores down the cane Also in blackberry
Remedy —As soon as the tip of the cane wilts, cut it off below the lower girdle and burn it
RASPBERRY BEETLE (*Byturus unicolor*) —A light brown beetle one-seventh inch long feeds on the opening leaves and blossoms The small white grub feeds between the berry and receptacle of red raspberries
RASPBERRY CANE MAGGOT (*Phorbia rubivora*) —Small, white maggot which burrows in the new canes and girdles the shoot. The eggs are laid by a fly in April or May

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Treatment —Pull up or out off canes several inches below the girdle and burn them.

RASPBERRY HORNTAIL (*Hartigia abdominalis*) —A whitish larva, about 1 inch in length when mature, when young it burrows under the bark, girdling the tip It then tunnels out the pith
Treatment —Cut off infested canes when wilting is observed.

RASPBERRY ROOT-BOREER (*Bembecia marginata*) —Larva about 1 inch long, boring in the roots and the lower parts of the cane, remaining in the root over winter
Remedy —Dig out the borers Destroy wild berry bushes

RASPBERRY SAW-FLY (*Monophadnus rubi*) —Larva about ¾ inch long, green, feeding upon the leaves
Remedies —Hellebore, arsenicals, after fruiting

RED-NECKED CANE-BORER (*Ipsilus ruficollis*) —A yellowish white flattened grub, ¾ inch in length when mature, burrows in the canes causing swellings or galls characterized by the splitting of the bark The parent beetle is ⅓ inch in length, black, with thorax or "neck" reddish
Treatment —Cut out and burn all infested canes.

RED-SPIDER —See *Peach* Do not use lime-sultur on raspberry foliage

TREE-CRICKET (*Ecanthus nigricornis*) —Small and whitish cricket-like insect, puncturing canes for 2 or 3 inches, and depositing eggs in the punctures
Remedy —Burn all infested canes in winter or very early spring

Brassica —See *Cabbage*

Brussels Sprouts.—See *Cabbage*

Buxus OLEANDER SCALE —See *Hedera*

Cabbage CABBAGE APHIS (*Aphis brassicæ*) —These small, mealy plant-lice are especially troublesome during cool, dry seasons, when their natural enemies are less active
Treatment —Thorough spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint in one hundred gallons water, adding four or five pounds of soap

CABBAGE-LOOPER (*Autographa brassicæ*) —A pale green looping caterpillar, striped with lighter lines, over 1 inch in length when mature Especially destructive to late cauliflower
Treatment —Very difficult to poison Some growers dust the plants with pure paris green, using a blower

CABBAGE MAGGOT (*Pegomya brassicæ*) —A small white maggot, the larva of a small fly, eating into the crown and roots of young cabbage, cauliflower, radish, and turnup plants
Treatment —Carbolic acid emulsion diluted with thirty parts of water, applied the day following the transplanting of the cabbage plants, and repeated once a week for several applications Remove a little earth from about the plants, and spray on the emulsion forcibly Better results may be secured by using tightly fitting cards cut from tarred paper In seed-beds, protect the plants by surrounding the bed with boards 1 foot wide placed on edge, across which a tight cover of cheese cloth is stretched.

CABBAGE-WORM or CABBAGE-BUTTERFLY (*Pontia rapæ*).—The green caterpillars hatch from eggs laid by the common white butterfly There are several broods every season.
Treatment —If plants are not heading, spray with kerosene emulsion or with paris green to which the sticker has been added If heading, apply hellebore.

CUTWORMS —See *Corn*

DIAMOND-BACK MOTH (*Plutella maculipennis*) —A pale green, active caterpillar, about ½ inch in length when mature, feeds on the under sides of the leaves Pupates in an open-work silken cocoon on the leaves Destructive to late cauliflower.
Treatment —Same as for cabbage looper

FLEA-BEETLES —See *Potato*

HARLEQUIN CABBAGE-BUG (*Murgantia histrionica*) —Bug about ½ inch long, gaudily colored with orange dots and stripes over a blue-black ground, feeding upon cabbage, two to six broods
Treatment —Hand-picking Place blocks about the patch, and the bugs will collect under them In the fall make small piles of the rubbish in the patch, and burn them at the approach of winter Practise clean culture Destroy all cabbage stalks and other cruciferous plants in fall Early in the spring, plant a trap crop of mustard, radish, rape, or kale When the over-wintering bugs congregate on these plants, destroy them with pure kerosene or by hand

Cactus. MEALY-BUGS.—See *Citrus.*

Cactus *Chelinidea vittigera* —A yellowish bug resembling the common squash stink bug (*Anasa tristis*), feeding on the joints of opuntia, causing small circular discolored areas and destruction of the plants
Treatment —Destroy young with gasolene torch. In winter, burn trash in which adults are hibernating

COTTONY COCHINEAL INSECT (*Dactylopius confusus*) —A scale insect covered with large flocculent masses of pure white wax.
Control —Usually kept in check by its predaceous enemies.

Melitara junctolinella —Large indigo-blue (young), or conspicuously banded (last stage) larvæ living within the joints of opuntia, causing tumor-like swellings
Control —Burn injured joints with gasolene torch

Mimorista flavidissimalis —Yellowish caterpillars burrowing in the young joints, thus destroying new growth Their presence is indicated by exuding sap
Treatment —Powdered arsenate of lead dusted on the young growth early in the season

Narnia pallidicornis —Brownish yellow bugs about ¾ inch in length injuring the fruit.

CATALOGUE OF INSECTS, continued.

Control.—Destroy the gregarious bugs with the gasolene torch.

Opuntia longicorns (*Moneilema sp*) —Shining, black, wingless beetles ¾ to 1 inch in length The larvæ burrow in the main stems and older joints of the prickly pear
Control —Hand-picking the beetles, burning infested stems spraying with arsenate of lead

Carnation CARNATION MITE (*Pediculopsis graminum*) —A minute mite found in the buds and instrumental in transmitting the bud-rot disease
Treatment —Gather and burn all infested buds

GREEN PLANT-LOUSE (*Myzus persicæ*) —Small greenish plant-lice infesting the terminal branches
Treatment —Fumigation with hydrocyanic acid gas or tobacco

Carrot. CARROT BEETLE (*Lagyrus gibbosus*) —A reddish brown beetle ½ inch or more long, which attacks the young plants The larva lives in the ground, where it feeds on humus
Prevention —Crop-rotation and other remedies for white grub See under *Corn*

CARROT RUST FLY —See *Celery.*

PARSNIP LEAF-MINER —See *Parsnip*

PARSNIP PLANT-LOUSE —See *Parsnip*

PARSNIP WEB-WORM —See *Parsnip*

Carya —See *Hickory*

Castanea —See *Chestnut*

Catalpa. CATALPA-MIDGE (*Cecidomyia catalpæ*) —Small yellowish-maggots, scarcely ⅛ inch in length when mature, attacking the seeds, terminal buds, ends of branches and leaves, deforming them
Treatment —Plow in early fall or late spring to destroy pupæ in nurseries

CATALPA SPHINX (*Sphinx catalpæ*) —A sulfur-yellow caterpillar with black head and a broad black stripe down the back, about 2½ inches in length when mature, defoliates the trees Several broods a season
Treatment —Arsenate of lead when the caterpillars are small Hand-picking later

Cauliflower.—See *Cabbage*

Ceanothus CITRUS MEALY-BUG —See *Citrus*
MEALY-BUG —See *Banana*
OYSTER-SHELL SCALE —See *Apple*

Celery. CARROT RUST-FLY (*Psila rosæ*) —Minute whitish yellow maggots infesting the roots and stunting the plants
Preventive —Late sowing and rotation of crops Celery or carrots should not follow each other

CELERY CATERPILLAR (*Papilio polyxenes*) —A large green caterpillar, ringed with black and spotted with yellow, which feeds on the leaves
Treatment —Hand-picking as soon as observed

CELERY LEAF-TYER (*Phlyctænia ferrugalis*) —A greenish caterpillar, feeding on the under side of the leaves
Treatment —Spray with arsenicals while the larvæ are still young

CELERY LOOPER (*Autographa falcigera*) —A greenish looping caterpillar with white stripes, about 1½ inches long when mature, feeds on the tender leaves
Treatment —No satisfactory treatment known

LITTLE NEGRO BUG (*Corimelæna pulcraria*) —Glossy black bugs, ⅛ inch in length, that collect in clusters in the axils of the leaflets and cause the plants to wilt
Treatment —Kerosene emulsion or tobacco extract

PARSNIP PLANT-LOUSE —See *Parsnip*

Chard —See *Beet*

Cherry APHIS (*Myzus cerasi*) —Blackish plant-lice infesting the leaves and tips of new growth
Treatment —Spray as soon as the first lice appear with whale-oil soap or tobacco extract.

CANKER WORM —See *Apple*

CHERRY FRUIT FLIES (*Rhagoletis cingulata* and *R fausta*) —Small maggots infesting ripening fruit Adults are flies with banded wings and insert their eggs under the skin of the fruit
Treatment —Spray with arsenate of lead, five pounds in one hundred gallons sweetened with three gallons molasses to kill flies before egg-laying Should be done when flies first appear,—last of June in New York

CHERRY SCALE (*Aspidiotus forbesi*) —Resembles the San José scale
Treatment —Same as for *San José Scale.* See *Apple.*

PLUM-CURCULIO —See *Plum*

ROSE-CHAFER —See *Grape*

SLUG (*Eriocampoides limacina*) —Larva, ½ inch long, blackish and slimy, feeding upon the leaves, two broods
Treatment —Arsenicals, hellebore, tobacco extract

CHERRY TREE TORTRIX (*Archips cerasivorana*) —Tips of branches are frequently webbed into nests by colonies of lemon-yellow caterpillars
Treatment —Wipe out nests and destroy the caterpillars

PEACH TREE BORER —See *Peach*

FRUIT TREE BARK BEETLE —See *Peach*

Chestnut. CHESTNUT WEEVILS (*Balaninus proboscideus* and *B rectus*).—Brownish beetles with extremely long, slender snouts with which they bore holes into the nuts for deposition of eggs The grubs feed on the kernel, producing wormy nuts
Treatment —No satisfactory control measures known

CATALOGUE OF INSECTS, continued.

TWO-LINED CHESTNUT BORER (*Agrilus bilineatus*)—Slender, flattened grubs, ¾ inch long when mature, burrowing under the bark and girdling the trees
Treatment—Cut and burn infested trees to prevent spread.
EUROPEAN FRUIT LECANIUM—See *Plum*

Chrysanthemum GREEN APHIS (*Aphis rufomaculata*)—Small, green lice attacking the terminal shoots.
Treatment—Fumigation.
BLACK APHIS (*Macrosiphum sanborni*).—Small, black lice attacking the terminal shoots
Treatment—Fumigation.
TARNISHED PLANT-BUG—See *Aster*.
CHRYSANTHEMUM LEAF-MINER (*Oscinis sp.*)—Works in the leaves
Treatment—Hand-picking

Cineraria. LEAF-TYER—See *Celery*

Citrus BARNACLE SCALE (*Ceroplastes cirripediformis*)—A large, dark brown scale covered with a waxy secretion ⅛ inch in length Surface of scale sculptured like a miniature barnacle
Control—Resin wash or kerosene emulsion before the waxy covering is secreted
BLACK CITRUS LOUSE (*Toxoptera aurantiæ*)—Small, dull black lice, curling the leaves and killing the new growth
Control—Contact sprays before the leaves curl
BLACK SCALE (*Saissetia oleæ*)—A black, oval scale ⅛ inch in diameter with an "H"-shaped mark on the back of the female The young are light yellow to brown, unmarked The scales secrete honey dew in which a fungus grows smutting the fruit
Treatment—Fumigation On citrus, use a half to three-fourths of regular dosage between September and January On deciduous fruits and olive, water distillate, caustic soda mechanical mixtures or distillate emulsion may be used to kill scale less than one-half grown
CITRUS RED-SPIDER (*Tetranychus mytilaspidis*)—Bright red, minute mite, frequently abundant on fruit and foliage
Treatment—Dusting with sulphur or commercial lime-sulfur solution diluted 1-35 or 50 of water
CITRUS THRIPS (*Euthrips citri*)—Slender, minute, orange-yellow insects, less than one-thirtieth inch in length, scarring the fruit and injuring the foliage
Treatment—Lime-sulfur solution one part in eighty parts water (likely to cause slight injury to foliage) or "Black Leaf 40" tobacco extract, one part in 1,800 parts water Make four applications (1) as the last of petals are falling, (2) ten to fifteen days later, (3) three to four weeks after the second, (4) during the months of August or September (for California) In greenhouses, fumigate with hydrocyanic acid gas
COTTONY CUSHION SCALE (*Icerya purchasi*)—Red or yellowish scale insects with large, white, fluted, cottony masses which cover the eggs from ⅓ to ½ inch in length
Control—Natural enemies, principally by the common Vedalia
FLORIDA RED SCALE (*Chrysomphalus aonidum*)—Circular flat, brown scales, ⅛ to ⅛ inch in diameter
Treatment—Fumigation with full dosage schedule.
FLORIDA WAX SCALE (*Ceroplastes floridensis*)—Oval convex, white or pinkish, waxy scales with the upper surface evenly lobed, 1-12 to ⅛ inch in diameter
Control—Brown wash or kerosene emulsion applied to the young scale before the waxy covering is formed.
FULLER'S ROSE BEETLE—See *Strawberry*
GLOVER'S SCALE (*Lepidosaphes gloveri*)—Closely resembles the purple scale, but is longer and narrower
Control—Same as for *Purple Scale*, which see.
GREENHOUSE THRIPS (*Heliothrips hæmorrhoidalis*)—A slender, minute, yellowish brown insect destroying the blossoms and russeting the fruit
Treatment—Same as for *Citrus Thrips*, which see.
HEMISPHERICAL SCALE (*Saissetia hemispherica*)—A smooth, oval, convex soft scale without markings Common in greenhouses
Treatment—Same as for *Black Scale*, which see.
MEALY-BUG (*Pseudococcus citri*)—Small, soft-bodied scale insects, ⅛ to ⅜ inch long, covered with a white waxy secretion
Control—A thorough application of carbolic acid emulsion, spray under heavy pressure
MELON APHIS—See *Muskmelon*
MEDITERRANEAN FRUIT FLY (*Ceratitis capitata*)—Small white maggots burrowing in a great variety of soft, juicy fruits The parent fly is about the size of the house fly, yellowish marked with black, and with faintly banded wings Widely distributed in the tropical and subtropical regions of the world and a most serious horticultural pest wherever it occurs Rigid quarantine regulations have prevented its introduction into the United States
Treatment—Sweetened arsenate of lead to kill the flies before oviposition
ORANGE CHIONASPIS (*Chionaspis citri*)—Elongate, blackish brown scale with a gray margin and dark yellow exuviæ
Treatment—Fumigation, kerosene emulsion, one part in five parts of water, three applications at three-week intervals
ORANGE MAGGOT (*Trypeta ludens*)—Dirty white maggots, about ½ inch in length when mature, burrowing in the pulp. From four to twenty maggots may occur in a single orange The adult two-winged fly is straw-yellow in color with brownish markings and bands on the wings A serious pest to oranges in Mexico
Control—Pick up and destroy all infested fruit.

CATALOGUE OF INSECTS, continued.

ORANGE TORTRIX (*Tortrix citrana*)—Greenish white to dark, irregularly striped caterpillars, ½ inch long when mature, that burrow into the rind and induce decay.
Control—Destroy all infested fruit
PURPLE SCALE (*Lepidosaphes beckii*)—Reddish brown to rich purple oyster-shell-shaped scales ⅛ to ⅛ inch in length.
Control—Fumigate with full dosage schedule.
RED SCALE (*Chrysomphalus aurantii*)—Circular, flat, reddish scales, ⅛ to ⅛ inch in diameter
Control—Fumigation with full dosage schedule. On deciduous trees lime-sulfur solution, one part in nine parts of water, or distillate emulsion
SILVER MITE (*Eriophyes oleivorus*)—A minute, elongate four-legged yellow mite causing russeting of the orange and silvering of the lemon
Control—Same as for *Citrus Red Spider*, which see
SOFT BROWN SCALE (*Coccus hesperidum*)—Oval, yellowish brown, flat, soft scale, sometimes with darker markings, ¼ inch in length
Control—Same as for *Black Scale*, which see
WHITE-FLY (*Aleyrodes citri* and *A. nubifera*)—The immature stages are found on the under side of the leaves and are scale-like in form The adults are minute white-winged flies
Treatment—Fumigation Fungous parasites
YELLOW SCALE (*Chrysomphalus citrinus*)—Similar to the red scale but yellowish in color
Control—Same as for *Red Scale*, which see

Clematis RED SPIDER—See *Peach*
SOFT BROWN SCALE—See *Citrus*

Coconut COCONUT SCALE (*Aspidiotus destructor*)—Whitish to creamy transparent scales often abundant on under side of leaves and fruit
Treatment—When occurring on young trees spray with whale-oil soap, on older trees it is advisable to remove and burn badly infested leaves
COCONUT BEETLE (*Strategus anachoreta*)—Large black beetles attacking young trees near the "collar" One beetle will destroy a tree if not removed in time
Treatment—Dig out and destroy
COCONUT WHITE-FLY (*Aleyrodes cocois*)—Similar to the citrus white fly
Control—Contact insecticides. Destroy wild food plants
FLORIDA RED SCALE—See *Citrus*
PALM WEEVIL (*Rhynchophorus palmarum*)—Shining black snout beetles, the larvæ of which live in young palm trees reducing the interior tissues to a mass of pulp
Treatment—Dress all wounds with tar or similar preparations Avoid all unnecessary pruning Destroy all felled trees and stumps not used as traps The beetles may be attracted by the use of injured palm cabbages and trapped under rubbish
RHINOCEROS BEETLE (*Oryctes rhinoceros*)—A large beetle about 1¼ inches long, attacking and burrowing through the crown and stem
Treatment—Destroy all breeding-places, such as old coconut trees, stump, and cocao pods

Cocos—See *Coconut*.

Codiæum. GREENHOUSE THRIPS—See *Citrus*
MEALY-BUGS—See *Citrus*
PURPLE SCALE—See *Citrus*.

Coffee. BLACK CITRUS LOUSE—See *Citrus*
COFFEE LEAF-MINER (*Cemiostoma coffeella*)—A small caterpillar about ⅛ inch long, mines in the leaves producing small brownish areas Badly infested leaves drop
Treatment—No satisfactory treatment known.
HEMISPHERICAL SCALE—See *Citrus*
MEALY-BUG—See *Citrus*

Coleus MEALY-BUG—See *Citrus*.
Orthezia insignis—Ochreous to dark green scale insect covered with a white waxy secretion extending posteriorly into a broad plate
Treatment—Contact insecticides.
WHITE-FLY—See *Tomato*

Corn. ARMY-WORM (*Leucania unipuncta*)—A cut-worm-like caterpillar, which normally feeds on grass When this food-supply is exhausted, they migrate in numbers to other fields and attack corn, wheat, and similar crops
Preventive—To stop the advance of the "army," plow deep furrows so the dirt is thrown toward the colony, in the bottom of the furrows dig post-holes into which the caterpillars will fall and where they may be killed with kerosene
CHINCH-BUG (*Blissus leucopterus*)—A red or white and black sucking bug, three-twentieths of an inch long. Attacks wheat and corn in great numbers
Preventives—Clean farming to destroy suitable hibernating shelter. Stop the migration of the bugs from the wheat-fields into corn by maintaining along the field a dust strip 10 feet wide in which a furrow and post-hole barrier has been constructed This may be supplemented by a coal-tar barrier
ANGOUMOIS GRAIN MOTH (*Sitotroga cerealella*)—A small caterpillar living in the grains The adult is a small grayish brown moth Most destructive in storage
Treatment—Fumigate with carbon bisulfid, five pounds to 1,000 cubic feet Make bins perfectly tight and sprinkle over grain, covering with gas-proof tarpaulin Fumigate at least twenty-four hours This should be done when temperature is not below 65° F In steam-heated mills, the most practicable method of destroying grain-infesting insects is by holding temperature from 118° to 122° for several hours.

CATALOGUE OF INSECTS, contmued

CORN EAR-WORM (*Heliothis armiger*) —A green or brownish striped caterpillar feeding on the corn beneath the husk. Three to six generations yearly

Preventives —Plant as early as possible, and still avoid a "set-back" to the crop

CORN-ROOT APHIS (*Aphis maidiradicis*) —A bluish green aphis infesting the roots

Preventives —A short rotation period in corn, especially in dry years Deep and thorough and repeated stirring of old corn ground in fall and spring as a preparation for corn-planting Maintenance and increase of the fertility of the soil

CUTWORMS (*Agrotis, Hadena,* etc) —Soft-bodied caterpillars eating and cutting off the young plants

Preventives —Early fall plowing of grass lands intended for corn, pasturing by pigs of grass or clover land intended for corn, distributing a line of poisoned bran by means of a seed-drill To prevent the caterpillars entering from a neighboring grass field, destroy them with a line of poisoned vegetable bait

GRASSHOPPERS (*Acrididæ*) —Poison them with the following mixture Bran, twenty pounds, paris green, one pound, syrup, two quarts, oranges or lemons, three fruits, water, three and one-half gallons Mix the bran and paris green thoroughly in a wash-tub while dry Squeeze the juice of oranges or lemons into the water and add pulp and peel cut into small pieces Dissolve the syrup in the water and moisten the bran mixture with it, mixing thoroughly Sow broadcast in infested areas early in the morning

NORTHERN CORN ROOT-WORM (*Diabrotica longicornis*) —A whitish grub ⅔ inch long, which burrows in the roots

Preventive —Crop-rotation, corn should not follow corn

SOD WEB-WORMS (*Crambus sp*) —Gray or brownish caterpillars about ½ inch long, living in silk-lined burrows in the soil at base of plant They thrive in grass land

Preventive —Early fall plowing of grass land intended for corn, or else plow as late as possible the next spring

WHITE GRUBS (*Lachnosterna sp*) —The large white curved larvæ of the common June beetle

Preventives —Rotation of crops, do not let corn follow sod, but let a crop of clover or clover and oats intervene To help clear sod land of grubs, pasture to hogs any time between April and October To prevent laying of eggs in corn-field, keep the ground free from weeds during May and June Thorough cultivation and heavy fertilization

WIRE-WORMS (*Elaterida*) —Hard, yellowish, or reddish, cylindrical larvæ feeding on the roots

Preventives —Crop-rotation, let clover intervene between sod and corn, planting the corn late the second or third year. Early fall plowing

Cornus OYSTER-SHELL SCALE —See *Apple*
SAN JOSE SCALE —See *Apple*

Corylus HAZELNUT WEEVIL (*Balaninus obtusus*) —Small whitish grubs living in the kernels The adult is a yellowish brown beetle with a long, slender snout

Control —No efficient treatment known

Cosmos ROOT APHIS (*Aphis middletoni*) —Small bluish lice on the roots

Treatment —Tobacco dust mixed in the soil

Cotoneaster. PEAR LEAF-BLISTER MITE —See *Pear*

Cranberry CRANBERRY FULGORID (*Phyllosceles atra*) —Small, broad-bodied, black jumping insect punctures the vines, causing the leaves to turn brown and the fruit to shrivel

Treatment —"Black Leaf 40" tobacco extract, one pint to one hundred gallons of water, adding four to five pounds soap to kill young nymphs

CRANBERRY-GIRDLER (*Crambus hortuellus*) —Small caterpillars, feeding on the stems just beneath the surface of the sand

Preventive —Reflow just after picking, for a week or ten days, or reflow for a day or two about June 10

FALSE ARMY-WORM (*Calocampa nupera*) —Green to blackish caterpillars devouring the leaves and buds

Treatment —Reflow for from twenty-four to thirty-six hours soon after the middle of May It may be necessary to reflow a second time Destroy all caterpillars washed ashore while the water is on In dry bogs, spray early in May with arsenate of lead

FIRE-WORM, CRANBERRY WORM, or BLACK-HEADED CRANBERRY WORM (*Eudemis vaccinana*) —Small larva, green, black-headed, feeding upon the shoots and young leaves, drawing them together by silken threads, two broods

Treatment —Flooding for two or three days when the worms come down to pupate Arsenicals

FRUIT-WORM (*Mineola vaccinii*) —Small caterpillar working in the fruits, eating out the insides

Preventives —For bogs with abundant water, reflow for ten days immediately after picking Let the foliage ripen, and then turn on water for winter Draw off water early in April, and every third or fourth year hold it on until the middle of May For dry bogs spray three times with arsenate of lead during July Bury all screenings

YELLOW-HEADED CRANBERRY-WORM (*Acleris minuta*) —Stout, yellowish green, small caterpillar, with a yellow head, webbing up the leaves as it works

Treatment —Hold the water late on the bog in spring to prevent egg-laying Arsenicals from the middle of May till July 1

CATALOGUE OF INSECTS, continued

Crataegus PLANT-LICE —See *Apple*
OYSTER-SHELL SCALE —See *Apple*
RED-HUMPED CATERPILLAR —See *Apple*
SAN JOSÉ SCALE —See *Apple.*
SCURFY SCALE —See *Apple*
WOOLLY APHIS —See *Apple.*

Cucumber FLEA-BEETLES —See *Potato.*
MELON-WORM —See *Muskmelon*
PICKLE-WORM (*Diaphania nitidalis*) —Larva, about an inch long, yellowish white, tinged with green, boring into cucumbers, two broods

Preventives —Clean farming, fall plowing, and rotation of crops

Remedies —Kill the caterpillars before they enter the fruit by spraying with arsenate of lead about the time the buds begin to form, and repeat in two weeks

RED-SPIDER —See *Peach*

SPOTTED CUCUMBER BEETLE (*Diabrotica 12-punctata*) —Beetle, yellowish and black spotted, about ¼ inch long, feeding upon the leaves and fruit Sometimes attacks fruit trees, and the larva may injure roots of corn

Treatment —Same as for *Striped Cucumber Beetle*, which see.

STEM-BORER —See *Squash*

STRIPED CUCUMBER BEETLE (*Diabrotica vittata*) —Beetle, ¼ inch long, yellow with black stripes, feeding on leaves Larva ⅓ inch long and size of a pin, feeding on roots, two broods

Preventive —Cheap boxes covered with thin muslin or screens of mosquito netting, placed over young plants

Remedies —Arsenicals in flour, arsenate of lead, ashes, lime, plaster, or fine road dust sprinkled on the plants every two or three days when they are wet, air-slaked lime, plaster and kerosene, tobacco powder, applied liberally Apply remedies when dew is on, and see that it strikes the under side of the leaves

WHITE-FLY —See *Tomato.*

Cucurbita —See *Squash*

Currant BORER (*Sesia tipuliformis*) —A whitish larva, boring in the canes of currants, and sometimes of gooseberries The larva remains in the cane over winter

Treatment —In fall and early spring cut and burn all affected canes These canes may be distinguished by a lack of vigor and by limberness

CURRANT APHIS (*Myzus ribis*) —Small yellowish green lice attacking the under side of the leaves, distorting the leaves and causing them to turn red

Treatment —Contact insecticides when leaves first appear

CURRANT MEASURING- or SPAN-WORM (*Cymatophora ribearia*) —Larva somewhat over an inch long, with stripes and dotted with yellow or black, feeding upon the leaves

Treatment —Hellebore, applied stronger than for currant-worm Arsenicals, hand-picking

CURRANT-WORM, or CURRANT and GOOSEBERRY SAW-FLY (*Pteronus ribesii*) —Larva, about ¾ inch long, yellowish green, feeding on leaves of red and white varieties, two to four broods

Treatment —Hellebore, applied early, arsenicals for the early brood Treatment should begin while the larvæ are on the lowermost leaves of the bushes Before the leaves are fully grown, the holes made by the worms may be seen The second brood is best destroyed by killing the first brood

FOUR-STRIPED PLANT-BUG (*Pæciloscytus luteatus*) —A bright yellow, black-striped bug about ⅛ inch long, puncturing the young leaves and shoots of many plants

Treatment —Jarring into a dish of kerosene Kerosene emulsion when the nymphs are young Cut off the tips of the shoots in early spring to destroy the eggs

OYSTER-SHELL SCALE —See *Apple*
SAN JOSÉ SCALE —See *Apple*

Cycas HEMISPHERICAL SCALE —See *Citrus*
MEALY-BUG —See *Citrus*
OLEANDER SCALE —See *Hedera*
RED SCALE —See *Citrus*
SOFT BROWN SCALE —See *Citrus*
WHITE PEACH SCALE —See *Peach*

Dahlia GREENHOUSE THRIPS —See *Cutrus*
TARNISHED PLANT-BUG —See *Aster*

Date DATE PALM SCALE (*Parlatoria blanchardii*) —Small elongate gray or black scales with white edges Male scales are white

Treatment —Crop close, burn over trunks, after saturating with gasolene and use blast torch

MARLATT SCALE (*Phænicococcus marlatti*) —A soft-bodied, oval, wine-red insect, one twenty-fifth inch in length, partially covered with white wax, found in large colonies at base of leaves

Treatment —Carbolic acid emulsion poured in large quantities at base of leaves

OLEANDER SCALE —See *Hedera.*
RED SCALE —See *Citrus*
RHINOCEROS BEETLE —See *Coconut.*

Dewberry —See *Bramble Fruits*

Diospyros. WHITE FLY —See *Citrus.*
WHITE PEACH SCALE —See *Peach*

Dracæna LONG-TAILED MEALY-BUG (*Pseudococcus longispinus*). —Similar to the common mealy-bug, but has two long white anal appendages

Treatment —Same as for mealy-bug

CATALOGUE OF INSECTS, continued.

Echinocactus.—See *Cactus.*

Echinocereus.—See *Cactus*

Echinopsis.—See *Cactus*

Eggplant.—See article on *Eggplant.*

Elm —See *Ulmus.*

Eucalyptus BLACK SCALE —See *Citrus*
OLEANDER SCALE —See *Hedera*
RED SCALE —See *Citrus*

Eupatorium BARNACLE SCALE —See *Citrus*

Evonymous EVONYMOUS SCALE (*Chionaspis evonymi*) —Dark brown, convex scales, about one-twelfth inch in diameter with yellow exuviæ Male scales pure white parallel sides and strongly tricarinated
Treatment —Spray with kerosene emulsion every two weeks during the hatching periods until the scale has disappeared.
RED SCALE —See *Citrus*

Ferns FLORIDA WAX SCALE —See *Citrus*
GREENHOUSE THRIPS —See *Citrus*
HEMISPHERICAL SCALE —See *Citrus.*
MEALY-BUGS — See *Citrus*
OLEANDER SCALE —See *Hedera*
SOUTHERN FERN-CUTWORM (*Callopistria floridensis*) —Velvety black or apple-green caterpillars, 1⅞ inches in length when mature, feeding on the fronds
Treatment —Fry poisoned baits

Ficus COTTONY CUSHION SCALE, GREENHOUSE THRIPS, MEALY-BUG, PURPLE SCALE, RED SCALE, SOFT BROWN SCALE —See *Citrus*

Fuchsia GREENHOUSE THRIPS —See *Citrus*
MEALY-BUGS —See *Citrus*
RED-SPIDER —See *Peach*
WHITE FLY —See *Tomato*

Gardenia CITRUS WHITE FLY —See *Citrus*
JAPANESE WAX SCALE (*Ceroplastes ceriferus*) —White to creamy waxy masses, ¼ to ¾ inch in diameter
Control —Young scales may be killed with kerosene emulsion before the waxy covering is formed
ORTHEZIA —See *Coleus*

Genista GENISTA CATERPILLAR (*Mecyna reversalis*) —Pale yellowish brown caterpillars marked with numerous black spots and setæ, feeding on the foliage
Treatment —Arsenicals

Geranium MEALY-BUGS —See *Citrus*
RED-SPIDER —See *Peach*
WHITE-FLY —See *Tomato*

Gooseberry CURRANT-BORER, CURRANT MEASURING- OR SPAN-WORM, FOUR-STRIPED PLANT-BUG, GOOSEBERRY- OR CURRANT-WORM —See *Currant*
GOOSEBERRY FRUIT-WORM (*Dakruma convolutella*) —Larva about ¾ inch long, greenish or yellowish, feeding in the berry, causing it to ripen prematurely
Treatment —Destroy affected berries. Clean cultivation. Poultry

Grape GRAPE-CURCULIO (*Craponius inæqualis*) —Larva small, white, with a brownish head Infests the grape in June and July, causing a little black hole in the skin and a discoloration of the berry immediately around it The adult is a grayish brown snout-beetle, about one-tenth inch long
Treatment —Spray with arsenate of lead while the beetles are feeding on the leaves The beetles may be jarred down on sheets, as with the plum-curculio Bag the clusters
GRAPE ROOT-WORM (*Fidia viticida*) —The small white grubs feed upon the roots, often killing the vines in a few years. The adults are small grayish brown beetles that eat peculiar chain-like holes in the leaves during July and August
Treatment —Cultivate thoroughly in June, especially close around the vines to kill the pupæ in the soil At the first appearance of the beetles, spray the plants with arsenate of lead at the rate of eight or ten pounds in one hundred gallons of water, to which should be added one gallon of molasses
GRAPE-SLUG or SAW-FLY (*Selandria vitis*) —Larva, about ½ inch long, yellowish green with black points, feeding upon the leaves, two broods
Remedies —Arsenicals, hellebore
GRAPEBERRY-WORM (*Polychrosis viteana*) —Larva, about ¼ inch long, feeding on the berry, often securing three or four together by a web, two broods
Remedy —Spray with arsenate of lead before blossoms open Repeat after blooming and again in early July Destroy wormy berries in August.
GRASSHOPPERS —See *Corn*
GRAPE-VINE FLEA-BEETLE (*Graptodera chalybea*) —Beetle, of a blue metallic color, about ¼ inch long, feeding upon the buds and tender shoots in early spring
Treatment —Arsenicals to kill the grubs on leaves during May and June The beetle can be caught by jarring on bright days
GRAPE-VINE ROOT-BORER (*Memythrus polistiformis*) —Larva 1½ inches or less long, working in the roots
Preventive —Thorough cultivation during June and July.
Treatment —Dig out the borers
GRAPE-VINE SPHINX (*Ampelophaga myron*) —A large larva, 2 inches long when mature, green with yellow spots and stripes, bearing a horn at the posterior extremity, feeding upon the leaves, and nipping off the young clusters of grapes, two broods

CATALOGUE OF INSECTS, continued.

Treatment—Hand-picking. Arsenicals early in the season. There are other large sphinx caterpillars which feed upon the foliage of the vine and which are readily kept in check by hand-picking and spraying
LEAF-HOPPER (*Typhlocyba comes*) —These small yellowish leaf-hoppers, erroneously called "thrips," suck the sap from the under side of the leaves, causing them to turn brown and dry up
Treatment —Spray the under side of the leaves very thoroughly with one gallon "Black Leaf 40" in 1,000 gallons of water about July 1, to kill the young leaf-hoppers When using tobacco extract, add about two pounds soap to each fifty gallons to make it spread and stick better Repeat the application in a week or ten days In houses, tobacco smoke, pyrethrum poured upon coals held under the vines, syringing with tobacco-water or soapsuds
PHYLLOXERA (*Phylloxera vastatrix*) —A minute insect preying upon the roots, and in one form causing galls upon the leaves.
Preventive —As a rule, this insect is not destructive to American species of vines Grafting upon resistant stocks is the most reliable method of dealing with the insect yet known This precaution is taken to a large extent in European countries and in California, as the European vine is particularly subject to attack
Remedies —There is no reliable and widely practicable remedy known
ROSE-CHAFER (*Macrodactylus subspinosus*) —The ungainly, long-legged grayish beetles occur in sandy regions, and often swarm into vineyards and destroy the blossoms and foliage
Treatment —At the first appearance of the beetles, spray with arsenate of lead at the rate of eight or ten pounds in one hundred gallons of water, to which should be added one gallon of molasses
TREE CRICKET —See *Bramble Fruits*

Grapefruit —See *Citrus*

Guava BLACK SCALE —See *Citrus*
GUAVA MEALY-BUG (*Pseudococcus nipæ*) —Closely resembles the ordinary mealy-bug
Treatment —Carbolic acid emulsion
HEMISPHERICAL SCALE —See *Citrus*
MEDITERRANEAN FRUIT FLY —See *Citrus*

Hedera BLACK SCALE, FLORIDA RED SCALE, HEMISPHERICAL SCALE, MEALY-BUGS —See *Citrus*
OLEANDER APHIS (*Aphis nerii*) —Deep yellowish plant-lice, marked with black, cluster on the young shoots and buds
Treatment —Contact insecticides
OLEANDER SCALE (*Aspidiotus hederæ*) —Flat, circular, gray scales, ⅛ inch in diameter
Treatment —Same as for *San José Scale* (apple), which see.
SOFT BROWN SCALE —See *Citrus*

Helianthus STEM MAGGOT —See *Artichoke*

Heliotropium RED-SPIDER —See *Peach*

Hibiscus MELON APHIS —See *Muskmelon*

Hickory. GALL APHIS (*Phylloxera sp.*) —Yellowish green plant-lice causing hollow galls on the leaves, petioles and small twigs
Treatment —Spray with contact insecticides just as the buds are opening
HICKORY BARK BEETLE (*Eccoptogaster quadrispinosa*) —Small brown beetle burrowing into twigs, buds and green nuts in June and July Early in August the females penetrate the bark of living trees forming longitudinal burrows along the sides of which eggs are deposited The grubs burrow transversely in the sap-wood, soon killing the trees
Treatment —Cut and burn all infested trees before May of each year
NUT WEEVIL —See *Pecan*
TWIG-GIRDLER —See *Apple*

Hollyhock HOLLYHOCK BUG (*Orthotylus delicatus*) —A small green bug attacking the hollyhock with much damage.
Treatment —Kerosene emulsion, tobacco extracts.
MELON APHIS —See *Muskmelon*

Horse-Radish CABBAGE-WORM —See *Cabbage.*
FLEA BEETLES —See *Potato*
HARLEQUIN CABBAGE-BUG —See *Cabbage.*

Ipomœa. SOFT BROWN SCALE —See *Citrus.*

Iris WHITE-FLY —See *Citrus*

Jasminum CITRUS WHITE-FLY —See *Citrus.*
SOFT BROWN SCALE —See *Citrus.*

Juglans —See *Hickory.*

Juniper BAGWORM (*Thyridopteryx ephemeræformis*) —Small caterpillars in curious bag-like shelters defoliating the trees in early summer
Treatment —Arsenate of lead, two pounds to one hundred gallons of water
JUNIPER SCALE (*Diaspis carueli*) —Snow-white, circular scales with yellow central exuviæ
Treatment —Nothing known
JUNIPER WEB-WORM (*Phalonia rutilana*) —Small flesh-colored caterpillar that webs the leaves together
Treatment —Arsenicals

Kale —See *Cabbage*

Kohlrabi —See *Cabbage*

Kumquat —See *Citrus*

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Lantana GREENHOUSE WHITE-FLY.—See *Tomato.*
MEALY-BUGS —See *Citrus*
ORTHEZIA —See *Coleus*

Larix CASE-BEARER (*Coleophora laricella*) —A small reddish brown caterpillar mining the leaves when young In September it constructs a case and feeds on the surrounding leaves for a time, migrates to the branches and there hibernates
Treatment —Spray with lime-sulfur before the buds open to destroy the hibernating caterpillars
LARCH SAW-FLY (*Lygaonematus erichsonii*) —Grayish green larvæ with black heads feeding on the foliage
Treatment —Spray with arsenicals

Laurus. BLACK SCALE —See *Citrus*
FROSTED SCALE —See *Apricot*
SOFT BROWN SCALE, and THRIPS —See *Citrus*
WHITE PEACH SCALE —See *Peach.*

Lemon —See *Citrus*

Lespedeza SMOKY CRANE-FLY (*Tipula infuscata*) —Dirty yellowish maggots, ⅝ inch long, feeding on the roots, often in great abundance
Treatment —Short crop-rotation.

Lettuce APHIS, or GREEN-FLY (*Macrosiphum lactucæ*) —A plant-louse on forced lettuce
Preventive —Tobacco-dust applied on the soil and plants as soon as the aphis makes its appearance, or even before Renew every two or three weeks if necessary Fumigating with tobacco is the surest remedy
CABBAGE-LOOPER (*Autographa brassicæ*) —Larva somewhat over an inch long, pale green, with stripes of a lighter color, feeding on leaves of many plants, as cabbage, celery, and endive
Remedies —Pyrethrum diluted with not more than three times its bulk with flour, kerosene emulsion, hot water.
GREENHOUSE WHITE-FLY —See *Tomato*
ROOT-LOUSE (*Rhizobius lactucæ*) —Small dull-whitish lice, about one-tenth inch in length, feeding on the roots
Treatment —Crop-rotation and tobacco dust placed in the soil about the plants

Liriodendron TULIP TREE SCALE (*Toumeyella liriodendri*) —Large, nearly hemispherical scales clustered in masses on the under side of branches
Treatment —Scrape badly infested branches Spray with kerosene emulsion or soap solution

Lupine LUPINE APHID (*Macrosiphum albifrons*) —Large, green lice covered with fine white powder, infesting the plants
Treatment —Contact insecticides

Lycopersicum —See *Tomato*

Magnolia. BLACK SCALE, CITRUS WHITE FLY, GLOVERS' SCALE —See *Citrus*
MAGNOLIA SCALE (*Neolecanium cornuparvum*) —Large, convex scales, pinkish in color, and covered with fine powdered wax
Treatment —Kerosene emulsion or tobacco extract to kill the young scales

Maclura Treated under Toxylon

Mangifera CITRUS MEALY-BUG —See *Citrus*
FRUIT FLY (*Anastrepha acidusa*) —Small yellowish maggots infesting the ripening fruit
Treatment —Try sweetened arsenate of lead to kill the flies
GREENHOUSE WHITE-FLY —See *Citrus*
MANGO WEEVIL (*Cryptorhynchus mangiferæ*) —Brown weevils about ¼ inch long, the grubs living within the seeds
Treatment —Gather and destroy all fallen fruit

Mimulus. *Ceroputo yuccæ* —Closely resembles the common mealy-bug
Treatment —As for mealy-bugs

Monstera SCALE (*Hemichionaspis aspidistra*) —Brownish, oyster-shell-shaped scales, attacking the foliage
Treatment —Wash the leaves with soapsuds and tobacco extract

Mushroom MAGGOTS (*Sciara sp*) —Small whitish or yellowish white maggots with black heads
Treatment —Exclude flies from house or cellar with fine screens Sterilize manure by heating to 150° F. Fumigate with tobacco
MUSHROOM MITE (*Tyroglyphus lintneri*) —A minute mite preventing growth of spawn by eating the mycelium
Control —In infested houses remove all compost and disinfect by drenching cellar with boiling water Use sterilized manure
SPRINGTAILS (*Achoreutes sp*) —Small black or brown jumping insects which sometimes swarm in on the beds
Treatment —Fumigate with potassium cyanide, three to six ounces to each 1,000 cubic foot of air-space Sterilize all manure with heat before using
SOWBUGS (*Armadillidium sp* and *Porcellio sp*) —Oval, grayish or slate-colored creatures bearing seven pairs of legs, frequently injure mushrooms These are commonly known as sowbugs and pillbugs.
Treatment —Mix one quart of cornmeal with sufficient brown sugar to sweeten, then add two tablespoonfuls of paris green. Moisten with water and scatter in places frequented by these sowbugs

Muskmelon MELON APHIS (*Aphis gossypii*) —Small, dark green, sluggish lice found abundantly on melon vines, causing curling of the leaves and death of the plant

CATALOGUE OF INSECTS, continued

Treatment —Fumigate with tobacco preparations under cloth-covered frames placed over the plants Cloth should be treated with linseed oil before using, to make gas-proof In large fields, spray with "Black Leaf 40" tobacco extract, three-fourths pint to one hundred gallons of water, adding four pounds of soap
MELON CATERPILLAR (*Diaphania hyalinata*) —Pale, greenish yellow caterpillar about ⅝ inch in length when mature, feeding on the foliage early in the season, later boring in the fruits.
Treatment —Use arsenicals early in the season
PICKLE-WORM —See *Cucumber*
STEM-BORER —See *Squash.*

Narcissus GREEN APHIS —Tobacco extract, soap solution or fumigation
NARCISSUS BULB FLY (*Merodon equestris*) —Grayish maggots, ½ to ¾ inch in length when mature, feeding in the bulb. The adult is a large hairy fly
Control —Examine bulbs and discard infested ones, burning them If bulbs are placed in water for from two to eight days the maggots will usually leave them

Nasturtium APHIS A dark-colored plant-louse.
Treatment —Spray the plants with tobacco extract or soap solution

Nectarine —See *Peach*

Nelumbo PLANT-LICE —Use tobacco preparations for controlling these pests.

Nepenthes MEALY-BUGS —See *Citrus*

Nerium OLEANDER SCALE —See *Hedera.*

Oak BROWN-TAIL MOTH —See *Apple*
GIPSY MOTH —See *Apple*
PIT-MAKING OAK SCALE (*Asterolecanium variolosum*) —Circular greenish yellow scales with a glassy appearance Especially destructive to golden oak
Treatment —Kerosene emulsion or soap solution.
TENT CATERPILLARS, TUSSOCK MOTH; TWIG-PRUNER —See *Apple*

Okra MELON APHIS —See *Muskmelon.*

Olive BLACK SCALE —See *Citrus*
BLACK CITRUS LOUSE —See *Citrus*
Chrysomphalus rossi —Circular or oblong, reddish to dark brown scale with a central black spot
Treatment —Same as for *Red Scale* —See *Citrus*
OLEANDER SCALE —See *Hedera*
PINEAPPLE SCALE —See *Pineapple*
PURPLE SCALE, RED SCALE, THRIPS —See *Citrus*

Onion BLACK ONION FLY (*Tritoxa flexa*) —Whitish maggots attacking the bulbs of onions
Treatment —Same as for cabbage maggot
ONION MAGGOT (*Phorbia cepetorum*) —Small maggot feeding on the bulb and roots, several generations
Treatment —Use lime, tobacco dust or hellebore as repellents to prevent oviposition Some of the maggots may be killed by applying carbolic acid emulsion or hellebore decoction to the soil about the plants
CUTWORMS —See *Corn*
ONION THRIPS (*Thrips tabaci*) —Minute, elongate, pale yellow insects attack the leaves, causing them to wilt
Treatment —Tobacco sprays Spray with paris green one pound in one hundred gallons water sweetened with twenty pounds brown sugar when thrips first appear.

Orange —See *Citrus*

Orchids HEMISPHERICAL SCALE —See *Citrus*
ORCHIDS ISOSOMA (*Isosoma orchidearum*) —Small, white larvæ infesting the buds causing them to become unduly enlarged.
Treatment —Cut off and destroy infested buds
SCALE INSECTS —Several species
Treatment —Wash plants with nicotine solutions and soapsuds

Papaver. PLANT-LOUSE (*Aphis rumicis*) —Shining black plant-louse that clusters on leaves and stems
Treatment —Contact insecticides

Parsnip. PARSLEY-WORM (*Papilio asterius*) —Larva, 1½ inches long, light yellow or greenish yellow with lines and spots, feeds upon leaves of parsley, celery, carrot, and related plants When the worm is disturbed it ejects from the anterior end two yellow horns, with an offensive odor
Remedies —Hand-picking Poultry are said to eat them sometimes Upon parsnips, arsenicals
PARSNIP-LOUSE (*Hyadaphis pastinacæ*) —Greenish plant-lice.
Treatment —Contact insecticides
PARSNIP WEB-WORM (*Depressaria heracliana*) —Larva, about ½ inch long, feeding in the flower-cluster and causing it to become contorted
Treatment —Arsenicals, applied as soon as the young worms appear, and before the cluster becomes distorted Burn the distorted umbels Destroy all wild carrots
PARSNIP LEAF-MINER (*Acidia fratria*) —Small, whitish maggots mining the leaves
Treatment —Hand-pick infested leaves.

Passiflora MEALY-BUGS —See *Citrus.*

Pea. CUT-WORMS —See *Corn*
PEA-WEEVIL, or PEA-BUG (*Bruchus pisi*) —A small brown-black beetle, living in peas over winter The beetle escapes in fall and spring, and lays its eggs in young pea-pods, and the grubs live in the growing peas.

CATALOGUE OF INSECTS, continued.

Treatment —Hold over infested seed one year before planting Late planting in some localities Fumigation with carbon bisulfid

PEA APHIS (*Macrosiphum pisi*).—A rather large green plant-louse, often attacking peas in great numbers and causing enormous losses

Treatment —Rotation of crops, early planting. When peas are grown in rows, the brush-and-cultivator method may be used The plant-lice are brushed from the plants with pine boughs, and a cultivator follows stirring the soil. This operation should be performed while the sun is hot and the ground dry Most of the lice will be killed before they can crawl back to the plants. Repeat every three to seven days

Peach BLACK APHIS (*Aphis persicæ-niger*) —A small black or brown plant-louse, which attacks the tops and roots of peach trees When upon the roots it is a very serious enemy, stunting the tree and perhaps killing it Thrives in sandy lands

Treatment Kerosene emulsion, tobacco decoction and extracts

CLOVER MITE (*Bryobia pratensis*) —Small reddish mites attacking the leaves, causing them to turn yellow

Treatment —Lime-sulfur while trees are dormant In summer, use self-boiled lime-sulfur, as a dust, or sulfur paste.

FLAT-HEADED BORER —See *Apple*

FRUIT TREE BLACK BEETLE (*Scolytus rugulosus*) —A small beetle similar to the peach tree bark-beetle

Treatment —Same as for *Peach Tree Bark-Beetle*, which see.

KATYDID —This insect is often troublesome to the peach in the southern states in the early spring, eating the leaves and girdling young stems

Remedy —Poisoned baits placed about the tree

GREEN PEACH-LOUSE or APHIS (*Myzus persicæ*) —A small insect feeding upon the young leaves, causing them to curl and die

Treatment —Lime-sulfur, kerosene emulsion, or tobacco extract After the buds open, either of the last two

PEACH TREE BARK-BEETLE (*Phlœotribus liminaris*) —A dark brown beetle one-tenth inch in length burrowing under the bark

Treatment —Burn all brush and worthless trees as soon as the infestation is observed Keep the trees in healthy condition by thorough cultivation and the use of fertilizers Apply a thick whitewash to the trunk and branches three times a season (1) the last week of March, (2) second week in July, (3) first week in October

PEACH TREE-BORER (*Sanninoidea exitiosa*) —A whitish larva, about ¾ inch long when mature, boring into the crown and upper roots of the peach, causing gum to exude

Remedies —Dig out the borers in June and mound up the trees At the same time apply gas-tar or coal-tar to the trunk from the roots up to a foot or more above the surface of the ground

PEACH TWIG-MOTH (*Anarsia lineatella*) —The larva of a moth, ½ inch long, boring in the ends of the shoots, and later in the season attacking the fruit Several broods

Remedy —Spray with lime-sulfur just after the buds swell Spray trunks and larger branches in late spring to kill first brood pupæ in the curls of bark

PLUM-CURCULIO (*Conotrachelus nenuphar*) —This insect may be successfully controlled on peach by spraying with arsenate of lead, four pounds to one hundred gallons of self-boiled lime-sulfur spray, first, when the "husks" drop from the fruit, second, ten days or two weeks later It is unsafe to spray peaches more than twice with arsenate of lead

RED-SPIDER, or MITE (*Tetranychus bimaculatus*) —A small mite infesting many plants, both in the greenhouse and out-of-doors It flourishes in dry atmospheres, occurring on the under sides of the leaves In some forms it is reddish, but usually light-colored and two-spotted Common

Remedies —Persistent syringing with water will generally destroy them, if the spray is applied to the under surface. Use lots of force and little water to avoid drenching the beds Sulfur and water Dry sulfur In orchard trees, flour paste.

ROUND-HEADED APPLE TREE BORER —See *Apple*

WHITE PEACH SCALE (*Diaspis pentagona*) —Circular gray scales with the exuviæ, at one side of the center

Remedy —Same as for *San José Scale*. See *Apple*.

Pear APPLE TREE-BORER, BUD-MOTH, CODLIN-MOTH; FLAT-HEADED BORER —See *Apple*

MIDGE (*Diplosis pyrivora*) —A minute mosquito-like fly, lays eggs in flower-buds when they begin to show white These hatch into minute grubs which distort and discolor the fruit, New York and eastward. Prefers the Lawrence. Introduced in 1877 from France

Remedies—Destroy the infested pears. Cultivate and plow in late summer and fall to destroy the pupæ then in the ground.

PEAR-LEAF BLISTER-MITE (*Eriophyes pyri*) —A minute mite which causes black blisters to appear upon the leaves. The mites collect under the bud-scales in winter

Remedy.—Lime-sulfur or miscible oil as a dormant spray

PEAR PSYLLA (*Psylla pyricola*) —These minute, yellowish, flat-bodied, sucking insects are often found working in the axils of the leaves and fruit early in the season They develop into minute, cicada-like jumping-lice. The young psyllas secrete a large quantity of honey-dew, in which a peculiar black fungus grows, giving the bark a characteristic sooty appearance. There may be four broods annually, and the trees are often seriously injured

CATALOGUE OF INSECTS, continued

Treatment —Clean culture, remove rough bark from trunks and larger branches to discourage adults from hibernating, spray with "Black Leaf 40" tobacco extract, one pint in one hundred gallons of water, adding four pounds soap, on warm days in November or April to kill hibernating adults Spray with lime-sulfur, winter strength, when the blossom clusters appear, to destroy eggs

Summer treatment —Spray with "Black Leaf 40" tobacco extract just as the last of the petals are falling to kill young Repeat if necessary

PEAR THRIPS (*Euthrips pyri*). — Minute insects one-twentieth inch in length, dark brown when adult, white with red eyes when young, that attack the opening buds and young fruits in early spring They suck the sap from the tender growth, and the females lay eggs in the fruit-stems, causing a loss of the crop The nymphs hibernate in the ground a few inches from the surface A serious pest in California and recently introduced into New York

Treatment —Thorough cultivation during October, November, and December (in California) Make two applications of "Black Leaf" tobacco extract, one gallon in sixty gallons of 2 per cent distillate oil emulsion, the first just as the fruit-buds begin to open, the second just after the petals fall In the East it may be controlled by timely applications of tobacco extract and whale-oil soap

PEAR-TWIG BEETLE (*Xyleborus pyri*) —Brownish or black beetle, one-tenth inch long, boring in twigs, producing effect much like pear blight, and hence often known as "pear-blight beetle" It escapes from a minute perforation at base of bud, probably two broods

Treatment —Burn twigs before the beetle escapes

Pecan BUD-MOTH (*Proteopteryx deludana*) —A brownish caterpillar about ½ inch in length, feeding on the opening buds in early spring and on the under side of the leaves in summer

Treatment —Arsenate of lead in summer to kill larvæ of second brood Lime-sulfur and arsenate of lead in dormant season just before buds open, to destroy hibernating larvæ

CASE-BEARER (*Acrobasis nebulella*) —A small caterpillar living inside a case which it carries with it It attacks the opening buds

Treatment —Arsenate of lead as soon as the buds begin to open Repeat if necessary

BORER (*Sesia scitula*) —A wood-boring caterpillar working in the sap-wood

Treatment —Digging out

PECAN WEEVIL (*Balaninus caryæ*) —A dull, dark brown beetle with a long and slender snout with which it punctures the husk and shell of the maturing nuts for oviposition The grubs live within the nut feeding on the kernel

Treatment —Destroy all infested nuts This should be as soon as they fall

ROSE-CHAFER —See *Grape*

ROUND-HEADED BORER —See *Apple*.

SLUG —See *Cherry*

TWIG-GIRDLER (*Oncideres cingulatus*).—A brownish gray beetle, about ½ inch long, which girdles twigs in August and September The female lays eggs above the girdle The twigs soon fall

Remedy —Burn the twigs, either cutting them off or gathering them when they fall

TWIG-PRUNER —See *Apple*

Persimmon TWIG-GIRDLERS —See *Pecan*

WHITE PEACH-SCALE (*Diaspis pentagona*)

Remedy —Lime-sulfur when the trees are thoroughly dormant

Picea SPRUCE BUD-WORM (*Tortrix fumiferana*) —Small caterpillar feeding on the young foliage, causing the tips of the twigs to turn reddish, due to the dying of the foliage Frequently serious in forests

SPRUCE GALL APHID (*Chermes abietis*) —Plant-lice causing cone-shaped, many-celled galls at the bases of young shoots

Treatment —Spray with whale-oil soap, one pound in two gallons of water, in early spring Cut off all galls and burn before the lice leave them

Pine PINE LEAF-SCALE (*Chionaspis pinifoliæ*).—Small white scales frequently abundant on the foliage

Treatment —Kerosene emulsion or tobacco extracts when the young are hatching

PINE WEEVIL (*Pissodes strobi*) —Small grub working in the terminal branch, which is killed, causing distorted trees

Treatment —Cut out and burn infested branches

Pineapple KATYDID (*Acanthacara similis*) —A large katydid which attacks, among other plants, the leaves of the pineapple

Remedy —Arsenicals, before the plants are mature

MEALY-BUGS (several species) —These mealy white insects attack the plant at the base of the leaves, usually underground.

Treatment.—Set only clean plants, or dip them in resin wash or kerosene emulsion In the field apply tobacco dust freely in the bud before the bloom begins to appear, or spray with kerosene emulsion

PINEAPPLE SCALE (*Diaspis bromeliæ*).—Circular, thin, pure white scales with yellow exuviæ infesting leaves and fruit.

Treatment.—Kerosene emulsion and resin wash.

RED-SPIDER (*Stigmæus floridanus*) —Minute mites occurring in great number at the base of the leaf, where they induce rot.

Treatment —Tobacco dust applied to bud.

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Plum. CANKER-WORM.—See *Apple.*
CURCULIO (*Conotrachelus nenuphar*)—Larva, a whitish grub, feeding in the fruit
Remedies—Arsenate of lead, six pounds to one hundred gallons of water; apply as soon as the calyx falls, and repeat two or three times at intervals of about ten days Jarring the beetles on sheets very early in the morning, beginning when trees are in flower, and continuing from four to six weeks, is probably the most certain procedure There are various styles of sheets or receptacles for catching the insects as they fall from the tree. Clean culture.
FLAT-HEADED BORER—See *Apple*
PEAR-TWIG BEETLE—See *Pear.*
PLUM-GOUGER (*Coccotorus prunicida*).—A small larva, feeding upon the kernel of the plum. The beetle bores a round hole in the plum instead of making a crescent mark like the curculio.
Remedy—Catch the beetles in a curculio-catcher.
SAN JOSÉ SCALE—See *Apple*
EUROPEAN FRUIT SCALE (*Lecanium corni*)—A large circular scale occurring on plum, occasionally very destructive
Remedy—Thorough spraying with kerosene emulsion, one part to five of water, in the winter More dilute emulsion or tobacco extracts in midsummer, when the young insects are on the leaves and young shoots. Miscible oils when trees are dormant
SLUG—See *Cherry*
TENT CATERPILLARS—See *Apple.*
TWIG-PRUNER—See *Apple.*

Poinsettia. MEALY-BUGS—See *Citrus.*

Pomegranate. BLACK SCALE, CITRUS THRIPS, FLORIDA WAX SCALE—See *Citrus*
OLEANDER SCALE—See *Hedera.*
WHITE-FLY—See *Citrus.*

Pomelo—See *Citrus.*

Populus BLACK SCALE—See *Citrus.*
COTTONWOOD LEAF-BEETLE (*Lina scripta*).—A striped beetle feeding on the leaves and shoots of poplars and willows.
Remedy.—Arsenicals
OYSTER-SHELL SCALE—See *Apple*
POPLAR BORER (*Cryptorhynchus lapathi*).—A whitish grub burrowing in the wood
Treatment—In nurseries, spray thoroughly about the middle of July with arsenate of lead to kill the parent beetles

Potato. COLORADO POTATO-BEETLE (*Leptinotarsa decemlineata*)—Beetle and larva feed upon the leaves
Remedies—Arsenicals, either dry or in spray, about a third stronger than for fruits. Hand-picking the beetle
FLEA-BEETLE (*Haltica*)—Small, dark-colored jumping beetles that riddle the leaves with holes.
Preventive—Bordeaux mixture as applied for potato blight acts as a repellent
POTATO TUBER-WORM (*Phthorimæa operculella*)—A small caterpillar burrowing in the stems and tubers both in the field and in storage
Preventives—Clean cultivation, sheep and hogs to destroy the small potatoes left in the field after digging. Crop-rotation over a considerable area On digging, remove the potatoes at once to an uninfested storeroom Do not leave them on the field over night
STALK-WEEVIL (*Trichobaris trinotata*)—A grub boring in the stalk of the potato near or just below the ground. Serious in the West and in some places eastward
Remedy—Pull all infested vines as soon as they wilt, and spread them in the sun where the insects will be killed. Burn the vines as soon as the crop is harvested. Destroy all solanaceous weeds
WIRE-WORMS—See *Corn.*

Primula. WHITE-FLY.—See *Citrus.*

Privet or **Prim.** PRIVET WEB-WORM (*Diaphania quadristigmalis*).—Small larva feeding in webs on the young shoots of the privet, appearing early in the season, two to four broods
Remedies—Trim the hedge as soon as the worms appear, and burn the trimmings. Probably the arsenicals will prove useful

Prune.—See *Plum.*

Prunus.—See *Plum.*

Pseudotsuga. SEED CHALCIS (*Megastigmus spermotrophus*)—Small whitish grub devours the kernel of the seed, often destroying the whole crop
No known remedy

Pyrus.—See *Apple.*

Quince. GREEN APHIS.—See *Apple*
QUINCE CURCULIO (*Contrachelus crataegi*).—This curculio is somewhat larger than that infesting the plum, and differs in its life-history The grubs leave the fruits in the fall, and enter the ground, where they hibernate and transform to adults the next May, June or July, depending on the season
Treatment.—When the adults appear, jar them from the tree onto sheets or curculio-catchers and destroy them To determine when they appear, jar a few trees daily, beginning the latter part of May Arsenicals. Pick and burn all infested fruits a month before harvest.
ROUND-HEADED BORERS.—See *Apple.*
SLUG—See *Cherry.*

Radish. MAGGOT (*Pegomya brassicæ*).—Treated the same as the *Cabbage Maggot*, which see.

CATALOGUE OF INSECTS, continued.

Raspberry.—See *Bramble Fruits.*

Rhododendron. BORER (*Sesia rhododendri*).—Whitish caterpillars burrowing in the trunk and larger branches which are often killed
Treatment.—Dig out borers or cut out infested branches and burn
LACE BUG (*Leptobyrsa explanata*)—Small, lace-winged bugs on the under side of the leaves, causing them to turn brown and die
Treatment.—Spray with soap solution.

Rhubarb. RHUBARB-CURCULIO (*Lixus concavus*).—A grub ¾ inch long, boring into the crown and roots. It also attacks wild docks
Remedy—Burn all infested plants and keep down the docks. Hand-picking.

Rhus. APPLE TREE-BORER.—See *Apple.*
JUMPING SUMAC-BEETLE (*Blepharida rhois*).—Larva, ½ inch long, dull greenish yellow, feeding on leaves, two broods.
Remedy—Arsenicals.

Ribes.—See *Currant.*

Robinia. LEAF-MINER (*Odontota dorsalis*).—A black and yellowish white grub about ¼ inch in length, mining the leaves, causing blister-like spots.
Treatment—Arsenate of lead the last of July to first of August
LOCUST-BORER (*Cyllene robiniæ*)—Large, brownish yellow grub burrowing in the trunk, causing large ugly scars The beetle is black prettily marked with yellow stripes and bands.
Remedy—None known

Rose. MEALY-BUG—Tobacco extracts, syringe the plants in the morning, and two hours later syringe again with clean water.
ROSE APHIS (*Macrosyphum rosæ* and *Myzus rosarum*)—Greenish plant-lice, attacking leaves and buds
Treatment—Tobacco extracts and soap solutions
ROSE-CHAFER, ROSE-BEETLE, or "ROSE-BUG"—See *Grape.*
ROSE LEAF-HOPPER (*Typhlocyba rosæ*)—A very small hopper, often mistaken for thrips, living on the leaves of roses.
Remedies—Whale-oil soap, kerosene, kerosene emulsion; dry pyrethrum blown on bushes when leaves are wet, tobacco extracts
ROSE MIDGE (*Neocerata rhabdophaga*)—Small maggots, distorting leaf and flower-buds
Treatment—No satisfactory treatment known
ROSE SCALE (*Aulacaspis rosæ*)—Small, whitish circular scales.
Treatment—Soap solutions or tobacco extracts when young are hatching
WHITE-FLY—See *Tomato.*

Rubus—See *Bramble Fruits.*

Salix COTTONWOOD LEAF-BEETLE.—See *Populus.*
OYSTER-SHELL SCALE—See *Apple.*
POPLAR-BORER—See *Populus*
WILLOW-WORM (*Euvanessa antiopa*)—Larva nearly 2 inches long, black, feeding upon leaves of willow, elm, and poplar: two broods
Remedy—Arsenicals.

Salvia. ORTHEZIA—See *Coleus.*
WHITE FLY—See *Tomato*

Scilla NARCISSUS BULB FLY—See *Narcissus.*

Smilax. CITRUS WHITE FLY—See *Citrus*

Solanum—See *Potato*

Sorbus SAN JOSÉ SCALE; SCURFY SCALE—See *Apple*

Spinach. FLEA-BEETLE—See *Potato*
LEAF-MINER (*Pegomya vicina*)—Small maggot mining the leaves.
Treatment—Clean cultivation to destroy its wild food plant (lamb's quarters) Destroy all infested leaves By raising spinach as an early or late crop, much of the damage can be avoided
SPINACH APHIS (*Myzus persicæ*)—Same as green peach aphis
Treatment—Spray at first appearance of lice with "Black Leaf 40" tobacco extract, three-fourths pint to one hundred gallons of water, adding four pounds of soap.

Squash CUCUMBER BEETLES.—See *Cucumber.*
MELON APHIS.—See *Muskmelon.*
SQUASH APHIS (*Nectarophora cucurbitæ*).—Large, light green plant-louse attacking the leaves.
Treatment—Same as for melon aphis.
SQUASH LADY-BIRD—See *Cucumber*
SQUASH STINK-BUG (*Anasa trista*).—Large, dark brown bug hibernates as adult under rubbish Female lays large brown eggs in patches on the leaves. The young are greenish, feed in colonies on under side of leaves, causing them to wilt and die.
Treatment—Trap adults in spring under boards laid on the ground Destroy eggs by hands. Young can be killed with "Black Leaf 40" tobacco extract, one pint in one hundred gallons of water, adding four to five pounds of soap
STEM-BORER (*Melittia satyriniformis*)—Soft, white, grub-like larva which bores inside the stem and causes rot to develop, killing the vine.
Preventives.—Plant early squashes as traps As soon as the early crop is gathered, burn the vines to destroy eggs and larvæ of the borer. Fall harrowing of infested fields will help to expose the pupæ to the elements Cut out borers whenever found After the vines have grown to some length, cover some of the joints with earth, so that a new root-system will develop to sustain the plant in case the main root is injured.

CATALOGUE OF INSECTS, continued.

Strawberry. CROWN-BORER (*Tyloderma fragariæ*).—White grub, ⅛ inch long, boring into the crown of the plant in midsummer. The mature insect is a curculio or weevil

Preventives —Rotation of crops Isolation of new beds from infested beds. Plant uninfested plants.

FULLER'S ROSE-BEETLE (*Aramigus fulleri*).—White grub, ⅛ inch long, feeding in the crown The adult is a grayish brown snout-beetle with a whitish bar on each wing-cover.

Treatment —Short rotation Plant on uninfested land

LEAF-ROLLER (*Ancylis comptana*) —Larva less than ½ inch long, feeding on the leaves, and rolling them up in threads of silk, two broods

Treatment —Turn under in the fall all old beds that have become worthless Spray with arsenate of lead, four pounds in one hundred gallons of water, after the eggs are laid but before the leaves are folded—the first half of May in the latitude of New Jersey

ROOT-BORER (*Anarsia sp*) —Larva about ½ inch long, whitish, boring into the crown of the plant late in the season, and remaining in it over winter.

Remedy.—Burn the plant

ROOT-BORER (*Typophorus canellus*).—A whitish grub ⅛ inch in length feeding on the roots The parent beetle is brownish, and appears in great numbers in May

Treatment —Arsenicals to kill the beetles. Plant new beds at a distance from old ones.

ROOT-LOUSE (*Aphis forbesi*) —From July to the close of the season the lice appear in great numbers on the crowns and on the roots of the plants

Remedies —Rotation in planting Disinfect plants coming from infested patches by dipping the crowns and roots in kerosene emulsion, or tobacco extract. Fumigation

SAW-FLY (*Emphytus maculatus*) —Larva nearly ¾ inch long, greenish, feeding upon the leaves, two broods.

Remedies —Hellebore, arsenicals for second brood

WEEVIL (*Anthonomus signatus*) —Beetle ⅛ inch long, reddish black, feeding on flower-buds, particularly those of the pollen-iferous varieties

Preventives —Plant principally profusely flowering varieties Clean culture Destroy all wild blackberry and raspberry vines in the vicinity.

WHITE GRUBS —See *Cor*

Sweet Pea TARNISHED PL . BUG.—See *Aster*. (They puncture and kill the flower-stem.)

Sweet Potato CUTWORMS - Poisoned bait; late planting, keep the land free from weeds the previous fall

FLEA-BEETLE (*Chætocnema confinis*) —Small, dark-colored beetles, which attack the plants soon after they are reset

Treatment —Dip the plant in a strong solution of arsenate of lead before resetting, spray once or twice later with the same. Rotation of crops Destroy all bindweed and wild morning-glory plants

ROOT-BORER (*Cylas formicarius*) —A whitish grub ¼ inch in length, burrowing through the tubers

Preventive —Burn infested tubers and the vines

SAW-FLY (*Schizocerus ebnus* and *S privatus*) —Small larva about ¼ inch long, working upon the leaves. The fly is about the size of a house-fly

Remedies —Hellebore and arsenicals.

TORTOISE BEETLES (*Cassidini*) —Beetles of brilliant colors and their slug-like larvæ which eat holes in the leaves of newly reset plants

Treatment —Same as for next.

Tamarix. CANE-BORER (*Schistocerus hamatus*).—Whitish grub, ⅜ inch in length, burrowing in the twigs

Treatment —Cut and burn all infested branches.

Theobroma. CACAO BEETLE (*Steirastoma depressum*).— Large grubs, 1½ inches long, burrowing under the bark.

Control —Dig out or kill with a wire.

CACAO FRUIT FLY (*Ceratitis punctata*).—A small maggot attacking the pods

Treatment —Spray when flies appear with sweetened arsenate of lead, four pounds to one hundred gallons of water

CACAO THRIPS (*Heliothrips rubrocincta*).—Small active insects attacking leaves and pods. In the young the abdomen is banded with red

Treatment —Careful cultivation to produce vigorous growth.

Thuya BAGWORM —See *Juniper*.

Tomato. FLEA-BEETLES —Dip the young plants in a strong solution of arsenate of lead Bordeaux mixture acts as a repellent.

FRUIT-WORM (*Heliothis obsoleta*) —Larva 1 inch in length, pale green or dark brown, faintly striped, feeding upon the fruit. Also on corn and cotton

Treatment.—Hand-picking Avoid planting close to corn or cotton, or after either of these crops or after peas or beans. Practise fall or winter plowing

TOMATO-WORM (*Phlegethontius sexta* and *P quinquemaculata*) —A very large green worm feeding upon the stems and leaves of the tomato and husk tomato Seldom abundant enough to be very serious, kept in check by parasites

Remedies.—Hand-picking, rotation of crops, clean culture; turkeys.

WHITE-FLY (*Aleyrodes vaporariorum*) —Tomatoes grown under glass are often badly infested with white flies, the young of which are scale-like and occur on the under side of the leaves.

Treatment —Fumigation.

Toxylon. BAGWORM —See *Juniper*.

SAN JOSÉ SCALE.—See *Apple*.

CATALOGUE OF INSECTS, continued.

Tropæolum.—See *Nasturtium*.

Tsuga. BAGWORM.—See *Juniper*.

Turnip.—See *Cabbage*

Ulmus. CANKER-WORM —See *Apple*.

ELM LEAF-BEETLE (*Galerucella luteola*) —A small beetle, imported from Europe, which causes great devastation in some of the eastern states by eating the green matter from elm leaves, causing the tree to appear as if scorched

Remedy —Arsenate of lead, six pounds to one hundred gallons, just as the eggs are hatching.

ELM SAW-FLY LEAF-MINER (*Kaliosysphinga ulmi*).—A greenish white larva feeding between the two layers of the leaf, causing large blotches, when abundant, the leaf dies and falls They sometimes kill the trees in two or three years.

Treatment —While the blotches are small, spray with "Black Leaf 40," tobacco extract, one gallon in 800 gallons of water, adding four pounds of whale-oil soap to each hundred gallons

LEOPARD MOTH (*Zeuzera pyrina*).—White to pinkish caterpillars boring at first in the smaller twigs and branches Later the nearly mature caterpillars attack the larger branches and trunk, doing very serious injury. The white moths, beautifully marked with black and blue, have a wing expanse of about 2½ inches

Treatment —Cut off and destroy all infested branches The spread of the pest is very slow if the branches of the trees do not interlace

WILLOW-WORM —See *Salix*.

Violet APHIS.—Fumigation when grown under glass.

GALL-FLY (*Contarinia violicola*) —The adult is a minute mosquito-like fly The whitish or yellowish maggot feeds in folds of the opening leaves, which become deformed, turn brown, and die

Treatment —Fumigation is practically of no value Thorough hand-picking as soon as any sign of injury is noticed. Do not let the pest become established in the house

RED-SPIDER (*Tetranychus bimaculatus*) —Minute mites which cause the leaves to turn paler and become yellowish

Treatment —On greenhouse violets there is nothing better than a stiff spray of clear water so applied as not to drench the beds Repeat the spraying once or twice a week.

Vitis.—See *Grape*

Walnut —See *Hickory*

Watermelon MELON APHIS —See *Muskmelon*.

Yucca (*Lonchæa chalybea*) —Small maggot destroying the buds Very serious pest

Treatment —Collect and burn all infested shoots

LONG-HORNED BEETLE (*Lagochirus obsoletus*) —A white grub 1¼ inches in length when mature, boring in the trunk and doing great damage The adult is a large reddish brown beetle and feeds on the foliage

Treatment —When beetles are most abundant prune plants to the ground and burn. Spray with arsenicals to destroy beetles

SPHINX CATERPILLARS (*Dilophonota ello*) —Large caterpillar feeding on the foliage The parent moth is a large hawk-moth rather showily colored

Treatment —Arsenate of lead, six pounds to one hundred gallons of water.

Zea.—See *Corn*

C. R. CROSBY.
ROBERT MATHESON.

Spraying.

Spraying is the art of protecting cultivated plants from insect enemies and vegetable parasites by covering them with a material which shall have a toxic or physically injurious effect upon the animal or vegetable organism.

Historical sketch.

The history of spraying is interesting The story of its progress in America differs in details from the history of its development in Europe, but the main features in each country are very similar In both places, insect enemies made the first draft on the ingenuity of man in devising methods by which to hold them in check. Vegetable parasites were studied afterward. It is a curious fact that, in the case of both insects and fungi, in America, some of the most injurious forms came from Europe and were the means of directing attention to wholesale methods of destroying them Some of these enemies, comparatively harmless in their native home, like the currant-worm and codlin-moth, have done more to forward spraying methods in the United States than anything else.

The first insecticides used in America, as well as in Europe, were not of a poisonous nature They were

substances that had an injurious effect on the body of the insect. These were of two kinds, mainly: infusions which were astringent, and caustic substances which burned the tissues Tobacco water and alkaline washes have been used for many years. One of the first poisons to be used was white hellebore The employment of arsenical poisons may be said to belong to America, and even at the present time has small place in the economy of fruit-growing in Europe. The widespread use of arsenical poisons is largely due to the influence of the incursion of the potato-bug There are no reliable records which give us the exact date of the first use of paris green. It probably occurred about 1865 or 1866. However, towards 1870 paris green was used very generally throughout the western region in which the potato-bug first appeared. At this time it was applied almost exclusively in the dry form diluted with gypsum or flour. From potato to cotton, tobacco and finally to fruit trees, is the development of this poison for destroying leaf-eating insects. So far as records are available, it appears that fruit trees were first sprayed with paris green between 1873 and 1875. Among pioneer sprayers, should be mentioned the names of C V. Riley, United States Entomologist; LeBarron, State Entomologist of Illinois; William Saunders, London, Ontario, Can ; J S. Woodward, Lockport, N Y.; T. G Yeomans & Sons, Walworth, N. Y.; A. J. Cook, Agricultural College, Mich.



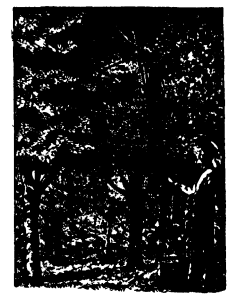
1326. Apple cluster ready for the spray. The blossoms have not yet opened.

Following paris green came london purple, then white arsenic, and later arsenate of lead. Since that time many different forms of arsenical poisons have been compounded, offered to the public and frequently used. A few years ago paris green was used extensively, but its popularity now is decreasing, probably because it contains a large percentage of soluble arsenic, which increases the danger of foliage injury. London purple has been largely dropped by fruit-growers, owing to its variable quality White arsenic, in combination with soda and with lime, forms a reliable insecticide and is used by some growers, especially those who make a practice of preparing the home-made solutions. Arsenate of lead is the insecticide used most widely by the growers at the present time. It possesses several advantages, the more important of which are a small percentage of soluble arsenic and better sticking qualities.



1327. Splint broom for applying spray. An early device.

The sucking insects presented a more difficult problem of control than the biting insects, and a longer time elapsed before effective methods had been devised for treatment One of the first efficient sprays for these insects was kerosene in the form of a soap-and-water emulsion, which was recommended by Riley and Hubbard. Among the earlier sprays for these insects was also tobacco and whale-oil soaps, both of which are used rather widely at the present time. Later the miscible oils were introduced. These proved to be very effective and are still used. The most important step in the control of the sucking insects is marked by the introduction of the lime-sulfur wash This mixture, which was originally developed as a dip for the control of scab on sheep, was first used as an insecticide on fruit trees in 1886 by F Dusey, of Fresno, California. The wash proved very efficient and with modifications came quickly into favor Now lime-sulfur is the leading insecticide for the control of certain scale insects and also, in a more dilute form, the leading fungicide for the more troublesome diseases of the apple.



1328. A bucket pump

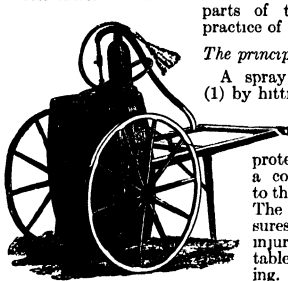
The treatment of fungous diseases of plants by liquid applications began with the discovery of bordeaux mixture Early in the 1880's, diseases of grape-vines threatened the extinction of French vineyards. The situation engaged the attention of French investigators Notable among them were A Millardet and his co-workers of the Academy of Science, Bordeaux, France He, with others, discovered partly by accident and partly by experiment that solutions of copper prevented the development of downy mildew. After much experimentation, "bouillie Bordellaise" was found to be effective in preventing the growth of downy mildew and other plant parasites infesting the grape in that region. The announcement was definitely made in 1885 The following year the European formula for bordeaux mixture was published in several places in the United States, and immediately there began an unparalleled period of activity in economic vegetable pathology This mixture, though somewhat modified and developed, continues to be a leading fungicide. The value of lime-sulfur as a fungicide applied to the peach during the dormant season to control the leaf-curl has been recognized About 1907,



1329. Knapsack pump.

Cordley discovered that lime-sulfur in more dilute form may be applied to the apple and some other tree fruits in foliage without danger of foliage injury, and that in addition to being as effective as bordeaux it produces no spray injury on the fruit. Since then lime-sulfur as a fungicide has practically replaced bordeaux in the case of those fruits for which it can be used on the foliage with safety. The self-boiled lime-sulfur was developed about 1907 as a fungicide for the control of the brown rot of the peach.

The rapidity of the spread of spraying knowledge among fruit-growers is remarkable. Only a few years ago it was an unknown art by the rank and file. Today agricultural clubs and granges purchase their spraying materials by the carload direct from the manufacturer. The American farmer leads his fellow-workers in all parts of the world in the practice of spraying.



1330. A garden barrel pump.

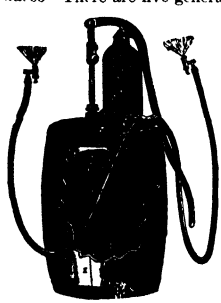
The principles of spraying.

A spray may be effective (1) by hitting the enemy, (2) by placing poison before the depredator, and (3) by protecting the plant with a covering unfavorable to the growth of the pest. The cautious farmer insures his crop against injury by insect or vegetable parasites by spraying. The fruit-grower asks, "Do I need to spray this year? My trees are not blossoming" "Certainly," we answer, "spray to protect the foliage from possible injury by insect or fungous disease" Healthy foliage is essential to the protection of health and vigor and fruit-buds Spray this year for next year's crop.

Insecticides kill by contact or by means of a poisonous principle, their efficiency depends largely on the time and thoroughness of the application. If applied too soon they may be dissipated before the insects appear; if applied late the injury is only partly prevented, because insects feed less voraciously and are harder to kill as they approach maturity in the larval stage. With the vegetable parasite, the case is not essentially different The tree is covered with a thin coating which destroys spores of fungi resting there and prevents other spores from germinating. Fig 1326 shows the stage of development of fruit-bud calling for bordeaux mixture and paris green The keynote to success is thoroughness Hasty sprinklings are worse than useless, they discourage and disappoint the beginner. Full protection is not afforded unless each leaf, twig and branch has been covered Time is the next most important factor bearing on success The early spray is most effective This applies particularly to the treatment of fungous diseases. Spray before the buds open Get ahead of the enemy

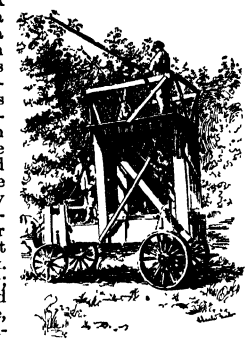
Spraying machinery.

Bordeaux mixture was first applied with a broom (Fig 1327). Poison distributors were first made in America for the protection of cotton, potato and tobacco There are five general types of pumps· (1) The hand portable pump, often attached to a pail or other small reservoir, suitable for limited garden areas. (2) The knapsack pump carried on a man's back and operated by the carrier The tank is made of copper, holds five gallons and is fitted with a neat pump which may be operated with one hand while the nozzle is directed with the other. This pump has been modified recently so that all the pumping is done when the sprayer is filled and before it is placed on the shoulders.

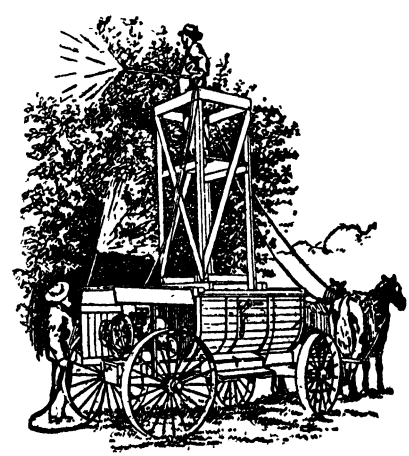


1331. An orchard barrel pump.

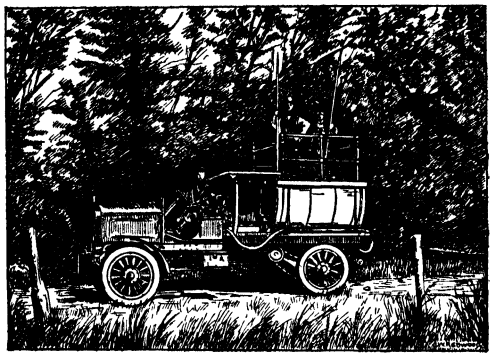
Excellent for spraying small vineyards and vegetable-gardens. (3) A barrel pump; a strong force-pump fitted to a kerosene barrel or larger tank suitable for spraying young trees; may be mounted on a cart, wagon, or stone-boat, depending on the character of the ground and size of trees. (4) A gear-sprayer; being a tank provided with a pump and mounted on wheels. The pump is operated by power borrowed from the wheels as they revolve, and transferred by means of chain and sprockets. Suitable for vineyards and field crops, which may be satisfactorily covered by the spray as the machine moves along. For this reason it is not adapted to orchard work. (5) The power sprayer; power being furnished generally by gasolene, sometimes by compressed air. When the trees are large and the orchard over 5 acres in extent, a power sprayer will usually pay Some of these various types of machinery are shown in Figs 1328–1335. In recent years the spraying of field crops and shade trees has developed rapidly. The spray pumps have been adapted to this work by the use of special attachments For the field crops, nozzles are distributed along a horizontal arm, which makes it possible to cover a wide strip. The sprayers for shade trees are equipped with a more powerful pump, which is usually multiple-cylinder The pump must be capable of delivering a large quantity of material each minute under a pressure of 200 to 300 pounds. The nozzles for this work are of the solid stream type and are usually fitted with interchangeable tips varying from $\frac{1}{8}$- to $\frac{1}{4}$-inch aperture In order that the tops of high trees may be reached by the spray mixture, it is necessary to use a long extension rod, as well as very high pressure.



1332 Square tower, giving more working space for the nozzle-men than the conical form.



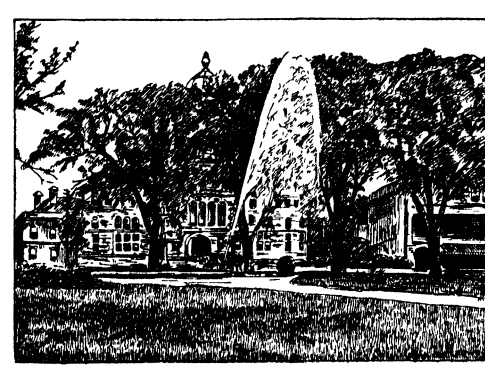
1333. A power sprayer for orchard use.



1334. A traction power sprayer, for street and park trees

The essentials of a good pump are (1) durability: secured by having working parts made of material least susceptible to the action of the various spray solutions, friction considered, (2) strength: obtained by a good-sized cylinder, substantial valves, wall and piston; (3) easily operated: found in a pump with a long handle, large air-chamber and smoothly finished working parts. A pump should be strong enough to feed two leads of hose and throw a good spray from four nozzles. Nearly all spray mixtures require constant stirrings to prevent settling and insure uniformity, and an agitator is a necessary part of the equipment.

Nozzles.—Much of the efficiency of a spraying machine depends upon the nozzle. It should be chosen for the particular work to be done, rather than for any special design. The development of nozzle construction has been rapid, new features being embodied as necessity demanded, until today there are four main types, each of which is intended for specific work: (1) The Bordeaux nozzle is the oldest of the modern types. It came into general use about 1890 and was at first universally adopted for all spray work. It throws a stream which may be regulated from a solid jet to a coarse fan-shaped spray, both of which are too coarse for general use. The Bordeaux has, however, one place in the list of modern spray nozzles and that is for the codlin-moth spray. For this application it is desirable to force the material into the calyx cups of the developing fruit and no nozzle does this quite so efficiently as the Bordeaux. (2) The Vermorel was the next step in development after the Bordeaux. It was very much superior to the latter, breaking the material up into finer particles, and was generally used until about 1906. This nozzle, however, does not possess any desirable features not found in the disc types and therefore has no special uses in modern spraying. (3) The disc nozzles are standard for general spraying work. They are represented by a large number of sorts, each made by different manufacturers, but all working on the same principle. The material is whirled inside of the nozzle before it reaches the final outlet, thus breaking it up into finely divided parts and producing the desired mist. The material is lastly passed through a disc, which may have either a large or small opening. For orchard and small crop spraying, the small opening is used, in which case the nozzle should be 3 to 7 feet from the object to be sprayed. For taller orchard trees and for small ornamental trees, the large opening is used. This produces a solid jet which breaks into finer particles at a distance from the nozzles, depending upon the pressure used. (4) Shade tree nozzles, to be used only for spraying very tall ornamental trees, and in connection with at least 300 pounds pressure. They throw a solid stream 30 or more feet in the air, at which point the material is broken into a coarse mist. This type came into use at the time of the introduction of the brown-tail and gypsy moths in the New England states, and has since been widely used for parks, estates and forest spraying. C. S. WILSON.



1335. Spraying park trees with the machine shown in Fig. 1334.

DISÉMMA: *Passiflora.*

DISOCÁCTUS (*two-shaped Cactus*). *Cactàceæ.* Bushy cactus, 2–3 ft. high, sometimes seen as a pot-plant in collections.

Stems terete, usually erect: branches flattened as in Epiphyllum: fls. regular, with very short tube; petals few, elongated, spreading; ovary nearly naked, small.

bifórmis, Lindl. (*Phyllocáctus bifórmis,* Lab.). Soon pendulous, the branches cylindrical: short branches lf.-like, the lower egg-shaped, the upper more lengthened: fls. small, purple-red, less than 2 in expansion; ovary without angles and with minute scales. Honduras. B.M. 6156. V. 2:159. J. N. ROSE.

DÍSPORUM (Greek, *double one-seeded*). Syn. *Prosártes. Liliàceæ.* FAIRY BELLS. Small perennial rhizomatous herbs, sometimes planted in the wild garden.

Allied to Smilacina and Streptopus, being leafy-stemmed, but fls. in umbels (or solitary): perianth 6-parted, with narrow deciduous segms; stamens 6, the filaments filiform or slightly flattened and longer than the extrorse anthers; ovary 3-celled, the ovules 2 or more in each cell, the stigma 3-cleft or entire: fr. a red or reddish few-seeded berry.—About 20 species, in N. Amer. and in the Himalayan region, Java to China and Japan. Little known to horticulturists; probably require no particular skill in cult.

A. *Lvs. rarely cordate at base.*

B. *Style 3-cleft.*

Ménziesii, Nichols. (*Prosártes Ménziesii,* Don). More or less soft-pubescent: st. 2–3 ft. long, forking, arching above: lvs. ovate to ovate-lanceolate, narrowly acuminate or the lowest acute, sessile, 2–3 in. long, often resin-dotted: fls. 1–3, greenish, cup-shaped, from the topmost axils, nodding, 9–12 lines long; pedicels puberulous; perianth-segms. nearly erect, acute, 6–11 lines long; stamens a third shorter; anthers included, 1½–2 times shorter than the filaments: fr. oblong-

obovate, narrowed to a short beak, salmon-colored. Calif. to Brit. Col.

lanuginòsum, Nichols. Woolly-pubescent: lvs. oblong-lanceolate, narrowly acuminate: perianth-segms. greenish, linear-lanceolate, acuminate, spreading, 6–9 lines long, stamens a third shorter; style and narrow ovary glabrous: caps. oblong-ovate, obtusish or with a very short, stout beak, glabrous; cells 1–2-seeded. Ont. to Ga. and Tenn. B.M. 1490. (as Streptopus).

BB. *Style entire.*

trachycárpum, Benth. & Hook. (*Prosártes trachycárpa,* Wats.). More or less pubescent: st. 1–2 ft. high, forking, with foliage on the upper half: lvs. ovate to oblong-lanceolate, acute or rarely acuminate, 2–4 in. long: pedicels pilose; perianth-segms. whitish, slightly spreading, more narrowly oblanceolate than in *D. Menziesii,* acute, 6–7 lines long, about as long as the stamens: fr. obtuse, rather deeply lobed, papillose. Neb. to Manitoba and Ore. and Wash.

AA. *Lvs. mostly cordate-clasping.*

oregànum, Benth & Hook. (*Prosártes oregàna,* Wats.). More or less woolly-pubescent: lvs. ovate to oblong-lanceolate, long-acuminate: perianth-segms. spreading, acute, narrowed below, very distinctly net-veined, 5–7 lines long, as long as or shorter than the stamens: fr. ovate, acutish, somewhat pubescent. Orc. and Idaho to Brit. Col.

D. Hookeri, Nichols (P lanuginosa var Hookeri, Baker). More or less rough-pubescent, with short, usually spreading hairs: lvs ovate or sometimes oblong perianth rather broad at the base. fr obovate, obtuse, red. Calif.—*D. Leschenaultianum,* D. Don, differs from the others here described by having white fls India, Ceylon B M 6935—*D. pillum,* Sahsb Readily told from American forms by its brown or purplish green fls. India, Java, China B M 916.

WILHELM MILLER.
L. H. B.†

DISSÒTIS (*of two kinds,* referring to the unlike anthers). *Melastomàceæ.* Some 60 or more species of bristly-hairy or villous shrubs, sub-shrubs or herbs of Trop and S Afr, some of which may occur sparingly in choice collections of coolhouse and warmhouse plants: lvs opposite, short-stalked, linear, ovate or orbicular, usually entire, 3–5-nerved, more or less strigose above: fls bracted, about 1 in. or more across, purple or violet, solitary, or capitate or paniculate at the ends of the branches; calyx 4–5-lobed; petals 4 or 5, obovate; stamens 8 or 10, very unequal, the anthers linear-subulate, usually beaked, with 1 pore, the larger set being joined to the filament by a long connective and the other set with much shorter or nearly obsolete connective· fr. an included coriaceous caps 4- or 5-valved at the apex Apparently none is in the American trade. *D. Irvingiàna,* Hook f Annual from upper Guinea, 1–3 ft.: lvs linear-oblong to lance-oblong, acute, 3-nerved: fls reddish purple, to 1¼ in. across; petals obovate. B.M. 5149. *D. incàna,* Triana, of Trop and S Afr, shrub, 2–3 ft.: lvs. linear to linear-oblong, obtuse: fls. rose-purple, to 1½ in. across. B M. 3790. *D plumòsa,* Hook. f. Shrubby, with long and slender shoots which are densely covered with small deep green lvs.: fls. bright magenta-rose, 1½ in. across. Trop. Afr. *D. Mahònii,* Hook. f. Prostrate, the sts. 6–8 in. long: lvs. short-stalked, nearly or quite orbicular: fls. rose-purple, 2 in. across, solitary. Uganda. B M. 7896. *D. modèsta,* Stapf. Slender: lvs. oblong, minutely serrulate: fls. few, crowded at ends of branches; petals obovate-elliptic; stamens blue-purple, reddish and yellow; style purple. Uganda. L. H. B.

DISTÍCHLIS (Greek, *two-ranked*). *Gramíneæ.* SALT-GRASS. MARSH SPIKE-GRASS. Rigid erect perennials, with extensively creeping wiry rootstocks: spikelets several-fld, compressed, dicecious; lemmas coriaceous, rigid, faintly many-nerved.—Species about 6, in salt marshes on the coastal regions of Amer. and in alkaline soil of the interior. One species, *D. spicàta,* Greene, with stiff, distichous involute blades and small narrow panicles is found in alkaline soil throughout the U. S. (Dept. Agric., Div. Agrost. 20:143). It is a good grass for binding soils subject to wash. Probably not in cult.

A. S. HITCHCOCK.

DÍSTICTIS (Greek *dis,* twice and *stiktos,* dotted; meaning obscure). *Bignoniàceæ.* Five or 6 species in Cent. and S Amer., very similar in fl. to Pithecoctenium, but caps smooth, oblong, curved, and branchlets not angular: lvs 2- or 3-foliolate, with simple or 3-fid. tendril: fls. large in ample terminal panicles; calyx tubular-campanulate, truncate, often splitting; corolla funnelform-campanulate, leathery, curved; stamens inclosed; ovary with the seeds in many rows. Adapted for cult. in subtropical regions only; treatment and prop. like Bignonia, which see. The following species is cult. in S. Calif. **D. cinèrea,** Greenm (*Pithecoctènium cinèreum,* DC). Tall climber, grayish tomentose throughout: tendrils 3-fid: lfts. 2–3, ovate or oval, obtuse and mucronulate or acutish, entire, 1–2 in. long: corolla purple, tomentulose outside, 2–3½ in. long and 1½–2½ in. across at the mouth Mex —The plant cult. under this name in Calif. is said to have white fls. and may not be the plant described above

ALFRED REHDER.

DISTÝLIUM (Greek, *dis,* twice, *stylos,* style; in reference to the two slender styles). *Hamamelidàceæ.* Ornamental woody plants grown for their handsome evergreen foliage.

Evergreen trees or shrubs: lvs. alternate, short-petioled, entire, or dentate, penninerved; stipules deciduous: fls polygamous or dicecious, apetalous, in axillary racemes, subtended by small bracts; sepals 1–5, or wanting; stamens 2–8 with short filaments; pistillate fls. with a superior stellate-tomentose ovary, with 2 slender styles, with several stamens or without stamens: fr. a woody dehiscent caps, 2-celled, with 1 seed in each cell —Six species in Japan, China, Himalayas and Java. Hardy only in warmer temperate regions Prop. is by seeds and layers.

racemòsum, Sieb & Zucc Tall tree, in cult usually shrubby: lvs. elliptic to elliptic-oblong, sometimes obovate, acute or obtusish, narrowed at the base, dark green and lustrous above, paler beneath, glabrous, 1¼–3 in. long: racemes stellate-pubescent, anthers red: caps ovoid, 2-pointed, tomentose, ½in long. March, April. Japan. S.Z. 1:94 S.I.F. 2.25 I T. 3:113.—The staminate fls. are conspicuous by the red color of their anthers. Var. **variegàtum,** Carr. Lvs bordered with yellowish white.—*D. chinénse,* Hemsl (*D. racemòsum* var. *chinénse,* Franch), a shrub with oblong-obovate lvs. ¾–1½ in long and usually sparingly toothed above the middle from Cent China is now possibly also in cult. H.I. 29:2835. ALFRED REHDER.

DITTANY is an old English word which in England often means *Dictamnus albus,* a plant of the rue family. The name is supposed to be derived from Mt. Dicte, in Crete, where the ancient dittany grew. The Cretan dittany is supposed to be *Origanum Dictamnus,* a plant of the mint family, and of the same genus with the wild marjoram. The plant commonly called dittany in the eastern United States is *Cunila origanoides,* Brit (*C. Mariana,* Linn.), another mint, native in dry lands. See *Cunila.* It has been used as a substitute for tea, and is a gentle aromatic stimulant. All these plants yield an oil used as a mild tonic.

DIURIS (Greek, *double-tailed,* alluding to the sepals). *Orchidàceæ.* Twenty or more glabrous terrestrial orchids of Austral., rarely seen in collections in cool or warm glasshouses. The lvs. are at or near the base of the bracted st. (which is usually 1–2 ft. high), few, narrow. fls. 1 to several in a terminal raceme, conspicu-

ous from the elongated tail-like lateral green sepals; remainder of perianth yellow, purple or white, sometimes purple-blotched or -spotted; dorsal sepal remaining close to and over the column; lip 3-parted. The species are attractive or even handsome *D. longifòlia*, R. Br, has fls several, yellow and purple, moderately large; dorsal sepal broadly ovate, the lateral long and narrow; lip as long as dorsal sepal, lobed from the base: lvs. linear, one of them often very long *D. maculàta*, Smith, is rather slender, usually under 1 ft. tall, with long-pedicelled yellow much-spotted fls, dorsal sepal erect and rigid, embracing the column at the base but open at the top, lip shorter than dorsal sepal, lobed from base. lvs. narrow. B M. 3156. *D punctàta*, Smith St. 1–2 ft. or more: lvs usually 2, and 3–6 in. long: fls 2 or 3, blue or purplish, often dotted but not blotched, dorsal sepal typically broadly ovate-oblong; lip about as long as dorsal sepal, divided to base. L. H. B



1336. Spinage dock.

DIZYGOTHÈCA (Greek, in allusion to the anthers having double the usual number of cells) *Araliàceæ* Graceful hothouse plants, grown practically exclusively for foliage; usually known as Aralia.

Usually shrubs, sometimes small trees, entirely unarmed, and differing in this from some hardy aralias: lvs always digitate, of 5–9 lfts, varying much in adult and juvenile characters, sometimes slender and threadlike, again broad and leathery, usually long-stalked. calyx and corolla 5-parted; stamens 5, with thick anthers; ovary 10-celled, styles 10 All these fl.-characters are drawn from wild plants, as the cult. specimens are not known to flower —Only 3 or 4 species are known in the wild state, all from the tropical isls. of the Pacific. The many names in horticultural literature are probably referable, ultimately, to some of these species, but their true position will be settled only when they flower. Here must be sought all the digitate-lvd. tender aralias of the first edition of this cyclopedia, the pinnate-lvd species going to Polyscias. R H 1912, p. 491.

Dizygothecas require light rich soil, made up of equal parts of sandy loam and peat or leaf-mold. They require plenty of water and a moist warm atmosphere Scale pests are numerous and must be kept down by frequent sponging with weak solutions of whale-oil soap, fir-tree oil or other insecticide

The names here used are retained in the absence of specific information as to what wild species of Dizygotheca they are to be associated with Only complete flowering material can settle this much-vexed question. All of the following are distinct horticulturally.

Kerchoveàna, Hort. Lvs the shape of a Ricinus, the 7–11 lfts. elliptic-lanceolate or oblong-lanceolate, with undulate and serrate margins and a pale midrib. S. Sea Isls Certificated in England in 1881 (Gn 19, p. 457). R H 1891, p 225.—Slender-stemmed, of beautiful habit. According to Harms, perhaps better put in Pseudopanax.

Veitchii, Hort. Lfts. 9–11, very narrow or almost filiform, undulate, shining green above and red beneath. New Caledonia —One of the best and handsomest species. Var. **gracillima,** Hort. (*Aràlia gracilìma*, Lind.). Lfts. still narrower, with a white rib R.H. 1891, p. 226. Gn 39, p 565. I.H. 22:225.—Very desirable. Originally described as *Aralia gracilima* (*thin-lined*), which name has been mistaken for *gracillima* (*very graceful*).

elegantíssima, Veitch. Petioles mottled with white; lfts. 7–11, filiform and pendulous New Hebrides. G.Z. 21, p. 28 —Excellent. Thought by Guillemin to be the juvenile form of some Dizygotheca Many of the greenhouse aralias have a permanent juvenile condition.

leptophýlla, Hort. Slender plant: lfts filiform and drooping, broadened at the extremities, deep green. Australasia.

Reginæ, Hemsl. (*Aràlia regìna*, Hort) Graceful: petioles olive, pink and brown; lfts. drooping, very narrow, not undulate New Hebrides. I H 26 337.

The following greenhouse aralias, with showy lvs, probably belong to Dizygotheca, unless otherwise noted

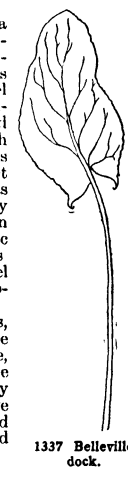
A. Chabrieri, Hort See Polyscias —*D crassifòlia*, Soland. See Pseudopanax —*D lóngipes*, Hort Lvs digitate, the lfts oblong-lanceolate, acuminate, wavy N Austral —*D nóbilis*, Hort "A theophrasta-like plant, with closely packed, bold foliage, the lvs oblong obovate-acuminate, undulate at the margins" Not certainly referable to Dizygotheca —*D Ovgàna*, Hort Like *A leptophylla*, but lfts deeply lobed, and nerves and veins brown S Sea Isls —*D quercifòlia*, Hort Lfts 3, sinuate lvs opposite. New Britain Perhaps not of the Araliaceæ The plant has opposite lvs —*D rotunda*, Hort Lf of a single orbicular-cordate lft or sometimes 3-foliolate, white-toothed Polynesia Not certainly referable to Dizygotheca —*D spectábilis*, Hort =?—*D splendidíssima*, Hort. Lvs pinnate, the lfts shiny green New Caledonia=Polyscias —*D ternàta*, Hort Lvs opposite, ternate, or 3-lobed, the lfts oblong-lanceolate and sinuate Not certainly referable to Dizygotheca —*D. Victòriæ*, Hort =Polyscias. N TAYLOR

DOCK. A name applied to various species of Rumex (*Polygonàceæ*) The commonest species—growing in fields and yards—are the curled or narrow-leaved dock (*R crispus*, Linn) and the bitter or broad-leaved dock (*R obtusifolius*, Linn). These are introduced from the Old World Several species are native See *Rumex*

Various species of docks and sorrels have long been cultivated as pot-herbs Some of them are very desirable additions to the garden because they yield a pleasant food very early in spring, and, once planted, they remain for years The Spinage dock and the Large Belleville are amongst the best kinds The former (Fig 1336) is the better of the two, perhaps, and it has the advantage of being a week or ten days earlier The crisp leaves (blade 1 foot long) appear early in April, when there is nothing green to be had in the open, and they can be cut continuously for a month or more. This dock is the herb patience (*Rumex Patientia*, Linn) It has long been an inhabitant of gardens, and it has sparingly run wild in some parts of this country It is a native of Europe

The Belleville (Fig 1337) is also a European and northern North American plant It has also become spontaneous in some of the eastern portions of the country It is really a sorrel (*Rumex Acetosa*, Linn). It has thinner, lighter green and longer-stalked leaves than the Spinage dock, with spear-like lobes at the base The leaves are very sour, and will probably not prove to be so generally agreeable as those of the Spinage dock; but they are later, and afford a succession. In some countries this sorrel yields oxalic acid sufficient for commercial purposes The round-leaved or true French sorrel (*Rumex scutatus*, Linn) would probably be preferable to most persons.

All these docks are hardy perennials, and are very acceptable plants to those who are fond of early "greens." Some, at least, of the cultivated docks can be procured of American seedsmen. They are readily grown from seeds, and give a good produce the second year and subsequently, and often yield good leaves the first season. L. H. B.



1337 Belleville dock.

DOCYNIA (derivation unknown). *Rosàceæ*, subfamily *Pòmeæ*. Ornamental woody plants grown for their handsome foliage and white flowers appearing in spring.

Evergreen or half-evergreen trees: lvs. alternate, entire, or serrate, sometimes slightly lobed: fls. short-stalked, in umbels before or with the lvs.; calyx densely tomentose, with lanceolate lobes; petals 5; stamens 30–50; styles 5, connate at the base and woolly; stigma 2-lobed; ovary 5-celled with 3–5 ovules in each cell. fr. a subglobose, ovoid or pyriform pome with persistent calyx.—Four species in China, Himalayas and Annam. Closely related to Malus, chiefly distinguished by the 3–5-ovuled cells and the 2-lobed stigma.

The species are very little known in cultivation and none of them seems to be in the trade. *D. Delavayi* has been introduced only very recently; *D. Doumeri* has been recommended as a stock for apples in tropical and subtropical countries and tried in Annam (R H 1904, p 246); *D. indica*, though known for about 100 years, does not seem to be at present in cultivation either in Europe or in this country. They are adapted only for warmer temperate or subtropical regions The fruits are more or less acid and are used for cooking, possibly they could be improved by selection and hybridization and might be developed into valuable fruit trees for warmer climates Propagation is by seeds and possibly by grafting on apple stock

D Delavàyi, Schneid (Pyrus Delavayi, Franch) Spiny tree, to 30 ft lvs. evergreen, ovate-lanceolate, rounded or broadly cuneate at the base, entire, glossy above, white-tomentose below, 2–4 in fr ovoid, about 1 in long S. W. China Franchet, Plant Delavay. 47.—*D Doùmeri*, Schneid (Pyrus Doumeri, Bois) Unarmed tree lvs ovate to ovate-lanceolate, entire or sparingly serrulate, white-tomentose below, 1–2½ in long fr subglobose, about 2 in. across Annam Jour Soc Bot France, 51 114, 115.—*D indica*, Decne (Pyrus indica, Wall D Griffithiana, Decne). Small tree lvs ovate to oblong-lanceolate, entire or serrulate, lobed in young plants, woolly while young, finally glabrescent, 2–4 in long fr subglobose, 1–1½ in across E Himalayas Wallich, Pl As Rar 2 173.—The closely related *D Hookeriàna* has larger lvs. and elongated fr. Nouv Arch Mus Hist. Nat Paris 10 15

ALFRED REHDER.



1338. Dodecatheon Meadia, the common shooting-star (×¼)

DODÁRTIA (Denis Dodart, physician and botanist, born in Paris in 1634). *Scrophulariàceæ*. One erect perennial herb related to Mimulus. *D. orientàlis*, Linn., grows in S. Russia and W. Asia, and may be found in choice collections of outdoor herbs: fls purplish, in terminal racemes: plant with rush-like few-lvd. branches: lvs opposite below, alternate above, linear and entire or broader and somewhat dentate: corolla with a cylindrical or flaring tube, 2-lipped; stamens 4, didynamous, included, the anther-cells distinct: caps subglobose, dehiscent, the many seeds somewhat immersed in the more or less fleshy placenta. July, Aug. B.M. 2199.—Apparently of minor horticultural value.

DODDER: *Cuscuta*.

DODECÀTHEON (Greek, *twelve gods*, old name of no application here). *Primulàceæ*. SHOOTING-STAR. AMERICAN COWSLIP. Small perennial herbs with cyclamen-shaped flowers on scapes, sometimes grown in wild or hardy gardens.

Glabrous, with a tuft of ovate or oblong entire or dentate lvs. at the base, and a slender single naked scape: fls. few or many in an umbel, nodding, white, rose or purple; corolla-lobes (5) and calyx reflexed; stamens 5, attached in the throat of the short corolla-tube, the short filaments more or less conjoined at base and the long slender anthers connivent into a cone: fr. an oblong or somewhat cylindrical 5- or 6-valved caps. —Dodecatheon is a puzzling genus to systematic botanists. It is found from Maine to Texas and from the Atlantic to the Pacific; and along the Pacific slope, from the islands of Lower Calif. to those of Bering Strait In this vast region it varies immensely. It is also found in Asia, especially northeastward. This wonderful distribution and variability is all the more remarkable if, as Gray once thought, it is all one species, because monotypic genera are considered, as a rule, to be comparatively inflexible or invariable. Pax & Knuth, on the other hand (Engler's Pflanzenreich, hft. 22, 1905), recognize 30 species. There is singular lack of agreement in the characterization of accepted species. Dodecatheon belongs to the same family with Primula and Cyclamen, but in a different tribe from the former, while its reflexed corolla-lobes distinguish it from most genera of its family. Many species and varieties may be expected to appear in the lists of dealers in native plants

Shooting-star is an appropriate name. The flowers have been compared to a diminutive cyclamen, for they are pendulous and seem to be full of motion (see Fig. 1338) The stamens in *D. Meadia* and all eastern species come to a sharp point and seem to be shooting ahead, while the petals fall behind like the tail of a comet The flowers represent every shade from pure white, through lilac and rose, to purple, and they all have a yellow circle in the middle, i.e., at the mouth of the corolla After the flowers are gone the pedicels become erect. Some forms have all their parts in fours. There are a number of good horticultural forms offered abroad.

They require an open well-drained soil, not too dry, and moderately rich, and a shady or partially shady position. They are propagated by division or by seeds, the latter method being rather slow.

Mèadia, Linn. (*D ellìpticum*, Nutt. *Mèadia Dodecàthea*, Crantz. *M. Dodecàtheon*, Mill. *M. carolinàna*, Kuntze). Fig. 1338. Erect and strong, to 2 ft.: lvs. ovate-oblong or oblong-linear, nearly or quite obtuse, dentate-crenate or nearly entire, 1–2 in wide, tapering into a more or less margined petiole: scape smooth, usually purple-spotted; fls 10–20; calyx deeply parted, the parts lanceolate; corolla-lobes linear-oblong, somewhat obtuse, rose-colored and whitish at base; anthers reddish yellow, the connective body purple and broadly ovate: caps. scarcely longer than calyx, with persistent style. May, June. Woods and prairies, Pa., W. and S. B M. 12.—This species runs

into many forms, some of which may be specifically distinct. Var. **splèndidum,** Hort, is an improved form, crimson with a yellow circle. Var **gigantèum,** Hort, is larger in all its parts: lvs. paler: fls. somewhat earlier, in some forms white. Var. **élegans,** Hort. Lvs. wider and shorter than the type: scape shorter; fls. more numerous, dark-colored. (The old generic name *Meadia* commemorates Dr. Richard Mead, 1673–1754.)

Jéffreyi, Van Houtte (*Mèadia Jéffreyi,* Kuntze) Plant somewhat glandular-viscid: rhizome vertical and short, strong: lvs oblanceolate, erect, entire, somewhat acute, mucronulate. scape 12–24 in. or more, bearing a many-fld umbel; calyx-lobes lanceolate; corolla deep red-purple, connective-body of anthers very narrow or subulate at apex, colored same as stamens. Mts, Calif and Ore. F.S 16:1662.

tetrándrum, Suksdorf, has the general aspect of *D. Jeffreyi,* but the lvs are ampler and relatively broader: roots, as in *D Jeffreyi,* are abundant, fleshy, fibrous, persistent: roots, lvs and scapes form a short, vertical crown. whole plant glabrous: corolla purplish, with a yellow ring near the base, segms and stamens usually only 4: caps circumscissile very near the apex. Mts., Wash and Ore

frígidum, Cham & Schlecht Plant 1 ft or less: lvs. obovate to ovate or oblong, acutish, entire or somewhat dentate: scape much exceeding the lvs, 2–3-fld; calyx-lobes longer than the tube, corolla-lobes oblong-linear, violet: caps oblong, twice longer than calyx Bering Strait to Rockies and Sierras B M 5871.

latílobum, Elmer (*D. dentàtum,* Hook *D. Mèadia* var *latílobum,* Gray). Larger than the last: lvs with blade 1–4 in long, oval or ovate to oblong, repand or sparingly dentate, abruptly contracted into long-winged petioles, obtuse. fls 2–4, calyx-lobes deltoid; corolla-lobes oblong, yellowish white: caps but little longer than calyx, opening from the apex by valves Wash., Ore, Idaho.

Hèndersonii, Gray. About a foot high, glabrous, deep green. lvs small, obovate or elliptic, 1 in or more long, narrowed to a short petiole. fls rather few, calyx-lobes triangular, acuminate, twice exceeding the tube; corolla-lobes dark purple with a yellow base, the staminal tube dark purple; anthers oblong, obtuse, short-apiculate; connective-body deep purple: caps ovoid, much exceeding the calyx, dehiscent by a circumscissile apex and splitting into 10 valves Calif. to Wash. G. 33:391.

Clèvelandii, Greene. One to 1½ ft. tall, glabrous: lvs. pale green, thickish, spatulate-ovate, petioled: fls 2–10, calyx-lobes ovate-lanceolate, acute, glandular; corolla-lobes purple with yellow base and a few purple spots in throat; anthers purple, the connective-body yellow: caps. oblong, circumscissile at apex. Feb.–May. S. Calif.—Fls. said to vary to pure white. Fragrant

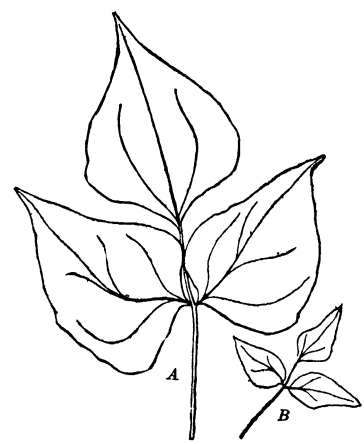
radicàtum, Greene. Glabrous: root short and corm-like with fibrous rootlets: lvs. 3–5, thin, light green, oblong-spatulate, crenate or nearly entire, blade attenuate into petiole of about equal length: fls. 3–5 or more on a stout scape 8–16 in tall; calyx-lobes lanceolate, about as long as the tube; corolla pinkish or bluish violet, the lobes oblong-linear and erect-spreading; staminal tube short; anthers purple, acute: caps. narrow-ovate, only slightly surpassing calyx-lobes. April. Wyo. to New Mex.—Recommended for alpine and rock-gardens. L. H. B.†

DODONÆA (Rembert Dodoens or Dodonæus, about 1518–1585, royal physician and author). *Sapindàceæ.* Trees and shrubs, somewhat planted in S. Fla. and S. Calif for ornament.

Leaves alternate, without stipules, simple or pinnate: fls. small, polygamous, unisexual, often dioecious, terminal or axillary, solitary or in racemes or panicles; sepals 5 or fewer; petals wanting; stamens mostly 8 (5–10) with very short filaments; ovary 3–6-celled, each cell 2-ovuled caps. winged on the back of each valve.—About 50 species, mostly in Austral., a few in Afr. and in Hawaii and N Amer. Lvs sometimes glandular and exuding resin-like or varnish-like substance.

viscòsa, Linn. Shrub, to 15 ft., viscid: lvs mostly oblong, cuneate at base, entire, with resinous dots on both surfaces: fls. greenish, in short terminal or axillary racemes; sepals ovate: caps about ¾in long and somewhat broader, broadly 3-winged, notched at apex, more or less cordate at base B R. 13 1051 (as *D. oblongifolia*) —A poorly defined plant, widely distributed in warm countries, occurring in Austral, S. Afr., in Mex., and forms of it in Fla and Ariz. Lvs varying from broadly spatulate to oblong to nearly or quite linear.

Thunbergiàna, Eckl. & Zeyh. Shrubs, 6–10 ft, glabrous, much branched: lvs. lanceolate or linear-lanceolate, narrowed at base, somewhat denticulate



1339. Leaves of Dolichos. *A,* **D. Lablab;** *B,* **D. lignosus.**

and somewhat viscid. fls. green, polygamous, racemose: caps ½in long, resinous and shining, 2–3-winged, as long as the stalk or longer. S. Afr.

triquètra, Andr. Erect shrub, the young branches flattened or very angular: lvs. oval-elliptic to oblong-lanceolate, acuminate, to 4 in long, entire or very nearly so. fls. in short oblong compact panicles or racemes; sepals minute: caps. of *D. viscosa,* middle-sized. Austral.

cuneàta, Rudge. Much-branched bush, usually viscid: lvs. small (usually under 1 in. long) obovate or cuneate, at the end rounded or truncate or toothed, on the sides entire or rarely obscurely toothed, short-petioled: fls. in short terminal scarcely branched racemes, or sometimes few in axillary clusters; sepals ovate-oblong: caps. of *D. viscosa,* the wings usually not very broad. Austral. L. H. B.

DOGBANE: *Apocynum.*

DOG'S-TAIL GRASS: *Eleusine indica.*

DOGTOOTH VIOLET: *Erythronium.*

DOGWOOD: *Cornus*

DOLICHÁNDRA: *Macfadyena.*

DOLICHODEIRA: *Sinningia.*

DOLICHOS (old Greek name). *Leguminòsæ.* Tropical twiners (a bush variety of *D. Lablab* is now being offered by seedsmen), of which a few forms are in cultivation, some for ornament and some for forage.



1340. Types of styles. *1*, D. Lablab; *2*, Vigna sinensis; *3*, V. sesquipedalis.

Keel of the corolla narrow and bent inward at right angles, but not distinctly coiled; style bearded under the stigma, which is terminal; stipules small. For botanical distinctions between Dolichos, Phaseolus and Vigna see *Vigna* The styles are points of difference (Fig. 1340). *D. japonicus*, a most worthy ornamental vine, will be found under *Pueraria*. For *D. sesquipedalis*, see *Vigna*—Perhaps 50–60 species, widely distributed. Three species of Dolichos are now grown in Amer.

A. *Style bearded only on a ring surrounding and just below the stigma.*

biflòrus, Linn. This species is now being intro. from India, where it is frequently used as a forage plant It differs from *D Lablab* in having the upper lip of the calyx 2-toothed and from *D. Lablab* and *D. lignosus* in having only a ring or brush of hairs just beneath the stigma, whereas the styles of the other species are bearded on a line extending down the inner face The seeds are small (average weight 035 gram) and rather strongly flattened. Their approximate dimensions are length ⅛–¼in., width $\frac{1}{16}$–⅛in., thickness $\frac{1}{32}$in. (2–2½ mm.).

AA. *Style bearded along the inner side.*

B. *Seeds small, ⅛–¼in. long by ⅛–⅙in. broad, average weight .02 grams.*

lignòsus, Linn. AUSTRALIAN PEA. Fig. 1339. Evergreen: fls white or rosy purple: lvs much smaller than in *D. Lablab*. A perennial rapidly growing vine, suitable for covering fences and outbuildings in warm countries; highly recommended in S. Calif. and Ariz. B.M. 380 — A form with white fls. is offered by seedsmen as *D. alba.*

BB. *Seeds large, ⅜–½in. long by ¼–⅖in. broad, average weight .10–.30 grams.*

Lâblab, Linn (*D cultràtus*, Thunb. *D. purpùreus*, Lindl. *Lâblab cultràtus*, DC.). HYACINTH BEAN. Figs 1339, 1340, 1341 Tall-twining (often 10–20 ft): lfts broad-ovate, rounded below and cuspidate-pointed at the apex, often crinkly: fls. purple or white, rather large, 2–4 at the nodes, in a long erect raceme: pods small (2–3 in. long) and flat, usually smooth, conspicuously tipped with the persistent style; seed black, mahogany or gray, in the white-fld. varieties, white, small (average weight about ¼ gram). Tropics. B.M. 896. B.R. 830 A.G. 14:84 —Cult. in this country as an ornamental climbing bean, but in the tropics the pods and seeds are eaten Annual. It is easily grown in any good garden soil Like common beans it will not endure frost. It is very variable. White-fld. and dwarf bush forms are now offered by seedsmen. A form with white fls. and very large growth is known among horticulturists as **D. gigantèus** (Fig. 1342).



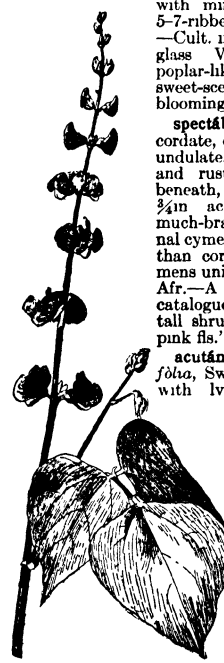
1341. Calyx cups and styles of Dolichos. *1*, D. lignosus; *2*, D. Lablab.

D. pseudopachyrrhizus, Harms, recently intro. into some of the European gardens from Trop. Afr., is a perennial form with a large tuberous rootstock: sts. long, round or angular: lvs long-stalked, 3-foliolate; lfts. very variable in shape, the lateral often ovate or elliptic and the terminal broadly rhomboid, 3¼–8 in long, 2½–7 in. broad: fls. small, chiefly violet-blue, in racemes 1½–1¾ ft long

GEO. F FREEMAN.

DOMBÈYA (after Joseph Dombey (1742–1795) French botanist and companion of Ruiz and Pavon in Peru and Chile). Syn. *Assònia, Astrapæa. Sterculiàceæ.* Shrubs or small trees of continental Afr., Madagascar and Seychelles, sometimes planted in Fla and Calif: lvs. often cordate, palmately nerved, frequently lobed. fls. rosy or white, numerous, in loose axillary or terminal cymes, in umbels, or crowded into dense heads, often very showy, calyx 5-parted, persistent; petals 5, stamens 15–20, 5 sterile, the remainder shorter, united into a tube or cup; ovary 2–5-celled, stigmas 5: fr. a loculicidal caps.—Probably 100 species, many new kinds having been made known recently with the opening of Trop Afr The dombeyas are yet little known in this country, although some of them promise well for lawn and park planting far south.

natalénsis, Sond. Distinguished by its cordate, acute lvs. and the narrowly awl-shaped lfts of the involucre: lvs. long, petioled, somewhat angular, toothed, with minute stellate pubescence, 5–7-ribbed: umbels 4–8-fld Natal. —Cult. in S. Fla. and North under glass Very rapid-growing, foliage poplar-like: fls. pure white, large, sweet-scented; a very good winter-blooming plant in S. Calif.



1342. Dolichos Lablab (form giganteus). (×⅓)

spectábilis, Bojer. Small tree: lvs. cordate, orbicular or oblong, acute, undulate, 5–9-nerved, rough above and rusty or whitish pubescent beneath, the petioles downy: fls. ¾in across, white, in many-fld. much-branched axillary and terminal cymes; sepals lanceolate, shorter than corolla; petals roundish; stamens united only at base. E Trop Afr.—A plant under this name is catalogued in this country as "a tall shrub with straw-colored and pink fls."

acutángula, Cav. (*Astrapæa tiliæfòlia*, Sweet). Low tree or shrub, with lvs. crowded at ends of branches. lvs thin, round-cordate, nearly glabrous, palmately 3–5-lobed: fls in 2-parted cymes; bracteoles large, ovate, falling, sepals ⅓in. or less long, reflexing, petals white or reddish, ½in long, oblique-obovate, stamens 18, being exceeded in length by the staminodia; ovary densely tomentose, and styles free at top only Mauritius and Bourbon. B.M. 2905 (form with entire lvs.).

punctàta, Cav. Tree, the young parts hairy: lvs smooth and firm, orbicular and deeply cordate, acute, 3–4 in. long, obscurely crenate: fls. 10–20 in a simple umbel that has a peduncle 2–3 times the length of the petiole; sepals linear-lanceolate, reflexed; petals rather longer than sepals, obdeltoid; ovary tomentose. Mauritius and Bourbon. Intro in S. Calif.

nairobénsis, Engler. Shrub or tree with terete branches that become glabrous or nearly so: lvs. ovate-cordate, acuminate, somewhat 3-lobed, irregularly crenate, 7-nerved, hairy, and tomentose beneath: fls. on long hispid pedicels in an umbel; bracteoles ovate-lanceolate; sepals lanceolate, becoming reflexed, tomentose outside; petals oblique and obtuse, scarcely

exceeding petals; staminodia narrowly spatulate; ovary tomentose. Nairobi.

Wallichii, Benth. & Hook. (*Astrapæa Wallichii*, Lindl.). Tree, to 30 ft.: lvs large, velvety, cordate, angularly lobed, with leafy stipules. fls. scarlet (pink?), in drooping umbels, the peduncles long and hairy. Madagascar.—A very showy plant when in bloom.

D. Bürgessiæ, Gerrard. Lvs pubescent, cordate, but with 2 deep, wide cuts, and 2 shallow ones besides the basal one. fls. numerous, large, white, rosy at center and along veins, petals rounded S Afr B.M 5487 —*D. calántha*, Schum Shrub, 10–12 ft.: lvs large (1 ft across), 3–5-lobed, coarsely toothed, cordate at base, pubescent above and tomentose beneath, with long petioles fls rose-colored, 1½ in across. British Cent. Afr B.M. 8424.—*D. Cayeuxii*, Hort., is a hybrid of D Mastersii and D. Walkohii fls. beautiful pink in pendulous, many-fld umbels. lvs cordate, acute, dentate, with long petioles.—*D Cèrea*, Baill Tall tree. lvs cordate or somewhat 3-lobed, 6 in. long and nearly as broad, toothed or crenulate, pubescent beneath fls lilac-rose, 2½ in. across. Madagascar. R.H 1911 84 —*D Dàmei*, Hort., is a hybrid of D. spectabilis and D. natalensis fls. rose-colored, also a white-fld. form (var alba) R H 1912, p. 178-9 —*D Mástersii*, Hook Shrub, 4–5 ft. high. lvs. velvety, heart-shaped, serrate. fls. fragrant, white, with thinner veins of rose than in D Burgessiæ; petals acute. Trop. Afr. B.M. 5639 —*D viburnifòlra*, Bojer, has very numerous white fls with narrower petals than any here described lvs cordate, 3-lobed, the cuts not so wide as in D. Burgessiæ. Comoro. B.M 4568.

L. H. B.†

DÓNDIA: *Hacquetia*.

DOÒDIA (after Samuel Doody, London apothecary). *Polypodiàceæ*. Greenhouse ferns.

Sori curved, placed in one or more rows between the midribs and the margins of the pinnæ: lvs. rigid. A genus of diminutive ferns related to Woodwardia.—Species 4 or 5. Ceylon to New Zeal.

All doodias, except *D. blechnoides*, are of dwarf habit, and are useful for fern-cases and for edgings of window boxes. Cool and intermediate temperatures are best. They are excellent for forming an undergrowth in coolhouses, as they seldom are infested with insects, and endure fumigation. Schneider recommends three parts of peat and one of silver sand. Loam does not help, but a little chopped sphagnum does. They are very sensitive to stagnant water, and do not like full exposure to sunlight. Always propagate by spores, but division is possible.

A. *Lvs. pinnatifid.*

áspera, R. Br. Lvs. 6–18 in. long, 2–4 in. wide, pinnatifid, narrowed gradually below. sori in 1 or 2 rows. Temp. Austral.—Crested varieties occur in cult.

AA. *Lvs. pinnate in the lower half.*

mèdia, R. Br. Lvs. 12–18 in. long, with pinnæ 1–2 in. long, the lower one gradually smaller Austral. and New Zeal —*D. Kunthiàna*, Gaud., from the Hawaiian Isls has close median pinnæ. *D. supérba*, Hort., is a larger garden form.

caudàta, R. Br. Lvs. 6–12 in. long, with pinnæ about an inch long, the spore-bearing ones shorter, apex often terminating in a long point. Austral and New Zeal.

blechnoides, Cunn. Lvs. 18 in. long; lf-blades 15 in. long, 6 in broad, broadest at the middle, the lowest pinnæ considerably narrowed; margins serrate: sori in an irregular row near midrib. New S. Wales.

L. M. UNDERWOOD.
R. C. BENEDICT.†

DORÈMA (*dorema*, a gift, an allusion to the gift of gum ammoniac). *Umbellíferæ*. About 4 odd large perennial herbs of S. W. Asia, yielding gum-resins, likely to be met with in collections of economic plants. Usually glaucous, with pinnately decompound lvs, and small white or yellow fls in close woolly umbels: calyx-teeth wanting or nearly so; petals ovate: fr. ovate, plano-compressed. *D. Ammoniacum*, D. Don, an erect fleshy-stemmed herb to 7 ft., with a few lvs. near the base and bracts above, yields gum-ammoniac, a medicinal product. This resin exudes on the sting of insects, occurring in yellowish brown "tears" or drops; it has a balsamic odor and bitter unpleasant taste. The plant is native in Persia and Afghanistan. Other species yield similar exudation.

DORÓNICUM (Latinized Arabic name). *Compósitæ*. LEOPARD'S BANE. Hardy herbaceous plants, 1–2 feet high, with yellow many-flowered heads

Stems little branched or not at all: lvs. alternate, radical ones long-stalked, st.-lvs. distant, often clasping the st: heads mostly one on a st. and 2–3 in. across, borne high above the basal crown of foliage, from April to June —From 20–30 species, natives of Eu. and Temp. Asia. The genus is allied to Arnica and distinguished by the alternate lvs. and by the style.

The plants are of easy culture in rich loam except *D. cordifolium*, which is an alpine species. The flowers are numerous and good for cutting. Doronicums have been strongly recommended for forcing.

A. *Root-lvs. not notched at the base, ovate.*

plantagíneum, Linn. Glabrous, but woolly at the neck, with long, silky hairs: root-lvs. ovate or oval, wavy-toothed, st.-lvs nearly entire, the lower ones narrowed into a petiole and not eared, the upper ones sessile, oblong, acuminate: rhizome tuberous, roundish, or creeping obliquely: stalk of the root-lvs about 3 in. long: typically about 2 ft high Sandy woods of Eu. G C III 17:229 J H III 55:109 Gn. 60:151 Var. **excélsum,** Hort (*D excélsum*, Hort *D. "Harpur Crew,"* Hort.), is more robust, grows about 5 ft. high and is probably more cult than any other kind of doronicum Fls sometimes 4 in across. Gn. 47, p. 269; 28:512; 38:437 G.C. II. 20:297. G. 19:441; 27:225 Gn W 24:221.

Clùsii, Tausch (*Árnica Clùsii*, All.) Lvs ovate or oblong; st.-lvs half clasping, with distant teeth or many small ones One subvariety has long, silky hairs on its lvs., while another has none Swiss and Austrian Alps.—"Soft, downy foliage," J. W. Manning. "Grows 2 ft. high," Woolson. "Larger and later fls. than *D. caucasicum*," Ellwanger and Barry.

AA. *Root-lvs. notched at the base, heart-shaped.*

B *Root tuberous.*

Pardaliánches, Linn Hairy lvs. toothed; lower st.-lvs. eared at the base of the stalk, subovate, upper ones spatulate-cordate, highest ones cordate-clasping, acute. Woods of lower mountains of Eu G. 22:499 —While all species are typically 1-fld., any of them may have now and then more than 1 fl. on a st., and this species particularly may have 1–5 fls

BB. *Root not tuberous.*

caucásicum, Bieb Glabrous except as noted above: lvs. crenate-dentate, lower st.-lvs. eared at the base of the stalk, the blade subcordate, highest ones cordate to half-clasping; lvs near the infl linear-lanceolate. Shady woods of Caucasus, Sicily, etc. B M. 3143 Gn. 28 p. 512., which shows sts. with 1 fl. and 1 lf.—Fls. 2 in. across

cordifòlium, Sternb. (*D. Colúmnæ*, Tenore). Glabrous, the st. very fibrous toward the base, scarcely 5 in tall: radical lvs cordate-kidney-shaped, the upper lvs. st.-clasping: heads solitary on the sts., the small lvs near it ovate-lanceolate, acuminate. An alpine species from S. E Eu. and adjacent Asia.

austriacum, Jacq. A trifle hairy: lvs. minutely toothed, lower st.-lvs. spatulate-ovate, abruptly narrowed at the base, half-clasping, highest ones cordate-clasping, lanceolate. Subalpine woods, Eu.

D. draytonénse, Hort., is a list name, not referable to any known species. It seems not to occur in horticultural or botanical literature —*D. magníficum*, Hort., described as a "very attractive perennial with large yellow fls. somewhat like a single sunflower," is also doubtful. It may be D. plantagineum var. excelsum.

WILHELM MILLER.
N. TAYLOR.†

DORSTÈNIA (Theodor Dorsten, professor of medicine at Marburg, died 1539). *Moràceæ* About 50 tropical herbs or small shrubs, remarkable for the dilated receptacle in which the unisexual fls are borne, being imbedded in the surface. Both staminate and pistillate fls. are without perianth; stamens 1–4; ovary 1-loculed; stigma 2-lobed Dorstenias are easily grown in warm shady glasshouses. The plants are not in the American trade, but they are often grown in botanical establishments to illustrate morphology The fig is a hollow receptacle formed of the axis of the fl -cluster, the dorstenia bears a flattened or cup-like receptacle, and is an intermediate stage between the fig and other plants. One of the common species is *D. Contrajérva*, Linn. (Fig 1343), which is native to Trop Amer.. fls on a scape. lvs round-cordate, palmately lobed or parted, the segms ovate or oblong and more or less toothed: receptacle irregularly rectangular, peltate: rhizome cylindric, nodose. Mex , W. Indies, Venezuela, Colombia. L. H. B.

DORYÀLIS: *Aberia.*

DORYÁNTHES (Greek, *spear-flower;* the flowering stem 8 to 25 feet high, crowned by a spike of flowers 3 feet high) *Amaryllidàceæ*. Great desert plants from Australia, with 100 or more leaves 6 feet long when full grown, being impressive for large conservatories, or for open ground in the South, where they will stand slight frost

The representative in Austral. of the American Furcræa and Agave lvs. in a dense basal rosette, those on the st much reduced· fls. large, bright red (often replaced by bulblets), in a large thyrse-like or paniced infl ; perianth with little or no tube, the segms long and falcate, stamens 6, attached at base of perianth, the filaments filiform: fr a turbinate caps , 3-valved. —Three or 4 species Little known under glass, as they require too much room A plant of *D Palmeri* remained at Kew 16 years before flowering. Plants of doryanthes are prop. by suckers, which are produced only after flowering. The process is very slow The young plants must be repotted for several years until they have attained a large size. They are said to do best in a compost of loam and leaf-mold in equal parts



1343. Dorstenia Contrajerva. (×¼)

excélsa, Correa. SPEAR-LILY. Lvs. sword-shaped, not ribbed, smooth, entire, with a very narrow cartilaginous margin, lower ones recurved, others erect: scape clothed with lanceolate lvs , which sheath the st at their base; fls in a globular head, deep crimson or maroon inside and out (there is a white-fld form). B.M. 1685. R H. 1865, pp 466, 471; 1891, p. 548. G C. II. 11·339 Gn.W. 16:681. G.W. 9, p. 521. H.F. II. 7:136.

Pálmeri, W. Hill. Even more gigantic than *D. excelsa:* lvs. longer and broader, slightly ribbed and a longer brown point· fls in a thyrsoid panicle, bright scarlet outside, whitish within. B.M. 6665. F S. 20.2097. R.H 1891:548. G C II 17:409. G W. 12, p. 222. New shoots are said to be produced at the base, which bloom in one or more years.

D Guilfóylei, F M. Bailey, QUEENSLAND-LILY, is a large and fine species from N Queensland, perhaps a form of D. Palmeri. lvs. 9 ft. long, over 8 in. wide· fls rich crimson, 4 in. long It yields a good fiber. Gn. 44, p. 69. G C. III. 45 383

WILHELM MILLER.
L. H. B.†

DORYÓPTERIS (Greek, *lance-fern*). *Polypodiàceæ*. Small pot ferns with oddly pretty leaves.

Leaves with continuous marginal sori and copiously anastomosing veins —About 20 species, in warm countries Sometimes joined to Pteris, which see for culture. Not to be confused with Dryopteris.

palmàta, J Smith Lvs 4–9 in each way, with 5 or more triangular lobes or the fertile still more divided; ribs black W Indies to Brazil —Sometimes considered to be a variety of *D pedata,* Fée.

nóbilis, J Smith Larger; lvs sometimes 1 ft. long, pedately bipinnatifid, ribs chestnut S Brazil.

D decípiens, with lvs resembling a geranium lf , 3–6 in. each way, is sometimes cult , as is *D díscora*, with more divided lvs. Both are natives of the Hawaiian Isls.

L M UNDERWOOD.

DOSSINIA (E P Dossin, Belgian botanist, 1777–1852) *Orchidàceæ* One species of terrestrial orchids, allied to Anœctochilus, but lacking the bearded fringe on the lower part of the labellum. This species may possibly be cult by a few amateurs who are skilled in the cult. of dwarf warmhouse foliage plants

D marmoràta, C Morr (Anœctochilus Lowei, Hort). Lvs golden-veined or marbled, 4–5 in long, elliptic scape pubescent, 10 in high, spike 5 in long, with many white, pubescent fls Java F S 4 370 —There is a stronger-growing var , with foliage better colored.

DOUGLÁSIA (after David Douglas, the Scotch botanist, who explored California, Oregon and British Columbia in 1823 and 1829) Incl *Arètia. Primulàceæ* Low tufted perennial herbs, one of which is used in alpine gardening

The genus is closely allied to Androsace and Primula, but in those two genera the lvs come from the root, while Douglasia has branches, though very short ones, which are densely clothed with lvs Douglasia has a corolla-tube equaling or exceeding the calyx, somewhat inflated toward the top, with 5 scales or crests beneath the sinuses, calyx 5-lobed, persistent, stamens 5, included; ovary 5-ovuled. fr a turbinate 1- or 2-seeded caps —Seven or 8 species in mountains of Eu., and W N Amer , considered to be 6 by Pax & Knuth in Engler's Pflanzenreich, hft 22 (1905) The fls are yellow in *D. Vitaliana*, which is the cult species, but otherwise rose-purple The plants require the treatment accorded to other alpines; see *Alpine Plants*, Vol I.

Vitaliàna, Hook f (*Primula Vitaliàna*, Linn. *Androsace Vitaliàna*, Reichb. *Arètia Vitaliàna*, Lodd. *Gregòria Vitaliàna*, Duby). Height 2 in · sts numerous, prostrate, somewhat woody: branches denuded of lvs at the base, but at the tips clothed with overlapping linear entire pilose lvs · fls nearly stalkless, solitary or 2 or 3, yellow, rather large, corolla-tube 2 or 3 times longer than the calyx, the lobes ovate-lanceolate, obtuse Alps, Pyrenees. L B C. 2:166.

Some of the American douglasias, all with rose or purple fls are sometimes listed by foreign specialists in alpines —*D dracæa*, Hook Glabrous lvs ciliate with short and simple hairs, apex obtuse fl 1 on a scape, corolla-tube about equaling calyx plant loosely cespitose High arctic Amer —*D dentàta*, Wats. Like D. nivalis and by some considered to be a form of it, but coarser and

with broader often spatulate lvs which are entire and sparingly denticulate. Cascade Mts., Wash.—*D. laevigata*, Gray. Mature lvs. cornaceous, the margin smooth or rarely minutely ciliate, blade oblong or oblong-lanceolate and obtuse. fls. 2–5, corolla-tube almost twice as long as calyx. Ore., Wash.—*D. montana*, Gray. Mature lvs. prominently ciliate on the margins, destitute of forked hairs, the blade very small and linear or lanceolate. fls. single, the corolla-tube less than the calyx or just equaling it. Mts., Wyo., Mont. Runs into several forms, 2 of which have been described as species (D. biflora, Nelson and D. or Androsace uniflora).—*D. nivalis*, Lindl. Mature lvs. covered with minute 2–3-forked pairs, margins not ciliate, blade linear and usually entire. fls. 3–7, the corolla-tube hardly exceeding the calyx. Columbia River. L. H. B.†

DOUGLAS SPRUCE. *Pseudotsuga Douglasii.*

DOWNÍNGIA (after Andrew Jackson Downing, famous American pomologist and landscape gardener). *Campanulàceæ*, or *Lobeliàceæ* when this family is kept distinct. Low herbs, much branched, sometimes grown as garden annuals; flowers blue with white or yellow markings or blotches.

Leaves alternate, entire, passing above into bracts: fls. in the axils of the lvs. or upper sessile bracts; corolla 2-lipped, the upper lobes much narrower than the 3 lower ones; tube of stamens free from the corolla: seeds numerous, small, oblong to spindle-shaped, in a very long linear caps. that bears at its apex the leafy linear calyx-lobes and is dehiscent lengthwise by 1–3 valves or fissures.—Six to 8 species, mostly in Calif. (1 in Chile), usually in moist places and margins of spring pools, sometimes in salty marshes or in mountains. Rafinesque's name Bolelia (anagram of Lobelia) is older, but is discarded by the list of "nomina conservanda" of the the Vienna code. The plants are little known in American gardens. They are easily grown annuals, and are said to make interesting pot-plants. The species are often not well distinguished, and some of them may be color forms. The plants grow about 6 in. high, and have been recommended for edgings.

pulchélla, Torr. (*Clintònia pulchélla*, Lindl.). Erect or ascending, 2–10 in., usually simple. lvs. oblong-ovate to linear, ½in. long, obtuse: fls. deep blue, the center of lower lip yellow with a white border, and marked with violet and yellow in throat; lower lip with 3 roundish apiculate lobes; upper lip deeply 2-cleft with spreading oblong-lanceolate segms. May, June, in Calif. B.R. 1909. R.H. 1861: 171. G.W. 15, p. 213. R.H. 1895, p. 19, shows its straggling habit as a pot-plant. Many of the branches fall below the top of the pot.

élegans, Torr. (*C. élegans*, Douglas). St. usually simple, 4–7 in.: lvs. ovate to lanceolate. the broad lip moderately 3-lobed; the 2 divisions of the smaller lip lanceolate, parallel; lower lip sky-blue with darker veinlets and the main part white with 2 green or yellowish spots; the throat often purple-spotted and yellow-lined. May. Calif. B.R. 1241. L. H. B.†

DOXÁNTHA CAPREOLÀTA, Miers: *Bignonia capreolata*

DRÀBA (Greek name for a cress). *Cruciferæ.* WHITLOW-GRASS. One of the important groups of spring-flowering plants for the alpine garden.

A large and widely scattered genus of tufted hardy annual or perennial herbs, with stellate hairs. lvs. often in a rosette, mostly uncut: scapes or sts. leafy or not, racemes short or long, fls. without bracts, small, white, yellow, rosy or purple; stamens 6: fr. an oval, orbicular or linear flat pod with several to many marginless seeds in 2 rows in each cell; cotyledons accumbent.—Some 150 species in temperate and arctic regions of the world, many of them in mountains. Many species occur in the lists of alpine gardeners. They are more or less alyssum-like.

Drabas are very pretty dwarf compact alpine plants, with small but numerous flowers admirably adapted for the rockery or front part of a sunny border. They require a sunny position and an open soil. It is important that they be well matured by the autumn sun. The plant forms a dense little rosette of lvs., and has a neat appearance at all times. In spring, drabas are thickly covered with their little flowers and when planted in masses are decidedly effective. Propagation is chiefly by division; also by seed, which may be sown in the fall if desired. (J. B. Keller.)

INDEX.

aizoides, 7.
Aizoon, 8
alpina, 15
androsacea, 6.
aurea, 16
bruniæfolia, 11.
bryoides, 12.
cinerea, 3.
cuspidata, 10.
Dedeana, 9.
fladnizensis, 6.
gigas, 5
hispida, 14
imbricata, 13.
lapponica, 6.
Mawii, 4.
olympica, 11.
pyrenaica, 1.
rigida, 12.
tridentata, 14.
violacea, 2.
Wahlenbergii, 6.

A. *Fls. rose or purple.*

1. **pyrenàica,** Linn. ROCK BEAUTY. Height 2–3 in.: lvs. wedge-shaped, 3-lobed at apex: fls. white at first, changing to rosy pink. May. Mts., S. Eu. B.M. 713. —Said to be easily prop. by cuttings. This is *Petrocallis pyrenaica*, R. Br., under which name it will be found again.

2 **violàcea,** DC. St. woody at base, branched: 6–12 in.: lvs. obovate-oblong, obtuse, equally woolly



1344. Draba Dedeana.

on both sides. scapes leafy, petals obovate, dark purple. Andes of Ecuador at elevations of 13,000–15,000 ft. B.M. 5650.

AA. *Fls. white (sometimes yellowish in No. 6).*

B *Plants biennial or annual.*

3 **cinèrea,** Adams. St. nearly simple: lvs. oblong-linear, stellate pubescent. petals twice longer than calyx: pods oblong, pubescent, shorter than the pedicel. Early spring. Siberia.

BB. *Plants perennial.*

C. *Lvs. rigid.*

4 **Máwii,** Hook. Forming low, densely tufted, bright green patches: st. much branched, densely clothed with spreading, rosulate lvs: lvs. linear-oblong, obtuse, bristly, with a prominent midrib below: scape very short, woolly, 2–4-fld., very short-pedicelled; petals thrice as large as the sepals, obcordate, white: pods ellipsoid, compressed. Spain. B.M. 6186.

5. **gigas,** Stur (properly *Árabis Carduchòrum*, Boiss.). Lvs. rosulate and rigid, linear and obtusish, ciliate: scape 1 in. or less, the fruiting raceme short and contracted; fls. white: fr. glabrous, elliptic-linear, the style very short, the valves 1-nerved and keeled. Armenia.

CC. *Lvs. not rigid.*

6. **fladnizénsis,** Wulf. (*D. androsàcea*, Willd. *D. Wáhlenbergii*, Hartm. *D. lappónica*, Willd.). Plant 2–3 in., much branched at base. lvs. rather loosely rosulate, oblong-linear to lanceolate, ciliate, usually somewhat villous or stellate-pubescent, less than ½in. long: scape usually glabrous or only slightly villous; fls. sometimes yellowish: pods elliptic-oblong to ovate-lanceolate, not hairy. Arctic regions and Cent. Eu.



XXXVII. Dracæna Goldieana, a "foliage plant" from tropical Africa.

AAA. *Fls. yellow.*

B. *Lvs. rigid, keeled, ciliate.*

7. aizoïdes, Linn. Cespitose, 2–3 in.: lvs. linear and acutish: scape glabrous, the raceme elongating in fr.; petals yellow, twice exceeding the calyx; anthers about equaling the petals. fr. oblong-elliptic, glabrous or setulose; style as long as the pod is wide. March. Cent. and S. Eu.—B.M 170. Variable.

8. Aizoon, Wahl. About 3 in. high· lvs. broad-lanceolate, strongly ciliate. scape hairy, with sulfur-yellow fls , the filaments being paler or greenish. April. Eu.—Diverse in habit.

9. Dedeàna, Boiss & Reut. Fig. 1344 Densely cespitose: scape and pedicels pubescent lvs oblong-linear, attenuate at base: petals broadly obcordate-cuneate; stamens scarcely longer than calyx. fr. ellipsoidal or ovoid. Spain —In habit like *D. aizoides;* fls. paler yellow.

10. cuspidàta, Bieb Cespitose: lvs linear-acute: scape villous or woolly, the fruiting raceme short; petals yellow, twice exceeding the calyx, anthers equaling the petals: fr lanceolate and somewhat turgid, setulose Asia Minor —Aspect of *D aizoides,* but scape shorter and pod somewhat inflated

11. olympica, Sibth. (*D. brunæfolia,* Stev.). Densely and broadly cespitose, about 4 in high: lvs. narrowly linear, somewhat keeled. petals deep golden, twice as long as the calyx and stamens· fr. small, turgid-compressed, style very short. June Greece, Orient.—Runs into many forms.

12. rigida, Willd (*D. bryoides,* DC.). Powdered: lvs minute, and very short, oblong-linear and keeled, obtusish, the margin more or less ciliate· scape glabrous, bearing a rather long raceme; petals deep golden yellow, much exceeding calyx· fr. elliptic or nearly linear · Caucasus, Armenia.

13. imbricàta, Meyer. Very dwarf, much powdered: lvs. very small, oblong, obtuse, 3-sided, ciliate, densely imbricate: raceme nearly sessile, glabrous, 3–5-fld.; petals deep golden, twice exceeding the calyx; filaments exceeding calyx: fr. ovate-orbicular, glabrous, nearly plane, style very short. Caucasus.—An excellent little rock alpine.

BB. *Lvs not rigid or keeled*

14. hispida, Willd. (*D. tridentàta,* DC.). About 3 in. high. lvs obovate, narrowed into a long petiole, obscurely 1–3-toothed at the apex, somewhat bristly scape not hairy, petals yellow, cuneate, retuse, twice longer than calyx: fr oblong-linear, not hairy. Russia, Caucasus

15 alpina, Linn Densely cespitose, with a much-branched caudex· lvs lanceolate or oblong, obtuse or acute, pubescent: flat: scape more or less hairy: pods oblong to ovate, style very short. April. Greenland, N. Eu , Asia.

16. aurea, Vahl. Doubtfully perennial or biennial, pubescent throughout with stellate hairs, the caudex simple or little branched: lvs. oblanceolate to lanceolate, to 2 in., entire or remotely serrate· petals bright yellow to almost white: pods lanceolate to linear, acute, often twisted. New Mex., and Ariz in mountains and north. B.M. 2934.

D. borealis, DC Fls. white· stellate-pubescent, more or less cespitose, st 2–12 in , simple or sparingly branched lvs ovate to oblong-ovate, flat, ½in. or less. style short and stout Brit. Col. to the high N , Japan —*D. elata,* Hook. f Fls yellow tall biennial, the st about 1 ft. high from the previous year's rosette of spatulate lvs. Himalayas.—*D. frigida,* Saut. Fls white scape about 2-lvd , loosely pubescent lvs lanceolate or elliptic, stellate-tomentose: fr oblong, glabrous, the style very short or almost none Alps —*D. Gilliesii,* Hook & Arn Fls white, ¾in or less across tufted perennial, 1–10 in , variable· lvs. ovate-oblong, coarsely toothed· fls few to many in an erect raceme. Chile B M. 7913. Gn 63, p 243 —*D grandiflora,* Hook & Arn. Fls white, in racemes· plant small and tufted, with tomentose lvs. oblong-spatulate. High Andes. Gn. 63, p. 242. Showy, hardy in England.—*D. Salamonii,* offered abroad, is described as "very close, compact tufts, white fls "—*D verna,* Linn. Whitlow-Grass A winter annual, widely naturalised from Eu , with white fls , bifid petals, oblong-obovate to oblanceolate rosulate lvs., slender scapes 2–6 in., and glabrous round-oval to oblong pods

L. H. B.†

DRACÆNA (*female dragon;* the dried juice supposed to resemble dragon's blood). *Liliàceæ.* Dracena. Ornamental hothouse or stove plants, frequently with variegated leaves.

Often arborescent, with sword-shaped or broad lvs. mostly crowded at the summit of the st.: fls. clustered in panicles or heads, greenish-white or yellowish; perianth salver-form or campanulate; lobes 6, spreading, stamens 6. fr a 3-celled berry. Differs from Cordyline in having larger fls , and solitary instead of many ovules in each cell of the ovary.—About 40 tropical woody plants, a few being in cult See Baker, Journ. Linn Soc , vol 14, for a monograph of the genus. ·

Dracæna Draco, of the Canaries, is the dragon tree. It reaches a height of 30 to 60 feet, branching when of great age. The dragon tree of Teneriffe, famous for centuries, was 70 feet high, and one of the oldest of known trees. See *Cordyline* for other names not found in this article; also for culture.

The following key to the cultivated species of both Dracæna and Cordyline is based upon the lvs.

INDEX.

Bœrhavii, 1
deremensis, 5.
Draco, 1.
fragrans, 4.
Godseffiana, 8
Goldieana, 6.
Hookeriana, 3.
Knerkii, 4
latifolia, 3
Lindenii, 4
Massangeana, 4.
Rothiana, 4
Rumphii, 3.
Sanderiana, 7.
thalioides, 7
umbraculifera, 2
variegata, 3.
Victoria, 4.

KEY TO THE SPECIES.

A. *Lvs. long and sword-shaped, sessile.*
B. *The lvs glaucous beneath, 2–5 in. wide.* **C. indivisa**
BB. *The lvs with both faces similar, narrower.*
C. *Of mature plants narrow (6–15 lines broad)* **C. stricta**
CC *Of mature plants broader (1–2 in).*
D *Margins green.*
E *Color of lvs glaucous-green, costate, 1½–2 ft by 15–21 lines* **D. Draco**
EE. *Color of lvs green, costate, undulate below, 2–3½ ft by 1½–2 in* **D. umbraculifera**
EEE. *Color of lvs green, costa obscure, 3–4 ft. by 13–18 lines* **C. australis**
DD *Margins white-pellucid* **D. Hookeriana**
AA *Lvs oblanceolate, broadly petioled or sessile.*
B. *Size of lvs 3–4 in. by 1½–2 in , opposite or whorled* **D. Godseffiana**
BB. *Size of lvs. 12–15 in. by 18–21 lines, alternate.* . . . **C. rubra**
BBB. *Size of lvs. 1½–3 ft. by 2–4 in., alternate.*
C. *Pedicels 1–1½ lines long, perianth 5–7 lines long* **D. fragrans**
CC *Pedicels 1½–2 lines long, perianth 7–8 lines long* . **D. deremensis**
AAA. *Lvs. ovate, lanceolate, or elliptical; petioles narrow*
B *The lvs 4–8 in. by 2–2½ in , oblong-falcate, green* **C. Haageana**
BB *The lvs 7–8 in. by 4–5 in , oblong, white-spotted* **D. Goldieana**
BBB. *The lvs. 7–10 in by ½–1½ in , lanceolate, white-margined* . . . **D. Sanderiana**
BBBB. *The lvs. 10–18 in. by 1–3½ in., elliptical* . . . **C. terminalis**

1. Dràco, Linn. Dragon-Tree. Arborescent (60 ft high), branched: lvs. very numerous, crowded, sword-shaped, erect or the outer recurved (1½–2 ft. x 1¼–1¾in.), scarcely narrowed below, long-attenuate at the apex, glaucous-green· pedicels 3–6 lines long: bracts minute, lanceolate: perianth 4 lines long, green-

ish; filaments flat: berries orange. Canary Isls. B.M. 4571. R H 1869, p. 416, 1880, p 196. G C II. 14:749. G.W. 12:233 J F. 2, pl. 124 —Fine for conservatory. **D. Bœrhàvii,** Tenore, is a garden form, with elongated lvs, all recurved.

2. **umbraculifera,** Jacq. Arborescent (3–10 ft. high), simple: lvs. very numerous, crowded, sword-shaped (2–3½ ft. x 1½–2 in), outer recurved, all green and shining, attenuate at the apex, scarcely narrowed toward the conspicuously undulate base, costa distinct on both faces. pedicels 4–6 lines long bracts minute, deltoid. perianth large, 2 in. long, white, tinged with red; filaments filiform. Mauritius L B C. 3·289.

3 **Hookeriàna,** Koch (*C. Rumphii,* Hook *D. Rumphii,* Regel). Trunk 3–6 ft high, sometimes branched. lvs numerous, densely clustered, sword-shaped (2–2½ ft x 1½–2 in.), outer reflexed, all long-attenuate at the apex, scarcely narrowed below, margin white-pellucid, lower face concave, indistinctly costate beneath bracts 1½–3 in long, white. pedicels 3–4 lines long; perianth greenish, 12–15 lines long; filaments filiform· berries orange Cape of Good Hope **D. latifòlia,** Regel, is a horticultural variety, with lvs. 3–3½ in. wide G C III. 20 305 (var *latifolia*). B M. 4279 (as *Cordyline Rumphii*) Var **variegàta,** Hort. Variegated foliage.

4. **fràgrans,** Ker-Gawl (*Áletris fràgrans,* Linn. *Sansevièria fràgrans,* Jacq). Arborescent (20 ft high or more), sometimes branched· lvs. (1½–3 ft. x 2½–4 in) sessile, oblanceolate, lax and spreading or recurved, flaccid, green and shining, acute, indistinctly costate:



1345. Dracæna fragrans var. Lindenii.

bracts minute, scarious, deltoid: pedicels 1–1½ lines long; fls glomerate; perianth 6–8 lines long, yellow: berry orange-red. Guinea. B M. 1081 A G. 18.389. F.R. 4:189. Gn. M. 8 270. G.W. 12 232. G. 2 286. —Much used for greenhouse and table decoration. **D. Knérkii,** Hort Form with glossy light green, less pendulous lvs. **D. Rothiàna,** Hort. A garden form. I.H. 43, p 97. R.H 1877, p. 68. **D. Victòria,** Hort A garden form. Gn. 63, p. 77. Var **Lindenii,** Hort. (*D Lindenii,* Hort). Fig 1345 Lvs recurved, traversed from base to apex by creamy white bands. Very decorative. I.H. 27:384. F R. 4:191. G W. 14:321. A.F. 35:1241. G.C. III. 30·176. Var. **Massangeàna,** Hort. (*D. Massangeàna,* Hort.). A broad yellow stripe along the center of the lf. throughout its entire length. F.R. 4:193.

5. **dereménsis,** Engler. Plant 9–15 ft. high, branched. lvs. 1½ ft. long, 2 in. wide, narrowed into a broad petiole-like base· infl. large; fls on pedicels 1½–2 lines long, perianth 7–8 lines long, with tube 4 lines long, dark red without, white within, unpleasant scented. Afr. G C III. 50:23. G.M. 54:523. G.W. 11:505 (all as var. *Warneckii*).

6. **Goldieàna,** Hort. Plate XXXVII. Trunk simple, slender· lvs distant, spreading, thick-oblong (7–8 in x 4–5 in), cuspidately pointed, base broadly rounded or cordate, glossy green, conspicuously white-spotted and banded, young lvs often tinged with red; petioles erect (2–3 in long), deeply grooved. fls unknown W. Trop. Afr B.M. 6630. R H. 1878, p 15. I H. 25 300; 42, p 257. G C II 17.49. G Z 22:1 G. 2·271; 14.239. G.W. 12 235.—A fine foliage plant.

7. **Sanderiàna,** Hort. (*D. thaloides* var. *variegàta,* Hort ?). Slender. lvs distant, alternate, spreading or recurved (7–10 x ½–1½ in), narrowly lanceolate, acuminate, on rather broad petioles (1–3 in long), glossy-green, broadly margined with white Congo. A F. 8 1281; 11·235. I H 40·175. G C. III 13·445. G W 14:322 Gn W. 14:617. G. 23:533. G.L. 16:235. —Intro in 1893.

8 **Godseffiàna, Hort.** Woody, but very slender, rather diffuse· lvs at many nodes small, erect, scale-like and lanceolate, the others opposite or in whorls of 3, oblong or obovate, spreading, cuspidate, sessile (3–4 x 1½–2 in), firm, green, with copious white spots. raceme short-peduncled. bracts small. fr globular, greenish yellow or red, nearly 1 in diam Congo. G C III 21 347 Gn 50, p 276, 51 298, and p 299. A.F 13 1310 F E 10, supp 2 12 Gng. 6·294. G. 19:388 —Fine for decorative purposes.

The following are apparently not in the American trade *D americàna,* Donnell Smith Twenty to 40 ft high lvs linear-sword-shape, 8-15 in long, green fls white, small, in dense panicles Allied to D Draco Cent Amer S T S 1 207 New —*D arbòrea,* Link Lvs green, sword-shaped, dense, sessile Gt 46 1438, and p 226 G W 8 260, 12 232 —*D Broòmfieldii,* Hort Lvs spreading or recurved, strap-shaped, undulate, sessile, deep green bordered with broad white margins J H III 33 541 G C III 20 667, 23 249, 33 249 (var) G 27 597 G W 13 4 — Botanical status obscure —*D concinna,* Kunth Lvs oblanceolate, green, purple on the margin, green-petioled —*D cylindrica,* Hook Lvs linear-lanceolate, or obovate-lanceolate, bright green, spreading B M 5846 —*D Eeckhantii,* Hort F R 1 46 Gn W 16 697 —*D elliptica,* Thunb Lvs spreading, petioled, thickish, elliptic-lanceolate, glossy, acute, longitudinally striate B M 4787 G C II 17 261 (var maculata) —*D ensifòlia,* Hort Amer =Dianella ensifolia —*D Kewénsis,* Hort Lvs dark green, broadly oblong-lanceolate-acute, petiole red, half as long as the blade New Caledonia New May be a form of C terminalis G C III 33 265 F E 15 619 — *D marginàta,* Lam Lvs sword-shaped, dense, spreading, green, margined and veined with red G W 12 235 —*D marmorata,* Hort B M 7078 —*D phrynioides,* Hook Lvs petioled, mostly oval, acuminate, coriaceous, spotted with yellowish white, pale beneath B M 5352 —*D reflèxa,* Lam Lvs lanceolate or sword-shaped, acute, contracted into a petiole —*D Saposchnikòwi,* Regel. Lvs sword-shaped, crowded, green Gt 705 —*D Smithii,* Baker. Lvs large, narrowly sword-shaped, crowded, bright green B M. 6169

Some trade names, the botanical status of which is in doubt, are the following *alba-marginata, albamensis, Alexandria, angustifolia, angustata, argenteo-striata, DeSmetiana, edmontonensis, elefantissima, Elizabethæ, Frederica, Hendersonii, imperator, Jamesii, Janssenii, Lacourtii, Mayi, Mandeana, Offeri, perelyana, recurva, Salmonea, Sheperdii, spectabilis D nova-caledonica* is probably Cordyline neocaledonica, Lindl., with bronze lvs

K. M. WIEGAND.

DRACOCÉPHALUM (Greek, *dragon's head,* from the shape of the corolla) *Labiàtæ.* Hardy herbaceous annual and perennial plants of easy culture and of minor importance.

Allied to Nepeta, differing in having the calyx mostly straight rather than curved and unequally toothed: mostly erect herbs, with opposite entire, toothed or deeply cut lvs., the upper ones passing into bracts: fls. in many-fld. verticils which are axillary or terminal, blue or purple or rarely white; calyx tubular, about 15-nerved; corolla, upper lip somewhat notched and arched, the lower one 3-cleft and the middle part notched or 2-cleft; stamens 4, didynamous, the 2

anther-cells divaricate.—Forty species in Eu. and Asia and very sparingly in N. Amer.

Sandy loam, moderately rich, and a rather moist, partially shaded situation will suit these plants best. In a sunny dry border they are never very showy; the flowers are of short duration, and are seldom at their best except in very moist seasons Propagation is by division or seeds. The species described below are erect-growing.

A. *Lvs. entire, not cut in any way.*

Ruyschiàna, Linn. (*Ruyschiàna spicàta,* Mill.). Perennial, 2 ft.: sts. slightly pubescent: lvs. linear-lanceolate, glabrous: bracts ovate-lanceolate, entire: whorls in somewhat interrupted spikes; fls 1 in. long, purplish blue or purple; anthers villous. Siberia **Var. japónicum,** Hort., has white fls shaded with blue, and is a distinct improvement. G.C. II. 12.167.—According to Vilmorin, this species has been sold as *D. altaiense* (see *D. grandiflorum*).

AA. *Lvs. deeply 3–5-cleft.*

austriacum, Linn., has the habit of the above, and belongs to the same subgenus Ruyschiana, but the lvs. are divided and more distinctly revolute at the margin About 1–1½ ft high fls blue, 1½ in. long and more perennial. July, Aug Eu., Caucasus.

AAA *Lvs. cut only at the margin, mostly crenate.*

B. *Whorls crowded together into spikes or heads.*

grandiflòrum, Linn (*D altaiénse,* Laxm.). Perennial, about 1 ft high: root-lvs long-stalked, oblong, notches at base; st.-lvs few, short-stalked, ovate, not notched at base, the uppermost still more rounded: whorls in spikes 2–3 in long, the lowest whorl usually at some distance: fls 2 in long, blue. June, July. Siberia B M 1009 P M 13 51

speciòsum, Benth Allied to *D. grandiflorum,* but st. pubescent instead of pilose above: root-lvs more broadly heart-shaped, and all lvs. pubescent beneath instead of nearly glabrous, and wrinkled fls purplish to deep purple. June, July Himalayas B M. 6281.

BB. *Whorls distant, in long racemes*

Moldávica, Linn (*Moldávica punctàta,* Moench) Lvs lanceolate, incise-crenate, the floral ones narrower and pectinate: fls in few-fld loose clusters; corolla 2 or 3 times as long as calyx, blue or white. European annual, 1–2 ft., sparingly run wild in N. Amer. Eu., N. Asia.

Rúprechtii, Regel. Perennial: dwarf or compact, 1–1½ ft.: lvs. ovate-lanceolate, incised and toothed: fls. rosy purple or lilac, about 1 in. long, in axillary clusters. Turkestan. Gt. 1018.

nùtans, Linn. Perennial, 1 ft: lvs. ovate-crenate, the floral ones oblong-lanceolate and more nearly entire: fls. blue May–July N Asia. Mn. 4:137. B.R. 841. Var. **alpina,** Hort., is advertised.

*D canarién*se=Cedronella triphylla.—*D. canéscens,* Linn = Lallemantia.—*D. virginiánum,* Linn.=Physostegia.

WILHELM MILLER.
L. H. B.†

DRACÓNTIUM (derived from the Greek word for *dragon*). *Aràceæ.* Greenhouse or hothouse plants, grown more for curiosity than for beauty.

Herbs with long-petioled lvs.: petioles verrucose; blades deeply 3-parted, these again parted: spathe oblong, convolute below; spadix short-stalked, short, cylindric, free, densely many-fld.; fls perfect, with a perianth: fr. a 2–3-celled berry, each cell 1-seeded.—About a half-dozen species in Trop. Amer. Cult. as for Amorphophallus.

ásperum, Koch (*Amorphophállus nivòsus,* Lem.). Petioles up to 9 ft. long and over 1 in. thick, roughened toward base with small warts conjoined in series, marked with large livid green and brown spots; blades up to 3 ft. broad, 3-parted, the divisions bipinnate, the ultimate segms. oblong to lanceolate: peduncles 4 in or more long; spathe up to 10 in. long; spadix 1½–2 in. long. Brazil. I.H. 13, p. 14; 12:424.

GEORGE V. NASH.

DRACÚNCULUS (Latin, *a little dragon*). *Aràceæ.* Odd tuberous plants sometimes grown under glass.

This plant has interesting dragon-fingered lvs. and a terrifying odor when in flower. Its tubers are sold by bulb dealers under the name of *Arum Dracunculus.* The monographer of this order (Engler, in DC. Mon.



1346. Dracunculus vulgaris.

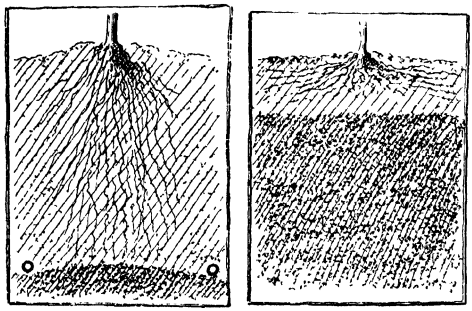
Phan., vol 2, 1879) puts this plant into the genus Dracunculus because the ovules are attached to the base of the ovary, while in Arum they are attached to the side. The lvs of the true arums are always arrow-shaped, while in Dracunculus they are sometimes cut into finger-like lobes. There are only 2 species. The common one is an entertaining, not to say exciting, plant. It is well worth growing for the experience, though its stench is not quite so bad as that of a helicodiceros, sold as *Arum crinitum,* which makes any house unbearable in which it flowers Nearly all arums are ill-smelling. For cult., see *Arum.*

vulgàris, Schott. Fig 1346. Sheath of lvs. livid, spotted; stalks green, blades with 10 fingers projecting from a bow-shaped base: tube of spathe streaked with purple except at the bottom; spathe purple all over and much darker along the wavy border. Medit. regions. G.C. III. 47:198. WILHELM MILLER.

DRAGON PLANTS. The dragon arum, dragon root or green dragon, is the native *Arisæma Dracontium.* The dragon plant of Europe is *Dracunculus vulgaris.* The dragon's head is not an aroid, but a Dracocephalum, a genus of mints False dragon's head is Physostegia. The dragon's blood of commerce is a dark red, astringent, resinous secretion of the fruits of a palm,

Dæmonorops Draco. Other kinds of dragon's blood are produced by *Dracæna Draco* and *Ecastophyllum monetaria* (now referred to Dalbergia). "Sticks," "reeds," "tears" and "lumps" of dragon's blood are known to commerce. The resin is used in coloring varnishes, dyeing horn in imitation of tortoise shell, and in the composition of tooth-powders and various tinctures. The dragon tree is *Dracæna Draco*

DRAINAGE. Underground or sub-drains serve to relieve the land of free water, which is harmful to most plants if left to stagnate in the surface soil or subsoil. They serve not only to dry the land in early spring, but indirectly to warm it, for if the water is removed the sun's heat warms the soil instead of cooling it by evaporating the surplus water Tenacious lands devoted to gardening and small-fruits are made more productive, warmer and earlier by sub-drainage Drains promote nitrification, assist in liberating mineral plant-food and cheapen tillage. They serve not only to remove deleterious stagnant water, but they promote aëration as well, and this hastens beneficial chemical changes in the soil. Drainage promotes the vigor, healthfulness and fruitfulness of plants Tenacious soils are made more friable by drains, thereby giving



1347. Diagrams to explain the effect of lowering the water-table by means of under-draining On the undrained soil, the roots do not penetrate deep; and when droughts come, the plants suffer.

easier access to plant roots, while the percolation through the soil of rainwater, which carries some plant-food, is hastened Rain-water in the spring is warmer than the soil, in midsummer it is cooler than the soil: therefore, percolation of rain-water warms the soil in the spring and cools it in extremely hot weather. Drains serve not only to relieve land of free water, but they impart to it power to hold additional available moisture, which materially benefits plants during droughts

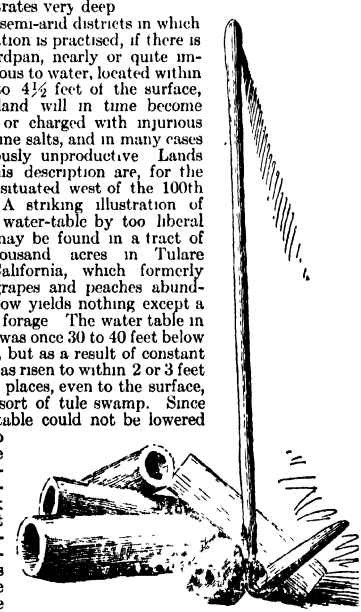
Drainage is of two kinds, surface and sub-drainage. On land on which large outlays of money are to be expended, as in horticultural plantations, it is of the utmost importance that the soil be freed to considerable depths from stagnant water. Trees, many shrubs, and even some garden crops send their roots deeper into the subsoil than most of the cereals, hence they require a greater depth of drained feeding-ground. In horticulture the planting may often precede the harvest by five to ten years, while with many farm crops the harvest follows the planting in a few months. If the grain-raiser loses one crop, an annual, by planting on wet land, the loss is not great, but if the orchardist loses fifteen to twenty years of labor by planting on undrained lands, before the mistake is discovered, the losses are serious. Some lands require little more than to be relieved from surplus surface water in early spring. This may be accomplished by forming ridges and open furrows as far asunder as the rows of trees are to be placed But it is only rarely that surface drainage fully prevents serious damage from surplus moisture. Surface drainage may be considered a cheap way of temporarily alleviating undesirable conditions. It does not always eradicate them. Fig. 1347 illustrates how sub-drainage lowers the water-table (or the area of standing water), and thereby ameliorates the soil

Sub-drainage consists in placing conduits of tile or other material in the ground at depths varying from 2½ to 4 feet, and at such distances apart as will serve to relieve the subsoil of deleterious stagnant water When suitable stones are at hand, they are sometimes used instead of tile for forming drainage conduits If such use is made of them, the drains should be somewhat deeper than tile drains, since the stones which form the drain occupy nearly a foot of the depth of the ditch and are more likely to become obstructed, especially if placed near the surface, than are tile drains The throats or openings of stone drains are irregular in size, while those of tile drains are smooth and uniform in size, and are, therefore, most desirable Years ago, various flat-bottomed tiles (Fig 1348) were employed, but the style in general use at present is the cylindrical unglazed tile shown in Fig 1349 They should be hard-burned. Because of the low cost of cement, tiles made of sand and hydraulic cement have recently come into use; they require no burning, are stronger than tiles made of clay and are just as efficient, except in alkali and where frost penetrates very deep



1348. Old-fashioned drain-tile.

In semi-arid districts in which irrigation is practised, if there is a hardpan, nearly or quite impervious to water, located within 3½ to 4½ feet of the surface, the land will in time become sour or charged with injurious alkaline salts, and in many cases ruinously unproductive Lands of this description are, for the most part, situated west of the 100th meridian. A striking illustration of raising the water-table by too liberal irrigation may be found in a tract of several thousand acres in Tulare County, California, which formerly produced grapes and peaches abundantly but now yields nothing except a little hardy forage The water table in this region was once 30 to 40 feet below the surface, but as a result of constant irrigation has risen to within 2 or 3 feet and, in low places, even to the surface, forming a sort of tule swamp. Since the water-table could not be lowered enough to restore the land by under drainage, for lack of an outlet within reasonable distance, it is probable that the only way to reclaim it

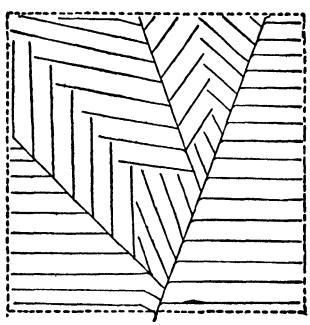


1349. Common cylindrical drain-tile; and a scoop for preparing the bed for the tile.

would be to sink a well and pump the surplus water into a surface ditch. Irrigation with pure water would then sweeten the soil and render it again productive; and the whole process of restoration need not be excessively expensive.

If the hardpan is less than 2 feet in thickness, the land may be improved greatly for orchard and vineyard purposes by the use of dynamite. Blasting should be deep enough to allow the surplus water to escape into the porous earth or gravelly soil beneath the hardpan. On the Pacific coast this method of draining orchard and vineyard land has been quite successful. In any case, unless the soil has good natural sub-drainage, it is both wise and economical to blast out holes for trees and vines; for the cost of digging holes, if they are as large and deep as they should be, is lessened by an amount almost equal to the cost of blasting.

Recently, powerful tractors have solved, to some extent, the problem of drainage in many cases by making deep plowing possible before planting and during the first few years of subsequent tillage of the orchard or vineyard. This machine with the tillage implement turns easily at the ends of the field within the space allowed for turning a span of horses and a plow; it can pass under limbs where a 14-hand horse (56-inch) can

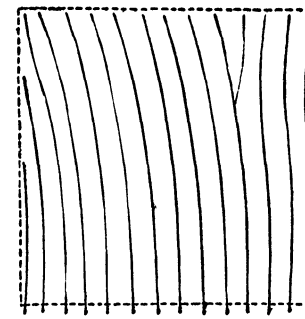


1350 Improper method of draining a field

pass, and as close to the plants as a span of horses can. It furnishes also power and locomotion for spraying and for opening trenches to a considerable depth (18 to 44 inches) for the reception of drain-tile.

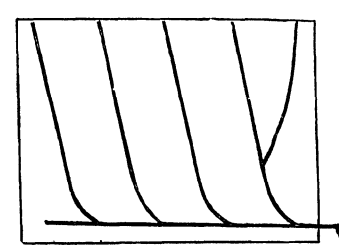
In some regions, drains are placed 200 to 300 feet apart, and serve their purpose well In others they should not be placed farther apart than 20 to 30 feet. Wherever the subsoil is composed of tenacious fine clay, through which the water moves upward or downward with difficulty, the narrower intervals are necessary. In some instances the surplus water in the subsoil is under pressure by reason of water which finds its way into it from higher levels, and if this is not removed, the water has a constant tendency to rise to the surface. In many such cases drains placed at wide intervals may serve to relieve the pressure and drain the land. Since sub-drains are designed to be permanent, are expensive to construct and difficult to repair, the principles of drainage should be well understood, and the work should be undertaken only after a most careful inspection of the land and after the fundamental principles of the subject have been mastered

Mains and sub-mains should be avoided so far as possible, since they greatly increase cost, tend to become obstructed, and are often unnecessary. The three long mains in Fig 1350 are not drains, strictly speaking, since the land may be as fully drained without them, as shown in Fig 1351, therefore, they serve only to conduct the water of the drains proper Tiles of 3 to 4 and 5 inches diameter should be used when the drains are infrequent and the flow of water considerable. Smaller ones, 2 to 3 inches in diameter, will suffice when the intervals between the drains are narrow.



1351. Best method of draining a field.

Drains should have as uniform a fall as possible, and no abrupt lateral curves or sharp angles should occur as are seen in many places in Fig 1350 If the drain has a rapid fall in its upper reaches, as is often the case, and but slight fall in the lower, a silt basin should be constructed at the point at which the rapid changes into the slight fall, if obstructing silt is present All drains which may be necessary should be placed before the planting occurs Orchard lands may be drained in the spring, fallowed in the summer, and planted in the fall or the following spring Drains placed at frequent intervals because of the tenacity of the soil should be comparatively shallow, for if placed deep or at wide intervals, the water will be too long reaching them. If drains are placed at wide intervals they should be at least $3\frac{1}{2}$ feet deep to be most efficient If the parallel system is adopted (Fig 1351), there may be more outlets to construct and maintain than is desirable; if so, the system might be modified by constructing a submain, one side of which will serve also as a drain, and but one outlet will be required (Fig 1352) Drains through which water runs for the greater part of the year are likely to become obstructed by roots, if water-loving trees, such as the willow, soft maple, and elm, are



1352. Showing how the drains may be gathered into one when there is only one place at which an outlet can be secured.

allowed to grow near them If floating silt is present, the joints of the tiles should be protected for two-thirds of their upper circumferences by a narrow strip of tarred building paper (Fig 1353), or collars should be used Stone drains should receive a liberal covering of straw or some similar material before they are filled

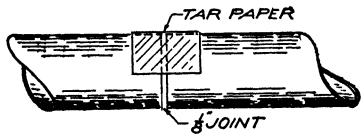
Drainage for landscape work.

The value of a thorough knowledge of the possibilities of drainage in landscape work has been overlooked until recent years as a definite field entirely apart from general drainage for agricultural purposes.

Drainage under the headings of this article is installed with the following objects in view.

1. Maintaining well-drained areas for firm lawn surfaces.

2. Maintaining well-drained and firm surface conditions for recreation areas.



1353. Covering a joint.

3. Draining of surface water and ground water from roads.

4. Draining foundations for walks.

5. Preserving the normal soil conditions for newly planted trees.

6. Draining swamp and marsh areas to prevent breeding of mosquitos.

1. Drainage for lawns.

The secret of a perfect lawn is attributed to drainage conditions which provide a well-drained subsoil and a firm surface that may be readily freed from any excess water during heavy rains. The installation of drainage for this purpose is required only in the more compact soils that do not drain naturally. Sandy soils seldom require artificial drainage unless immediately underlaid with a stratum of impervious clay. On any lawn the topography of which does not permit the ready surface run-off and the subsoil of which is compact clay, the necessity of installing sub-surface drainage is strongest.

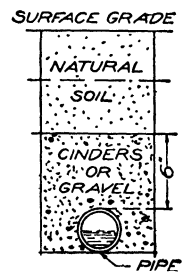
A drainage system for providing ideal soil conditions for perfect lawns must be installed carefully. Four-inch tile, is often used in the lateral systems while either 6-inch vitrified pipe, or the No 2 quality of 6-inch round tile, is used for the main lines All drains should be laid on an even grade of not less than ⅛ of an inch fall to each linear foot of drain, and preferably not less than ¼ of an inch fall for each foot of drain. If perfect drainage is desired, the distance apart of these drains should not exceed 20 feet In accordance with the general laws of drainage, tile should be laid at a more shallow depth in the heavy soils than in the lighter soils, and should be spaced at closer intervals than 20 feet, this space varying largely with the desire to free the lawn immediately of any excess surface water.

In all tile drainage whether for lawns or other purposes, a space of approximately ⅛ inch should be allowed between the ends of the pipes. The covering of tar paper and cinders should be placed over each joint as shown in Fig. 1353. The tile should be placed on a firm bottom of clay or other natural soil, and surrounded on all sides, and covered to a depth of not less than 6 inches with cinders, crushed stone, or washed gravel (Fig. 1354). In very heavy clay, the trench excavated for the tile should be filled with cinders, crushed stone or gravel to a line separating the looser top soil from the clay subsoil (Fig. 1355). In heavy soil and for perfect lawn drainage, the lines of tile ought not to be laid deeper than 2½ feet and the cinder fill should not be less than 15 inches in depth. In the lighter sandy loam soils, the tile may be laid to a depth of 3 to 3½ feet.

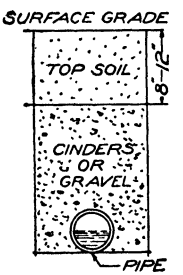
It is often found necessary when lawns are constructed on sandy soil to prevent excessive drainage, rather than to encourage drainage conditions. In these extreme sandy soils, the surface water seeps away so readily that the lawns become exceedingly dry during the warm and dry months. To prevent this condition a layer of clay 4 inches deep should be distributed over the sandy sub-grade prepared for the lawn, at a depth varying between 10 and 18 inches below the proposed finished surface of the lawn. This clay is thoroughly compacted and serves as a partial barrier against abnormal seepage which would otherwise occur, and thereby retains the moisture necessary for the capillary attraction to feed the roots of the lawn grasses.

2. Recreation areas.

Areas naturally falling under this heading are tennis-courts (clay and turf), bowling-greens, clock-golf areas, and croquet-lawns. All of these require a more careful study of drainage conditions than is



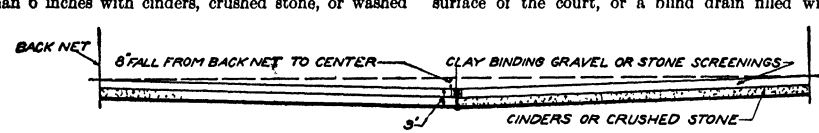
1354. The filling of a drain.



1355 Applying good top soil.

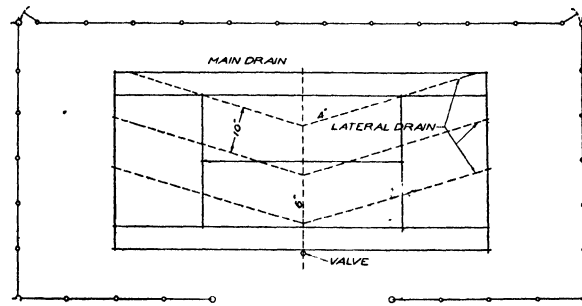
given to the average lawn. It is essential that such areas be so completely drained that the surface condition is always firm, even after the average continuous heavy rains

Tennis-courts —These areas require the most careful study of drainage conditions The average tennis-court requires two types of drainage,—surface and sub-surface Surface drainage is cared for in two ways, (1) either by giving the court a gradual slope to one end, or (2) as shown in Fig. 1356, where the surface of the court is sloped from either end toward the middle line. This method, shown in Fig. 1357, gives probably the most satisfactory results, because, in this way, if surface conditions at the middle of the court are correct, the surface water is cared for most readily and with the shortest possible run-off. This drain across the middle of the court may be either an open concrete drain with a plank laid over the top and flush with the surface of the court, or a blind drain filled with a



1356. Draining a tennis-court.

coarser crushed stone and fine crushed stone, over which is spread a thin layer of washed sand. The bottom of the drain ought to be approximately 6 inches lower, at the point where the outlet to the sub-drain is located, than the elevation at the extreme high points of the drain. The method of establishing these grades varies largely with the requirements of this particular problem The water, as it reaches the low point in the drain, is conducted at once into the main 6-inch drain, which also takes ground-water from the underground system of drains. When the court is so constructed that one end is lower than the other, in order to assist surface-drainage conditions the courts should be level from side to side Fig. 1357 shows the general distribution of the system of tile to care for the sub-surface water in tennis-court construction This would apply equally well to the construction of other recreation areas, including clock-golf-greens, bowling-greens and croquet-lawns. In the construction of all tennis-courts, the trenches excavated for the tile should be filled with cinders or an equally porous material to a height not less than 6 inches below the proposed finished grade of the court



1357 Draining a tennis-court.

Clock-golf-greens, bowling-greens, and croquet-lawns.— A thorough distribution of tile drains installed as outlined below, should meet all the requirements commonly imposed from the drainage standpoint upon the construction of these recreation areas Lines of 4-inch tile should be placed, at intervals of not more than 10 feet. For the most thorough and ideal drainage of these areas, provided the cost is not prohibitive, the construction would be as follows A neat sub-grade should be made at a depth not exceeding 15 to 18 inches below the proposed finished surface of the recreation area The necessary lines of tile should be laid in trenches at a depth varying between 2 and 2½ feet below the finished grade, these trenches to be filled with cinders, crushed stone or gravel (Fig 1355) On this sub-grade, thus completed, the entire recreation area should be filled to a point approximately 6 inches below the proposed finished grade, with cinders, or some equally porous material. On this finished surface, the remaining 6 inches should be filled with a layer of loam free from clay, but composed of a small percentage of sand. In this way, a firm surface will be obtained which will readily care for any surface and subsoil water.

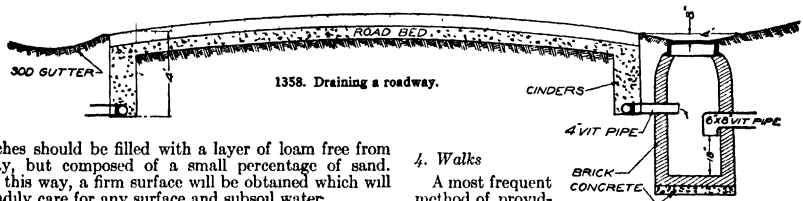
3. Roads.

The secret of a perfect road surface lies (1) in the proper crown of the road, and (2) in the adequate drainage of the subsoil or foundation. The first provision cares for the surface water, and the second provision eliminates any surplus ground-water.

On all private estates on which roads are constructed on heavy clay soils and not on grades greater than 4 per cent, the secret of success depends upon drainage installed in either of the two ways shown in Fig. 1358 or Fig. 1359. Installing a line of drains under the middle of the road is used in soils in which the ground-water level is abnormally high. Such drains should range in depth from 2 to 3½ feet below the finished surface of the road, and the trenches should be filled with a porous material and not with the natural soil. The method of installing drainage under the sides of the road, as shown in Fig. 1358 is used in heavy clay soils, and serves to keep the foundation of the road on well-drained soil These drains are installed at a depth varying from 2 to 3 feet in trenches filled with cinders or equally porous material

Turf pleasure roads, so frequently constructed on private estates, should be thoroughly drained with a line of tile placed under the middle of the road, unless the road is constructed on a heavy foundation of field-stone or gravel which forms a natural drain path for surface-water and soil-water

In providing drainage along the sides of roads constructed on clay soils through virgin woods, it is sometimes necessary to carry these drainage lines a considerable distance through the woods to suitable outlet points The joints of all such lines of drainage should be cemented, otherwise the artificial conditions produced by the increased drainage will work serious injury to many large trees growing on either side In general it is very unsafe to install drainage lines through virgin woods, without this precaution Roads constructed through such woods would better be drained by laying a line of tile under the middle of the road as shown in Fig. 1359.



1358. Draining a roadway.

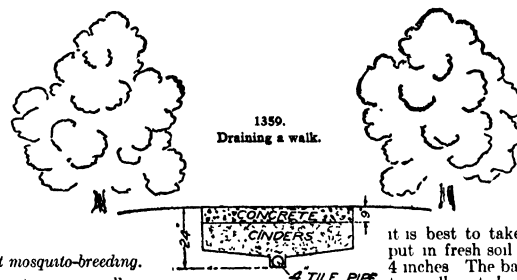
4. Walks

A most frequent method of providing drainage for walks is that shown in Fig. 1359. A line of 4-inch tile is laid at a depth varying between 18 inches and 30 inches below the finished grade of the walk and following the middle line of the walk The trench for the tile is filled with a porous material to a height even with the bottom of the cinders used for the foundation of the walk, or laid as shown in Fig 1359

5. Newly planted trees.

All trees planted in clay soil require drainage If the pockets in which such trees are planted are not

thoroughly drained, the area excavated and re-filled with soil when the trees are planted becomes a pocket for ground-water. This pocket or reservoir collects the water, which, if not carried off by means of drains, will very likely cause the death of the trees. All large trees, especially those which do not grow best with their roots in the water, must be provided with drainage. The common method of drainage is to install a line of 4-inch tile leading from the bottom of the excavated hole to a main line of tile which may have been installed for other drainage purposes, or to the nearest outlet if no such line exists.



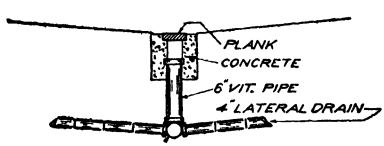
1359. Draining a walk.

6. Drainage to prevent mosquito-breeding.

It is a frequent practice, especially on large estates, to install open ditches from 50 to 100 feet apart in swamps and in salt marshes, in order to provide a means for draining such areas, and thus preventing the presence of stagnant water, which is conducive to the breeding of mosquitos These trenches are excavated at depths varying from 2 to 3½ feet. The more frequent the trenches, the shallower they may be made and still provide adequate drainage.

The foregoing article pertains only to the particular phases of drainage especially to be considered in connection with landscape work For additional information on the general details concerned with drainage, refer to the main article upon drainage, p. 1072.

A. D. TAYLOR.



1360. Detail of drain connections (See Fig 1356.)

Drainage and watering for newly transplanted trees.

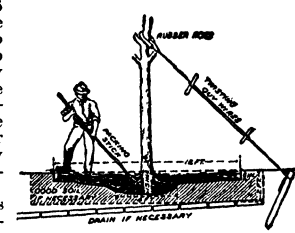
Drainage is an essential in all retentive soils and is a safeguard even on sandy gravelly subsoils against overwatering. Drainage is likely to be vetoed on the score of expense or on the excuse that the subsoil is gravelly; whereas, there are only gravel stones in hardpan which holds water. A drain made by filling a pit with stones is frequently inadequate as it fills with water, which backs up into the hole, saturates the soil around the roots and rots them. Rotting of only a part of the roots may injure the tree more than the cutting off of that amount of roots

The soil in which to plant should be open, porous and aërated Soil which has been piled up as in grading operations is likely to be sour from the decay of the sod and from the packing by teams and scraper. Muck from ponds which has been piled and mixed with lime for a year may still be sour Clay soil packed by the water and packing-sticks may remain too compact and not aërated enough, may be too much saturated with water and, therefore, rot the roots. Manure should not be mixed in the soil around the roots on account of the danger of souring and rotting the roots. This rotting is determined by digging down to the roots and finding them of blue-black color with a sour smell. Sometimes this decay has not reached through the bark of the roots and other times it has penetrated the bark and turned the cambium blue-black. Sour soil is likely to be of bluish or greenish color rather than chocolate-brown, and have a sour smell like that underneath a manure heap. The smell is most readily detected by breaking open a lump of soil In digging into sour soil and soil that is over-saturated, the spade makes a peculiar sucking noise as in digging in a bog. If at the time of examination the soil is already become sour, it is best to take out this sour soil and put in fresh soil covering the roots only 4 inches The ball of earth in the center will not be so liable to get sour because it has not been disturbed As brought out by Stringfellow in the "New Horticulture," soil that is dug over will take in water and become saturated; whereas, soil that has not been disturbed will retain air in the soil-spaces even if submerged. The ball of earth is also prevented from becoming saturated by the undisturbed feeding-roots which absorb the moisture.

Watering cannot be by rule, but must depend on examination of both ball of earth in the center and the outer roots The difficulty will be to keep the ball of earth sufficiently damp on account of the rapid withdrawing of moisture by the roots The danger will be that the soil outside the ball of earth will take up the water too rapidly, remain saturated several days and rot the roots Examination is best done by shovel and fork, digging down 1½ feet both in the ball and outside. An easier way is to bore into the soil with an auger. It will usually be found that the central ball of earth is dry and dusty in the summer even if the surface and outer soil is damp The growth of weeds and grass will indicate the same. A good way to water is to make a basin around the width of the ball of earth, fill it with water 6 inches deep, make crowbar holes into the ball for it to soak in Many mistakes are made in overwatering—letting the hose run all night or watering every day, thereby rotting the roots

Mulching is frequently neglected, the tree starving for lack of humus A close-cut lawn around a newly planted tree may be the ideal of neatness, but it means starvation and thirst for the tree and is the principal cause of slow growth over several years, making new, bare and ugly landscapes The mulch should extend as wide as the roots and be from 3 to 6 inches deep, of strawy manure, leaves, grass, salt hay or similar organic matter. Too much manure may sour the soil and rot the roots, if it lies heavy and compact and keeps out the air. Light strawy manure is better. If the mulch blows about and is untidy, it may be kept in position by wire netting, earth, or the planting of small shrubs

HENRY HICKS.



1361. Setting a newly transplanted large tree.

DRÌMIA (name refers to the acridity of the roots). *Liliàceæ* Bulbous S. African and Trop. African plants of the Scilla tribe, with gamophyllous perianth and a campanulate tube, the segms linear-oblong and reflexing: stamens 6, shorter than the segms., and inserted at the throat of the perianth-tube; ovary sessile, ovoid, 3-celled, becoming a loculicidally 3-valved membranous caps.: lvs. either broad and rather fleshy or narrow and rigid, often appearing at a different season from the bloom: fls on a naked peduncle or scape, in a simple raceme —About 30 species, none of which appears to be regularly in cult. *D. oligospérma*, C H Wright Probably from S. Afr , and very recently described. fl -clusters over 6 ft high, much branched, the beautiful white fls with 3 green nerves on the oblanceolate spreading petals opening late in the afternoon. bulb elliptic, 6 in long: lvs 12–14, rosulate, 1½ ft. long, linear-acuminate, glabrous. Likely to come into commercial cult.

DRÌMYS (from a Greek word, used in allusion to the sharp or acrid taste of the bark). *Magnoliàceæ* About 10 evergreen trees or shrubs, allied to Illicium, distributed from Mex. to the Straits of Magellan, and in Austral., New Zeal , and islands Glabrous and aromatic plants with pellucid-punctate lvs , and polygamous dichmous or perfect fls. on 1- to many-fld. peduncles, white, yellowish or rose-colored and showy; sepals 2–4; petals 6–∞, in 2 or more series, stamens ∞, on thickened filaments, ovaries usually 2–∞, with sessile stigma and many seeds *D Winteri*, Forst. (*Wintèra aromatica*, Murr), is a S American small tree (to 50 ft), with milk-white fls 1 in or more across, jasmine-scented; petals 8–12, pale cream-yellow lvs. alternate, evergreen, elliptical or lanceolate, coriaceous, somewhat acuminate, entire, glabrous, very aromatic: branches with reddish bark. umbels (3–9-fld) often nearly equaling the lvs : scarcely known either as a glasshouse subject or for outdoor cult in warm countries. B.M. 4800.

L. H B.

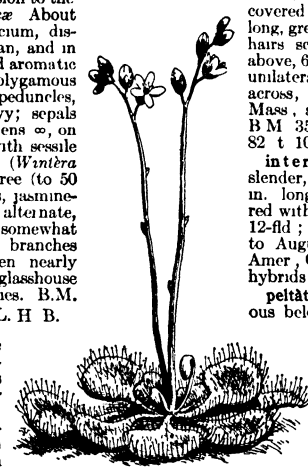
DRÓSERA (Greek *droseros, dewy*, from the dew-like excretions on the tips of the leaf-hairs) *Droseràceæ* A group of carnivorous plants popularly known as the SUNDEWS or DEW-PLANTS

The sts usually short, slender or compressed, rarely elongate and upright in such types as *D. peltata*: lvs varying from linear through lanceolate to circular, often arranged in a rosette, and beset over their upper surfaces with fine often irritable hairs, that excrete a clear neutral viscid fluid which entangles and catches insect prey; the hairs then bend inward toward the lf -center, the fluid becomes acid and also excretes a proteinaceous ferment by which the animal tissues are digested, the dissolved products being then absorbed for the plant's nutrition. fl -scapes slender, ending in curved scorpioid cymes of blooms, ¼–1½ in across, and varying from white through pink to scarlet or crimson; sepals, petals and stamens 5 each, while the carpels vary from 5–3, are syncarpous with parietal placentation, and bear as many style-arms or lobes: fr a caps.—About 90 species scattered over the world, though most abundantly in Austral. Monograph by Diels in Engler's Pflanzenreich, hft 26. The species usually grow in moist muddy soil, at times almost floating in water, as in the common N. J. species, *D. intermedia*. Some Australian kinds form tubers, and can then survive through dry periods. The lvs. in our native species wither in autumn, and a small winter bud-rosette is formed, which unfolds its lvs. in the succeeding spring.

The native and exotic species all grow well if treated as greenhouse plants, and grown in fine muddy loam topped by a little sphagnum. They should also be kept constantly moist in their root extremities, and exposed to bright light. The following native and exotic species are now often grown in collections They can be propagated by seeds, by division of the shoots, or by cutting the slender rhizomes into short lengths of ½–1 in. The last, when placed in moist soil, root and form buds in two to three weeks.

binàta, Labill. (*D. dichótoma*, B. & S) Sts. short: lvs long-stalked, 6–16 in high, once- to twice-forked into long-linear reddish green segms. that are covered with viscid hairs scape branched above, fls white, ½–¾in across; fls June, July. Austral and N Zeal. B.M 3082 —Intro in 1823 Easily grown and prop by division of the crowns

capénsis, Linn. St slightly elongate: lvs in a terminal rosette, linear to spatulate, tapered into petiole, obtuse at apex. scapes 6–10 in long with 5–20 secund purple fls.; fls June, July. Afr , southwestern part of Cape Colony B M 6583 —Intro. in 1875.



1362. Drosera rotundifolia. (×½)

filifórmis, Raf. St. short, hair-covered: lvs linear, erect, 6–8 in long, greenish with abundant purple hairs scape equal to or longer than above, 6–15-fld., fls. rather crowded, unilateral; petals pink-purple, ¾in. across, fls. June, July. Del. to Mass , along sandy coastal places. B M 3540 Torrey, Fl N. York, 82 t 10

intermèdia, Hayne. Rhizome slender, 1–4 in long: lvs 1½–2½ in. long, long-petioled, spatulate, red with glandular hairs. scape 6–12-fld ; petals white; fls April (Fla) to August (New Bruns) E. N Amer , Cuba, and Eu —Forms wild hybrids at times with other species.

peltàta, Smith. St 6–10 in., bulbous below, slender elongate above ground, with scattered peltate glandular lvs., and terminating in delicate 6–10-fld stalks· petals white to pink From India through China, Japan and the Philippines to Austral. G.C II.19:436 —A pretty, delicate and striking species now not uncommon in cult

rotundifòlia, Linn Fig 1362. St short, slender: lvs. ¼–2 in , with elongate non-glandular petiole and circular red-glandular blade· scape slender, 5–12-fld.; petals white, expanding in bright sunshine; fls. May (Carolinas) to Sept (Newfoundland).—A classic plant, owing to Darwin's studies in "Insectivorous Plants"

Trâcyi, Macfarlane Habit of *D. filiformis*. Lvs. 12–16 in , pale green with light green glandular hairs: scape 15–24 in.; fls purple, ¾in. across. Abundant over the coastal area of the Gulf states from mid-Fla to La. Fl. April, May.—One of the largest species of the genus

J. M. MACFARLANE

DROSOPHÝLLUM (*dew-leaved*). One of the 6 genera of the *Droseràceæ*, comprising a single species in S Spain, Portugal and Morocco, sometimes seen in collections of insectivorous plants, and for the interesting morphology, the lvs. being revolute rather than involute as in the droseras and other plants. *D. lusitánicum*, Link, is a sub-shrubby little plant, the simple st. 2–6 in. high bearing at the top long-linear glandular insect-holding lvs.: fls. 1½ in across, on an elevated stalk (1 ft. high), bright yellow, with 10–20 stamens, alternating in length, bearing short yellow anthers; petals

5, obovate, thin, twisted after anthesis; styles 5, filiform: fr. a narrow caps, ¾ in. long, 5-valved B.M. 5796.—The glands of this interesting plant are purple, some stalked and some sessile, viscid, not motile See Diels, in Engler's Pflanzenreich, hft. 26 (1906) for monographic treatment, where the Droseraceæ is reduced to 4 genera, Byblis and Roridula being removed from the family; and Darwin studied it and described it in Chap. XV of "Insectivorous Plants." L. H. B.

DRŸAS (Greek, *wood-nymph*). *Rosàceæ* Dwarf hardy tufted evergreen somewhat shrubby plants, sometimes transferred to gardens.

Leaves alternate, petioled, simple, entire or crenate, tomentose: fls large, white or yellow, borne singly on slender scapes; sepals 8–10, persistent; petals 8–10, obovate or oval; stamens many, with subulate filaments; pistils many, sessile, with a terminal style that persists and elongates on the achene. High northern or mountain plants, of N Amer., Eu and Asia, of which 4 species are recognized by Rydberg (N. Amer Flora, xxii, part 5, 1913), allied to Geum

The best known cult. species, *D. octopetala*, requires a well-drained porous soil, a sunny but not dry position It is well to shade the foliage from bright sun during the winter months with evergreen branches to prevent the foliage from having a scorched appearance. A capital plant for the rockery. Propagated by cuttings, division, or by seed (J. B Keller.)

octopétala, Linn Densely cespitose with a woody caudex or st.· lvs rugose, elliptic, oval or oblong, deeply and regularly crenate, white-tomentose beneath: scapes 2–8 in long; fls white, the petals elliptic or obovate-elliptic, and the sepals linear or linear-lanceolate. seeds with a feathered awn 1 in long. North temperate and arctic regions

Drúmmondii, Rich Cespitose perennial with decumbent caudex lvs elliptic or obovate, white-tomentose beneath but nearly or quite glabrous above, somewhat rugose, coarsely crenate fls yellow, the petals elliptic-spatulate or obovate and almost erect, the sepals ovate or ovate-lanceolate Que to Ore and N B.M 2972—A good rockery plant; 4 in., more or less

D. integrifòlia, Vahl Fls white, sepals linear or linear-lanceolate lvs lanceolate or lance-elliptic, the margins mostly revolute High northern N Amer.—*D tomentòsa*, Farr Fls yellow, sepals ovate or ovate-lanceolate lvs obovate or elliptic, coarsely crenate, tomentose on both surfaces Canadian Rockies L. H. B

DRYMOGLÓSSUM (Greek, *wood* and *tongue*, of no direct significance) *Polypodiàceæ*. Small ferns, 5 to 10 species, occurring wild in both tropics, with wide creeping rootstalks, and small, entire lvs.: sori resembling those of Polypodium None is advertised in Amer. Three or 4 kinds are mentioned in horticultural literature abroad, but are not cult. here L M Underwood

DRYMÒNIA (from Greek for an oak wood· growing on trees). *Gesneriàceæ*. Prostrate or climbing woody plants, sometimes grown under glass, but apparently not offered in this country Fls. white or yellowish, mostly large, on short axillary usually solitary pedicels, calyx large, oblique, 5-parted; corolla-tube prominently ventricose, declinate, gibbous or saccate at base, the 5 lobes broad and spreading and only slightly unlike; stamens affixed in the base of the corolla, 4 perfect; disk-glands large at rear, small or wanting in front; style elongated fr fleshy, ovate, becoming 2-valved: lvs. opposite, thickish —Some 15 species in Cent and S. Amer., closely allied to Episcia. Warmhouse plants, requiring the treatment of other gesneriads. One species is offered abroad: *D. Turrialvæ*, Hanst, from Costa Rica: tall shrub· lvs. broadly ovate, blistered, metallic-colored. fls. large, white, pendulous, the lower lobe toothed, calyx red. *D. punctàta*, Lindl.=*Episcia punctata*. L. H. B.

DRYMOPHLŒUS (Greek words meaning oak and smooth inner bark) *Palmàceæ*, tribe *Arèceæ* Spineless pinnate palms, with slender medium caudices.

Leaves terminal, equally pinnatisect, the segms. cuneate-oblong or linear, broadly oblique, submembranaceous, 3- to many-nerved, the margins recurved at the base; rachis scaly, 3-sided, sheath long spadix with a short peduncle and slender branches, spathes 2 or many, the lower one 2-crested. This genus contains a tropical palm, with very distinct wedge-shaped lfts and ornamental scarlet frs., borne every year. It flowers when only a few feet high, and is suitable for pot culture.—Species 12. Australasia and the Pacific isls.

The chances are that most of the plants now known to the American trade as *D. oliviformis* are really *D. appendiculata* The true *D oliviformis* is said to have been offered by a few dealers as *Ptychosperma Rumphii*. *D. appendiculata* was described and figured by William Watson, in Garden and Forest, mistakenly as *D. oliviformis*, as explained in B.M. 7202 He adds, "Like all the palms of this section of the border, Drymophlœus requires a tropical moist house with abundance of water at all times." G C II. 24·394 The plant figured was about fourteen years old, 3 feet high, with leaves about 3 feet long. The plant takes about six months to mature its fruits.

appendiculàtus, Scheff. (*Arèca grácilis*, Giseke, not Roxbg or Thouars). St 6–10 ft · lvs terminal, 5–6 ft. long, arching: lfts 14–20, wedge-shaped, raggedly cut, serrate· spadix from between the lvs, short-stalked, about a foot long; the yellow buds and white fls make an attractive contrast at the flowering season (June) Moluccas, New Guinea B M. 7202 G F 4 331—The *D. oliviformis* of most dealers not of Martius.

D Moorèanus, Hort "An erect-growing palm with grayish green lvs"—*D oliviformis*, Mart., not the trade plant of that name, has narrower lfts than the above, and the fr. half immersed in the greatly enlarged perianth Jared G Smith. N Taylor †

DRYNÀRIA (Greek, *oak-like*) *Polypodiàceæ* Some 10 or more E Indian ferns, with round naked sori, as in Polypodium, but with a fine network of netted veins which are arranged in distinctly rectangular meshes The most distinctive feature is in the shape of the lvs which are either of 2 sorts, as in Platycerium, the cup lf having the shape of an oak lf, or the base of each lf is separately lobed and oak-like. **D. quercifòlia**, with 2 sorts of lvs, the spore-bearing 2–3 ft long, is the commonest species **D. rigídula,** Swartz (*D dwersifòlia*, R Br), a similar but larger species from the same region also appeared at one time in the American trade, but the species are seldom seen in cult in this country *D musæfòlia* is occasionally seen in fine collections, where it is grown for its striking simple foliage, which reminds one of the bird's nest fern (*Asplenium Nidus*). It is really a Polypodium, which see for description. R. C. Benedict †

DRYÓPTERIS (Greek, *oak-fern*). *Polypodiàceæ*. Wood-Fern. A widely distributed genus of handsome ferns with dissected foliage, the native species sometimes grown in the hardy border and the tropical kinds under glass.

Plants bearing round sori either naked or covered with heart-shaped or reniform indusia, which are fixed at the center or along the sinus· veins either wholly free or the lowest united.—Several hundred species have been referred to this genus. A considerable number of our common woods ferns belong to this genus. The species have been variously known under the names Lastrea, Aspidium, and Nephrodium. Other species sometimes referred to under this genus may be found under *Polystichum* and under *Lastrea*. For *D. acrostichoides*, see *Polystichum;* for *D. decurrens*, see

Tectaria. In N. Amer., known to many as *Aspidium.* For cult. see *Ferns.* Not the same as Doryopteris.

INDEX.

basilaris, 18.
Boottii, 13
Clintoniana, 7.
crenata, 19.
cristata, 7
dilatata, 12.
dissecta, 15.
effusa, 14.
Filix-mas, 9.
Fischeri, 3
Goldieana, 8
hirtipes, 1
intermedia, 12
marginalis, 10
noveboracensis, 2
Otaria, 16.
parasitica, 17.
patens, 6
philippinensis, 18.
simulata, 5.
spinulosa, 12
Thelypteris, 4.
viridescens, 11.

A. *Veins entirely free.*

B. *Pinnæ lobed less than one-third to midrib.*

1. **hirtipes,** Kuntze (*Nephròdium hirtipes*, Hook.). Lvs. rather rigid, 2–3 ft. long, 8–16 in. broad, on stalks clothed with dense black scales; pinnæ with broad, blunt lobes, the lower ones not reduced in size: sori medial on the lobes. India.

BB. *Pinnæ cleft nearly to midrib, or lvs. bipinnate or tripinnatifid.*

C. *Texture thin, membranous; veins simple or once forked.*

D. *Lower pinnæ gradually reduced to mere lobes.*

2. **noveboracénsis,** Gray (*Aspídium noveboracénse*, Swartz) NEW YORK FERN. Lvs somewhat clustered from creeping rootstocks, pale green, 1–2 ft. long, tapering both ways from the middle. Canada to N. C. and Ark

3. **Fischeri,** Kuntze (*Lastrèa opàca*, Mett.) Lvs 6–8 in. long, 2–3 in. wide, bipinnatifid, cut into close, entire lobes, the lowest much reduced; surfaces smooth. Brazil.

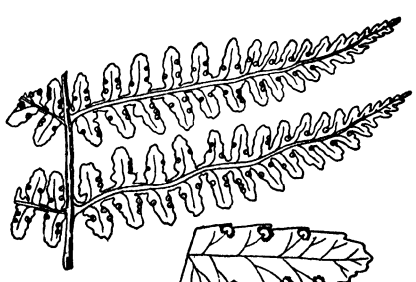
DD *Lower pinnæ scarcely smaller than those above.*

E. *Veins forked.*

4. **Thelýpteris,** Gray (*Aspídium Thelýpteris*, Swartz). MARSH FERN. Rootstock creeping: lvs scattered, clear green, 1–2 ft long; margins of the spore-bearing pinnæ often strongly convolute: sori 10–12 to each segm. Canada to Fla and Texas —A form with pinnæ variously forked at tip is known as *Pufferæ.*

EE. *Veins simple.*

5 **simulàta,** Davenp Rootstock creeping: lvs yellowish green, scattered, 8–20 in. long, 2–7 in wide, with 12–20 pairs of lanceolate pinnæ: sori rather large, somewhat distant, 4–10 to each segm. Native in N. Y. and New England, where it may be confused with *D. Thelypteris.* G.F. 9:485.



1363. Dryopteris marginalis. (Detail ×1)

6. **pàtens,** Kuntze. Lvs. clustered at the end of a thick rootstock, 2–3 ft. long, 4–10 in. wide, soft-hairy beneath; pinnæ cut three-fourths to the midrib, the basal segms. usually longer. Fla. to Texas and Calif. and Trop. Amer. A.G. 20:25.

CC. *Texture firm or subcoriaceous; veins 2–4 times forked.*

D. *Lvs. bipinnatifid or nearly bipinnate: indusia large, mostly flat.*

7. **cristàta,** Gray (*Aspídium cristàtum*, Swartz). Lvs. 1–2 ft. long, with short, triangular pinnæ 2–3 in., long, are much wider at base. Var. **Clintoniàna,** Underw (probably a distinct species), is larger, with pinnæ 4–6 in. long, and with the sori rather near the midvein. Canada to Ark.; also in N. Eu. —Hybrids are described with *D. marginalis* and other species. G.F. 9:445.

8 **Goldieàna,** Gray (*Aspídium Goldieànum*, Swartz). Lvs. growing in large crowns, 2–4 ft long, 12–18 in. wide, the pinnæ broadest at the middle: indusia very large. Canada to Ky.—One of our largest and most stately native species.



1364. Dryopteris parasitica. (×½)

DD. *Lvs. mostly bipinnate: indusia convex, rather firm.*

9. **Filix-más,** Schott (*Aspídium Filix-más*, Swartz) MALE FERN. Lvs growing in crowns, 1–3 ft long: sori near the midvein. Used as a vermifuge, as is also the next species. Eu., Canada and Colo.

10 **marginàlis,** Gray (*Aspídium marginàle*, Swartz) Fig 1363. Lvs 6 in to 2 ft. long, growing in crowns, mostly in rocky places: sori close to the margin Canada and southward — One of our commonest ferns, and gathered with *D. spinulosa intermedia* for use with cut-fls.

DDD. *Lvs. mostly tripinnatifid; segms. spinulose-toothed: indusia shriveling at maturity.*

E *Lf -stalks naked, polished.*

11. **viridéscens,** Kuntze. Lvs. 18–24 in. long, on stalks two-thirds as long; lower pinnæ largest: sori near the midribs. Japan.

EE *Lf -stalks scaly.*

12. **spinulòsa,** Kuntze (*Aspídium spinulòsum*, Swartz). Lvs. ovate-lanceolate, with a few pale, deciduous scales at the base. indusia smooth, without marginal glands. Var. **intermèdia,** Underwood. Lvs. evergreen, the scales more persistent, with brown centers, and the margins of the indusia with stalked glands. One of our commonest wood ferns in the northern states. Extensively gathered for use with cut-fls. Probably a distinct species Var. **dilatàta,** Underwood, has similar scales to the last and tripinnate lvs. In woods at altitudes of 1,500 ft. upward, from Canada to Ore.; also in Eu. Probably a distinct species.

13. **Boòttii,** Underwood (*Aspídium Boòttii*, Tuckm.). Lvs. elongate-lanceolate, with broadly oblong pinnules: indusia minutely glandular. Intermediate between *D. cristata* and *D intermedia.* Probably a hybrid. Canada, N. Y. and New England.

DDDD. *Lvs. ample, 4–6-pinnatifid.*

14. **effùsa,** Urban. Lvs. 3–4 ft. long, 2 ft or more wide, with polished stalks and from short, creeping rootstocks: sori abundant, scattered, often without indusia. Cuba to Brazil.

15. **dissécta,** Kuntze (*Lastrèa membranifòlia,* Hort.). Lvs 1–5 ft. long, 1–3 ft. wide, membranous, decompound; segms. broad and blunt; surfaces nearly naked: sori near the margin, abundant. India and Madagascar to Austral.

AA. *Veins not entirely free, the lower vernlets of adjoining segms. united.*

16 **Otària,** Kuntze (*Lastrèa aristàta,* Hort.). Lvs. 1 ft. long, with a long terminal pinna an inch or more wide, with lanceolate lobes, and 6–12 similar lateral pinnæ; texture thin, surfaces naked; veins united halfway from the midrib to the edge. Ceylon to the Philippines.—Good for table ferneries, but slow of growth.

17. **parasítica,** Kuntze (*Nephròdium mólle,* R. Br. *D. móllis,* Underwood, in preceding edition). Fig. 1364 Lvs. 1–2 ft. long, 8–12 in. wide, bipinnatifid, the pinnæ cut into blunt lobes, lower pinnæ distant from the others and somewhat shorter; surfaces finely villose. Tropical regions of both hemispheres.—Often grows as a weed in greenhouses.

18 **basilàris,** C. Chr. (*Nephròdium philippinénse,* Baker. *D. philippinénsis,* Underwood, in Cyclo. Amer Hort.). Lvs 2–3 ft long, 12–18 in wide, bipinnatifid, smooth, with a naked rachis; lower pinnæ scarcely smaller. sori midway from midrib to margin, with firm, smooth indusia Philippines

19. **crenàta,** Presl Lvs 1–2 ft. long, on stalks nearly as long, with a terminal pinnæ 6–8 in. long, often 2 in. wide, and 4–8 similar lateral pinnæ; margins bluntly lobed: sori near the main veins. Cuba and Mex. to Brazil.

L. M Underwood.
R. C. Benedict.†

DRYPÈTES (probably from Greek for *drupe,* from the character of the fruit). Guiana Plum. Whitewood. *Euphorbiàceæ* Tropical evergreen greenhouse shrubs. Glabrous· lvs. leathery, alternate, simple, mostly entire· fls. dicœcious, in axillary clusters or pistillate single, apetalous, staminate fls. with calyx imbricate and a rudimentary pistil; stigma broad, nearly sessile; pistil 1-celled, 2-ovuled.—About 10 species in Trop. Amer., 2 native in S. Fla. They do well in light loam. Prop. from cuttings in sand with heat **D. laterifìora,** Urban (*D cròcea,* Poit. *Schæffèria laterifìora,* Swartz), of W. India region, 6 ft. high, lvs elliptical, pointed, has been in cult.

J. B S Norton.

DUCHÉSNEA (A. N. Duchesne, monographer of Fragaria in 1766) *Rosàceæ.* Fragaria-like perennial trailing herbs, differing in the calyx being 5-parted and the lobes alternating with larger leafy 3–5-toothed bracts, the petals yellow, and the receptacle dry and spongy rather than becoming fleshy or pulpy as in the strawberry: lvs. ternate, with short-stalked lfts.: fls. solitary, on the runners; stamens 20–25, short.—Two species in S. Asia, one of which has run wild in this country, and is useful as a basket-plant and as a low ground-cover.

indica, Focke (*Fragària índica,* Andr.). Yellow Strawberry. A neat plant trailing close on the ground, with leafy runners, pubescent: lfts. rhombic-ovate, more or less petioled, coarsely crenate, obtuse: fls. about ¾in. across, on peduncles equaling or exceeding the lvs.: fr. usually less than ½in. diam., red, insipid. In waste grounds, N. Y., west and south.

L. H. B.

DUCKWEED: *Lemna.*

DUCKWHEAT: *Fagopyrum.*

DUDAIM MELON: *Cucumis.*

DÚDLEYA (named for the late Wm. R. Dudley, professor of botany in Stanford University). *Crassulàceæ.* Shortly caulescent or acaulescent perennials, with flat, linear to ovate, acute basal lvs.: fls. in short or elongated panicles, orange-yellow or red, rarely white: lvs. on flowering branches much shorter and relatively broader than the basal ones, sessile or clasping: corolla nearly cylindrical or slightly angled, the segms. united below the middle; stamens twice as many as the calyx-lobes: carpels erect, many-sided.—Some 60 species have been described, all from the west coast of N. Amer. None of them has proved very satisfactory as a bedding plant, and as a rule the species do not compare with the echeverias in horticultural value. The following species are described in this work under Cotyledon (p. 868):

D Cotyledon, Brit. & Rose, as *C. califórnica.*
D pulverulenta, Brit. & Rose, as *C. pulverulenta.*
D Purpusii, Brit. & Rose, as *C. Purpusii.*
D. lanceolata, Brit. & Rose, as *C. lanceolata.*

J. N. Rose.

DUGUÈTIA (named in honor of J. J. Duguet, who in 1731 wrote a work on plants). *Aberemòa,* R. E. Fries, not Aubl. *Annonàceæ.* A genus of Trop. American shrubs and trees, about two dozen species, differing



1365. Duguetia quitarensis. (Branch × ½)

from Annona in technical characters, particularly in imbricating petals and distinct angular rigid carpels becoming detached from the alveolate receptacle when mature, and usually with stellate-pubescent or scurfy indument. *D. lanceolàta,* St. Hil, the type of the genus, is a Brazilian tree. *D. quitarénsis,* Benth., Fig. 1365, with very similar fr which turns red when ripe, has recently been collected on the Isthmus of Panama by Henri Pittier; and *D. furfuràcea,* Benth. & Hook. f., a low plant with edible orange-colored fr. as large as an apple, in the province of Minas, Brazil, by Shamel, Popenoe, and Dorsett, of the Bureau of Plant Industry. From this genus must be separated *Fusæa longifolia,* Safford (*Annona longifolia,* Aubl.), the fr. of which is a solid globose syncarpium, and the outer circles of stamens sterile and petal-like, while the indument is composed of simple silky hairs. See *Fusæa.*

W. E. Safford.

DULÍCHIUM (old Latin name). *Cyperàceæ.* One perennial species, *D. arundinàceum*, Brit. (*D. spathàceum*, Pers), in E. N. Amer., which has been offered by collectors as a bog-plant. It is grass-like, with terete leafy culms which are hollow and unbranched, 2–3 ft. tall; it has linear flattened spikelets sessile in 2 ranks on peduncles that arise from the lf -sheaths. It is distributed in swamps about ponds from Newfoundland across the continent and to Fla. and Texas; of no special value.

DURÁNTA (after Castor Durantes, physician in Rome and botanist, died about 1590). *Verbenàceæ.* Tropical American woody plants, some of which are cultivated outdoors in Florida and California, and in a few northern greenhouses.

Shrubs or trees, glabrous or woolly, often armed with axillary spines: lvs. opposite or in whorls, entire or toothed: racemes long and terminal or short and axillary; fls. small, short-pedicelled in the axis of a small bract; corolla-limb of 5 spreading oblique or equal lobes, the tube usually curved, stamens 4, didynamous; calyx enlarging and inclosing the fr ; stigma 4-lobed. fr an 8-seeded juicy drupe.—Eight or 10 species, Mex , W. Indies, S. Amer., one reaching Key West

Plumièri, Jacq. (*D. spinòsa*, Linn. *D. inérmis*, Linn. *D. rèpens*, Linn *D Ellisia*, Jacq. *Ellisia acùta*, Linn.). Golden Dewdrop. A variable shrub or small tree, minutely pubescent or becoming glabrous: branches 4-angled: lvs obovate, oblong, ovate or elliptic, mostly entire, contracted into short petiole. fls. in panicled loose racemes; calyx-teeth subulate; corolla lilac, the limb less than ½in across, the lobes oblate; calyx yellowish, closed into a beak and covering the yellow drupe (which may reach about ½in diam). Key West, W. Indies, Mex., to Brazil. B M. 1759. B R. 244 —Branches either armed or unarmed. Attractive forms with white fls. and with variegated lvs. are reported in cult

Lorèntzii, Griseb. Spineless, the branchlets 4-angled: lvs small, coriaceous, ovate or elliptic, obtusish, strongly serrate toward apex, petioled: fls. in terminal interrupted racemes (white?); calyx tubular, 5-ribbed, short-toothed; corolla-tube exserted, cylindrical; corolla-limb unequally 5-parted, the lobes oval-orbicular; stamens included, didynamous: fr. a 2-pyrenous berry. Argentina, offered in S. Calif.

stenostàchya, Tod. Closely allied to *D. Plumieri* Spineless, to 15 ft. high, branchlets 4-angled: lvs. oblong-lanceolate, acuminate, serrate or entire, pubescent on the veins beneath, 3–8 in. long· fls lilac, less than ½in across, pendulous in slender racemes, 3–4 at the end of the branches, in fr. 6–12 in. long: fr. yellow, about ½in. across. Brazil. Offered in S. Calif.

L. H. B.

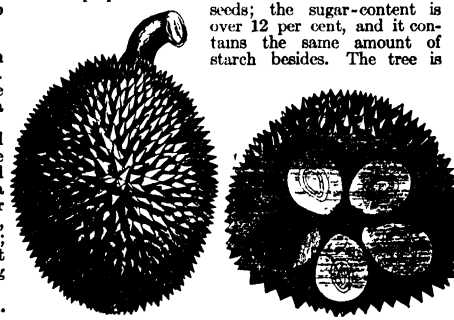
DURAZNILLO: *Jatropha.*

DÙRIO (from a Malayan vernacular). *Bombacàceæ.* Trees of the Indian archipelago and Malaysia, one of which yields the durian (*D. zibéthinus*, Linn.), a much-prized fruit of the East. Fig. 1366. There are probably a dozen other species of Durio, mostly Bornean and recently described.

The durian is a tall tree (to 80 ft.), with oblong acuminate entire lvs., colored and scaly beneath, pinnately veined, coriaceous: fls. large, whitish, in lateral cymes or fascicles; calyx bell-shaped, 5-lobed, subtended by an involucre; petals 3; staminal column divided above into many filaments in 4–6 groups, the anthers twisted; ovary 5-celled, each cell many-ovuled, bearing a long style with a capitate stigma: fr. ovoid or globular, often 10 in. long, very spiny, somewhat woody, mostly indehiscent, the large seeds and carpels surrounded by a firm cream-colored edible pulp. The fr. has a strong offensive odor.

The durian is discussed as follows by O. W. Barrett in the Philippine Agricultural Review:

"The durian has an odor that can be compared only to a mixture of old cheese and onions, flavored with turpentine; but those who eat it love it so dearly that the smell does not bother them. . . . The fruit weighs about five pounds, nearly one-third of which is edible pulp and about one-sixth of which is edible seeds; the sugar-content is over 12 per cent, and it contains the same amount of starch besides. The tree is magnificent and stately, and grows usually in open country, in the edges of forests, around native villages, and in clearings.—It can hardly be called a cultivated tree; at least, it is hardly ever grown in orchards, although on the other hand it could hardly hold its own in the real wild. Throughout Malaysia it is considered the most delicious fruit. Europeans, of course, generally revolt at the unpleasant odor; a fair proportion, however, of the foreign residents soon grow to relish the durian. Although it would not be wise, perhaps, for one unaccustomed to the fruit to eat a large quantity of the pulp at one sitting, there is apparently no substance in it that would cause indigestion or any other result than a rather unpleasant breath for a few hours after eating. The chemical body which is responsible for the very pronounced odor is probably one of the sulfur compounds with some base perhaps similar to that of butyric acid —Harvesting the durian is not unattended with danger, for soon after it becomes mature the heavy fruit falls, and occasionally kills or severely injures the unlucky individual underneath."



1366. The durian—Durio zibethinus. (×⅛)
(From an early representation of the fruit.)

The seeds are eaten roasted, and the unripe fruit boiled as a vegetable. The tree has been successfully introduced into Jamaica, but is not in general cultivation in that island.

The specific name, *zibethinus*, is said to be derived from the practice of using the decomposed fruit as a bait for the civet-cat or zibet Fig 1366 is reduced from Vol 7 of the Trans of the Linn Soc , 1804, illustrating Konig's historic account of the fruit.

L. H. B.

DUSTY MILLER: *Lychnis Coronaria;* also species of *Centaurea* and *Senecio.*

DUTCHMAN'S BREECHES: *Dicentra Cucullaria.*

DUTCHMAN'S PIPE: *Aristolochia.*

DUVÀLIA (for Duval, an early botanist). *Asclepiadàceæ.* About 20 succulent very dwarf leafless herbs, mostly of S Afr , rarely seen in cult.: sts. decumbent or erect, sometimes subterranean and with the tips appearing above the surface, 4–6-angled and with spreading teeth, each of which bears a minute rudimentary lf.: fls. solitary or in small clusters or cymes, usually borne near the middle of the young sts.; corolla rotate, deeply 5-lobed, with a cushion-like ring around the outer corona and supporting it; corolla-lobes linear-

lanceolate to ovate, folded longitudinally backward; corona double, from near the top of the staminal column, the outer one flat and entire and angled, the inner one with turgid more or less pointed lobes; stamens affixed in the base of the corolla, united into a tube around the ovary: fr. erect smooth follicles. Cult. of Stapelia and similar succulents. The species are essentially fancier's plants and apparently not in the trade.

DUVERNÒIA (J. G. Duvernoy, pupil of Tournefort, or G. L. Duvernoy, of Strassburg, writer on natural history). *Acanthàceæ*. By some authors united with Adhatoda, which genus is by some included in Justicia. The genus comprises 15 or more herbs or shrubs: fls. single or in short spikes; calyx short, 4-toothed, the back lobe toothed or parted; corolla-tube short; limb labiate, the upper lip helmet-shaped and 2-toothed, the lower lip flat The species seem not to be in the trade, although *D. Dewévrei*, DeWild, has been cult. in Belgium: it is a tufted herb, about 2 ft. high: lvs. oblong, petiolate: fls. paniculate; upper lip of corolla white with red stripes and the lower greenish white; corolla about ½in. long. Congo.

DWARFING. Dwarf plants are those that never attain the height or size of the usual or representative individuals of the species Some dwarfs are "natural," being represented by varieties of prevailingly small size; and these varieties usually reproduce more or less true from seed or cuttings Thus there are dwarf petunias, lobelias, asters, cannas, peas, beans. Such dwarfing comes within the field of breeding

The "artificial" dwarfs are produced by more or less arbitrary manipulation, as by grafting on stocks of small growth, heading-in the top or the root or both, by confining the roots, by withholding food and water, and by various forms of contortion and constriction.

Plants are dwarfed to keep them within bounds in small areas, to increase flower-bearing and fruit-bearing in proportion to the size of the subject, to bring all parts within reach and control, to express the skill and satisfy the conceit of the gardener, and to extend the range of interesting plant forms; and plants may be adapted to adverse soils or conditions by grafting on hardy or more reliable roots that may chance to have a dwarfing tendency. Dwarf plants are very useful in flower-gardens and in landscape work. The picturesque dwarfs of the Japanese type are amongst the most curious of plant forms.

The Japanese practice of dwarfing. Figs. 1367, 1368.

The art of dwarfing trees has been long practised among the Japanese gardeners. Some trees are more adapted for this purpose than others The following have been considered to be most suitable:

Chamæcyparis obtusa	Acer trifidum.
Pinus pentaphylla.	Styrax japonica.
Pinus parviflora	Lagerstræmia indica.
Pinus Thunbergii.	Punica Granatum.
Pinus densiflora	Trachycarpus excelsa.
Larix leptolepis	Rhapis flabelliformis.
Juniperus rigida.	Rhapis humilis
Juniperus chinensis var. procumbens	Zelkowa acuminata.
	Millettia japonica.
Podocarpus chinensis.	Wistaria floribunda.
Podocarpus Nageia.	Wistaria brachybotrys.
Tsuga Sieboldii	Prunus Mume
Tsuga diversifolia.	Evonymus alata.
Cryptomeria japonica	Cycas revoluta.
Acer palmatum	

Various species of Japanese flowering cherries, ivies, bamboos, fruit trees, etc.

Before entering into a discussion of dwarfed trees, one should have a clear understanding between the "bonsai" or artistic plant and the "hachiuye" or ordinary potted plant.

There are two styles in which the "bonsai" is presented, one is the planting of one or more tiny trees of picturesque form in an artistic shallow pot; and the other is the representing of a part of a miniature garden or forest embracing trees, shrubs, grasses, mosses, rocks, and ponds. The former is simply an improved or modified potted plant, whereas the latter exhibits an imaginary scene, so that one might feel by glancing upon the pot in a little Japanese chamber as if he were at that moment strolling in such a garden or wandering within forest. A little piece of stone gives an idea of Mt. Fuji, and a drop of water the surface of the Japan Sea We often suspect the tree, covered with mossed bark, of not more than ½ foot in height, would reach the cloud, or it might suggest a wintry landscape brought in amidst scorching summer days to release a man from heat.



1367 Japanese dwarf tree.

The success in raising a valuable "bonsai" depends entirely on the skill of dwarfing the trees, and it requires a long experience Remember always what the home of the plant was, and treat it according to its habitat In other words, climate, soil, environment, nourishment, and all other circumstances of its original state should accompany the tree; and the degree of humidity, both in the air and ground, is of prime importance in the dwarfing process. Some have the erroneous notion that the dwarfing is accomplished merely by bending the tree unnaturally The roots are confined to check growth, without making other alteration. The shape and size of the branches or leaves are affected by the firmness of the earth, the way of watering, the kinds of fertilizer, and the degree of sunshine Between the leaves there should be ample air and frequent sunshine. Some plants need only slight moisture, and others much. Too wet is worse than too dry Many are thoughtless in giving water, not considering the condition of the soil. Judicious watering is one of the first requisites to success. For example, after being placed on balconies or terraces in the daytime, the potted plants should be exposed outdoors during the night, if not stormy. Japanese gardeners use many different fertilizers in accordance with the time of growth, kind of plant, and purposes (i.e., whether for branches or leaves, for flowers or fruits), some of them being: oil-cake, bone-meal, tankage, clam-shells, barnmanures, night-soil, wine lees, tea dregs, cow's milk, rice-bran, fish refuse, iron-rust, and others.



1368. Training a branch.

Plants both of "bonsai" and "hachiuye" dwarfs should be repotted every two or three years, in order to destroy the old fibrous roots, and to give a chance for new ones. Otherwise, trees are deprived from taking any nourishment, and will soon die. This practice is to be done in February or March, when the aim of dwarfing is completed; whereas the pruning is to be between April and June, to secure more or even larger flowers

Pine.—This is one of the most difficult plants to be treated as a dwarfed tree, although it will hardly result in failure, if taken direct from the mountain or seashore while new young needles are steadily growing. Pines that have suffered through various difficult

weather are preferred. About half a year previous to removal, a ditch should be made around the plant. In removing, the main root should be carefully cut off by scissors, leaving its end downward to avoid the resin from accumulating, which otherwise might destroy the tree. For different shapes, the branches are to be twisted to and fro, as shown in the cut (Fig. 1368); bind the part with hemp-palm rope, and pull it moderately toward the trunk with a cord. The special nature of this tree is to dislike the humid earth. Having no pleasing flower or fruit, the pine must exhibit merit in the arrangement of needles or the color of the bark The best time to transplant is in autumn. For fertilizers, one may use oil-cake or a bone-meal.

Mume (*Prunus Mume*) —This is different from the Japanese flowering cherry; the beauty of the flower should accompany the picturesque form of the tree itself. The age of the tree is highly regarded. Slender branches as well as grotesque trunks with mossy bark are usually chosen Hence, all dwarfed Mume plants are raised by grafting The potting of Mume may take place as soon as the flowers have fallen. The pot is to be kept in shade at least one month, the earth having been thoroughly pressed. To have more flowers, the old roots are destroyed, and the branches cut, leaving a few branchlets Potted Mume is fertilized with thin liquid manure, oil-cakes or occasionally cow's milk, between December and February

Pomegranate —In this plant, the portion of the roots which is close to the main trunk may be exposed to the air. As a dwarfed tree, pomegranate is enjoyed both for fruits and flowers All new sprouts are to be pinched off, other than those that will produce flowers Until the fruits have grown larger, one should wait for manuring. For flowers, oil-cake, tankage, or bone-meal are used; for fruits a light fertilizer is used.

Bamboos —Choose one of the most proper kinds and keep it in a pot for two or three years Then wait upon several shoots coming up One year after this, these new bamboos are transferred into other pots. The practice needs much patience and great skill, and it would hardly pay, knowing that the prime age of bamboo is only for four or five years. ISSA TANIMURA.

Dwarf fruit trees.

Generally speaking, dwarf trees are those which by various means are made to remain smaller than normal trees of the same species or variety Three means are in common use in dwarfing trees· by growing on dwarfing stocks, restricting the root run, and by pruning to check or suppress the growth of the top Horticulturally speaking, and particularly as the term is applied to fruit trees, dwarf trees are those which are grown on dwarfing stocks A discussion of dwarf fruit trees is, then, most largely concerned with dwarfing stocks

Dwarfing stocks are not modern innovations. For at least three centuries, various stocks have been used to dwarf apples, pears, plums, cherries and quinces. In fact, dwarf fruit trees were quite as common, or even more so, in Europe a century ago than they are at present They have been grown in America, at least dwarf apples and pears, for nearly a century, during which time in recurring periods they have received much attention from fruit-growers. There is in horticultural literature much data, which, while fragmentary, is still substantial, to guide us in the use of dwarfing stocks and to indicate the value of dwarf fruit trees

The action of dwarfing stocks is readily explained after a statement of what stocks are. A dwarfing stock is always a smaller, a weaker, or a slower-growing variety or species than the tree to be propagated on it. The top conforms to the roots chiefly because of the inability of the latter to furnish sufficient nutrition. The tree is dwarfed through starvation. Other than in size the trees are little or not at all affected, although minor changes in the fruit and in the bearing habit are supposed to be brought about by dwarfing.

Dwarf fruit trees are propagated by the same methods employed in growing standard trees with preference given to budding dwarfing stocks, whereas standard trees are still largely propagated by grafting Propagators hold that a better union can be obtained by budding than by grafting, and since it is always difficult to secure a good union between plants as widely divergent as stock and cion in a dwarf tree must of necessity be, budding should have the preference of the two methods. In fact the chief problem in growing dwarf fruit trees is to find a stock with which the larger growing cion can easily be worked and with expectations of a close and permanent union. This brings us to the matter of stocks for the several fruits

Dwarf apples are commonly grown on two stocks—the Paradise and the Doucin Both of these, it must be understood, are class names, there being in the literature a dozen or more varieties of Paradise and about as many of the Doucin. Carefully compared, the many kinds in use can be reduced to the French Paradise (Pommier du Paradis), English Paradise, and the Dutch Paradise for the first class, while the Doucin stocks may be grouped under the Doucin, the English Broad-leaved and the English Nonsouch. There is much confusion in the names of dwarf apple stock in nurseries and the grower will be fortunate if he gets what he calls for. Of these two classes, the Paradise stocks make the dwarfer plants and should be used for trees to be kept as true dwarfs and for all that are to be trained in fancy forms. The Douchin stocks are the better for free-growing trees.

Pears are dwarfed by growing on quince roots. Any quince may be used, but the Angers, upon which quinces are commonly propagated, is the best dwarfing stock for the pear. Comparatively few pears can be successfully worked on quince roots because stock and cion do not make a good union. This antipathy is obviated by budding the quince with a pear which unites readily; the next year the untractable variety is budded on the more amenable variety, the resulting tree being thus pear on quince, followed by pear on pear—the "double-working" of nurserymen.

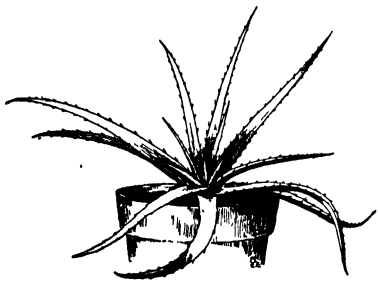
There is no question but that the Mahaleb is a dwarfing stock for the cherry, and in Europe, where it has long been used, it is always regarded as such. In America, where the Mahaleb in the last quarter century has all but superseded the Mazzard, a free-growing stock, it is not so commonly known that there is a difference in the size of trees on the two stocks. It must not be understood that the Mahaleb stock gives a true dwarf cherry, but it has a very decided dwarfing effect on either sweet or sour cherries.

Stocks for plums have not been well tested—a statement that holds for all stone fruits It is very certain, however, that varieties of *Prunus insititia*, as the Damsons or the St. Julien, the latter one of the best of all plums for a stock, have a dwarfing effect on the varieties of the larger-growing trees of *P. domestica*, as do also several of our free-growing native species, among which *P americana* may be recommended for cold climates. For true dwarf trees, however, the only stocks that give promise are the dwarf natives, of which *P. pumila* and *P. Besseyi* have been found to unite readily with several varieties each of either the Domestica or Triflora plums, and to make very good dwarfing stocks for them

Peaches, apricots and nectarines are dwarfed by budding on *P. cerasifera*, *P insititia* and *P americana*. It is probable that all of these fruits, and the cherry as well, can be grown on *P. pumila* and *P. Besseyi* as true dwarfs, several experiments having demonstrated that good unions form between the peach, at least, and these dwarf sand cherries. As to whether the union

would be sufficiently permanent to make the trees so obtained worth while, remains to be seen.

The great advantage of a dwarf tree is its small size, which permits the planting of more varieties of a fruit in a small space. Dwarf fruits, then, deserve, in particular, the consideration of amateur fruit-growers and of those who want small-growing fillers for permanent orchards. Trees of small size are easier to prune, spray, and to care for in every way. Because of the low stature and compact head of the dwarfs, wind causes less injury to trees and crops.



1369. Dyckia rariflora.

Another very material advantage of the dwarfs is that they come into bearing earlier than the standards. The desirability of early bearing from several standpoints is obvious. Advocates of dwarf fruits very generally assert that the fruit from the dwarf trees is of higher quality, higher color and better flavor. As a generalization, this is not true, though it probably is true for a few varieties of each of the several fruits under consideration. Tests of many varieties of apples on dwarf and standard stocks on the grounds of the New York Agricultural Experiment Station show that more often the fruit from standard trees is the better. Pear-growers have found that comparatively few varieties of this fruit are improved in the qualities named by growing as dwarfs. Size, color and quality of fruit are as likely to be affected deleteriously as beneficially by dwarfing

Dwarf stocks are much used to adapt varieties to soils. This is the chief value of most of the propagating plants named for the stone-fruits. The true purpose of such stocks must be clearly kept in mind —the dwarfing in this case is a disadvantage attendant upon the use of the stock for another purpose.

The disadvantages of dwarfing stocks, in America at least, are rather more pronounced than their advantages. They may be summed up as follows: Nearly all dwarf trees are shorter-lived than standards—the exceptions are very few. All dwarf trees, whether trained in fancy forms or free-growing, need more care than standard trees. The chief items needing extra care are pruning, tilling and fertilizing. It is more difficult to propagate dwarf trees and the cost of the plants is therefore greater, making the cost an acre, with the increased number of trees, much greater. Lastly, it is most difficult to secure trees, especially of apples, on dwarfing stocks that are known to be true to name.

In conclusion, it may be said that we have just passed through one of the recurring periods of interest in dwarf trees in America and that commercial fruit-growers are more than ever convinced that for the present, at least, dwarf trees are of little value to them. The place of these trees is in gardens of amateurs and on the estates of those who can afford to grow and train them for their beauty as well as for their fruit. There is, however, a possible future for dwarf fruits in commerical plantations, when the refinements of horticulture have been carried far enough to show the special adaptations of varieties of the several fruits to different stocks and when the care of dwarf trees is better understood.

U. P. Hedrick.

DÝCKIA (after Prince Salm-Dyck, German botanist, and author of a great work on succulent plants). *Bromeliàceæ*. Succulents, grown under glass and in the open far South.

Dyckias somewhat resemble century plants, but with smaller spines, as a rule, and flowering regularly. They are usually stemless, and the lvs. form dense rosettes. —About 60 species in S Amer. For cult., see *Agave*. They are rarely cult. in Fla. and Calif., and in a few northern collections. Following have showy yellow fls.

A. *Infl. amply branched or panicled.*

altíssima, Lindl. (*D. princeps*, Lem.). Lvs spiny at the margin: floral bracts small, all manifestly shorter than the fls. Brazil.

AA. *Infl. not branched, a raceme or spike.*

B. *Filaments forming a tube. fls. with scarcely any pedicel.*

rariflòra, Schult. Fig. 1369. Lvs. with small spines on the margin, shorter than in *D. altissima* sepals not emarginate at the apex. upper sheaths of the scape shorter than internodes. Brazil. B M. 3449 B.R 1782

BB. *Filaments not forming a tube all the way fls with a short but conspicuous pedicel.*

sulphùrea, C. Koch, not Baker Lvs with small spines at the margin: sheaths of the scape longer than the internodes, the higher ones entire bracts lanceolate, the lowest conspicuously longer than the pedicelled fls. blades of petals wide and longer than stamens. Brazil.

Wilhelm Miller.

DÝPSIS (obscure name). *Palmàceæ*, tribe *Arèceæ*. Madagascar palms that have been poorly described, are little known and of scarcely any horticultural significance. They are all small, unarmed palms, with reed-like sts.: lvs. terminal, entire, bifid at the apex or pinnatisect; segms. split at the apex or irregularly tooth[1], the apical one confluent; sheath short. spadices lon. loosely fld.: fr. small, oblong or ovoid, straight o. curved, oblique at base.—Perhaps half a dozen species.

No species of Dypsis are common in cultivation, as they possess but little beauty. They are among the easiest and quickest to germinate. All of them require a stove temperature. *D. madagascariénsis*, Nichols. is also known as *Areca madagascariénsis*, Mart., and is so treated here. *D. pinnatifrons*, Mart. (*A. gracilis*, Thouars), is one of several plants that have been known as *Areca gracilis* It is a pretty palm, now grown in large quantities by some dealers. G.C. II. 24:394. The genus is closely related to Chamædorea.

N. Taylor.†

DYSCHORÍSTE (name refers to the scarcely divided or lobed stigma). Incl. *Calóphanes*. *Acanthàceæ*. Fifty or more annuals or perennials of the tropics of Amer., Afr., and Asia, allied to Ruellia and Strobilanthes. None of them is apparently in regular cult. They are plants with opposite mostly entire small lvs and blue or pale fls in short-stalked cymes. *D. nobilior*, C. B. Clarke (*D. Hildebrandtii*, Lind.), is a free-flowering shrub, with a penetrating odor, and hairy branches: lvs elliptic, nearly 2 in. long, slightly crenulate: fls. purple-blue in many distant and dense axillary cymes; corolla less than ½in. long. Brit. Cent. Afr.; recently cult. at Kew.

E

EARTH-NUT, EARTH-PEA. Little-used names for the peanut, goober or pinder, *Arachis hypogæa*. The words earth-nut and ground-nut are used for many subterranean tubers, without much discrimination, and therefore they have small value as vernaculars. They may be applied to the underground tubers of *Apios tuberosa*, *Panax trifolium*, *Erigenia bulbosa*, *Cyperus esculentus*, and others Earth-apple, earth-gall and similar variants are in use for various plants.

EATÒNIA: *Sphenopholis*

ÉBENUS (Greek name for the ebony). *Leguminòsæ*. About 15 species of silky-hairy herbs or sub-shrubs, of the eastern Medit region and eastward to Beluchistan, allied to Onobrychis, sometimes planted in borders but apparently not offered in this country Fls reddish or purplish, papilionaceous, in dense axillary long-peduncled spikes; standard obovate or obcordate, narrowed to base; wings short or minute; keel about equaling the standard, the apex obtuse and oblique; calyx-lobes subulate and plumose. pod obovate or oblong, compressed, included in the calyx-tube, indehiscent, 1- or 2-seeded lvs odd-pinnate or some of them somewhat digitately 3-foliolate or even simple *E crética*, Linn , is shrubby with lvs. usually of 5 (sometimes 3) lfts , and reddish purple fls. in ovate-cylindrical spikes Crete B M 1092 (as *Anthyllis cretica*) *E Sibthorpii*, DC , is herbaceous, with more lfts , and purplish fls in spherical spikes

This genus has no relation to the ebony, which is of the genus Diospyros (particularly *D Ebenum*)

EBONY: *Diospyros Ebenum*

ECBÁLLIUM (Greek, *to throw out*). *Cucurbitàceæ*. SQUIRTING CUCUMBER. A perennial trailing vine, easily grown as an annual in any garden, cultivated for its explosive fruits

When ripe, the oblong prickly fr squirts its seeds at the slightest touch, or sometimes at the mere vibration of the ground made by a person walking by Some of the old herbalists called this plant *Cucumis asininus* Another curious fact about the plant is that a powerful cathartic is made from the juice of the fr., which has been known for many centuries. A preparation of it is still sold in the drugstores as *Trituratio Elaterini* The drug "elaterium" is derived from the juice of the fr Eceballium has only 1 species, and is closely related to the important genera Cucumis and Citrullus. With them it differs from Momordica in lacking the 2 or 3 scales which close the bottom of the calyx Other generic characters are: prostrate herb, fleshy, rough hairy: lvs. heart-shaped, more or less 3-lobed. tendrils wanting· fls. yellow, the staminate in racemes, pistillate usually from the same axils with the staminate fls , calyx 5-cut. It is a native of the middle and eastern Medit. regions, especially in rich moist forests

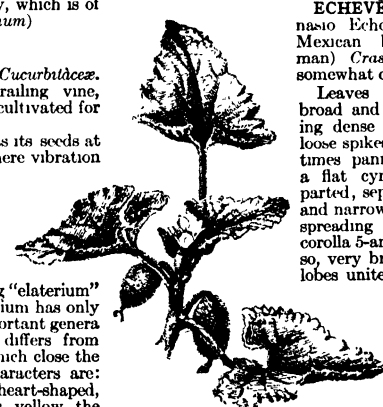
Elatèrium, A. Rich (*Elatèrium cordifòlium*, Moench. *Momórdica Elatèrium*, Linn). SQUIRTING CUCUMBER. Fig. 1370. Described above; grown in this country as a curiosity. B.M. 1914. WILHELM MILLER

ECCREMOCÁRPUS (Greek, *pendent fruit*). *Bignoniàceæ*. An attractive half-hardy tendril-climber.

Shrubs, but grown as annuals in the N , tall climbing: lvs. opposite, 2-parted or -pinnate: fls yellow, scarlet or orange, mostly racemose; calyx campanulate, 5-parted; corolla-tube elongated; limb more or less 2-lipped or in *E. scaber* small and nearly entire; stamens 4, didynamous, included, disk annular. fr. an ovate or elliptic loculicidal 1-celled caps.—Three or 4 species of tall somewhat woody plants from Peru and Chile, climbing by branched tendrils at the end of the twice-pinnate lvs., and having very distinct fls of somewhat tubular shape, which are colored yellow, orange or scarlet.

Eccremocarpus has two sections, in one of which the corollas are cylindrical, but in the section Calampelis, to which *E. scaber* belongs, the corolla has a joint at a short distance beyond the calyx, then swells out on the under side, and suddenly constricts into a neck before it reaches the small circular mouth, surrounded by five very short rounded lobes.

scàber, Ruiz & Pav (*Calàmpelis scàber*, D. Don). About 10 ft. high. lvs bipinnate; lfts. obliquely cordate, entire or serrate: fls. 1 in. long, orange, in racemes. July, Aug Chile. B R 939. B.M. 6408. Var **coccíneus,** Hort , has scarlet fls. Var. **aûreus,** Hort , has fls bright golden yellow Var. **carmíneus,** Hort , has fls. carmine-red.—*E. scaber* is hardy in the southern parts of the U. S., and makes a most attractive perennial woody subject. It is also satisfactory in the open in the N if given a warm exposure, blooming readily from seed the first year. L. H. B.†



1370. Echallium Elaterium (×½)

ECHEVÈRIA (named for Atanasio Echeverria, an excellent Mexican botanical draughtsman) *Crassulàceæ* Stemless or somewhat caulescent succulents.

Leaves fleshy, but usually broad and flat, commonly making dense rosettes: fls borne in loose spikes or racemes or sometimes paniculate, but never in a flat cyme, calyx deeply 5-parted, sepals usually elongated and narrow, unequal, commonly spreading but sometimes erect; corolla 5-angled, usually strongly so, very broad at base; stigma-lobes united below, very thick and nerveless, erect but often spreading at tip; stamens 10, 5 attached near the middle of the petals, the other 5 either free or attached lower down on the corolla: carpels 5, erect; ovules and seeds many.—More than 60 species of this genus have been described. Most of them have been in cult. in Washington and at the New York Botanical Garden, although but few are in the trade. It is confined almost entirely to Mex., one species extending into the mountains of W. Texas, and one or two species extending into Cent. Amer. Many of the species are valuable for flat bedding on account of their compact rosettes and highly colored foliage. For cultural notes, see *Cotyledon* (with which it has been united by many authors).

INDEX.

amœna, 1.
atropurpurea, 9.
campanulata, 25.
carnicolor, 12
coccinea, 4
elegans, 17
fulgens, 24
gibbiflora, 26.
glauca, 19
linguæfolia, 6.
lurida, 10
maculata, 13.
metallica, 26
microcalyx, 2.
mucronata, 3
Peacockii, 15
Pringlei, 8.
pubescens, 5.
pulvinata, 7.
Purpusii, 2
racemosa, 11.
rubromarginata, 21.
sanguinea, 9.
Scheeri, 23.
secunda, 20.
setosa, 14
simulans, 18.
subrigida, 22.
subsessilis, 16.

A. *Sepals orbicular, very small, obtuse.*

B. *Corolla twice as long as thick; sepals appressed.*

1. **amœna,** De Smet. Nearly stemless, with numerous offshoots. lvs in small but dense rosettes: flowering branches slender, 4–8 in long; fls. 1–8, in slender racemes; corolla red, 4–5 lines long Native of Mex. —This species was intro into cult. nearly 40 years ago.

BB *Corolla little longer than thick; sepals not appressed.*

2 **microcàlyx,** Brit & Rose (*E Púrpusii*, Brit). Shortly caulescent, sometimes 1 ft high: corolla yellow-pink, 4 lines long Native of Mex.

AA *Sepals linear to ovate.*

B. *Fls. axillary, arranged in loose spikes or racemes.*

C. *The fls in spikes*

D *Plant not caulescent, glabrous throughout.*

3 **mucronàta,** Schlecht. Caulescent, glabrous throughout. basal lvs in a dense rosette 4–8 in long: fls. sessile; corolla 1 in or more long, reddish tinged with yellow E Mex.

DD. *Plant caulescent, pubescent throughout.*

4 **coccínea,** DC (*Cotylèdon coccínea*, Cav.). St. 1–2 ft high, finely grayish pubescent lvs oblanceolate, largest 8–9 in long infl a spike of 15–25 fls. Common in Cent Mex Page 870.

5 **pubéscens,** Schlecht (*Cotylèdon pubéscens*, Baker). A similar species is sometimes cult., with obovate-spatulate lvs

CC. *The fls. in racemes.*

D. *Species caulescent.*

E. *Infl compound below, corolla pale.*

6. **linguæfòlia,** Lem Sts. 1 ft. or more high, very leafy: lvs thick, fleshy, green, nearly terete at base: flowering branches long and drooping, each consisting of a simple raceme. fls. cream-colored Mex.—This species has long been in cult., and has not been collected wild in recent years. It is so very different from the other echeverias of Mex. that we are led to suspect that it may be of hybrid origin.

EE *Infl. simple throughout; corolla bright-colored.*

F. *Plant pubescent throughout.*

7. **pulvinàta,** Rose (*Cotylèdon pulvinàta*, Hook.). Sts. 4–6 in. high, somewhat branching, becoming naked below. young branches, lvs and sepals covered with a velvety pubescence: lvs. clustered in rosettes at the top branches, about 1 in. long, very thick. fls. in a leafy raceme; corolla scarlet, sharply 5-angled. Mex.—This is a very distinct echeveria, with a remarkable pubescence.

8. **Pringlei,** Rose (*Cotylèdon Pringlei*, Wats.). This is perhaps nearest *E. pulvinata*, although not so pubescent nor so attractive a plant

FF. *Plant glabrous throughout.*

9. **atropurpùrea,** Baker (*Cotylèdon atropurpùrea*, Baker. *E sanguínea*, Morr.). Sts. 4–8 in. high, glabrous throughout: lvs aggregated at the top of the st. in a dense rosette, usually dark purple above, somewhat glaucous: flowering branches elongated; sepals somewhat unequal; corolla bright red, strongly angled. Probably native of Mex., but known only from cult. specimens. Page 870.

DD. *Species not caulescent.*

10. **lûrida,** Haw. (*Cotylèdon lùrida*, Baker). Plants stemless, glabrous and glaucous throughout: lvs. forming a flat, rather open rosette, narrowly oblong, 2–4 in long, acute, tinged with purple, especially when old: flowering branches 12–32-fld.; sepals thick, spreading or even reflexed; corolla bright red. Known only from garden material, but undoubtedly from Mex. B.R. 27:1.

11. **racemòsa,** Schlecht. & Cham. This is similar to *E. lurida*, and was considered by Baker to be a synonym; but they are here kept distinct. The material of *E. racemosa* now in cult. was secured at the type locality of the species, Jalapa, Mex.

12. **carnícolor,** Morr. (*Cotylèdon carnícolor*, Baker). Another somewhat similar species, but with only 6–8 fls. It is known only from garden specimens.

13. **maculàta,** Rose. This belongs also to this alliance, but grows at higher localities in Mex., and has brighter green lvs. It ought to live throughout the year in our southern gardens.

BB *Fls. terminal, arranged in secund spikes or racemes, either simple or compound.*

C. *Infl. a simple raceme.*

D. *Plant hairy throughout.*

14. **setòsa,** Rose & Purpus Plants stemless, giving out offsets from the base: lvs often 100 or more, forming a dense, almost globular, rosette, thickish but flattened, about 2 in. long, covered on both sides with setiform hairs infl usually a simple secund raceme with 8–10 fls.; petals red at base, yellow at tip, setose without Contr Nat Herb 13 pl 10 —A very peculiar species, recently collected by C A. Purpus in Puebla, Mex.

DD. *Plant glabrous throughout.*

E. *The fls sessile.*

15. **Pèacockii,** Croucher (*Cotylèdon Pèacockii*, Baker). Stemless· lvs about 50 in a close rosette, obovate, spatulate, white-glaucous, slightly red toward the tip, faintly keeled on the back. flowering branches forming a scorpioid spike; corolla bright red, 6 lines long. It is doubtless of Mexican origin, although often reported as from New Mex. or Calif. Page 870.

EE. *The fls pedicelled.*

F *Lower pedicels short.*

16. **subséssilis,** Rose. This is very similar to *E. Peacockii*, but has shortly pedicelled fls. It is a very beautiful species, well suited for flat bedding. Native of Cent. Mex.

FF. *Lower pedicels elongated.*

G. *Lvs. very turgid.*

17. **élegans,** Rose. Stemless: lvs. numerous, sometimes 80–100 in cult. specimens, forming very compact rosettes, very glaucous, pale bluish green, very turgid, with translucent margins, these sometimes reddish: flowering branches pinkish, with 8–12 lvs ; fls in a succulent raceme; corolla 5 lines long, its segms. distinct nearly to the base, pinkish with yellow spreading tips.—Known only from material collected near Pachuca, Mex., by J. N. Rose This is one of the most beautiful species of the genus, and is well suited for rockeries or for use in flat bedding. This is not to be confused with *Cotyledon elegans*, N. E. Br., which is *Oliveranthus elegans*.

18. **símulans,** Rose. A similar species with somewhat different habit and lvs., and with slightly different corolla; sepals appressed rather than spreading.

GG. *Lvs. not turgid.*

H. *The lvs. glaucous green.*

19. **glaûca,** Baker (*Cotylèdon glaùca*, Baker). Stemless: lvs. in small but dense rosettes, nearly orbicular,

broadened just above the apex, almost truncate, but with a decidedly purple mucro, very pale, slightly glaucous: fls. 15–20 in a small secund raceme. Cent. Mex.—Often confused with *E. secunda*, but apparently specifically distinct. Page 870.

HH. *The lvs. with reddish margins.*

20. **secúnda,** Booth (*Cotylèdon secúnda*, Baker). Fig 1083. Stemless, glabrous: lvs numerous, inclined to be erect, forming a dense rosette, bluish green, ovate-cuneate, broad at margin and more or less reddish: fls. 12–15 in a secund raceme. Mex. Page 870.

CC. *Infl. a compound raceme.*

D. *Plants acaulescent.*

E. *Sepals widely spreading.*

21. **rubromarginàta,** Rose Stemless or sometimes with a short st.: lvs comparatively few, stiff, ascending, glabrous, glaucous, with a somewhat crenulate, red margin: flowering sts. sometimes a foot high, more or less paniculate. Mex.

EE. *Sepals erect and closely appressed to the corolla*

22. **subrígida,** Rose (*Cotylèdon subrígida*, Rob. & Seaton). Stemless, glaucous throughout lvs. in a dense rosette, flat, acute, very glaucous, bluish green, tinged with purple, the margins of young ones bright scarlet Mex.—This is one of the most beautiful of all the echeverias. It is especially suitable for growing in clusters.

DD *Plants caulescent.*

E. *Shape of lvs acute.*

F. *Lvs. tapering into a long narrow stalk.*

23. **Scheèrii,** Lindl (*Cotylèdon Scheèrii*, Baker). Sts. sometimes 2 ft. tall, or more often branched, glabrous, and somewhat glaucous: infl a few-branched panicle, petals red or tinged with yellow, thick, erect or spreading at tip. Undoubtedly Mex, but known only from cult material. B R 31.27. Page 870.

FF. *Lvs. somewhat narrowed downward, but with a broad base.*

24. **fúlgens,** Lem. (*Cotylèdon fúlgens*, Baker). Sts. usually 4–8 in high, glabrous throughout: lvs few in each rosette. infl paniculate; corolla strongly 5-angled, coral-red without, yellowish within. Mex. Page 870.

EE *Shape of lvs. obtuse*

F. *Lvs. rounded on the face.*

25 **campanulàta,** Kunze Short, caulescent, the branches crowned by rosettes of large lvs : lvs. spatulate, tapering into thick petioles, very glaucous, obtuse at apex. petals thick, reddish without, yellowish within, somewhat spreading at tip. Mex. B R 1247 (as *E. gibbiflora*).—It is said to be near *E. gibbiflora*, but it certainly has very different foliage.

FF. *Lvs. concave or flat on the face.*

26. **gibbiflòra,** DC Sts. often tall, 2 ft. or more high, glabrous throughout: lvs. 12–20 in a close rosette, obovate-spatulate, often highly colored: infl. a lax panicle. Mex. Var. **metállica.** A very common and popular greenhouse plant It is very similar to the type, but has more highly colored lvs. Page 870.

E. argéntea, Lem , I H 10 Misc 78, 1863=Dudleya pulverulenta —*E. Bernhardyàna*, Foerst , is a garden species or form from an unknown source —*E. bracteòsa*, Landl & Paxt =Pachyphytum sp —*E. cinèrea* is listed in Johnson's Gardener's Dict , p 264, 1894, as a hybrid —*E. clavifòlia*, Deleuil, is a hybrid of Pachyphytum bracteolosum and Courantia rosea —*E. Clèvelandii* is a hybrid in cult. at the White House, Washington —*E. cyánea*, Johnson Gard. Dict , is a garden hybrid —*E. dealbàta*, Johnson Gard. Dict. garden hybrid —*E. Desmetriàna*, L De Smet = E. Peacockii —*E. erécta*, Deleuil, is said to be a hybrid of E coccinea and E atropurpurea. —*E férrea*, Deleuil, said to be a hybrid of E. Scheerii and E Calophana —*E. globòsa*, Hort ex E Morr. in B H 24 161. (1874) Caulescent or nearly so: lvs numerous, forming a dense rosette, spatulate, pale and somewhat glaucous, about 3 in. long, broadest near the top and there ½–1 in. broad, mucronate at tip, rather flat. flowering branches weak and spreading, bearing a few linear bracts, branched at top into 2 secund racemes, sepals linear, very unequal, somewhat ascending, corolla both before and after flowering strongly 5-angled, reddish below, yellowish above and within, petals free nearly, if not quite, to the base, stamens opposite the petals borne on the lower third of the corresponding petals, the 5 alternate stamens free nearly to the base carpels free, erect This description is drawn from a plant in the Washington Botanical Garden of unknown origin It resembles somewhat E secunda —*E grandiflòra*, E Morr , is evidently a typographical error for E grandifolia, Haw —*E grándis*, E Morr =E gibbiflora(?) —*E grandisépala*, Deleuil, is said to be hybrid of E metallica and a Courantia —*E herbacea*, Johnson Gard Dict , is a garden hybrid —*E. imbricata*, Deleuil, Cat 1874, Deleuil in E Morr B H 21 329 (1874) Deleuil in A De Smet R B. 3 147 (1677) This is cult in the Washington Botanical Garden, and in the White House grounds This species seems to be a favorite as a border plant in Washington City parks It is said to be a cross between E glauca and E metallica The infl , while secund as in E glauca, is generally, although not always, 2-branched, while the lvs are larger than in the true E glauca —*E metállica decòra*, Rodgers, I H 30 505, is a variegated form of C metallica. —*E mirábilis*, Deleuil, is a hybrid —*E mutábilis*, Deleuil, is said to be a hybrid of E. Scheerii and E lingulæfolia —*E ovata*, Deleuil, is said to be a hybrid of E Scheerii and E metallica —*E pachyphytoides*, L De Smet, is a cross of Pachyphytum bracteosum and E metallica —*E prunósa*, Deleuil, is said to be a hybrid between E lingulæfolia and E coccinea —*E pulverulénta*, Nutt =Dudleya —*E Purpusii*, Schum =Dudleya —*E rosacea*, Land & André I H 20 121, said to be close to E secunda, locality not given —*E rósea*, Lindl =Courantia —*E scaphylla*, Deleuil, is a hybrid of Urbinia agavoides and E lingulæfolia —*E securifera*, Deleuil, is a hybrid —*E spathulàta*, Deleuil, is a hybrid —*E spiralis*, Deleuil, hybrid —*E. stellàta*, Deleuil, hybrid

J N. Rose.

ECHIDNÓPSIS (*viper-like*, alluding to the serpent-like sts). *Asclepiadàceæ*. A few species of leafless succulents of Trop. Afr. and Arabia, not sufficiently distinguished from Caralluma; allied to Stapelia, which see for cult None of the species seems to be in the trade The sts are many-angled and tessellate, bearing small mostly fascicled fls. in the grooves. corolla rotate or approaching campanulate, 5-lobed, fleshy, yellow or purple-brown; staminal column very short and arising from the base of the corolla, and bearing the corona The following species have recently been mentioned in garden literature: *E cereiformis*, Hook f. is 6 in high, with elongated cylindrical serpentine or pendulous sts. and bright yellow fls in fascicles B M. 5930 *E Dammannàna*, Spreng. not Schweinf , is similar but has dark brown-purple fls. Nile Land. *E Bántu*, N E Br , has 7–8-ribbed sts. ¾in. or less diam and vinous-purple fls in pairs toward the tips of the branches S Arabia. B M 7760 *E somalénsis*, N E Br , has columnar cereus-like shrubby cylindrical 6–8-furrowed branches, and nearly sessile dark purple yellow-spotted fls. solitary or in 2's or 3's. Somaliland. B.M. 7929.

ECHINÀCEA (Greek, *echinos*, hedgehog; alluding to the sharp-pointed bracts of the receptacle). *Compósitæ*. Purple Cone-Flower. Perennial stout herbs, more or less grown in the border or wild garden.

Closely related to Rudbeckia, but rays ranging from flesh-color, through rose, to purple and crimson (one species, not in the trade, has fls. yellow to red), while those of Rudbeckia are yellow or partly (rarely wholly) brown-purple: the high disk and the downward angle at which the rays are pointed are features of echinaceas; the disk is only convex at first, but becomes egg-shaped, and the receptacle conical, while Rudbeckia has a greater range, the disk from globose to columnar, and the receptacle from conical to cylindrical; heads many-fld , mostly large; disk-fls. fertile, rays pistillate but sterile; pappus a small-toothed border or crown: sts. long and strong, nearly leafless above, terminated by a single head.—Five species in N. Amer., 2 of them from Mex., the others native to the U. S. By some treated as a section of Rudbeckia; by others now called Brauneria, which is an older name.

Echinaceas and rudbeckias are stout, and perhaps a little coarse in appearance, but their flower-heads, sometimes 6 inches across, are very attractive, and borne in succession for two months or more of late summer.

With the growing appreciation of hardy borders and of native plants, it should be possible to procure four or five distinct colors in the flower, associated with low, medium and tall-growing habits. They do well in ordinary soils, and may be used to help cover unusually dry and exposed spots.

They respond well to rich soil, especially sandy loam, and prefer warm and sunny sites. They are perennials of easy culture. Propagated by division, though not too frequently; sometimes by seeds. The roots of *E. angustifolia* are black, pungent-tasted, and are included in the United States pharmacopœa as the source of an oleo-resin.

purpùrea, Moench. (*Braunèria purpùrea*, Brit.). Commonly not hairy, typically taller than *E. angustifolia*, 2 ft. or more high: lvs. ovate-lanceolate, or the lower ones broadly ovate, often 5-nerved, commonly denticulate or sharply serrate, most of them abruptly contracted into a margined petiole; upper lvs. lanceolate and 3-nerved: rays at first an inch long and broadish, later often 2 in. long or more, with the same color-range as *E. angustifolia*, but rarely almost white. Rich or deep soil. Va. and Ohio to Ill. and La. G.L. 19:28. G.M. 22: suppl. Nov. 11; 31:374. Gng. 5:41. Var **serótina,** Bailey (*Rudbéckia purpùrea* var *serótina*, Nutt. *R. serótina*, Sweet.) The varietal name means late-flowering, but the chief point is the hairy or bristly character of the plant. L.B.C. 16:1539. P.M. 15:79 (as *E. intérmedia*).—Perhaps the best form for garden purposes, the rays said to be much brighter colored, broader and not rolling at the edges.

angustifòlia, DC. (*B. angustifòlia*, Brit.). Bristly, either sparsely or densely: lvs. narrower than in *E. purpurea*, from broadly lanceolate to nearly linear, entire, 3-nerved, all narrowed gradually to the base, the lower into slender petioles. fl.-heads nearly as large as in *E. purpurea*, but sometimes much smaller. Prairies and barrens, Sask. and Neb. to Texas, east to Ill., Tenn. and Ala. B.M. 5281. G.W. 4:164.—This species has several forms, which approach and run into *E. purpurea*.

A dealer advertises (1912) a "red sunflower" obtained by crossing a species of Echinacea with Helianthus multiflorus. It is described as 5–6 ft. high, with fls. 4–7 in. diam., red. See *Helianthus*.

N. TAYLOR.†

ECHINOCÁCTUS (Greek, *spine* and *cactus*). *Cactàceæ*. A very large group of globular, strongly ribbed, and strongly spiny cacti, growing from the United States to South America, particularly abundant in Mexico.

Sometimes these cacti become very short-cylindrical; occasionally the ribs are broken up into tubercles which resemble those of Mammillaria; and rarely spines are entirely wanting: the fls. usually appear just above the young spine-bearing areas, but sometimes they are farther removed, and occasionally they are in the axil of a tubercle; the ovary bears scales which are naked or woolly in the axils, and the fr. is either succulent or dry. —The genus is well developed within the U. S., about 40 species having been recognized, but its extreme northern limit is the southern borders of Colo., Utah, and Nev., apparently having spread from the great arid plateau regions of Mex. proper and Low. Calif. The genus extends throughout Mex. but is not found in Cent. Amer. It is well represented, however, in the drier regions of S. Amer. Echinocactus and Mammillaria are distinguished chiefly by the way in which the fls. are borne,—terminal on the tubercles in the former, and axillary to tubercles in the latter. In external appearance they are very similar. The genus Astrophytum is here included, although it seems to be very different from the typical forms of Echinocactus and should doubtless be kept distinct. It is impossible to identify with certainty all of the specific names found in trade catalogues, but the following synopsis contains the greater part of them. In all cases the original descriptions have been consulted, and in some cases it is certain that a name originally applied to one form has been shifted to another. The following synopsis may be useful, therefore, in checking up the proper application of names, but it may thus leave some of the common species of the trade unaccounted for. No attempt is made to group the species according to relationships, but a more easily handled artificial arrangement, chiefly based upon spine characters, is used. It must be remembered that the species are exceedingly variable, especially under cult., and large allowance must be made for the characters given in the key and in the specific descriptions.

Unlike most globular forms of cacti, echinocacti do not readily produce offsets; consequently they must be propagated by seeds if one wishes to increase these plants in quantity. Seeds of echinocactus, and, in fact, most cacti, will germinate as freely as seeds of other plants, provided they have been allowed to ripen properly before gathering and carefully dried afterward. The months of May and June have been found to be by far the most favorable for germination. Seeds of echinocactus will then germinate in five or six days, while during the winter months it takes almost as many weeks. Opuntias will germinate in even less than six days; they germinate most readily of all the Cactaceæ, and grow the fastest afterward, while mammillarias are the slowest to germinate and grow the slowest afterward.—The seeds should be sown in well-drained 4-inch pots in a finely sifted mixture of one part leaf-mold, one part loam and one part charcoal dust and silver sand. The surface should be made very smooth, and the seeds pressed lightly into the soil with the bottom of a flower-pot and then covered with about ⅜ inch of fine silver sand. This allows the seedlings to push through readily and prevents the soil from crusting on the surface of the pots, as they usually have to stay in their seedling pots at least one year. The pots should be placed in a greenhouse where they will receive plenty of light but not the direct sunlight, for, although cacti are natives of desert regions, the seedlings will roast if exposed to full sunlight under glass. For the first winter, at least, the seedlings should be kept in a temperature of not less than 60° and carefully looked over every day to ascertain the condition of the soil, for, although they should be kept on the dry side, they must never be allowed to become quite dry during the seedling stage. When about a year old they may be transplanted to shallow pans not more than 6 inches in diameter, and prepared with the same mixture as for seedling pots. These pans will be found better than small pots, because the soil may be kept more evenly moist and the seedlings do better in consequence. When grown from 2 to 3 inches in diameter, seedling echinocacti may be transferred to pots, using only sizes just large enough to accommodate them, as they make but few roots. Pot them in a mixture of two parts fibrous loam, one part leaf-mold and one part pounded brick and silver sand. During the spring and summer months, established plants may be given a liberal supply of water, but must be studiously watered during the fall and winter months.—During the winter they should be given a light position in a dry greenhouse, with a night temperature of 45° to 50°, and a rise of 10° by day. For the summer, they may be either kept in an airy greenhouse or placed in some convenient position outside, plunging the pots in the soil or in some light non-conducting material. Some of the species will begin to blossom in May and others at intervals during the summer. The flowers vary considerably in size, and embrace a good range of color, from white to deep yellow, and from faintest purple to deep rose. They do not readily produce seed (in New England, at least) unless artificially pollinated.—Like most of the cactus family, the more cylindrical species

will readily unite when grafted upon other kinds, not only in the same genus, but in other genera of Cactaceæ, and for weak-growing species it may often be an advantage to graft upon some stronger-growing species. *Cleistocactus Baumannii* (or *C. colubrinus*) makes an excellent stock to graft upon, choosing stock plants of reasonable size and height. The system known as "wedge-grafting" is perhaps best for the purpose, and the early spring months, or just as the growing season is about to begin, is the best time for grafting.—If plants of echinocactus can be kept in a healthy condition, they are not much troubled with insect pests; mealy-bug is their worst enemy and should be removed at once with a clean mucilage brush.—The following varieties have been found to be among the most easily grown: *E. capricornis, E coptonogonus, E. cornigerus, E. Grusonii, E. horizonthalonius, E. longihamatus, E. myriostigma, E. setispinus, E. texensis*, and *E. Wislizenii*. (E J Canning.)

INDEX.

arrigens, 31
bicolor, 36
brevihamatus, 5.
capricornis, 15
coptonogonus, 13.
cornigerus, 9
crispatus, 31
cylindraceus, 2
Echidne, 23
electracanthus, 22
Emoryi, 26
flavovirens, 37
Grusonii, 45
helophorus, 29
hexaedrophorus, 32
horizonthalonius, 21.
ingens, 20
intertextus, 38.
Johnsonii, 40.
Lecontei, 43.
leucacanthus, 18.
limitus, 42
longihamatus, 3.
lopothele, 33.
major, 13.
Marbellæ, 19.
Monvillii, 11.
multicostatus, 14.
myriostigma, 50.
obvallatus, 30.
Orcuttii, 39.
ornatus, 19.
orthacanthus, 37.
Ottonis, 35.
Palmeri, 46.
Pfefferi, 12.
phyllacanthus, 17.
pilosus, 48.
polyancistrus, 10.
polycephalus, 41.
rectispinus, 25.
recurvus, 27.
rincorensis, 16.
robustus, 34.
saltillensis, 46.
Scopa, 47.
setispinus, 28.
Sileri, 44
sinuatus, 6
texensis, 24.
Treculianus, 6.
turbiniformis, 49.
uncinatus, 1, 7.
Vanderveyi, 23
viridescens, 42.
Visnaga, 20.
Whipplei, 8
Wislizenii, 4.
Wrightii, 1.

A. *Spines, or some of them, hooked (Nos. I–10).*

B. *Central spine solitary.*

1. **Wrightii,** Coulter (*E. uncinatus* var *Wrightii*, Engelm.). Oval, 3–6 in. high, 2–3½ in diam.: radial spines 8, arranged as in *E uncinatus;* central spine solitary, angled, flexuous and hooked, elongated (2–6 in.), erect, straw-color, with dark tip: fls 1–1½ in. long, dark purple. Texas and N. Mex.

BB. *Central spines 4.*

C. *Some or all of the spines annulate.*

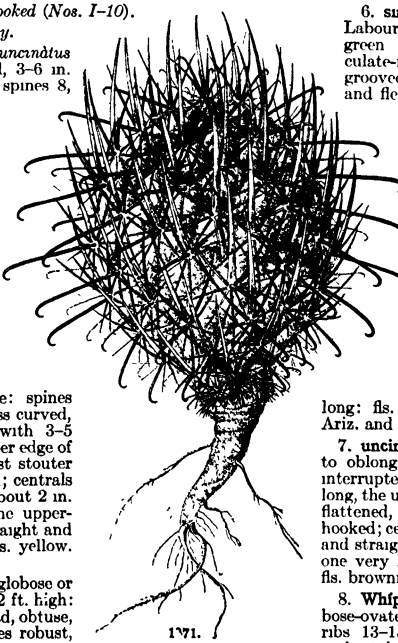
2. **cylindráceus,** Engelm Globose to ovate or ovate-cylindrical, simple or branching at base, becoming as much as 3 ft. high and 1 ft. diam.: ribs 13 in younger specimens, 20–27 in older ones, obtuse and tuberculate: spines stout, compressed, more or less curved, reddish; radials about 12, with 3–5 additional slender ones at upper edge of areole, 1–2 in. long, the lowest stouter and shorter and much hooked; centrals 4, very stout and 4-angled, about 2 in. long and $\frac{1}{12}$–$\frac{1}{8}$in. broad, the uppermost broadest and almost straight and erect, the lowest decurved: fls. yellow. S. W. U. S. and Low. Calif.

3. **longihamátus,** Gal. Subglobose or at length ovate, becoming 1–2 ft. high: ribs 13–17, often oblique, broad, obtuse, tuberculate-interrupted: spines robust, purplish or variegated when young, at length ashy; radials 8–11, spreading, straight or curved or flexuous, the upper and lower ones 1–3 in. long, the laterals 2–4 in.; centrals 4, angled, the upper ones turned upward, straight or curved or twisted, the lower one stouter, elongated (3–8 in.), flexuous and more or less hooked: fls. yellow, tinged with red, 2½–3½ in. long. Texas and Mex.

4. **Wislizénii,** Engelm. At first globose, then ovate to cylindrical, 1⅔–4 ft high: ribs 21–25 (13 in small specimens), acute and oblique, more or less tuberculate: radial spines ⅜–2 in. long, the 3 upper and 3–5 lower ones stiff, straight or curved, annulate, red (in old specimens the 3 stout upper radials move toward the center and become surrounded by the upper bristly ones), the 12–20 laterals (sometimes additional shorter ones above) bristly, elongated, flexuous, horizontally spreading, yellowish white; centrals 4, stout, angled, and red, 1⅜–3½ in. long, the 3 upper straight, the lower one longest (sometimes as much as 4–5 in.), very robust (flat and channeled above), hooked downward fls. yellow or sometimes red, 2–2⅜ in. long. From S Utah to N. Mex. and Low. Calif.

CC. *None of the spines annulate.*

5. **brevihamátus,** Engelm. Globose-ovate, very dark green: ribs 13, deeply tuberculate-interrupted, the tubercles with a woolly groove extending to the base: radial spines mostly 12, terete, straight, white or yellowish, with dusky tips, ½–1 in long, the upper longer; central spines 1 (rarely 1 or 2 additional ones), flattened, white with black tips, the 2 lateral ones divergent upward, straight or a little recurved, 1–2 in. long, the uppermost one weaker, the lower stoutest and darkest, porrect or deflexed, hooked downward, ¾–1 in long: fls funnelform, rose-color, 1–1½ in. long. S. W. Texas and New Mex.



1371.
Echinocactus Whipplei. (×½)

6. **sinuátus,** Dietr. (*E. Treculiànus,* Labour.). Globose, 4–8 in. diam, bright green ribs 13, oblique, acute, tuberculate-interrupted, the tubercles short-grooved: radial spines 8–12, setiform and flexible, the 3 upper and 3 lower purplish brown and straightish (the lower ones sometimes more or less hooked), ⅛–1 in long, the 2–6 laterals more slender, longer (1–1⅔ in.), often flattened, puberulent and whitish, sometimes flexuous or hooked; central spines 4, puberulent, yellowish (or purplish variegated), the 3 upper ones slender, flattened or subangled, erect and generally straight (rarely hooked). 1⅜–2 in long, the lowest one much stouter, flattened or even channeled, straw-color, flexuous, more or less hooked (sometimes straight), 2–4 in. long: fls. yellow, 2–3 in. long. Texas, Ariz. and N. Mex.

7. **uncinátus,** Gal. Glaucescent, globose to oblong: ribs 13, obtuse, tuberculate-interrupted: radial spines 7 or 8, 1–2 in. long, the upper 4 or 5 straw-color, straight, flattened, the lower 3 purplish, terete and hooked; centrals 4, the upper 3 rather stout and straight, about 1 in. long, the lowest one very long, flattened, hooked at apex: fls. brownish purple. N. Mex.

8. **Whipplei,** Engelm Fig. 1371. Globose-ovate, 3–5 in. high, 2–4 in. diam.: ribs 13–15 (often oblique), compressed and tuberculately interrupted: radial

spines usually 7, compressed, straight or slightly recurved, ½–⅗ in. long, lower ones shorter than the others, all white excepting the two darker lowest laterals; central spines 4, widely divergent, the uppermost one flattened, straight and white, 1–1⅗ in. long, turned upward in the plane of the radials (completing the circle of radials), the others a little shorter, quadrangular-compressed, dark brown or black, becoming reddish and finally ashy, the 2 laterals straight, the lowest one stouter and sharply hooked downward: fl. greenish red. N. Ariz. Fig. 1371 is adapted from the Pacific Railroad Report.

BBB. *Central spines 5 to 8.*

9. **cornígerus,** DC. Globose or depressed-globose, 10–16 in. diam.: ribs about 21, very acute and wavy (not tuberculately interrupted): radial spines 6–10, white and comparatively slender, or wanting, centrals red and very robust, angular-compressed, with long, sharp, horny tips, the upper 3 erect-spreading, 1–1½ in. long, the lower 2 weaker and declined, the central one longer, more rigid and keeled, very broad (½–⅔in.) and hooked downward: fls. purple, 1–1½ in long Mex.

10 **polyancístrus,** Engelm. & Bigel. Ovate or at length subcylindric, becoming 4–10 in high and 3–4 in. diam: ribs 13–17, obtuse, tuberculately interrupted: radial spines 20 or more, compressed and white, the uppermost wanting, the 4 upper ones broader and longer (1–2 in.) and dusky-tipped, the laterals shorter (⅘–1 in.), the lowest very short (½in.) and subsetaceous; central spines of several forms, the uppermost one (rarely a second similar but smaller one above or beside it) compressed-quadrangular, elongated (3–5 in.), white with dusky tip curved upward, the other 5–10 teretish or subangled, bright purple-brown; upper ones long (2–4 in.) and mostly straight, the others gradually shortening (to about 1 in.) downward and sharply hooked. fls. red or yellow, 2–2⅘ in. long and wide. Nev. and S. E. Calif.

AA *Spines not hooked (Nos. 11–48).*

B. *Central spines none or indistinct.*

11. **Monvíllii,** Lem Stout, globose and bright green: ribs 13–17, tuberculate, broadest toward the base, undulate; tubercles somewhat hexagonal, strongly dilated below. radial spines 9–12, the lower ones somewhat longer, very stout, spreading, yellowish translucent, reddish at base; central wanting· fls varying from white to yellow and red. Paraguay

12 **Pfeifferi,** Zucc Oblong-globose, becoming 1–2 ft. high and 1 ft diam.: ribs 11–13, compressed and somewhat acute: spines 6, about equal, rigid, straight, divergent or erect, pale transparent yellow with a brownish base; very rarely a solitary central spine. Mex.

13. **coptonogònus,** Lem., var **màjor,** Salm-Dyck. Depressed, from a large indurated naked napiform base, 2–4 in across the top ribs 10–15, acute from a broad base, more or less transversely interrupted and sinuous: spines 3, annulate, very stout and erect from deeply sunken areoles, reddish when young, becoming ashy gray; upper spine stoutest, erect and straight, or slightly curved upward, flattened and keeled, and occasionally twisted, 1½–2¼ in. long; the 2 laterals erect-divergent, straight or slightly curved, terete above and somewhat quadrangular below, 1–1½ in. long; all from an abruptly enlarged base: fls said to be small and white, with purplish median lines. Mex.

14. **multicostàtus,** Hildmann. Depressed-globose: ribs very numerous, 90–120, compressed into thin plates which run vertically or are twisted in every direction: spines exceedingly variable, in some cases wanting entirely, in others 3 or 4, short, rigid, and translucent yellow; in others more numerous, larger, and often flattish; in still other cases very long and flat, interlacing all over the plant; no centrals: fls. white, with a broad purple stripe. Mex.

15. **capricórnis,** A. Dietr. Globose: ribs about 11, broad, spotted all over with white dots: clusters of spines distant, usually seen only near the apex; spines 5–10, long and flexuous; centrals not distinct: fls. large, yellow. Mex.

16. **rinconénsis,** Poselg. Cylindrical, covered with ivory-white spines which are tipped with crimson: spines 3, with no centrals: fls. large, purple-crimson, darker at base. N. Mex.

17. **phyllacánthus,** Mart. From globose to cylindrical, with depressed vertex, simple or prolíferous, 2½–3⅗ in broad: ribs 40–55 (sometimes as few as 30), very much crowded and compressed, thin, acute, very wavy, continuous or somewhat interrupted: radial spines 5 (sometimes 6 or 7), straight and spreading, the 2 lowest ones white, rigid, ⅛–¼in. long, half as long as the 2 darker, angled, larger laterals, the uppermost spine thin and broad, channeled above, faintly annulate, flexible, grayish pink, ¾–1 in long; central spines none. fls. small, dirty white. Mex.

BB. *Central spine solitary (sometimes 2–4 in E. crispatus, E helophorus, and E. setispinus, or wanting in E. lophothele).*

C *Sts. with less than 13 ribs.*

18 **leucacánthus,** Zucc. Somewhat clavate-cylindrical, pale. ribs 8–10, thick, obtuse, strongly tuberculate, the areoles with strong wool radial spines 7 or 8, similar, straight, finely pubescent, at first yellowish, at length white; central spine solitary, more or less erect, rarely wanting. fls light yellow Mex

19 **ornàtus,** DC (*E Mirbéllii,* Lem.) Subglobose: ribs 8, broad, compressed, vertical, thickly covered with close-set white woolly spots, making the whole plant almost white: radial spines 7, straight, stout, yellowish or becoming gray; central spine solitary Mex.

20 **íngens,** Zucc. (*E Visnàga,* Hook.) Very large (sometimes as much as 10 ft high and as much in circumference), globose or oblong, purplish toward the top: ribs 8, obtuse, tuberculate. areoles large, distant, with very copious yellowish wool. radial spines 8 or more; central spine solitary; all the spines shaded yellow and red or brownish, straight, rigid, and interwoven: fls. bright yellow, about 3 in broad Mex

21. **horizonthalònius,** Lem Glaucous, depressed-globose or at length ovate or even cylindric with age, 2–8 in. high, 2½–4 in diam · ribs 8–10 (fewer in very young specimens), often spirally arranged, the tubercles scarcely distinct by inconspicuous transverse grooves: spines 6–9, stout, compressed, reddish (at length ashy), recurved or sometimes almost straight, nearly equal, ⅓–1½ in. long (sometimes long and slender and almost terete, sometimes short, stout and broad); radials 5–8, upper ones weaker, lowest wanting; a single stouter decurved central (sometimes wanting): fls. pale rose-purple, 2½ in long or more. New Mex. and N Mex.

CC. *Sts. with 13–27 ribs.*

22 **electracánthus,** Lem. Globose or thick cylindrical, becoming 2 ft high and 1 ft diam: ribs about 15: radial spines about 8, equal, rigid, spreading, yellowish, about 1 in. long; the central one solitary, red at base: fls. clear yellow. Mex.

23. **Echídne,** DC. (*E. Vanderæyi,* Lem.). Depressed-globose, 5–7 in diam., 3–4 in. high: ribs 13, acute. radial spines 7, broad, rigid, spreading, yellowish, 1 in. or more long; central spine solitary and scarcely longer than the others: fls. bright yellow, 1 in. or more long Mex.

24. **texénsis,** Hopf. Mostly depressed (sometimes globose), 8–12 in. diam., 4–6 in. high, simple: ribs

mostly 21 (sometimes 27, and in smaller specimens 13 or 14) and undulate· spines stout and fasciculate, reddish, compressed; the exterior 6 or 7 radiant, straightish or curved, unequal, ½–¾in long in some cases, 1½–2 in in others, much shorter than the solitary and stout recurved central, which is sometimes ⅛–¼in. broad. fls. about ½in. long, parti-colored (scarlet and orange below to white above). Texas and N. E. Mex.

25. **rectispīnus,** Brit. & Rose Fig. 1372. Globose, at length cylindrical ribs 13–21, obtuse and strongly tuberculate: radial spines 7–9, very unequal, the 3 upper ones 4–5 in. long, the lower 1½–3 in. long and paler, the central very long (12–13 in.), straight or slightly decurved: fls. about 1½in long, pinkish; ovary bearing a few ovate, scarious, naked scales. Low. Calif.

26 **Ēmoryi,** Engelm. Becoming large, globular to cylindrical plants, 1–4 ft. high. ribs 13–21, obtuse: radial spines 7–9, nearly equal, stout, 1–2 in long, central spine single, porrect, hooked fls red, tipped with yellow fr 1–2 in. long, covered with thin bracts S Ariz and N Sonora



1372 Echinocactus rectispinus. No. 25

27 **recúrvus,** Link & Otto Subglobose and very stout ribs about 15, covered with broad, dark red spines, the radials spreading, the central one recurved and very stout. Mex

28 **setispīnus,** Engelm Subglobose, 2–3½ in diam ribs 13, more or less oblique, often undulate or somewhat interrupted: radial spines 14–16, setiform and flexible, ⅜–½in long, the uppermost (the longest) and lowest ones yellowish brown, the laterals white; central spines 1–3, setiform and flexuous, dark, 1–1½ in. long: fls funnelform, 1½–3 in long, yellow, scarlet within. Texas and N. Mex.

29. **helóphorus,** Lem. Depressed globose, light green with purple-red veins· ribs about 20, compressed, obtuse· radial spines 9–12, very stout and porrect; central spines 1–4, stronger and annulate; all the spines pearl-gray. Mex.

ccc *Sts. with 30 or more ribs.*

30. **obvallātus,** DC. Obovate-globose, depressed: ribs very numerous, vertical: spines most abundant towards the apex, unequal, spreading, stout, whitish; the 3 upper radials and solitary central strong, the others (especially the lowest) small: fls. purple, with whitish margin. Mex —The name was suggested by the appearance of the terminal cluster of fls. surrounded by a fortification of strong spines.

31. **crispātus,** DC (*E. dīrrigens,* Link) Globose, 5 in. or more high: ribs 30–60, compressed and sharp, more or less undulate-crisped: spines 7–11, widely spreading, more or less flattened, the upper larger and brown at tip, the lower shorter and white, or all of them brown: fls. purple, or white with purple stripes. Mex.

cccc. *Sts. tuberculate, as in Mammillaria*

32 **hexædróphorus,** Lem. More or less globular, dark gray· ribs deeply tuberculate, giving the appearance of a mammillaria, with hexagonal tubercles: radial spines 6 or 7, radiating like a star, central spine solitary, erect, longer; all the spines annulate, reddish brown: fls. white, tinted with rose Mex

33. **lopothèle,** Salm-Dyck. Globose, strongly tuberculate, after the manner of Mammillaria: tubercles quadrangular, bearing clusters of 5–10, more or less porrect, long, rigid, and equal spines, central solitary or wanting: fls. white or yellowish. Mex.

BBB. *Central spines 4 (2 or 3 in E. Sileri and sometimes 3 in E. Scopa).*

c. *Ribs less than 13.*

34. **robústus,** Otto Clavate and stout: ribs about 8, compressed, vertical radial spines about 14, the upper ones slender, the lowest 3 stronger; central spines 4, 4-angled at base, transversely striate, the lowest one largest; all the spines purple-red, 1½–3 in. long: fls. golden yellow Mex.

35. **Ottōnis,** Link & Otto Depressed-globose or ovate, 3–4 in. high· ribs 10–12, obtuse: radial spines 10–18, slender, yellowish, more or less straight and spreading, about ½in. long; central spines 4, dusky red, stronger, the uppermost very short, the 2 laterals horizontal, the lowest longest (1 in.) and deflexed: fls. lemon-yellow, becoming 2–3 in. diam. Mex.

36 **bícolor,** Gal Globose-ovate, stout, 1½–4 in. diam., sometimes becoming 8 in high: ribs 8, oblique and obtuse, compressed, tuberculate-interrupted. lower radials and centrals variegated red and white; radials 9–17, spreading and recurved, slender and rather rigid, the lowest one ½–1 in long, the laterals 1–2 in. long and about equaling the 2–4 flat flexuous ashy upper ones; centrals 4, flat and flexuous, 1½–3 in. long, the uppermost thin and not longer than the erect and rigid laterals, the lowest very stout, porrect and very long: fls funnelform, bright purple, 2–3 in. long. N Mex.

cc *Ribs 13–27.*

37. **orthacánthus,** Link & Otto (*E. flavovīrens,* Scheidw.) Globose, yellowish green: ribs 12 or 13, vertical, acute: radial spines 14, unequal, straight and spreading; central spines 4, stronger, the lowest the largest; all the spines rigid, annulate, and grayish white Mex

38 **intertéxtus,** Engelm. Ovate-globose, 1–4 in. high: ribs 13, acute, somewhat oblique, tuberculate-interrupted, the tubercles with a woolly groove: spines short and rigid, reddish from a whitish base and with dusky tips, radial 16–25, closely appressed and interwoven, the upper 5–9 setaceous and white, straight ⅛–½in long, the laterals more rigid and a little longer, the lowest stout and short, a little recurved; centrals 4, the 3 upper ones turned upward and exceeding the radials and interwoven with them, the lower one very short, stout and porrect: fls. about 1 in. long and wide, purplish. Texas and N. Mex.

39. **Órcuttii,** Engelm Cylindrical, 2–3½ ft. high, 1 ft. diam., single or in clusters up to 18 or more, not rarely decumbent: ribs 18–22, often oblique: spines extremely variable, angled to flat, ¼–3 in. wide; radials 11–13, unequal, lowest and several laterals thinnest; centrals 4: fls. about 2 in. long, deep crimson in center, bordered by light greenish yellow. Low. Calif.

40. **Jōhnsonii,** Parry. Oval, 4–6 in. high: ribs 17–21, low, rounded, tuberculately interrupted, close set, often oblique, densely covered with stoutish reddish gray spines: radial spines 10–14, ⅜–1½ in. long, the upper longest; centrals 4, stouter, recurved, about 1½ in. long: fls. 2–2¾ in. long and wide, from deep red to pink. Utah, Nev., Calif.

41. **polycéphalus,** Engelm. & Bigel. Globose (6–10 in. diam) to ovate (10–16 in. high, 5–10 in. diam.) and cylindrical (reaching 24–28 in. high and about 10 in. diam.), profusely branched at base: ribs 13–21 (occasionally 10): spines 8–15, very stout and compressed, more or less recurved and reddish; radials 4–11, comparatively slender (the uppermost the most slender), 1–2 in. long; the 4 centrals much stouter and longer (1½–2½ in.), very unequal, the uppermost one usually broadest and curved upward, the lowest one usually the longest and decurved: fls. yellow. Utah to Calif.

42. **viridéscens,** Nutt Globose or depressed, simple or branching at base, 4–12 in. high, 6–10 in. diam.: ribs 13–21 (fewer when young), compressed and scarcely tuberculate: spines more or less curved and sometimes twisted, reddish below, shading into greenish or yellowish above; radials 9–20, ¾–⅘in long, the lowest shortest, robust, and decurved; centrals 4, cruciate, much stouter, compressed and 4-angled, ⅘–1⅔ in long, the lowest broadest, longest and straightest fls yellowish green, about 1⅗in. long. S. Calif —*E limátus*, Engelm., is closely related to this species and is thought by some to be identical with it.

43. **Lecóntei,** Engelm. Resembles *E Wislizenii*, but often somewhat taller (sometimes becoming 8 ft high and 2 ft. diam), usually more slender, and at last clavate from a slender base: ribs somewhat more interrupted and more obtuse: lower central spine more flattened and broader, curved (rather than hooked) or twisted, usually not at all hooked, sometimes as much as 6 in. long: fls rather smaller. From the Great Basin to Mex. and Low. Calif.

44. **Sileri,** Engelm. Globose: ribs 13, prominent, densely crowded, with short rhombic-angled tubercles: radial spines 11–13, white; centrals 3, black, with pale base, ⅗in. long, the upper one slightly longer: fls. scarcely 1 in. long, straw-colored. Utah.

45. **Grùsonii,** Hildmann. Globose, completely covered by a mass of almost transparent golden spines, which give the plant the appearance of a ball of gold: centrals 4, curved: fls. red and yellow. Mountains of Mex.—From illustrations it is evident that the radial spines are somewhat numerous and widely spreading, and that the centrals are prominent and more or less deflexed.



1373. **Echinocactus Palmeri.** No 46.

46. **Pálmeri,** Rose (*E. salulléns*is, Poselg.). Fig. 1373. Very stout, globose: ribs 15–19, compressed, dark green: spines very prominent, 5–7 in a cluster, stout and porrect, sometimes becoming 5 in. long; centrals 4. Mex.—Schumann makes this a variety of *E. ingens.*



1374. **Echinocactus myriostigma** No 50.

ccc. *Ribs 30 or more.*

47. **Scòpa,** Link & Otto More or less cylindrical, 1 ft. or more high, 2–4 in. diam , at length branching above: ribs 30–36, nearly vertical, tuberculate: radial spines 30–40, setaceous, white; central spines 3 or 4, purple, erect; sometimes all the spines are white. fls. yellow. Brazil. —The species is exceedingly plastic in form, branching variously or passing into the cristate condition.

BBBB. *Central spines 5–10*

48. **pilòsus,** Gal. Globose, 6–18 in high. ribs 13–18, compressed, little if at all interrupted. radial spines represented by 3 slender ones at the lowest part of the pulvillus or wanting; centrals 6, very stout, at first purplish, becoming pale yellow, the 3 upper ones erect, the 3 lower recurved-spreading: fls. unknown N. Mex

AAA. *Spines entirely wanting.*

49. **turbiniförmis,** Pfeff Depressed-globose, grayish green, with 12–14 spirally ascending ribs, cut into regular rhomboidal tubercles; tubercles flat, with a depressed pulvillus, entirely naked excepting a few small setaceous spines upon the younger ones: fls. white, with a purplish base Mex —The depressed and spineless body, with its surface regularly cut in spiral series of low, flat tubercles, gives the plant a very characteristic appearance.

50. **myriostígma,** Salm-Dyck (*Astróphytum myriostígma*, Lem.). Fig 1374 Depressed-globose, 5 in diam ribs 5 or 6, very broad, covered with numerous somewhat pilose white spots, and with deep obtuse sinuses spines none' fls large, pale yellow Mex

E chrysánthus (E chrysacanthus)=(?).—*E Dræpelnus*=(?) —*E Lewinii*=Lophophora —*E micromèris* = Mammillaria — *E Poselgerianus*, A Dietz =Mammillaria Scheeri. —*E Simpsonii*=Pediocactus —*E trifurcátus*=(?). —*E. Williamsii*=Lophophora.

JOHN M COULTER.
J. N. ROSE †

ECHINOCÈREUS (*spiny Cereus*). *Cactàceæ*. Condensed globular, cylindrical or prostrate cacti of the United States and Mexico.

Stems single or cespitose, sometimes forming large clusters of 200–300 sts., distinctly ribbed, usually low in stature, or, if elongated, sprawling or creeping, generally very spiny' fls. yellow, purplish or scarlet, with rather a short funnel-

shaped tube; fl.-tube and ovary covered with clusters of spines; stigma-lobes always green. This genus has commonly been merged into Cereus, although it seems to be quite distinct.

Most of the species of Echinocereus are unsuited for greenhouse purposes, for when brought under glass they survive only for a few years The very large flowers of some species make them very attractive while in bloom.

INDEX.

scifer, 9.	De Lætii, 1.	phœniceus, 10.
adustus, 18.	dubius, 23	polyacanthus, 8.
Berlandieri, 4.	Engelmannii, 22	procumbens, 3
Blankii, 5	enneacanthus, 24.	rigidissimus, 19.
cæspitosus, 17.	Fendleri, 21	Rœtteri, 16.
chloranthus, 12	gonacanthus, 6.	rufispinus, 18.
chrysocentrus, 22.	longisetus, 11.	Scheeri, 2.
coccineus, 10.	Merkeri, 25.	stramineus, 27.
conglomeratus, 26.	mojavensis, 20	triglochidiatus, 7.
conoideus, 10	paucispinus, 6	variegatus, 22
ctenoides, 15.	pectinatus, 18	viridiflorus, 13.
dasyacanthus, 14.		

A *Sts covered with long weak bristles or hairs, and resembling a small plant of Cephalocereus senilis.*

1 **De Lætii,** Gürke Low and cespitose, 6–10 in high: ribs 17–20 radial spines numerous; central spines 4 or 5, intermixed with long, hair-like bristles entirely hiding the plant. fls small, rose-colored Mex —This species has been secured in great quantities by European dealers It closely simulates a small *Cepha ocereus senilis,* but has very different fls. and fr.

AA. *Sts. variously covered with spines, but not like the above (Nos 2–27)*

B. *The sts. weak and trailing, at least becoming prostrate.*

C *Ribs nearly continuous*

2 **Scheëri,** Lem (*Cèreus Scheèri,* Salm-Dyck). Branching freely from the base of the st and forming dense clusters branches upright or ascending, about 8 in long by 1 in diam., slightly tapering toward the apex, dark green ribs 8–9, straight or sometimes inclined to spiral, separated above by sharp grooves which become flattened toward the base, low arched: areoles little more than ¼in apart, round, yellowish white radial spines 7–9, spreading, needle-like, the under pair the longest, about ¼–⅜in long, white with yellowish bases; centrals 3, the lower the longest, about ⅜in, red with brown bases; later all the spines become gray fls red, from the upper part of the st, about 5 in long, ovary and tube bracteate and furnished with abundance of wool and spines. Mex.

CC. *Ribs divided into tubercles.*

D. *Central spines, when present, short: flowering areoles bearing cobwebby wool*

3 **procúmbens,** Lem (*Cèreus procúmbens,* Engelm.). Branching from the lower part of the st and so forming clusters: branches procumbent or ascending, angled, at the base tapering into cylindrical, 1½–5 in long by ½–¾ in. diam: ribs mostly 5, rarely 4, straight or spiral, on the upper portion of the branch almost divided into tubercles: areoles ¼–½in apart, round, sparingly white curly-woolly, soon naked: radial spines 4–6, subulate, stiff, straight, sharp, in young growth brownish, then white, at the base often yellowish and the tip brownish, horizontally spreading, the upper the longest, reaching ¼in. length; central solitary or absent on the lower areoles, somewhat stronger, ⅜–⅝ in long, darker: fls lateral, from just below the crown, 3–4 in long, carmine-red to violet, with white or yellowish throat: fr. ellipsoidal, green, ⅝in. long. Mex.

DD. *Central spines slender: flowering areoles with short wool.*

E. *Length of central spine ¾in.*

4. **Berlandièri,** Lem. (*Cèreus Berlandièri,* Engelm.). Sts prostrate, richly branching, forming dense clusters, the branches upright or ascending, 2–3 in. long or longer, by ½–¾ in diam., light or dark green, and in young growth often purplish: ribs 5–6, broken up into as many straight or spiral rows of tubercles; tubercles conical, pointed: areoles ⅜–⅝ in. apart, round, white-woolly, soon naked. radial spines 6–8, stiff bristle-form, thin, horizontally spreading, white, about ⅝in. long, the upper one sometimes light brown and somewhat stronger, central solitary, yellowish brown, sometimes reaching ¾in. length: fls. from the upper lateral areoles, 2–3 in. long, red to light pink: fr. ovoid, green, bristly. S. Texas and N Mex.

EE. *Length of central spine 1 in. or more.*

5. **Blánkii,** Palmer (*Cèreus Blánkii,* Poselg.). Branching freely from the base and thus forming clusters: sts. columnar, tapering above, about 6 in. long by 1 in diam, dark green: ribs 5–6 (rarely 7), straight, almost divided into tubercles: areoles about ⅜in. apart, round, white curly-woolly, later naked: radial spines mostly 8, horizontally spreading, the under pair the longest, reaching about ⅝in. length, all stiff, straight, thin, white or the upper ones carmine-red when young, later reddish brown, central solitary, porrect, later deflexed, 1–1¼ in long, white or brownish, black when young: fls from near the crown, 2½–3 in. long, purple-red to violet. Mex R H 1865.90.

BB. *The sts. usually short and stout, usually erect.*

C. *Fls rather small, scarlet.*

D *Ribs 5–7.*

E *Spines terete.*

6. **paucispìnus,** Rumpl (*Cèreus paucispìnus,* Engelm.) Clustered in irregular bunches: sts. cylindrical to ovoid, 4–7 in high by 1¾–3 in diam: ribs 5–7, undulate. areoles ⅜–⅝in apart, round, white-woolly, later naked radial spines 3–6, spreading, subulate, straight or curved, round, bulbose at the base, the lowest one longest, reaching ¾in, light-colored, the upper ones reaching to about ½in, reddish or brownish; central solitary or none, reaching about 1½ in. length, somewhat angled, brown-black, porrect or upright; later all the spines blackish: fls. 2 in. or more long, dark scarlet to yellowish Texas and Colo.

Var. **gonacánthus,** K Sch (*E. gonacánthus,* Lem. *Cèreus gonacánthus,* Engelm. & Bigel.) Radial spines 8, very large, angled and sometimes twisted, the upper strongest, reaching nearly 3 in length, light or dark yellow with brown tips; central always present, deeply grooved, often flattened, 3 in. or more long. Colo.

EE *Spines angled*

7 **triglochidiàtus,** K. Sch. (*E. triglochidiàtus,* Engelm *Cèreus triglochidiàtus,* Engelm.). Radial spines usually 3, sometimes as many as 6, strong, angled, base bulbose, straight or curved, about 1 in. long, soon ash-gray. Texas and New Mex.

DD. *Ribs 9–11.*

E. *Axils of fl.-bracts filled with long cobwebby hairs.*

8. **polyacánthus,** Engelm. (*Cèreus polyacánthus,* Engelm.). Sts clustered, forming thick masses, cylindrical to ellipsoidal. ribs 9–13: radial spines 8–12, robust, subulate, stiff and sharp, under one the longest, nearly 1 in, upper ones scarcely ½in, white to reddish gray with dark tips; centrals 3–4, bulbose base, stronger, about the length of the radials or the lowest sometimes reaching 2 in., horn-colored; later all the spines become gray: fls. lateral, about 1¾–2¼ in. long, dark scarlet to blood-red: fr. spherical, about 1 in. long, greenish red, spiny. Texas to N. Mex.

EE. *Axils of fl.-bracts bearing short wool.*

F. *Central spines always solitary: sts. 6–8 in. high. Mex.*

9. **scifer,** Lem. (*Cèreus scifer,* Otto). Sts. thickly clustered, 6–8 in high by 1½–2 in. diam., becoming

gray and corky with age: ribs 9–11, usually 10: radial spines usually 9, spreading, under pair longest, about ½in., in young growth white, later horn-colored to gray, the upper ones brownish; central solitary, straight, porrect, at first ruby-red, later brown, 1 in. long: fls. lateral, 2 in. and more long, clear scarlet-red, with a yellow throat and sometimes a carmine border. N. Mex.

FF. *Central spines 1–4: sts. 2–4 in high New Mex. and Colo.*

10. **coccíneus,** Engelm. (*E phœníceus,* Lem. *Cèreus phœníceus,* Engelm.). Sts irregularly clustered, ellipsoidal to short-cylindrical, 2–4 in. high by 1½–2¼ in diam.: ribs 8–11, straight: spines bristle-form, straight, round; radials 8–12, white, ¼–½ in. long, upper ones shortest, centrals 1–4, stouter, white to yellow or brown, with bulbose base: fls from upper lateral areoles scarlet-red, with the corolla-throat yellow. Colo. to Ariz

Var. **conoídeus,** Engelm. (*E conoídeus,* Rumpl. *Cèreus conoídeus,* Engelm.). Central spine long and robust: fls. large, red S. Calif and N. W. Mex.

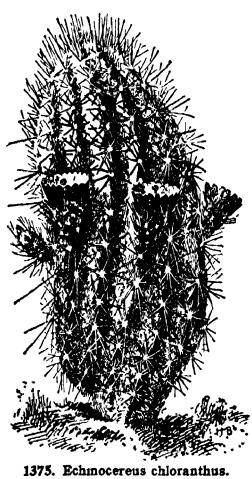
CC. *Fls. never scarlet, usually crimson or purplish, sometimes yellow.*

D. *Spines more or less pectinate. ribs 12 or more.*

E. *Areoles short, nearly orbicular.*

F *Color of spines white.*

11. **longisètus,** Lem (*Cèreus longisètus,* Engelm.). Sts. clustered, cylindrical, covered with long, dirty white spines, about 8 in high by 2 in diam., light green: ribs 11–14, straight, undulate. radial spines 18–20, straight, compressed, base thickened, subulate, flexuose, usually horizontally spreading, interlocking with adjacent clusters, the lower laterals the longest, reaching ⅜in. long, the upper more bristle-like and the shortest, all white; centrals 5–7, longer, reaching 2½ in., stronger, the upper ones scarcely longer than the longest radials; all are bulbose at the base; the 3 lower ones the longest and deflexed, spreading and sometimes curved: fls. red. Mex.



1375. Echinocereus chloranthus.

FF *Color of spines white and brown.*

12. **chlorânthus,** Rümpl. (*Cèreus chlorânthus,* Engelm.) Fig. 1375. Sts. in small clusters, cylindrical, slightly tapering above, 4–9 in high by 2–2½ in. diam: ribs 13–18, straight or rarely spiral: radial spines 12–20, horizontally spreading and appressed, sharp, the shortest one about ⅜in. long and white, the lower laterals a little longer and have purple tips; centrals 3–5, or in young plants absent, bulbose at the base, the upper ones shortest, about the length of the radials, and darker colored, with purplish tips, the lower ones stouter, about 1 in. long, deflexed, white; frequently all the spines are white: fls lateral, little more than 1 in. long; ovary and tube white bristly; petals green: fr. ellipsoidal, about ½in. long, spiny. Texas and New Mex

EE. *Areoles more or less elongated*

F. *Color of fls. greenish or yellow.*

G. *Fls. greenish.*

13 **viridiflórus,** Engelm. (*Cèreus viridiflórus,* Engelm.). Sts. solitary or only in age forming small, loose clusters, cylindrical or elongated, ellipsoidal, 3–7 in. high by 1–2 in. diam: ribs 13 radial spines 12–18, horizontally radiate, pectinate, straight or somewhat curved, subulate, the lower laterals the longest, about ½in., translucent ruby-red, the others white; centrals usually absent, rarely 1, strong, about ¾in. long, curved upward, red with brown point fls lateral, from just below the crown, broad funnelform, little more than 1 in long; ovary and tube spiny, corolla green, with a broad darker olive-green to pink stripe down the middle of each petal fr ellipsoidal, about ½in. long, greenish. Wyo. and Kans to Texas and New Mex.

GG *Fls yellow*

H. *Ribs 15–21: central spines unequal.*

14. **dasyacánthus,** Engelm (*Cèreus dasyacánthus,* Engelm.) Sts. solitary or sometimes forming open clusters, ellipsoidal to short-cylindrical ribs 15–21, straight or sometimes slightly spiral, obtuse radial spines 20–30, straight or sometimes slightly curved, subulate, stiff, sharp, pectinate, white with red or brown tips, later gray, the laterals longest, ½–1 in., the upper ones shortest, about ⅜in., those of one cluster interlocking with those of the adjacent clusters, centrals 3–8, the lower one longest, white with colored tips, mostly with bulbose bases fls from near the crown of the st large, 2½–3 in. long, ovary and short tube covered with white, reddish tipped stiff bristles, corolla yellow fr 1–1½ in long, ellipsoidal, spiny, green to reddish Texas

HH *Ribs 15 or 16 central spines very short, equal*

15. **ctenoides,** Lem (*Cèreus ctenoides,* Engelm.) Sts solitary or rarely branching, cylindrical to elongated ovoid, reaching a height of 6 in and a diam of 2½ in ribs 15–16, usually straight radial spines 13–22, horizontally radiate, pectinate, subulate, bases bulbose and laterally compressed, stiff, straight or often slightly curved, the laterals longest and about ⅜in., the upper ones very short, white or sometimes with brownish tips; centrals 2–3 or rarely 4, superposed, coarser, bulbose at the base, short and conical to ¼in long, reddish, later all the spines are gray fls lateral, from near the crown, 2½–3 in long, ovary and short tube white bristly, corolla yellow, with greenish throat. Texas and N Mex.–This species is very rare in cult.

FF. *Color of fls purple*

G *The spines irregularly pectinate*

16. **Rœtteri,** Rümpl (*Cèreus Rœtteri,* Engelm.). Loosely open clustered: sts upright, 4–6 in high, 2–3 in diam., cylindrical or ovoid ribs 10–13, straight: radial spines 8–15, subulate, thickened at the base, stiff, sharp, straight or slightly curved, the laterals longest, about ½in., the upper ones shortest, reddish with darker tips; centrals 2–5, stouter, bulbose at base, ¼–⅜in. long, the lower ones the longest, later all the spines are gray: fls lateral, from near the crown, 2½–3 in. long, purple-red to violet: fr. short ellipsoidal, spiny, green, ¾in. long. Texas to Ariz. and N. Mex.

GG. *The spines regularly pectinate.*

H. *Tube of fl. and spines of ovary slender and weak, the surrounding hairs long and cobwebby.*

17. **cæspitósus,** K. Sch. (*Cèreus cæspitósus,* Engelm.). Radials 20–30, curved, clear white or with rose-red tips; centrals absent, or 1–2 very short ones. Okla., Texas and Mex.

HH. *Tube of fl. and spines of ovary short and stout, the surrounding hairs short.*

I. *Central spines several.*

18. **pectinàtus,** Engelm. (*Cèreus pectinàtus,* Engelm.). Clustered sts. cylindrical or ovoid, reaching a height of 10 in. by 3 in. diam.: ribs 13–23, straight: radial spines 16–30, pectinate, horizontally spreading and appressed, straight or curved, the laterals longest, round, hardly ⅜in. long; central usually absent, or as many as 5, which are short, conical and superposed, white, with tips and bases variously colored with pink, yellow or brown; later all become gray: fls. lateral, from near the crown, 2½–4 in. long; ovary tuberculate and spiny, light to dark rose-red or rarely white. fr. globose, spiny, green to reddish green. Mex.

Var **adústus,** K. Sch (*Cèreus adústus,* Engelm.). Like the type, but with black-brown to chestnut-brown spines. Mex.

Var. **rufispìnus,** K. Sch. Of more robust growth: radial spines curved, red. Mex.

II. *Central spines none.*

19. **rigidíssimus,** Engelm (*Cèreus cándicans,* Hort. *C. rigidíssimus,* Hort.) RAINBOW CACTUS. Fig 1376. Sts comparatively shorter and thicker: radial spines 16–20, coarser and stiffer, straight or very little curved; base thickened, white, yellow or red to brown, these colors commonly arranged in alternating bands around the plant, the spines of adjacent clusters interlocking; centrals absent. Ariz. and N Mex.

DD. *Spines not pectinate.*

E. *Ribs 10 or fewer.*

F *Fls. crimson.*

20 **mojavénsis,** Rumpl (*Cèreus mojavénsis,* Engelm. & Bigel.). Sts. clustered, ovoid, reaching 3 in. height by 2 in. diam: ribs 8–12, conspicuously undulate: radial spines 5–8, the lowest pair the longest, reaching about 2¼ in. long; all are white with brown tips, subulate, straight or curved, strongly bulbose at the base; central solitary, or sometimes absent, stronger and somewhat longer and darker colored; later all the spines become gray: fls. 2–3 in. long, deep carmine: fr. ellipsoidal, about 1 in. long. Deserts of Ariz., Nev. and Calif.

FF. *Fls. purple-violet.*

G. *The spines dark, often of several colors.*

H. *Central spine 1.*

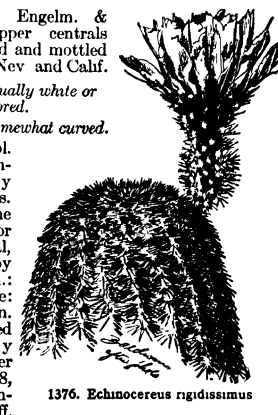
21. **Féndleri,** Rümpl. (*Cèreus Féndleri,* Engelm.). Irregularly clustered: st. cylindrical or rarely ovoid or even globose, sparingly branching, 3–7 in. high by 1¾–2½ in diam: ribs 9–12, straight or slightly spiral, undulate: radial spines 7–10, subulate, straight or curved, the lowest or the 2 lower laterals the longest, about 1 in, stronger, quadrangular, white; the 2 next higher brownish; the upper ones round, white and much shorter; all are bulbose at the base; central solitary (or in old plants 3–4), very strongly thickened at the base, round, black, sometimes with a lighter colored tip, curved upward, reaching a length of 1¾ in.: fls. lateral, from near the crown, 2–3½ in. long, dark carmine-red to purple and violet: fr. ellipsoidal, spiny, green to purple-red, about 1 in. long. Colo., Utah and south to N. Mex. B M. 6533.

HH. *Central spines several.*

22. **Engelmannii,** Lem. (*Cèreus Engelmannii,* Parry). Sts. clustered, cylindrical to ovoid, 4–10 in. high, 1¾–2½ in. diam., light green: ribs 11–13, undulate: radial spines 11–13, somewhat angled, stiff, sharp, straight or somewhat curved, horizontally spreading, the lowest or lower laterals the longest, about ½in., the upper ones the shortest, whitish with brown tips; centrals 4, stiff, straight, angled, stout, the lowest one deflexed, white to dark-colored, reaching a length of 2½ in, the upper ones about half as long, spreading, brown: fls lateral, from just below the crown, 1¾–2½in. long, purple-red: fr. ovoid, green to purple-red, spiny, later naked, about 1 in. diam.; pulp purple-red. Calif. to Utah and south into Mex.

Var **chrysocéntrus,** Engelm & Bigel. The 3 upper centrals golden yellow, the lowest white. Mojave Desert, Calif.

Var. **variegàtus,** Engelm. & Bigel. The 3 upper centrals curved, horn-colored and mottled with black. Utah, Nev and Calif.



1376. Echinocereus rigidissimus

GG. *The spines usually white or straw-colored.*

H. *Central spines somewhat curved.*

23. **dúbius,** Rümpl. (*Cèreus dúbius,* Engelm.). Tolerably thickly clustered: sts. branching at the base, cylindrical or elongated ellipsoidal, 4½–7 in. high by 1½–2¼ in diam.: ribs 7–9, undulate: areoles ⅜–⅝ in. apart, round, covered with short curly white wool, later naked: radials 5–8, subulate, horizontally spreading, stiff, round or faintly angled, the lower ones usually the longest, about 1 in. long, the upper ones about half as long, or sometimes absent, transparent white; centrals 1–4, stronger and longer, bulbose at the base, straight or curved, reaches 2½ in. length, the lowest one longest, straight, porrect or deflexed, the upper ones spreading: fls lateral, 2 in. long, rose-red to violet: fr. spherical, greenish to purple-red, covered with bundles of deciduous spines. Texas and N. Mex.

HH. *Central spines straight.*

I. *Sts erect, with the spines pale at base.*

24. **enneacánthus,** Engelm. (*Cèreus enneacánthus,* Engelm.). Freely branching at the base of the st. and thus forming thick, irregular clusters: branches ascending, usually 3–5 in. long by 1½–2 in. diam, green or sometimes reddish: ribs 8–10, straight, often divided by transverse grooves into more or less conspicuous tubercles: areoles ⅜–⅝in apart, round, white curly-woolly, soon naked: radial spines 7–12 (mostly 8), horizontally spreading, needle-form, straight, stiff, translucent white, base bulbose, the under one longest, reaching about ½in, the upper one very short; central solitary, or seldom with 2 additional upper ones, straight, porrect or deflexed, round or angled, whitish to straw-yellow or darker, ⅜–1½ in. long; later all the spines are gray: fls. lateral, from near the crown or lower, 1¾–2½ in. long, red to purplish: fr. spherical, green to red, spiny, ¾–1 in. long. Texas and N. Mex.

II. *Sts. spreading and flabby, with the spines red at base.*

25. **Mérkeri,** Hildmann. Sts. at first upright, columnar, later reclining and by branching at the base forming clusters, in new growth bright green, later gray to gray-brown and corky. ribs 5–9, undulate to more or less tuberculate: areoles ¾in. and more apart, round, white velvety, later naked: radial spines 6–9, the upper ones the longest, reaching 1¼ in. length, somewhat confluent with the centrals, subulate, spreading, straight; centrals 1–2, stronger, reaching a length of 2 in.; all the spines are white, nearly transparent, with red-tinted bulbose base. N. Mex.

EE. *Ribs 11 or 13.*

F. *Plants in small clusters: central spines sometimes solitary.*

26. **conglomeràtus,** Forst. Sts. clustered, columnar, somewhat tapering above, reaching a height of 1 ft. and 2 in. diam., light green: ribs 12–13, strongly undulate, tubercled above: radial spines 9–10, glossy, spreading, the lower pair the longest, base yellow; centrals 1–4, the lowest straight, porrect, reaching a length of 1½ in. and more, somewhat stronger than the rest. N. Mex.

FF. *Plants often 200 in a single mound: centrals never single.*

27. **stramíneus,** Rumpl. (*Cèreus stramíneus,* Engelm). Clustered in thick, irregular bunches: sts. ovoid to cylindrical, 4–8 in. long, 1½–2½ in. diam.: ribs 11–13: radial spines 7–10 (usually 8), horizontally radiate, straight or slightly curved, subulate, sharp, round or the long lower ones angled, transparent white, tolerably equal in length, about ½–¾in. or the lower ones sometimes longer and reaching a length of 1½ in; centrals 3–4, much longer, stronger, twisted, angled, straw-yellow to brownish, when young reddish transparent, the upper ones shortest and spreading upward, the lower ones porrect or depressed fls. lateral, 2½–3½ in. long, bright purple-red or deep dark red, to scarlet: fr ellipsoidal, about 1½ in. long, covered with numerous spines, purple-red. Texas to Ariz. and N Mex.

Horticultural names are. *E. paucispina,* no doubt a mutilation of paucispinus —*E. polycéphalus.*—*E. sanguíneus.*—*E Schlétsii*= E. Scheeri (?) —*E. tuberósus,* Rümpl =Wilcoxia —*E. Uèhri* — —*E. Uspéndkii.*

C. H. THOMPSON.
J. N. ROSE.†

ECHINÓCHLOA (Greek, *echinos,* a hedgehog, *chloa,* grass). *Gramíneæ.* Annual grasses with narrow inflorescence of several thick spikes Sometimes grown for grain and forage, but scarcely horticultural subjects.

Spikelets as in Panicum; glumes hispid-spiny, mucronate, the sterile lemma more or less awned — Species about 12, in the warm regions of both hemispheres. Regarded by many botanists as a section of Panicum. *E Crùsgalli,* Beauv., barnyard grass, is a common weed in cult. soil The spikelets are usually long-awned, the panicle 4–10 in long, green or purple. Dept Agric., Div. Agrost 7:82.

frumentàcea, Link (*Pánicum frumentàceum,* Roxbg). JAPANESE BARNYARD MILLET. Closely allied to *E. Crùsgalli,* but differing in the compact, somewhat incurved, appressed spikes, of nearly awnless spikelets: culms 1–4 ft, erect.—Cult. in S. E. Asia for the seed which is used for food. Occasionally cult. in U. S. for forage. Sometimes known as "billion-dollar grass."

A. S. HITCHCOCK.

ECHINOCÝSTIS (Greek, *hedgehog* and *bladder;* from the prickly fruit). Syn. *Micrámpelis Curcurbitàceæ.* WILD CUCUMBER. WILD BALSAM-APPLE. A profuse native annual vine which is a favorite for home arbors; the other species not generally cultivated, except perhaps the perennial-rooted megarrhizas.

Most of the species are annual herbs, with branched tendrils and palmately lobed or angled lvs.: fls. small, white or greenish, dioecious, the campanulate calyx 5–6-lobed and the corolla deeply 5–6-parted; stamens in staminate fls. 3; ovary 2-celled, with 2 ovules in each: fr. fleshy or dry, more or less inflated and papery, opening at the summit; seeds flattened, more or less rough.—The species are about 25, in the warmer parts of the western hemisphere, about 10 of them in the W. U. S., and 1 in the eastern states. The eastern species (*E. lobata*) is one of the quickest-growing of all vines, and is therefore useful in hiding unsightly objects while the slower-growing shrubbery is getting a start. Cogniaux, in DC. Mon. Phan. vol. 3, 1881. makes three sections of this genus, and this plant the sole representative of the second section, or true Echinocystis, because its juicy fr. bursts irregularly at the top, and contains 2 cells, each with 2 flattish seeds. The Megarrhiza group (kept distinct by some) is distinguished by its thick perennial root, large turgid seeds and hypogeal germination.

lobàta, Torr. & Gray. Lvs. wider than long, deeply 5-lobed, slightly emarginate at the base: tendrils 3–4-branched: staminate fls. small, in many-fld. panicles longer than the lvs.; calyx glabrous: fr. egg-shaped, sparsely covered with prickles New Bruns. and Ont. to Mont. and Texas, growing in rich soil along rivers and in low places. A G. 14:161. R.H. 1895, p. 9. G.C. III. 22:271. G.W. 10, p. 499.—Sometimes becomes a weed.

fabàcea, Naudin (*Megarrhìza californíca,* Torr.), is sometimes grown in fine collections and botanic gardens. It is a tendril-climber, reaching 20–30 ft. in its native haunts: lvs. deeply 5–7-lobed. fls. monoecious, greenish white, the corolla rotate· fr. densely spinose, globose or ovoid, 2 in. long; seed obovoid, nearly or about 1 in long and half or more as broad, margined by a narrow groove or dark line. S. Calif —Odd in germination (see Gray, Amer. Journ. Sci. 1877, and Structural Botany, p. 21).

L. H. B.†

ECHINÓPANAX (Greek, *hedgehog* and *panax,* referring to the prickly nature of the plant). *Araliàceæ.* Ornamental shrub, but rarely grown; very handsome on account of the large foliage and scarlet fruits.

Deciduous, prickly throughout· lvs. alternate, long-petioled, palmately 5–7-lobed, with serrate lobes, without stipules: fls greenish white, in umbels forming terminal panicles; calyx-teeth indistinct; petals 5, valvate, stamens 5, with filiform filaments, styles 2, connate at the base: fr. a compressed drupe.—One species, Pacific N Amer., Alaska to Calif., and Japan.

This is a strikingly handsome shrub with its large bright green palmately lobed leaves and scarlet fruits late in summer. Little known in cultivation; it will succeed best in moist and cool places and in partial shade Propagation is by seeds and by suckers and probably also by root-cuttings.

hórridum, Decne & Planch. (*Fátsia hórridum,* Benth & Hook. *Pànax hórridum,* Smith) Shrub, to 12 ft sts densely prickly: lvs. roundish-cordate, prickly on both sides, pubescent below, 5–7-lobed, lobes incisely lobulate and sharply serrate, 6–12 in. long. infl. tomentose: fr. scarlet, ⅓in. long. July, Aug; fr Aug., Sept.

ALFRED REHDER.

ECHÌNOPS (Greek, *like a hedgehog;* alluding to the spiny involucral scales). *Compósitæ.* GLOBE THISTLE Coarse thistle-like plants, with blue or whitish flowers in globose masses, sometimes used in the wild garden.

More or less white-woolly herbs: lvs. alternate, sometimes entire, usually pinnate-dentate or twice or thrice pinnatisect, the lobes and teeth prickly: fls. in globes; the structure of one of the globes is very odd; each fl. in the globe has a little involucre of its own, and the whole globe has one all-embracing involucre; fls. perfect and fertile (or sterile by abortion), corolla regular and no ray-fls; pappus of many short scales forming a crown: achene elongate, 4-angled or nearly terete, usually villous.—About 60 species, from Spain and Portugal to India and Abyssinia.

Globe thistles are coarse-growing plants of the easiest culture, and are suitable for naturalizing in wild gardens and shrubberies. An English gardener with an eye for the picturesque (W. Goldring) recommends massing them against a background of *Bocconia cordata,* or with such boldly contrasting yellow- or white-flowered plants as *Helianthus rigidum* or *Helianthus multiflorus.* The best species is *E. ruthenicus* (form of *E Ritro*). A few scattered individuals of each species are not so effective as a condensed group of one kind.

E. ruthenicus flowers in midsummer and for several weeks thereafter The silvery white stems and handsomely cut prickly foliage of globe thistles are interesting features They make excellent companions for the blue-stemmed eryngiums All these plants are attractive to bees, especially *E exaltatus*, which has considerable fame as a bee-plant. Globe thistles are sometimes used abroad for perpetual or dry bouquets.

A. *Lvs not pubescent nor setulose above but sometimes roughish above.*

Ritro, Linn (*E Vitro*, Hort) Tall thistle-like plant, with pinnate-lobed lvs, which (like the sts) are tomentose beneath, the lobes lanceolate or linear and cut, but not spiny involucre scales setiform, the inner ones much shorter fls blue, very variable G M. 46 69 R H 1890, p 524 G 31 611. Var. **tenuifòlius,** DC (*E ruthénicus*, Hort.), has the lower lvs. more narrowly cut, more or less spine-tipped Gn 45 174 —Perennials of S Eu, growing 2–3 ft high. They bloom all summer Lvs sometimes loosely webby above

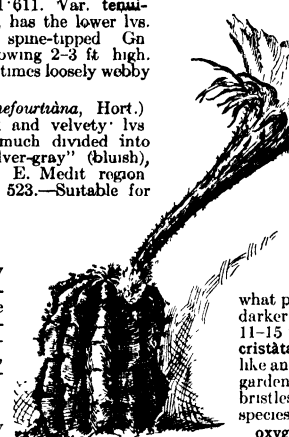
Tournefòrtii, Ledeb (*E Tournefourtiàna*, Hort.) Three to 4 ft, the sts branched and velvety lvs rough above, white-hairy below, much divided into 5 linear segms, spiny heads "silver-gray" (bluish), the involucral bracts free, bristly. E. Medit region Sept B M. 8217. R H 1906, p. 523.—Suitable for dry places

AA *Lvs pubescent or setulose above.*

B *Plant perennial*

sphærocéphalus, Linn Tall (5–7 ft) lvs pinnatifid, viscose-pubescent above, tomentose below, the teeth of the broad lobes yellow-spined fls white or bluish, the involucral bracts subulate-acuminate, free S Eu B R 356 (as *E paniculatus*)

hùmilis, Bieb Three to 4 ft lvs very hairy on both surfaces, webby above, those of the st essentially entire, the radical lvs sinuate-lyrate, almost unarmed, st -lvs with spiny tips heads large, blue, the involucral bracts all distinct and free Sept Asia



1377 Echinopsis gemmata.

bannáticus, Rochel Lvs hairy-pubescent above, tomentose beneath (as also the sts), the lower ones deeply pinnately parted, the upper pinnatifid, spiny fls blue Hungary. R H 1858, p 519

BB *Plant biennial*

exaltàtus, Schrad Tall, the st nearly simple and glandulose-pilose, the lvs pinnatifid, scarcely spiny: fls blue Russia B M 2457 (as *E strictus*, Fisch.).—Distinguished by its simple, erect st The garden *E commutàtus* may be the same as this

E. nudis, Hort, is a trade name that is unknown in botanical literature

N. Taylor †

ECHINÓPSIS (Greek, *hedgehog-like*). *Cactàceæ*. Sea-Urchin Cactus. South American small condensed cacti

Stems spherical to ellipsoidal or rarely columnar ribs prominent and usually sharp-angled. fls. usually long trumpet-shaped; ovary and tube covered with linear-lanceolate, cuspidate bracts which become longer toward the outer end of the tube, where they pass gradually into the outer petals, in their axils bearing long, silky, wavy hairs and usually a few rather rigid bristles.—This is a well-marked genus of about 18 species, although by some authors combined with Cereus. Cult as for Echinocactus; see also *Succulents*.

Only a few species of Echinopsis are grown in this country, although they are more easily grown and propagated than most of the United States species of cacti. The genus is well adapted for use as window plants.

A. *Ribs of st. divided into more or less evident tubercles*

Péntlandii, Salm-Dyck (*Echinocáctus Péntlandii*, Hook.). St. simple, later branching, spherical or ellipsoidal, reaching 6 in diam. ribs 12–15, divided between the areoles into oblique compressed tubercles radial spines 9–12, spreading, straight or slightly curved, yellowish brown, the upper the longest and strongest, reaching ½–1¼ in, central solitary, or seldom in pairs, porrect, curved, 1–1½ in, rarely 3 in long. fls. lateral, 2–2½ in long, yellow, orange, pink to scarlet-red fr. spherical, green, ¾ in diam. Peru, Bolivia. B M. 4124.—Probably not of this genus

AA. *Ribs of sts. not divided.*

B *Fls. red or pink.*

múltiplex, Zucc Sts at first rather clavate, later globose to ellipsoidal, abundantly branching, 6–12 in diam and the same in height, or rarely taller, light green to yellowish ribs 12–14, straight, scarcely undulate: radial spines about 10, subulate, straight, yellow to yellowish brown, with darker tips, reaching ¾ in length, very unequal, horizontally spreading, centrals mostly 4, of these the lowest is the longest, reaching 1½ in, somewhat porrect at first, later curved and deflexed, darker colored than the others fls rare, lateral, 11–15 in, rose-red S Brazil B M 3789 Var. **cristàta,** Hort Sts flat and spreading in growth, like an open fan or the fl.-stalk of the common garden cockscomb spines reduced to fine, stiff bristles This is merely a monstrosity of the species

oxygòna, Zucc. Sts at first simple, nearly spherical or rarely clavate, becoming short columnar, reaching 1½ ft height and 1 ft. diam., gray-green, darker above ribs 13–15, straight or wavy at the base. radial spines 5–15, horizontally spreading, very unequal, reaching ⅝ in, subulate, obliquely upright, centrals 2–5, somewhat longer, straight, porrect or deflexed, dark horn-colored, with black tips fls commonly many together, lateral, reaching 13 in length, pink to carmine-red, the inner petals lighter than the outer ones S Brazil.

triúmphans, Jacobi This is a hybrid between *E. Eyriesii* and *E. oxygona*, with pink double fls.

BB. *Fls. white.*

Eyrièsii, Zucc St. simple, commonly branching later, at first somewhat depressed, later short to rather tall columnar, reaching a height of 2 ft. and a diam of 4–6 in., dark green. ribs 11–18, straight, undulate, with sharp-angled margins: radial spines about 10, scarcely more than ⅛ in long, rigid, straight, slender conical, pointed, dark brown to black; centrals 4–8, but very little different from the radials. fls. lateral, 10–15 in. long, white: fr. small, ellipsoidal, about 1 in. long. S. Brazil, Uruguay and Argentina. B M 3411. B R 1707 (as Echinocactus)

gemmàta, K. Sch (*E. turbinàta*, Zucc) Fig. 1377. St. simple or sometimes branching, at first low spherical or short columnar, later more top-shaped, reaching 1 ft. height by 4–6 in. diam., dark green: ribs 13–14, rarely more, straight or sometimes slightly spiral with sharp or obtuse margins, which are but little or not at all undulate; central spines appear first, about 3–6 in number, very short, stiff, black; later the radials appear,

about 10–14, longer, horizontally spreading, at first yellowish brown, later horn-colored: fls. lateral or from the upper areoles, 9–10 in. long, clear white, with a pale greenish midline in the petals. S. Brazil.

tubifíora, Zucc. (*E. Duvàlii*, Hort. *E. Zuccarinii*, Pfeiff.). Sts. spherical to ellipsoidal, at first simple but later more or less branching, reaching 10 in. height by 8 in. diam., dark green: ribs 11–12, straight, with margins inconspicuously undulate: radial spines numerous, sometimes as many as 20, unequal, horizontally or obliquely spreading, yellowish white with brown tips, sometimes darker; centrals 3–4, the lowest the longest, reaching ⅝in., later deflexed: fls. lateral, about 14 in. long, white with pale green midline in the petals. S. Brazil and Uruguay. B.M. 3627.

C. H. THOMPSON.

ECHINOSPÉRMUM: *Lappula.* J. N. ROSE †

ECHINÓSTACHYS (Greek, *spiny head*). *Bromeliàceæ.* About a half-dozen species allied to Æchmea (with which some writers unite it), from S. Amer. Outer fl. parts bristly; petals broadly clawed, with 2 fringed scales or glands; ovary thick and fleshy, 3-seeded; spike cylindrical, thin, club-shaped: lvs. small, becoming darker after flowering. The species require hothouse conditions, as for Æchmea and related things. Three names have appeared in the American trade: *E. Hýstrix*, Wittm., for which see *Æchmea Hystrix*. **E. Pinelìana,** Wittm. (*Æ. Pinelìana*, Baker). Two to 3 ft.: peduncle and bracts brilliant red. lvs. 12–18 in. long in a rosette, strap-shaped, deltoid at summit, spine-edged. spike dense, 2–3 in. long, spiny; petals golden yellow and becoming black-brown, the tips fringed and incurved. Brazil. B.M. 5321. **E. Van Houtteàna,** Van Houtte (*Æ. Van Houtteàna*, Mez. *Quesnèlia Van Houtteàna*, Morr.) Lvs. many, strong-spined, sometimes white-banded beneath: fls. white, blue-tipped, in a crowded spike, the bracts reddish at the summit and white-downy at the base: 1–2 ft. Brazil.

L. H. B.

ECHÎTES (Greek, *viper;* possibly from its poisonous milky juice or from its twining habit). *Apocynàceæ.* Tropical American twining shrubs related to Dipladenia, and of similar culture.

The genus differs technically from Dipladenia in the 5-lobed disk and the glandular or 5-scaled calyx. Lvs. simple, opposite, penninerved: fls. usually showy, purple, red, yellow or white, in sub-cymose clusters; calyx small, 5-lobed, with many glands at the base inside or else 5 scales opposite the lobes; corolla salver-shaped, the throat usually contracted, the limb 5-lobed; stamens included, the filaments very short; stigma with an appendage in the form of a reversed cup or of 5 lobes.—Some 40 species, S. Fla. to Chile.

Andrewsii, Chapm. (*E. suberécta* Andr.) Lvs. 1½–2 in. long, close together, oval or oblong, mucronate, acute or rounded at the base, margins revolute; peduncles axillary, 3–5-fld., shorter than the lvs.; fls. yellow, 2 in. long; corolla-tube much dilated above the insertion of the stamens, bell-shaped, scarcely longer than the lobes; anthers tapering into a long bristle-like awn. Sandy shores, S. Fla., W. Indies. B.M. 1064. P.M. 7.101.

paludòsa, Vahl. Lvs. oblong, oval-oblong, or lanceolate-oblong, rounded toward the mucronate top: calyx-segms. glandular, devoid of an interior scale, oblong, mucronate-blunt, spreading; corolla-tube funnel-shaped above a cylindrical base; anthers oblong-lanceolate, acuminate, rounded-cordate at the base, hirsute on the back above. Mangrove swamps, S. Fla.

umbellàta, Jacq. Lvs. ovate or ovate-roundish, mucronate: fls. greenish white; calyx-segms. glandular, devoid of an interior scale; corolla-tube cylindrical, enlarged below the middle, tapering again above; anthers rigid, tapering from a hastate base, glabrous. S. Fla., W. Indies.

WILHELM MILLER.

ÉCHIUM (from the Greek for a *viper*). *Boraginàceæ.* VIPER'S BUGLOSS. Coarse, mostly rough herbs and shrubs, with spikes of blue, violet, red or white flowers, some of them grown in the open and others under glass.

Plant usually scabrous, hispid or canescent: lvs. alternate. fls. in unilateral, scorpioid, forked or simple spikes, with either small or foliaceous bracts; calyx with 5 narrow lobes; corolla tubular-trumpet-shaped, the throat oblique and dilated and without appendages; corolla-lobes 5, roundish and unequal, somewhat spreading or erect; stamens 5, inserted below middle of tube, unequal and exserted; ovary deeply 4-lobed; style filiform, 2-parted at top: fr. 4 nutlets.—Some 30–40 species, from the Canaries and Madeira (where they are specially important) to W. Asia. One species, *E. vulgare*, Linn., is a showy introduced biennial weed in fields and along roadsides, with blue or rose-tinted fls.; it is known as blue-weed and blue-devil. The shrubby species of Madeira and the Canaries are much confused, some of the names having been established on cult. material. This is particularly true of the forms passing as *E. candicans* and *E. fastuosum*, which are very unsatisfactorily determined (See Hooker, B.M. 6868). In those islands, the plants produce much forage and they persist from the goats in inaccessible places. (The portraits quoted below are cited under the names they bear.)

In rich soil echiums grow coarse and scarcely flower, and the flowers are never as richly colored as when the plants are more or less starved. Biennials seed freely, and the seed is sown as soon as gathered. *E. fastuosum* is said to be the handsomest of the shrubby kinds, grows 2 to 4 feet high, has long, pale green leaves covered with soft white hairs, and flowers of a peculiarly brilliant deep blue. Echiums are eminently suited for dry places, and need good drainage.

cándicans, Linn. f. (*E. fastuòsum*, Jacq. f., not Ait. *E. truncàtum*, Hort.) Forms a bush several feet high, but flowers at 3 ft., the lvs. and sts. white-hairy: branches thick, leafy toward the tips: lvs. lanceolate, the upper ones smaller, crowded and narrower; panicles much looser than the spikes of *E. fastuosum*, fls. sessile, pale blue, the buds reddish purple, the pink stamens protruding. Madeira, Canaries, on mountains. B.M. 6868. B.R. 44. G.C. III. 51.368. G.M. 55:376.—The fls. are said sometimes to be streaked with white or all white.

fastuòsum, Ait., not Jacq. This has darker blue fls. in a dense spike and perhaps less hoary foliage than *E. candicans*, the protruding filaments nearly white (said by some to be white in *E. candicans*). Coast, Canaries. R.H. 1876. 10. Gn. 10:546. G.C. III. 33.328. G.W. 15, p. 356.—*E. fastuosum* has dark blue, 5-lobed fls. about ½in. across, in spikes 6 in. long and 2 in. wide, perhaps as many as 200 fls. in a spike. Great masses of stamens are thrust out and add to the interest, and the young fl.-buds look like pink 5-pointed stars.

símplex, DC. Woody but biennial and not branched, 8–10 ft.: lvs. ample, oval-lanceolate: panicle very long, cylindrical, spike-like, the spikelets 2-fld., pedicelled; stigmas simple. R.H. 1912, p. 351. Gt. 51, p. 375. G.C. III. 53.20.

E. Auberiànum, Hort., not Webb & Berth. =*E. Bourgeanum.*—*E. Bourgeànum*, Webb. Stout and strict, 8–11 ft., the st. covered with long-linear drooping lvs. fls. rose-colored, in a dense pyramidal spike. Mountains, Canaries. R.H. 1912, p. 440. G.C. III. 53.25. A striking plant.—*E. callithýrsum*, Webb. Woody or tree-like, robust, hispid-hairy. lvs. strongly nerved. calyx-segms. very unequal. fls. pale red. floral lvs. exceeding the different cymes of the thyrse. Canaries.—*E. formòsum*, Pers. =Lobostemon.—*E. Pininàna*, Webb. & Berth. Very large species, reaching 16 ft., with an abundance of stout spreading long-oblong lvs. G.C. III. 53.20.—*E. Wildprètii*, Pears. A tall soft-hairy biennial with simple erect st. 2–3 ft. lvs. sessile, narrowly linear-lanceolate, hairy fls. pale red with long-exserted filaments, in a large terminal thyrse. floral lvs. much exceeding the different cymes. Canaries. B.M. 7847. G.C. III. 38.5, 52:317. G.M. 53.111. Gn. 76, p. 303. G. 27.261.

WILHELM MILLER.
L. H. B.†

EDELWEISS: *Leontopodium.*

EDGEWÓRTHIA (after M. P. Edgeworth, English botanist in East Indies, and his sister Maria). *Thymelæàceæ.* Ornamental woody subjects grown chiefly for their early yellow and fragrant flowers and for the handsome foliage

Deciduous sparingly branched shrubs, with stout branches· lvs. alternate, entire, short-petioled, crowded at the end of the branches. fls. in dense, peduncled heads, axillary, on branches of the previous year, with or before the lvs , apetalous; calyx-tube cylindric, with 4 spreading lobes, densely villous outside; stamens 8, in 2 rows, style elongated, stigma cylindric: fr a dry drupe —Two species in Japan, China and Himalayas.

These plants are hardy only in warmer temperate regions, but do not stand hot and dry summers; they thrive in any good well-drained garden soil; if grown in pots, a sandy compost of peat and loam, with sufficient drainage given, will suit them. Propagation is by greenwood cuttings in spring under glass, also by seeds

papyrífera, Zucc (*E. chrysántha,* Lindl *Dáphne papyrífera,* Sieb.). Small shrub with thick branchlets: lvs deciduous, membranous, elliptic-oblong to oblong-lanceolate, acute at the ends, at first clothed with silky hairs on both sides, later glabrous above, 3–5 in long heads of fls dense, up to 2 in across, on short axillary stalks; fls ¾in. long, densely silky-hairy outside, fragrant, yellow, drying whitish; ovary pubescent only at the apex April. Japan, China B R 33 48 F S 3.289.—Cannot withstand the long dry summers.

Gárdneri, Meisn Large shrub, with slenderer branchlets lvs persistent, of firmer texture fls with a more shaggy pubescence, drying black; ovary hairy throughout. otherwise very similar to the preceding species which is, by some botanists, considered not specifically distinct. April. Himalayas B M. 7180.

ALFRED REHDER

EDRAIÁNTHUS *Wahlenbergia* By some kept distinct, to include about a dozen species Spelled also *Hedræanthus*

EDUCATION, HORTICULTURAL. In the United States and Canada, instruction in horticulture is part of the publicly maintained colleges of agriculture. In Canada, these colleges are provincial rather than national or established by the Dominion The Canadian colleges of agriculture are· Nova Scotia and New Brunswick, Truro, N S ; Quebec, Sainte Anne de Bellevue (only in part provincial); Ontario, Guelph; Manitoba, Winnipeg, Saskatchewan, Saskatoon; British Columbia, in plan at the university being established at Victoria

In the United States, general horticultural education is mostly a part of a national system of professional and applied education of collegiate grade or name. There is a college of agriculture in every state in the Union, being part of a national system with cooperation and aid from the State. (For list, see *Experiment Stations,* p 1195)

There is little development, as yet, in North America of the training-school idea on either a private or a public basis, and relatively few institutions or establishments in which persons are trained for "gardening," as they are trained in the Old World. There is no recognized apprentice system for gardeners The whole subject, therefore, needs to be considered quite by itself and not in comparison with systems or methods of education in horticulture in other and older countries; and it is necessary to understand something of the system of publicly endowed industrial education, of which instruction in horticulture is a part. The general nature of these institutions in both Canada and the United States may be understood from a brief discussion of the land-grant institutions in the latter country.

The public industrial education of the United States, of college grade, is founded on the Land-Grant Act of 1862. By the terms of this great instrument, every state received from the federal government 30,000 acres of land for every representative that it had in Congress, the proceeds of which are to be used for "the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislature of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life" This endowment has been supplemented by subsequent direct federal appropriations, to further the objects for which the original grant was made. On this foundation, all the forty-eight states comprising the Union have established colleges of agriculture and the mechanic arts, about half of them separate institutions and about half of them connected with or part of state universities or other general institutions The states themselves have supplemented and extended the proceeds of the land-grant. These and the Canadian colleges represent many types of organization and method. Their purpose is increasingly to train young men and women broadly by means of agricultural and country-life subjects They are now exerting great influence in re-directing rural civilization They are rapidly putting agricultural and rural subjects into educational form, and are demonstrating that such subjects may have training and even cultural value equal to that of historical subjects.

The agricultural colleges contain many departments, and horticulture is usually one of these departments, coordinate with the others. Some of these departments, aside from the work in the fundamental arts and sciences, are as follows: agricultural chemistry, agronomy, entomology, plant physiology, plant pathology, bacteriology, plant-breeding, soils, farm crops, farm management (the principles of business as applied to farming), horticulture, pomology, floriculture, forestry, animal husbandry, poultry husbandry, veterinary, dairy industry or dairy husbandry, home economics, farm mechanics and engineering, rural economy or agricultural economics, landscape gardening or landscape art, drawing, rural education, meteorology, and extension teaching. It will be seen, therefore, that horticulture is only one contributing part in an educational establishment for the teaching of agriculture in a broad way.

Aside from these publicly endowed or maintained institutions, there are a few other regular colleges that teach horticulture with other work, but they have not made great headway, although the subject may assert itself strongly in some of them in the future. There are two or three training-schools, one for women. More training-schools will be needed.

The students in agriculture in the colleges of agriculture number many thousands, in some cases 1,000 and more in one institution They come from all walks and conditions of life, and from city and country alike. Some of them, of course, have strong inclinations for horticulture, and soon specialize in that subject The full course of instruction is four years, following college entrance requirements, and the student at graduation receives a diploma carrying Bachelor of Science or a similar degree. In many of these institutions, post-graduate work in a variety of subjects is provided, leading to a master's degree or even to a doctor's degree.

The first institutions to develop horticulture as a separate subject appear to have been those in Michigan, under W. W. Tracy, Chas. W Garfield and successors, Mr. Tracy having been instructor in horticulture as early as 1867; New York (1874) and in Ohio under

W. R. Lazenby; and in Iowa (1876) under J. L. Budd. The instruction by means of horticulture has now grown to great importance in many of the colleges, the staffs comprising, in some cases, as many as fifteen to thirty persons.

The horticultural work in the colleges.

We may now consider the horticultural teaching work of these colleges in more detail.

In the early days of such instruction, the horticulture was set over against the agriculture, and these two comprised the main applied groups The breaking-out of the group of horticulture was really the beginning of the broadening of these institutions and of their more perfect articulation with the conditions before them.

Horticulture, as understood in these colleges, comprises fruit-growing, flower-growing, vegetable-gardening, together with the nursery and glasshouse subjects naturally associated with them. With the further differentiation of the curriculum, horticulture tends to be split or separated into its three main parts, with separate units or teacherships for each, but this division has not yet proceeded far in most of the institutions. If this division is ever carried to its conclusion, the name "horticulture" as an educational unit may pass out.

In the colleges, horticulture is regarded as a phase of the general agricultural field. For the most part, the student approaches the subject from the point of view of farming by means of fruits or vegetables or even of flowers The strictly amateur phase is incidentally emphasized as a rule, and this undoubtedly is one of the weaknesses of the American horticultural instruction. The amateur attitude, however, will appear more markedly as the country develops and matures The present attitude very well represents the development that America is now making, as expressed particularly in the great orchard interests. The gardeners, as a group, have had relatively little touch with these institutions in the way of dictating or even influencing their development So far as institutions are concerned, the gardening phase of horticulture is well expressed where the great collections are, as at the Shaw or Missouri Botanical Gardens, Arnold Arboretum, New York Botanic Gardens, and others; and these institutions will also produce highly trained specialists in small numbers in related scientific lines.

The content of the work in the land-grant colleges varies greatly, depending, of course, on the constituency of the particular college as well as on the staff. Naturally, in the states in which horticultural interests are large, the work will express itself strongly in the college. Some of the courses in horticulture now offered in different colleges of agriculture may be displayed, showing how the subject is divided and what is considered to be the content of the instruction. These examples are chosen only to show the kind and the range of representative courses, and the writer makes no comment on them. Other courses might be chosen from the catalogues, but these are sufficient for illustration. In some cases, practically the same subject is entered twice: this represents the way in which the subject is phrased in different institutions. Some of the courses in landscape work that are given by departments of horticulture are also included.

Elements of horticulture —Fruit-growing, vegetable-gardening and ornamental planting, with special reference to the farm home

Gardening.—A personal and informal course for lovers of plants and gardens. The course consists of actual work with identification and growing plants, supplemented by conferences and informal discussions. Attention is given to garden literature and history, planning of grounds.

Cultivated plants —The relationship and classification of certain economic and ornamental plants of the temperate zone: identification of species examination of living plants and herbarium specimens.

Evolution of horticultural plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture, theoretical causes and observed factors that influence variation, particularly food-supply, climate and cross-fertilization.

Amateur floriculture.—Window-gardening, growing of flowers on the home grounds; containers, potting soils, fertilizers, preparation and planting of flower-beds, propagation and culture of plants suitable for window and garden.

Commercial floriculture.—Studies in the propagation and culture of the leading florist crops. As facilities permit, students are assigned space in the greenhouses for practical experience in the growing of roses, carnations, chrysanthemums, violets, sweet peas, and other plants. Discussions on diseases, insects, botany, and the packing, handling, and marketing of cut-flowers and plants for retail and wholesale markets. Classes participate in a required excursion.

Garden flowers —Designed to acquaint the student with garden plants and to give practical knowledge of the propagation and culture of the annuals, herbaceous perennials, bulbs, and shrubs used for cut-flowers or in ornamental planting

Greenhouse construction —The development of the modern greenhouse, types of houses, materials, and methods of construction, installation of heating systems, etc Laboratory practice in erecting section of cypress and iron frame houses, and in planning and estimating the cost of commercial ranges for flower- and vegetable-production. The class participates in a required excursion.

Greenhouse management.—Studies of the principles and practice of propagation, soils, potting, shifting, watering, ventilation, and fumigation of plants cultivated by florists

Conservatory plants —A study of the culture and uses of tropical and subtropical plants grown in conservatories, including palms, ferns, begonias, orchids, etc.

Floral design.—A study of the principles of floral art Practice in the arrangement of flowers in designs and bouquets, baskets, table decorations, interior decoration, etc

Greenhouse and garden practice.—Designed to give the student practical knowledge of greenhouse work Lectures and exercises in greenhouse management, propagation, compositing soils, potting, watering, etc

Investigation in floriculture —The investigation of problems in the growing of cut-flowers, exotics, and garden flowers, hybridizing, study of varieties. Designed primarily for upper classmen and graduate students

Elements of landscape gardening —Reconnaissance surveys and mapping, with special reference to the methods used in landscape gardening, detailed study of selected designs of leading landscape gardeners, grade design, road design and field work

General design.—Field notes, examination of completed works and those under construction, design of architectural details, planting plans, gardens, parks and private grounds, written reports of individual problems

Civic art —The principles and applications of modern civic art, including city design, city improvement, village improvement, and rural improvement

Trees and shrubs —Plant material important to landscape gardening, landscape value of each plant with respect to adaptability to the soil and situation and the use of the plant in design.

Advanced landscape design.—Real estate subdivisions and a complete set of plans, including a sketch plan, general plan, report, detailed study of architectural features, grading plans, planting plans, set of specifications, and estimate of cost

Landscape practice —Interpretation of topographic maps and their relation to landscape design, calculation of cut and fill, quantities of material, preparation of grading plans and working drawings

Exotics —Temporary decorative plants used in landscape gardening

Plant materials.—This course aims to make the student familiar with the character of the trees, shrubs and herbaceous perennials used in ornamental work, and with the methods of propagating them

Decorative and bedding plants —Tropical and subtropical plants used in decorative work in the conservatory, tender plants used in outdoor bedding

Home vegetable-gardening —A study of vegetables and their production for home use The planning and management of the garden, special crop requirements, factors influencing quality, and control of pests, will be considered The laboratory work consists of actual practice in the garden. The starting of early plants in hotbeds and frames, intercropping and succession-cropping to secure largest yields from small areas, are studied Each student assumes charge of his own plants and carries them through to the end of the term

Commercial vegetable-gardening.—The principles of vegetable-growing as applied in commercial production; the scope of the industry and its opportunities, choice of location, equipment, management. The vegetable crops are considered singly, as to their adaptation, culture, special requirements, varieties, enemies, marketing, and profits. The laboratory work includes exercises in growing plants under glass and in the planting and care of early outdoor vegetables. Each student assumes full charge of his own plantings.

For students specializing or desiring a fuller knowledge of vegetable-gardening, another course is given, throughout the year. Advantage is taken of the opportunity for practice in harvesting, packing, and marketing fall crops A two-days' excursion to two or three important vegetable-growing centers some time during May constitutes a part of the course Each student gives a part of his time to a special problem, to be agreed on. Report on this problem is presented in typewritten form

Vegetable-forcing —Vegetable-growing under glass. Important

forcing crops. Laboratory consists of practical work in crop-production Each student is assigned a plot in the greenhouse on which he grows vegetables to maturity, assuming full charge except in heating and ventilation. This is supplemented by descriptive studies.

Systematic vegetable crops —Lectures and descriptive studies dealing with vegetable crops, their origin and botany Special attention is given to varieties, and their adaptation to different cultural and market conditions. The important commercial types of the different vegetables are grown in the garden each year, and there is an abundance of first-hand material for the course.

Advanced vegetable-gardening —The student's time is divided between advanced studies of vegetable crops and their culture and the study of a special problem to be agreed upon. An excursion to two or three important vegetable-growing centers constitutes a part of this course

Elementary pomology —A study of the methods of propagation and early care of commercial fruits, including the growing of seedlings, cuttings, and layers, the principles of budding, grafting, pruning, and planting, the soils, varieties, and planting plans for the orchard.

Practical pomology.—A study of the soils and varieties for the orchard, cultivation, cover-crops, fertilization, spraying, pruning, and thinning as practised in orchard management, the picking, grading, packing, storing, and marketing of fruit This course considers the apple, pear, quince, cherry, plum, apricot, and peach.

Systematic pomology —A study of the varieties of the different fruits and of nomenclature, with critical descriptions, special reference being given to relationships and classification

Bush-fruits —A lecture course which considers the grape, raspberry, blackberry, dewberry, currant, gooseberry, and strawberry The topics discussed are varieties, planting, culture, picking, grading, packing, and marketing.

Small-fruits and grapes —The strawberry, raspberry, blackberry, dewberry, currant, gooseberry, grape History, extent of cultivation, soil, location; fertilizers, propagation, planting, tillage, pruning, insect enemies, diseases, varieties, harvesting, marketing.

Spraying of fruit trees —A study of the preparation and application of the spray mixtures used in orchard practice.

Nuciculture —Lectures on the practical and systematic phases of nut-culture, with special reference to the cultivation and improvement of the forms native to the United States

Subtropical pomology —A study of citrous and other tropical fruits, with special reference to American conditions. Laboratory work in describing and judging the various fruits

Plant-propagation —Grafts, buds, layers, cuttings, seeds

Systematic pomology —A course designed primarily for graduates and students who are preparing to do experimental work A study of the characters and botanical relationships of the fruits of the United States Each student is required to collect and mount a number of varieties and species.

Research in pomology —Original investigation of problems in pomology. A typewritten thesis is required.

The equipment for the horticultural work usually consists of classrooms, laboratories with tables and sometimes equipped for microscopic work, and herbaria; workrooms in which practice may be had in the mixing of soils, the compounding of spraying materials, the testing of machines, the study of vegetables and fruits, and the like; range of glasshouses; and a number of acres of land for gardens and orchards Sometimes the orchard area amounts to fifty and more acres In some colleges the plant-breeding is included with the horticulture and in some of those that are least differentiated the plant pathology and economic entomology are also included, as also forestry. In the courses detailed above, all these subjects are excluded as horticulture, since they are likely to be handled in regular departments by themselves in numbers of different courses.

The subject of landscape architecture, or landscape gardening, has developed in the institutions in the United States from two sides When it is an offshoot of colleges or departments of architecture, or when strongly dominated by architectural ideas, it is likely to be known as landscape architecture In the agricultural colleges, however, the subject has developed mostly from the horticultural or gardening side, and has usually been called landscape gardening. As a part of the curriculum, landscape gardening is given more or less attention in nearly all the land-grant institutions. In three or four of them, however, the subject is now being given special and professional attention, as also at Harvard. Two institutions in this country give a post-graduate degree, Master of Landscape Architecture or Master of Landscape Design.

Other forms of horticultural teaching.

The colleges of agriculture are engaged rather largely in extension work, the extension meaning all educational efforts prosecuted at the homes and on the farms of the people. The extension work is welfare work, and it is properly a necessary part of an institution that is maintained by the people for the service of the people Some of this extension work is horticultural. It comprises tests and experiments in orchards, gardens, and greenhouses; coöperation with growers' associations; surveys of conditions and industries; the issuing of popular bulletins and other literature, lecture-courses, reading-courses, and much correspondence See *Extension Teaching in Horticulture*, page 1199.

The experiment and research work of the institutions is also of course educational, but this effort is reserved for separate discussion See *Experiment Stations*, page 1195

In the public schools, there is now a strong sentiment for the introduction of agriculture. This pertains in all parts of the United States and Canada This agricultural instruction will be organized eventually on the same basis as other instruction in the common schools. Agriculture will include a great variety of subjects, the horticultural affairs being given their due consideration This will result in a gradual redirection of the youthful mind toward horticultural and other rural pursuits.

The nature-study movement is widespread and established, and the material of the teaching is largely of plants. School-gardening is growing in popularity and importance. All these subjects are finding their way into normal schools and colleges, in some of which there is definite horticultural work for the training of teachers Correspondence courses, the rural press, state departments of agriculture, and other agencies and enterprises are also forwarding horticultural education as a part of the general rural betterment

In the United States and Canada, horticulture is largely a training for citizenship, on the basis of general collegiate education The Americans have had a continental area to discover and to conquer; they are endeavoring to conquer it by many means, and the most fundamental means is by organizing all industry educationally. The horticultural subjects are important not only in themselves but in their personal appeal, and the organizing of horticultural knowledge into large plans and methods of human training is one of the best privileges of any people. L. H. B.

EEL-GRASS: *Vallisneria spiralis.*

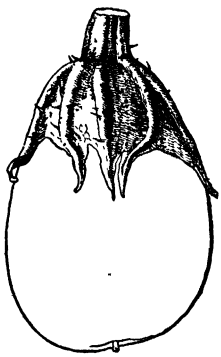
EGGPLANT (*Solànum Melongèna*, Linn.). *Solanàceæ.* GUINEA SQUASH. AUBERGINE of the French. Strong perennial herb or sub-shrub, grown as a vegetable-garden annual for its large fruits, which are eaten cooked; requires a long warm season



1378. Rotate corolla of eggplant; stamens connivent.

The eggplant is native of the tropics, probably from the East Indies, but its native land is not known. It is cultivated to a greater or less extent throughout the entire tropical regions. The first reports of its use as a vegetable come from India, hence the above assumption. In the United States it is cultivated as a vegetable as far north as New York, but it usually grows to greater perfection in the southern states. It is much grown in Florida. The demands for it in the early months of the year have not been fully supplied. Its cultivation demands a specialist as much as either celery or tobacco, while the specialization must be in a different direction from that of either one of these. Nearly all of the fruit

that grows to proper size is edible, and there is no special demand for particular flavors. Eggplants are forced under glass to a limited extent for home use. They require the temperature of a tomato house, and great care must be taken to keep off red-spider and mites. In order to insure large fruits, practise artificial pollination. Non-pollinated fruits will grow for a time, but always remain small (Fig. 1379).



1379. Non-pollinated fruit.

Soil.—Eggplant will grow on almost any land in the South, but it develops to greater perfection on a rich, deep, loamy soil free from debris. In the clay districts this is not easily secured, but there are often small fields that are sufficiently dry and yet contain enough sand to make eggplant-growing profitable. No matter whether clay land, loam or sandy land be employed for raising this crop, it will be necesssary to plow deeply and thoroughly. The land should be drier than that required by cabbage or beets. In fact it will stand a greater drought than the ordinary vegetables. On the other hand, one should not attempt to grow a crop on land that is composed of large particles, such lands as are ordinarily called "thirsty" in the vegetable-growing sections of Florida

Fertilizer.—On the coastal plains of the South Atlantic and Gulf States, barn manure is of doubtful value for fertilizing eggplant. When it is advisable to use this material, it is preferable to compost it and use it in the form of well-rotted stable manure A cheaper and at the same time preferable way of securing the humus necessary in the loamy sands is to grow leguminous plants that are not subject to root-knot Such plants will give much more humus and at a cheaper price than can be obtained by the use of stable manure. On the loamy sands, the fertilizer should not be applied until after the plants have been set out and have started. A small quantity is then applied by hand or by drill. On very poor land, as much as 200 to 500 pounds of a good home-mixed fertilizer should be used. In the course of two to four weeks, the eggplants will have shown the effect of the fertilizer and by this time will be making a considerable growth. A second application may then be made of as much more, or twice as much as was used the first time. Later in the season, when the plants are beginning to make bloom buds or setting the fruit well, an after-dressing of nitrate of soda could be applied if the plants show need of further fertilizing, using it at the rate of 100 to 300 pounds to the acre. This can be applied very readily by hand or by the use of a fertilizer drill. The hand method is more economical of fertilizer but more costly in applying. On the heavy clay lands less potash will be needed and in those places in which a stiff clay is employed for gardening purposes, the potash may be reduced to 4 or 5 per cent, or even eliminated. Ammonia and phosphoric acid are needed on nearly all the soils.

Propagating the seedlings.—The time required to bring plants into bearing from seeds varies with the condition of the soil and the temperature. During cool weather the plants grow very slowly, but during hot weather they grow rapidly and mature fruit in much less time. Those who wish to have early fruit and are able to use hotbeds or propagating-houses should sow the seed 120 to 150 days before the fruit is wanted. Prepare the hotbeds as for other seedlings, and sow in rows a few inches apart. When these are beginning to show their leaves or when the seedlings are beginning to look spindly, they should be pricked out and transferred to another bed. In this each plant should be given about a 2-inch square; then they may be forced until the plants crowd one another in the bed, when they should be transferred again. When the plants have attained the size of 6 inches, and the atmosphere will permit, they may be set out in the field. A somewhat more laborious, but at the same time more successful plan, is to plant the seedlings in 2-inch flower-pots and then shift to larger ones as often as the plants become pot-bound or crowd one another in the bed. Fig 1380 represents a plant three-tenths natural size, just taken from a flower-pot and ready to be shifted to a larger one. By shifting until 6-inch pots are reached, the eggplant may be forced along without injury to blooming size or even to a size when fruit is beginning to set, and then set out in the field without injury to the plants or crop Eggplant-growers should bear in mind constantly that from the time of sprouting the seeds to the harvesting of the crop, the plants cannot stand a severe shock in their growth without detriment to the crop When the plant is once started, it should then be forced right along and never allowed to become stunted during its growth The amount of damage done by neglecting plants before they are set in the field varies with the severity of the shock and the length of time during which the plant undergoes the disadvantageous conditions If it becomes necessary to harden the plants off before setting them in the field, this should be done gradually.

Culture in the field.—After the field has been thoroughly prepared in the way of plowing and fertilizing, which should have been done at least two weeks before the plants were set out, the rows should be laid off 3 to 4 feet apart The plants may be set 2 to 4 feet apart in the row, varying with the varieties to be used and the soil Tillage should be continued and varied according to the conditions of the weather. In a wet season it is well to cultivate the land as deeply as possible, while in dry weather cultivation should be shallow, simply sufficient to keep the weeds from growing, to keep the soil well aired, and to keep mulching of dry soil on the land. Under ordinary circumstances it does not pay to prune or pinch out the buds, but when the season is short this may be resorted to with some advantage. If it is desirable to have the fruit attain a certain size before frost, one may begin to pinch out the blossoms and new growth about three weeks before its usual occurrence. This same process will be of advantage when the fruit is to be brought into market at a certain time. A great many attempts have been made to hold eggplants over the summer, that is to have a spring cropping and then allow the plants to remain in the field, cultivate them up and make a fall crop from the old stalks. Sometimes this process is successful but generally speaking it is a wasteful and expensive method. The old plants that have borne a crop should be discarded and a fresh seed-bed started to bring the plants in at the



1380. Pot-grown plant ready for setting in the field.

time desired. If about 150 days are allowed from the time of sowing the seed, the grower will have a good field of fresh plants to start in with, which will produce a higher quality and larger quantity of fruit.

Marketing.—It is better to cut the fruit from the plant than to attempt to break it, especially if the work is being done by careless laborers. After cutting the fruit, it may be placed in large baskets and hauled to the packing-house for crating Each fruit should be wrapped separately in heavy paper, either manila or brown, and care must be exercised not to wrap it while moist. Formerly the large crate was generally employed, but in the last ten years there has been a decided tendency toward reducing the size of the crate. The eggplant crate is now about double the size of the bean crate, and usually ships at the 80-pound rate. The eggplant is regarded as a staple vegetable, consequently fancy wrapping-paper or fancy methods of packing do not pay for the trouble. It stands shipment well to distant markets, so that freight shipments are usually employed At times in the winter and spring, the price of eggplant becomes very high and then the shipments go forward by express.

Varieties —There are only a few varieties offered in the market. The New York Improved Spineless matures a little earlier than the Black Pekin. The New York Purple (Fig. 1381), Black Pekin and the New York Spineless are excellent for shipping purposes. The above varieties are the black-fruited, and the most popular in the United States, while the white-fruited sorts are said to be the most popular in Europe. For home use, the white-fruited varieties are preferable, but as these make poor sellers in the United States, one must raise the purple sorts for market. For home gardens, the early and small Early Dwarf Purple (Fig. 1382) is useful It is particularly recommended for northern climates There are three main types of eggplants, as follows The commoner garden varieties, *Solanum Melongena* var. *esculentum*, Bailey (Figs 1381, 1383); the long-fruited or "serpent" varieties, *S. Melongena* var. *serpentinum*, Bailey, the Early Dwarf Purple type var. *depressum*, Bailey (Fig 1382) See *Solanum*. The so-called Chinese eggplant is a different species, for which consult *Solanum*

Seed-growing.—This is by no means a difficult operation and may be done profitably in certain sections of the South For this purpose all defective or dwarfed plants in the field should be cut out By a little attention one will be able to know when the seeds have matured sufficiently for gathering. At this time the eggs usually turn a lighter color or even somewhat yellow. The fruit should be gathered and carried to the packing-house, where it may be left in a pile for two or three days, as there is very little danger from rotting. When a sufficient number have been collected, the laborers may be set to paring off the extra amount of meat on the outside of the seed The remaining core may then be cut longitudinally into quarters or eighths,



1381 Field-grown plant of New York Improved eggplant.



1382. Sprays of Early Dwarf Purple eggplant.

using a dull knife to avoid cutting the seed. After a quantity of these have been pared, they may be placed in a barrel and covered with water The barrel should not be made more than two-thirds full. In a day or two fermentation will set in and the meaty portion will macerate from the seed. The seed may then be separated from the meat by means of sieves, using first wide-meshed ones to remove the meat and then finer-meshed ones to screen out the seed from the finer pulp. The seed should not be allowed to stand more than two or three days in the macerating barrel, as the heat evolved by fermentation and the heat of the summer is liable to cause them to germinate After separating the seed from the pulp, it should be dried in the shade and wrapped in secure packages By covering with tin-foil or oil-paper, the atmospheric moisture will be kept out and molding prevented

Diseases —The most destructive of diseases in the lower South is a blight fungus which attacks the plant just beneath the surface of the ground, causing the softer tissues at this point to rot off and the plant to die. The fungus is not able to penetrate the harder portion of the stem, consequently the plant lingers along for weeks after being attacked A number of attempts have been made to cause this blight fungus to produce fruiting organs so it could be classified, but up to the present this has proved futile In such cases as this there is no remedy. After the plant is attacked, it is usually doomed. Much, however, can be done in the way of preventing the spread of this fungus If all plants are destroyed as soon as found to be affected, the fungus cannot perfect its sclerotia, or rusting state, and thus its propagating is prevented. The normal home of this fungus is in decaying vegetable matter If, therefore, a field is kept free from this sort of material one will do much to prevent this fungus from being present Some soluble form of fungicide, as Eau Celeste or potassium sulfide, may be sprayed about the roots of the plants to good advantage. Practise rotation of crops. A second form of blight is caused by *Bacillus solanacearum*. This disease has its origin of infection in the leaves, and is introduced by means of insects

which have fed upon diseased plants and carried the infection to the well ones. The disease works rapidly down the tissues and causes the death of the leaf and finally of the whole plant. The only remedy for this is to destroy all plants that are affected with the disease as soon as detected, and kill off all insects. When this disease is known to be present in a section, it is best to set the plants as far apart as practicable. In this way the danger of infection from insects is somewhat reduced. When the disease is known to be present in a field it should not be planted to this crop. Anthracnose (*Gloeosporium melongenæ*) does not cause great damage to this crop, but is one of the agents that reduce the profits. "It may be recognized by its producing decided pits in the fruit, upon which soon appear minute



1383. Long White eggplant.

blotches bordered with pink" Bordeaux mixture may be used to good advantage for preventing this disease. *Phoma solani* frequently causes damping-off in the hotbed. It often renders a whole bed worthless. Plants affected with this fungus usually fall over as if eaten off by some insect. Some plants, however, continue a miserable existence and finally die. Careful examination will reveal the point of injury, which is at the ground-level. The best preventive is to use well-drained beds and then avoid excessive watering. When damping-off is detected in a seedling bed, the atmosphere and surface soil should be dried as rapidly as possible, followed by one application of fungicide.

Insect enemies.—Among the most annoying of the insect enemies is the cutworm (larvæ of Noctuidæ). These insects are almost omnipresent, and when nearly full grown are liable to cut off plants that are 4 or 5 inches high. It is not common for one insect to cut off more than a single plant, but in ordinarily fertile soil there are enough cutworms present to destroy the entire field. So that, on the whole, it becomes very annoying. When these insects are quite destructive, it is possible to kill them with poisoned bran or poisoned cottonseed meal, sweetened with syrup or sugar. Another insect that does more or less damage is the cotton bollworm (*Heliothis armiger*). This insect does its damage by boring a hole into the stems or the fruit. In the latter case it causes it to rot before it is picked, or possibly in transit. As the fruit becomes larger there is less danger of attack from this insect, so that the main trouble occurs in the earlier stages of its growth. The eggplant aphis (*Siphonophora cucurbitæ*) is one of the most annoying pests to this crop. It usually makes its appearance about the time the crop is fit to ship, and appears in such numbers that the plants are ruined in the course of a week or two. The insect attacks the lower surface of the leaves, making it difficult to reach the pests with insecticides, but persistent efforts and a good tobacco decoction, applied with a fine nozzle, will give considerable relief. Sulfur spray or other mild contact insecticide will be found more uniformly effective than tobacco decoction Whale-oil soap is an excellent insecticide to use. Kerosene emulsion and insecticides made from the miscible oils, largely employed in proprietary insecticides, should be avoided. While they may be used effectively, there is considerable danger from scalding in handling by indifferent laborers.

P. H. ROLFS.

EGLANTINE: *Rosa rubiginosa*, also applied to *Rubus Eglanteria*, *Rosa Eglanteria*, and perhaps *Lonicera Periclymenum*

EGYPTIAN LOTUS: *Nymphæa Lotus*; also *Nelumbium*.

EHRÈTIA (G. D. Ehret, botanical painter, born in Germany, 1708 or 1710, died in England 1770). *Boraginàceæ* Tender trees and shrubs, found in the warmer regions of the world.

Plants with or without rough, short hairs: lvs alternate, entire or dentate fls small, often white, in cymes, corymbs, terminal panicles, or rarely all borne in the upper axils; calyx 5-parted or -cleft; corolla short-funnelform to rotate, with 5 obtuse spreading lobes; stamens 5, affixed in the tube, exserted or rarely included, the filaments very slender; style 2-lobed or -parted· fr a small drupe, usually containing two 2-celled 2-seeded nutlets —Species 40–50, the larger number in the Old World tropics, but widely dispersed about the globe. A few species are planted in S. Calif. and perhaps elsewhere along the southern parts.

A. *Lvs. toothed.*

B. *Foliage hairy.*

macrophýlla, Wall. Tree: lvs. 6–8 in. long, broadly elliptic, acuminate, bristly above and soft-hairy beneath, serrate: panicle terminal, pubescent; calyx ciliate: fr. globose, obscurely 4-grooved. Himalayas, China.

BB. *Foliage not hairy.*

acuminàta, R. Br. (*E. serràta*, Roxbg.). HELIOTROPE TREE. Tree, to 40 ft.: lvs. 3–4 in. long, elliptic to oblong, acuminate, serrate: panicles terminal and axillary; fls. clustered, sessile; corolla-tube very short. Trop. Asia, Japan and Austral. B.R. 13:1097. Hardy at Arnold Arboretum.

AA. *Les. usually not toothed.*

elliptica, DC. Tree, 15–50 ft. high: lvs. oval or oblong, sometimes serrate, nearly smooth, or with minute hairs and very rough above: fls. small, white, fragrant, in cymes or panicles; calyx-lobes broad-lanceolate and acute, as long as the corolla-tube: fr. a yellow globose drupe, the size of a small pea, with edible thin pulp. Texas, Mex.

WILHELM MILLER.
L. H. B.†

EICHHÓRNIA (after J. A. F. Eichhorn, a Prussian Minister, born 1779). *Pontederiàceæ*. Tropical aquatic herbs, grown for showy flowers and interesting habit.

Perennial, floating, rooting at the nodes: immersed lvs. on young sts. linear; emersed lvs. obovate or

rounded (or rarely lanceolate), the petioles in some species much inflated and acting as buoys: fls. in a spike or panicle, the scape 1-lvd.; perianth funnel-shape with a long or short tube; stamens 6, attached unequally in the tube, part of them exserted; ovary sessile, 3-celled; style filiform: fr. a caps. contained in the withering perianth, ovoid to linear.—About a half-dozen species in S. Amer., one reaching Afr.

This genus includes the water hyacinth (see Fig. 1384), the famous "million-dollar weed" that obstructs navigation in the St. John's River, Florida, and is a source of wonder and delight in every collection of tender aquatics in the North. The curious bladders made by the inflation of the petioles help the plant to float freely. About flowering time the plant sends down anchoring roots which, if the water be only 3 or 4 inches deep, penetrate the soil. The true hyacinths belong in an allied family (Liliaceæ); the pickerel weed, in the allied genus Pontederia, the ovary of which by abortion is one-celled, and each cell one-ovuled, while Eichhornia is three-celled and many-ovuled. The plants of this family have been greatly confused botanically, partly because the fugacious, membranous flowers are not well preserved in dried specimens, and partly because of variation in form of leaves, depending upon whether the plants grow in deep or shallow water, or in mud. The common water hyacinth sends out two kinds of roots, the horizontal ones often thick and fleshy, and apparently for reproductive purposes, the vertical ones long, slender, and clothed with innumerable small, horizontal fibers.

The flowers are most beautiful, and the plant is worthy of special cultivation. It is often called a water-orchid, being of such delicate coloring and texture. The plants must be more or less stationary although it is a floating plant, for they will not flower when drifted about by any light breeze or where the water is 2 or more feet deep as is often the case where nymphæas are grown. A depth of 9 to 12 inches of water is sufficient with a guard to keep the plants in bounds. Good soil underneath is necessary so that the plants will derive some nourishment. They will grow rapidly and flower profusely all through the season, and it may be necessary to thin out the plants, for when too crowded the petioles will become elongated and the plants unsightly. They can also be grown in a tub or tank observing the same method of culture. Propagated by division. (Wm. Tricker.)

A. *Lf.-stalks inflated: inner perianth-segms. not serrated.*

crássipes, Solms (*E. speciòsa,* Kunth. *Pontedèria crássipes,* Mart.) Fig. 1384. Lvs. in tufts, all constricted at the middle, bladder-like below, sheathed, many-nerved; scape 1 ft. long, with wavy-margined sheaths at and above the middle; fls. about 8 in a loose spike, pale violet, 6-lobed, the upper lobe larger and having a large patch of blue, with an oblong or pear-shaped spot of bright yellow in the middle; stamens 3 long and 3 short, all curved upward toward the tip. Brazil. B.M. 2932 (as *Pontederia azurea*). I.H. 34:14. A.F. 5:511. Var. **major,** Hort., has rosy lilac fls. Var. **aûrea,** Hort., has yellowish fls.

AA. *Lf.-stalks not inflated: inner perianth-segms. beautifully serrate.*

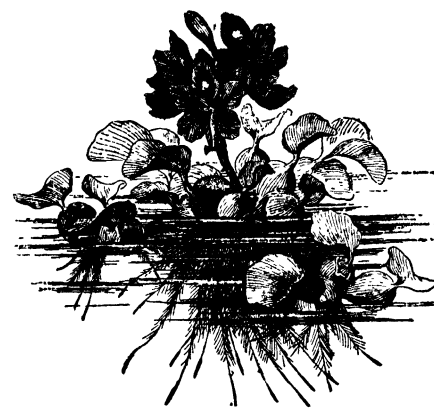
azûrea, Kunth. Lvs. on long or short not-inflated petioles, very variable in size and shape: scape often as stout as the lf.-stalk, gradually dilated into a hooded spathe; fls. scattered or crowded in pairs along a stout, hairy, sessile rachis; perianth bright pale blue, hairy outside, inner segms. beautifully toothed, the upper a trifle larger, with a heart-shaped spot of yellow, which is margined with white. Brazil. B.M. 6487. G.C. II. 25:17. I.H. 34:20. R.H. 1890:540.—One plant will become 5 or 6 ft. across in a season.

E. paniculàta, Spreng. Fls. in a compound spike or panicle, 2-lipped, purple and blue and with large white spots: lvs. long-petioled, cordate-acuminate, without petiole bladders. st. 12–18 in., often several. B.M. 5020 (as E. tricolor).

WILHELM MILLER.

ELÆÁGNUS (ancient Greek name, meaning a kind of willow; from *elaios,* olive). *Elæagnàceæ.* Shrubs and small trees, grown chiefly for their handsome foliage and for their ornamental fruits, edible in a few species.

Deciduous or evergreen, sometimes spiny: lvs. alternate, short-petioled, entire, clothed more or less with silvery or brownish scales: fls. axillary, solitary or in clusters, apetalous, perfect; perianth campanulate or tubular, 4-lobed; stamens 4, included, on very short filaments: fr. a 1-seeded drupe.—About 40 species in S. Eu., Asia and N. Amer. Monograph by Servettaz in Bot. Centralblatt, Beihefte 25, pt. 2:1–128 (1908).



1384. Eichhornia crassipes.

These are highly ornamental shrubs with handsome foliage and mostly decorative fruits; the flowers are inconspicuous, but mostly fragrant. Some of the deciduous species, as *E. argentea, E. multiflora* and *E. umbellata,* are hardy North, while the evergreen ones are hardy only South. A distinct feature of some species, as *E. argentea, E. angustifolia* and *E. parvifolia,* is the conspicuous silvery hue of their foliage, while *E. multiflora* and *E. umbellata* are the most ornamental in fruit.

They grow in almost any well-drained soil, including limestone, and prefer sunny position. Propagation is by seeds which do not germinate until the second year and ought to be stratified and sown the second spring, and by cuttings of mature and half-ripened wood; also sometimes increased by layers and by root-cuttings; varieties and rarer kinds can be grafted on seedlings of vigorous-growing species.

INDEX.

angustifolia, 1.
argentea, 5.
aurea, 7.
aureo-maculata, 7.
aureo-variegata, 7.
crispa, 4.
edulis, 4.
Frederici variegata, 7.
hortensis, 1
japonica, 2
longipes, 4
macrophylla, 6
maculata, 7
multiflora, 4.
orientalis, 1.
ovata, 4
parvifolia, 2.
pungens, 7.
reflexa, 7.
rotundifolia, 4.
Simoni, 7.
spinosa, 1.
tricolor, 7.
umbellata, 2, 3.
variegata, 7.

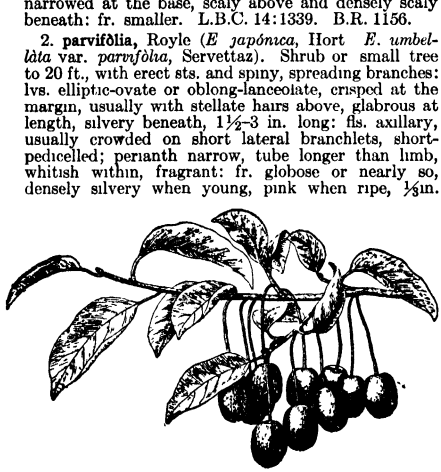
A. *Lvs. deciduous.*

B. *Winter-buds and lvs. beneath and usually the branchlets silvery white, without any brown scales.*

1. **angustifòlia,** Linn. (*E. hortènsis,* Bieb.). OLEASTER. Shrub or small tree to 20 ft., sometimes spiny:

lvs. lanceolate or oblong-lanceolate, quite entire, light green above, 2–3 in. long: fls. short-pedicelled, 1–3, axillary, on the lower parts of the branches; perianth campanulate, tube about as long as limb, yellow within, fragrant; style at the base included by a tubular disk: fr. oval, yellow, coated with silvery scales. June. S. Eu. W. Asia to W. Himalayas. Var. **orientàlis,** Dipp. (*E. orientàlis,* Linn. f. *E. horténsis* var. *orientàlis,* Schlecht.). Often spineless: lvs. often oblong or oval, usually rounded at the base, clothed more with stellate hairs beneath than with scales, usually glabrous above at length: fr. rather large to 1 in. long. A G. 21:405, 519, 613, 645. Var. **spinòsa,** Schneid. (*E. spinòsa,* Linn.). Spiny: lvs. linear-lanceolate or lanceolate, narrowed at the base, scaly above and densely scaly beneath: fr. smaller. L.B.C. 14:1339. B.R. 1156.

2. **parvifòlia,** Royle (*E japónica,* Hort *E. umbellàta* var. *parvifòlia,* Servettaz). Shrub or small tree to 20 ft., with erect sts. and spiny, spreading branches: lvs. elliptic-ovate or oblong-lanceolate, crisped at the margin, usually with stellate hairs above, glabrous at length, silvery beneath, 1½–3 in. long: fls. axillary, usually crowded on short lateral branchlets, short-pedicelled; perianth narrow, tube longer than limb, whitish within, fragrant: fr. globose or nearly so, densely silvery when young, pink when ripe, ½in.



1385. Elæagnus multiflora. (×½)

long. June; fr in Aug. Himalayas, China, Japan. B R. 29:51. Mn 5:145.—Not quite hardy N. Sometimes cult under the name of *E. reflexa,* which species, however, is evergreen. Var. *japonica macrophylla* is advertised but probably does not belong to this species.

BB. *Winter-buds and branchlets with reddish or yellowish brown scales and sometimes silvery besides: lvs. silvery white beneath, often with few brown scales.*

c *Fr. juicy, scarlet-red or brownish red.*

3. **umbellàta,** Thunbg. Spreading shrub, to 12 ft., often spiny, with yellowish brown branchlets, often partially silvery: lvs. elliptic or oval to ovate-oblong, above usually with silvery scales while young, sometimes glabrous, often crisped at the margin, 1½–3 in. long: fls. yellowish white, fragrant, 1–7 in the axils, usually crowded on short lateral branchlets, tube much longer than the limb, slender: fr. globose or oval, scarlet, ¼–½in. long, erect, on stalks ½–½in. long, clothed with silvery scales, mixed with brown scales while young. May, June; fr. in Sept., Oct. M.D.G. 1899:569. A.G. 12:206 R.H. 1901, p. 85. S.I.F. 2:54.

4. **multiflòra,** Thunbg. (*E. lóngipes,* Gray. *E. edùlis,* Sieb.). Gumi. Fig. 1385. Shrub, to 6 ft., with reddish brown branchlets: lvs. elliptic, ovate or obovate-oblong, with stellate hairs above, usually glabrous at length, mostly with scattered brown scales beneath, 1–2½ in. long: fls. usually solitary in the axils, sometimes 2 on the lower part of the branches or on short branchlets, yellowish white, fragrant; tube as long as the limb: fr. pendulous, oblong, ¾in. long, scarlet, on slender pedicels, much longer than the fr.; fr. with brown scales when young, ripening in June or July, of agreeable, slightly acid flavor. April, May. Japan, China B M 7341. L.I. 4 G F. 1:499. G.C. 1873: 1014. G M 31.715. B.H. 33:217. F E 13:830. A G. 1890:565 M.D G. 1901.573. Gng. 1.275, 277. Var. **rotundifòlia,** Servettaz (*E. rotundifòlia,* Gagnaire) Lvs. broadly oval, half-evergreen, glabrous above. Var. **ovàta,** Servettaz. Lvs usually with stellate hairs above while young, soon glabrous· fls. 1–3: fr. oval, ⅓–½in. long, nodding, with brown scales when young, ripening July or Aug ; pedicels ½in. long or longer. Japan M.D G. 1899. 569 (as *E multiflora*). Var **crispa,** Servettaz. Similar to the preceding var., usually spiny: lvs. oblong-lanceolate. pedicels as long as fr.

cc *Fr. rather dry, silvery white.*

5. **argéntea,** Pursh. Silverberry Erect shrub, to 12 ft., spineless, stoloniferous, with reddish brown branchlets: lvs ovate or oblong-lanceolate, silvery on both sides, often with scattered brown scales beneath, 1–3 in. long: fls. 1–3, axillary, yellow within, fragrant. fr oval or roundish oval, densely clothed with silvery scales, short-pedicelled, ⅓–½in. long. May, June Canada, south to Que , Minn., Utah. B.B. (ed 2) 2:576 B M. 8369

AA. *Lvs. evergreen: usually flowering in fall.*

6. **macrophýlla,** Thunbg Spineless shrub, to 6 ft , with silvery white branchlets: lvs broad-ovate or broad-elliptic, on stout and rather long petioles, scaly above, usually glabrous at length, silvery white beneath: fls axillary, with silvery and brownish scales outside; tube campanulate, abruptly narrowed at the base, as long as limb. Japan B.M 7638 G C III 25:90.

7. **púngens,** Thunbg Spreading shrub, to 6 ft , mostly spiny, with brown branchlets· lvs. oval or oblong, undulate and often crenulate at the margin, at length glabrous above, silvery beneath, more or less interspersed with brown scales, 2–4 in long fls in axillary clusters, tube cylindrical, slightly narrowed at the base, longer than the limb· fr short-stalked, about ¾in long, with silvery and brown scales Japan Var. **Frederici variegàta,** Servettaz Lvs. with yellow center and green margin Var. **maculàta,** Hort (var *aùreo-maculàta,* Hort). With a large yellow blotch in the middle A G. 13:122. A F. 23·1015. Var. **Simoni,** Rehd. (*E Simoni,* Carr.). Lvs rather large, oblong-elliptic, with few brown scales beneath or nearly without Var. **Simoni tricolor,** Hort Lvs like the former, but variegated with yellowish and pinkish white Var **reflèxa,** Rehd (*E. reflèxa,* Morr & Decne). Branches elongated and flexile: lvs ovate-lanceolate, acute or acuminate, lustrous above, only scaly while young, ferrugineous below H U 4.328 Var **variegàta,** Rehd (var *aùrea,* Servettaz., var *aùreo-variegàta,* Hort). Lvs margined yellowish white. G M 54:327

E. ferruginea, A. Rich. Spineless evergreen shrub, with spreading brown branches lvs with yellowish and brown scales beneath perianth with quadrangular, abruptly contracted tube fr long-stalked Japan —*E glàbra,* Thunbg Spineless evergreen shrub, with brown branches lvs shining above, with yellow and brown scales beneath perianth with slender, tubular tube, gradually narrowed toward the base, twice as long as the limb. fr short-stalked Japan. S I F 2 54.

Alfred Rehder.

ELÆIS (Greek, *olive*). *Palmàceæ,* tribe *Cocoíneæ.* Tropical spineless palms with pinnate foliage, of which the best known is the oil palm of western Africa, whose red fruits, borne in large clusters, yield the palm oil of commerce, which is used in making candles and soap

Leaves terminal, numerous, large and pinnately divided, the segms. sword-shaped, the margins in some species spiny: spadix short and thick. Young plants are grown for ornament in S. Calif., and in the N., but it is not hardy outdoors in U. S., according to Franceschi. The other 6 species are from Trop. S. Amer. The genus is separated from Cocos by the 1–3-seeded frs., with 3 pores above the middle.

guineénsis, Jacq. OIL PALM. Sts. stout, 20–30 ft., coarsely and deeply ringed: lvs. 10–15 ft.; petiole spiny-serrate; lfts. 50–60, linear-lanceolate, acute, the same color above and below. F.S. 14:1492.—From an early stage in growth, this is one of the most ornamental palms. Until it reaches several feet in height, it is a slow grower, consequently one does not see much of it, except in collections. It does best in a warm temperature, although it will thrive in an intermediate house. Seeds are always obtainable from several of the large European houses. It is but little grown as a commercial palm, as young plants do not show their full character. Given same treatment as *Areca lutescens*, will grow well. This treatment includes night temperature of 65° and plenty of water. JARED G. SMITH. N. TAYLOR.†

ELÆOCÁRPUS (Greek, *olive-fruit*) *Elæocarpàceæ*; formerly included in *Tiliàceæ*. Tropical trees, with showy flowers, in their juvenile stages also sometimes cultivated under glass.

Leaves simple, usually alternate; to 50 and 60 ft high or some of them practically shrubs in cult: fls. perfect or polygamous, in axillary racemes; sepals distinct, 4 or 5; petals 4 or 5, cut or fringed (rarely entire), attached about a thickened torus; stamens many (rarely 8–12), with long-awned anthers opening by a slit at the apex; ovary 2–5-celled: fr a drupe, with a large and bony stone, sometimes 1-celled by abortion. —Perhaps 100 species, in the Old World tropics. They are little known in cult. but are sometimes mentioned in greenhouse lists. The pulp of the fr. in some species is said to be edible; and the interesting sculptured stones of some kinds (as of the bead-tree of India, *E Ganitrus*, Roxbg.) are used for beads, heads of ornamented pins, and other decorations. They propagate by ripened shoots with the lvs. left on, and also by seeds when obtainable.

grandiflòrus, J. Smith. A much-branched shrub, about 7 ft high under glass: lvs. considerably clustered at the ends of branches, 3–6 in. long, broadly lanceolate; petiole ¼–1 in. long, with a few distant saw-teeth, or more or less round-toothed or wavy-margined: sepals 5, red outside, white inside; petals 5, white or pale yellow, silky outside, fringed. Java. B.M. 4680 (as *Monocera grandiflora*). F S 8:817. J.F. 4:339.—Lvs. rather leathery, dark green above, paler beneath. Warmhouse. Prop. by cuttings of nearly ripened wood.

cyàneus, Sims (*E reticulàtus*, Smith). Under glass a shrub, but in the wild a small tree and sometimes reaching 60 ft, glabrous: lvs elliptic-oblong, or lance-oblong, acuminate, prominently reticulate: fls. cream-white, fringed, in loose racemes that are shorter than the lvs; stamens many: drupe globular or nearly so, blue (whence the specific name). Austral. B.M. 1737. B.R 657 G.C. III 36:272; 51:393. G.M. 55:423. G. 34:389. Gn. 77, p. 301. L. H. B.†

ELÆOCÓCCA: *Aleurites cordata.*

ELÆODÉNDRON (Greek for *olive tree*, from the resemblance of the fruit). *Celastràceæ*. Tropical shrubs or small trees, some kinds of which are grown in the juvenile state under glass for the interesting foliage.

Leaves simple, entire or crenate, opposite or alternate, thickish, frequently evergreen: fls. inconspicuous, greenish or white, in axillary or lateral clusters; calyx usually 4–5-parted; petals 4–5, and exceeding the calyx; stamens 4–5, inserted under the edge of the thick disk; ovary single, mostly 3-celled; style very short: fr. a small fleshy or nearly dry drupe.—Species probably upward of 40, in Afr., India to Austral., and somewhat in S. Amer. Very closely allied to Cassine, a South African genus.

orientàle, Jacq. A graceful and handsome plant: the mature lvs. are very different from the juvenile lvs., being obovate, obtuse, crenate, cuneate at base, and 2–3 in. long, and the slender graceful young lvs. pass into them by gradual transition: fls. less than ¼in. across in close axillary cymes which are shorter than the lvs.; pedicels equaling or surpassing the corolla; calyx deeply lobed; petals yellow-green: drupe size of olive, oblong. Madagascar, Mauritius.—The plant holds its lower foliage well, or throws out new foliage to take the place of that which drops. It thrives in either an intermediate or a warmhouse. Prop. by single eye cuttings in small pots, kept rather warm. It has been said that *Aralia Chabrieri* of gardens belongs to this species (although of a different family), but this is apparently an error. See *Polyscias* for a discussion of this plant.

austràle, Vent. Intro. into S. Calif. from Austral., and prized for its holly-like foliage. In its native habitat it is a tree 30–40 ft. high, producing useful close-grained wood: lvs. mostly opposite, ovate to oblong-lanceolate, nearly or quite obtuse, entire or open-crenate, coriaceous, very reticulate beneath: fls. with parts in 4's: drupe about ½in. long, red, ovoid or globular L. H. B.

ELAPHOGLÓSSUM (Greek, *serpent tongue*). *Polypodiàceæ*. A large group of tropical ferns, with creeping rootstocks and simple leaves.

The sporangia cover the entire under surface of the fertile leaves which are usually much smaller than the sterile ones. Nearly all the species are free-veined but a few have netted venation.—There are 80–100 species in the tropics of both hemispheres. They were formerly included under Acrostichum. All require warmhouse treatment, an abundance of water at the roots, and an open porous compost.



1386. Elaphoglossum villosum. (×⅓)

INDEX.

conforme, 7. hirtum, 2. reticulatum, 10.
crinitum, 9. muscosum, 3. simplex, 6.
flaccidum, 8. petiolatum, 4. villosum, 1.
gorgoneum, 11. pilosum, 5.

A. *Veins all free.*

B. *Surface of lvs. densely scaly throughout.*

c. *Texture thin, flaccid.*

1. **villòsum,** J. Smith. Fig. 1386. Sterile blades 6–9 in. long; fertile lvs scarcely more than half as large, both with abundant slender, dark brown scales. Mex. and W. Indies. —Dwarf, variable.

cc. *Texture thick, leathery.*

2. **hirtum,** C. Chr. (*Acróstichum squamòsum*, Swartz). Sterile blades 6–12 in. long, the fertile narrower, on longer sts., both surfaces matted with bright reddish brown linear or lanceolate scales. Tropics of both hemispheres.

3. **muscòsum,** Moore. Sterile blades 6–12 in. long, fertile much shorter; upper surface slightly scaly, the lower densely matted with ovate, rusty scales. Tropics of both hemispheres. S. 1:211 (as Acrostichum).—Very distinct in habit, and an interesting greenhouse species.

BB. *Surface of lvs. slightly scaly.*

4. **petiolàtum,** Urban (*Acróstichum viscòsum*, Swartz). Sterile blades 6–12 in. long, narrowed gradually at the base: the fertile shorter, on longer stalks; texture

leathery, the surfaces somewhat viscid. Tropics of both hemispheres.

5. **pilòsum,** Moore. Blades flexuous, 6–8 in. long, ¾in. wide, with tufts of star-like scales beneath; texture herbaceous. Mex. to Colombia.—Chiefly of botanical interest.

BBB. *Surface of lvs. not scaly; texture leathery.*

C. *Margins of lvs. thick, cartilaginous.*

6. **simplex,** Schott. Sterile blades 4–12 in. long, with a very acute point, the lower portion gradually narrowed into a short, somewhat margined stalk. W. Indies to Brazil.

7. **conförme,** Schott. Sterile blades 2–9 in. long, with a bluntish point and wedge-shaped or spatulate base; fertile lvs. narrower. Tropics of both hemispheres.

CC. *Margins of lvs. not thickened.*

8. **flaccidum,** Moore. Sterile blades 6–12 in. long, with very acute point, the lower portion gradually narrowed to the short stalk; fertile lvs. on stalks 3–4 in. long. S. Amer.—Of botanical interest only.

AA. *Veins uniting to form a network.*

B. *Surface of lvs. densely clothed with narrow scales. (Hymenodum.)*

9. **crinitum,** Christ. ELEPHANT-EAR FERN. Fig. 1387. Blades 10–18 in. long, 4–8 in. wide, on densely scaly stalks; fertile lvs. smaller, on shorter stalks. W. Indies. F S. 9:936 (as *H. crinitum*).—Omit sand in potting, and avoid over-watering.



1387. Elaphoglossum crinitum.

BB. *Surface of lvs mostly smooth, 6–15 in. long.*

10. **reticulàtum,** Gaud. Blades on distinct stalks, with wedge-shaped bases, 1½ in. wide; veins forming copious meshes. (*Chrysodium.*) Hawaiian Isls.—Of botanical interest only.

11. **gorgòneum,** Brack. Blades tapering gradually downward to the short stalks, 2–3 in. wide; veins forming meshes only near the margin. (*Aconiopteris.*) Hawaiian Isls.—Of little decorative value.

L. M. UNDERWOOD.
R. C. BENEDICT.†

ELATÍNE (Greek name of doubtful application). *Elatinàceæ.* Small mostly glabrous creeping herbs, probably annuals, of temperate and warm regions (perhaps 10 species), sometimes used in bog- and water-gardening. They root at the nodes, spreading along the margins of streams and ponds. Lvs. opposite or verticillate, mostly broad, entire: fls. minute and inconspicuous, mostly solitary in the axils; sepals and petals 2–4, and stamens as many or sometimes twice as many; styles or stigmas 2–4: pod 2–4-valved. The plants are grown for their foliage cover. Four species are native in the U. S. and Canada, but they appear not to be in the trade. Abroad, **E. macrópoda,** Guss., of the Medit. region, is offered. Lvs. oblong, short-petioled: fls. axillary and terminal, 4-merous, stalked: caps. half shorter than the sepals.

The family Elatinaceæ is allied to the Hypericaceæ. It comprises perhaps 25 species in many parts of the world. The only other genus is Bergia, which differs from Elatine in being terrestrial and in having 5-merous fls. *B. texàna,* Seub., occurs in swamps and on wet banks from S. Ill. to Texas and Calif. The bergias are apparently not in cult.

L. H. B.

ELDER AND ELDERBERRY: *Sambucus.*

ELECAMPANE: *Inula Helenium.*

ELECTRO-HORTICULTURE is a term used by Siemens to designate the application of the electric light to the growing of plants. The term is an unfortunate one, since the use of electric light is not an application of electricity to plant-growing, but is a way of securing illumination. Any strong artificial light hastens assimilation and thereby causes plants to grow more rapidly The practical questions to be considered are, therefore, the expense of using the light, and whether there are injurious elements in the spectrum of the given light.

The spectrum of the electric arc light is the spectrum of carbon plus that of certain gases incident upon combustion The spectrum of the arc light is rich in rays which light beyond the luminous part, and these rays are very injurious to most plants. These rays of the ultra-violet part of the spectrum are eliminated by a plain glass, so that when the electric light is surrounded by a globe, or when the light is hung above the roof of the greenhouse, the injuries are reduced to a minimum. Experiments at Cornell University showed that each kind of plant behaves in its own way in the presence of electric light. It is not possible to prophesy what the results may be in a given species, without experiment. A few plants, as tomatoes, cucumbers, melons and carrots, seem to be very little affected either injuriously or beneficially. Nearly all flowers are hastened into bloom by the influence of the light, and their colors are often brighter than under normal conditions; but in very many cases they do not last so long. The best results are secured if the light is applied to the plants when they have reached nearly or quite their full stature. If applied very early in its growth, the plant tends to make flowers before it has attained sufficient size. In floriculture, therefore, the practical value of the electric arc light seems to be its influence in hastening the flowering of certain plants in dark climates, or when plants must be had for a definite season. For example, if the light is applied to Easter lilies for a month before their normal blooming time, the period of bloom may be hastened four to ten days.

Lettuce has shown greater beneficial results from the application of the electric light than any other plant with which careful experiments have been made. Lettuce which receives light from the arc lamp for half of each night may be expected to reach marketable size from one to two weeks before that which is grown in normal conditions.

As a rule, better results are secured when the light runs only half the night. A common two-thousand candle-power light has a marked effect on the growth of many plants at a distance of sixty to even one hundred feet. The incandescent light has a similar influence, but not so marked. It has no injurious effect, however.

As now understood, the application of the electric light to the growing of plants is a special acceleration to be used when the climate is abnormally cloudy or

when it is desired to hasten the maturity of crops for a particular date. Only in the case of lettuce is it yet thought to be of any general commercial importance; and even with lettuce, it is doubtful whether it will pay for its cost in climates that are abundantly sunny For the literature of the subject, consult the publications of the experiment stations of Cornell University and of West Virginia. See the article *Light*, Vol. IV.

Electroculture is a term employed to designate any culture of plants under the influence or stimulus of electric currents The electric stimulation may arise from the electrification of the atmosphere in the immediate vicinity of the plants, or from the application of electric currents to the plants themselves. In either case, electricity exerts an appreciable and often a very marked influence, resulting in accelerated germination and growth (see the discussion, pp. 30–35, Vol. II, Cyclo. Amer Agric.)

In recent years much more attention has been given to the stimulation of plants by electricity directly through the atmosphere than through the soil. According to experiments made at the Massachusetts Experiment Station, this method appears to be successful and offers a most promising field for future research. Of the various methods used to stimulate plants by electricity, direct currents applied through the soil prove less valuable than alternating currents or static charges In a series of experiments made with radish plants in closed glass cases, an average increase of 50 per cent was secured, and in another case 45 per cent increase when the case was charged from a static machine with an average potential of 150 volts for a few minutes each day There are some obstacles in the way of electrically treating plants by the use of high tension wires or static machines owing to the possibility of grounding through steam-pipes and iron posts, and nothing very definite has been obtained as yet from this method. High tension wires (100,000 volts, more or less) have been used in the field with fairly good results, but winds affect a charged atmosphere to a certain extent The use of high poles provided with points to collect atmospheric electricity has proved successful in laboratory experiments for the stimulation of plants and the fixation of nitrogen, and in the future probably some such method will become of practical use At present the various methods cannot be considered as of great economic importance. (G. E. Stone.)

ELEÓCHARIS (Greek-made word, meaning *delighting in marshes*) Sometimes written *Heleócharis*. *Cyperàceæ*. Rush-like native plants, mostly of low, wiry growth, and commonest in marshes and on muddy shores, mostly perennial. The culms are simple, terete or angular, bearing a spherical or oblong head of inconspicuous fls : lvs. usually reduced to mere sheaths They are interesting for the borders of ponds, and are very easy to naturalize. Numbers of species are likely to be offered by dealers in native plants; three have been listed: **E. interstincta** R. &. S. (*E. equisetoides*, Torr.). A shore plant, with terete knotted culms 2–3 ft. high, and cylindrical heads about the thickness of the culm; resembles horse-tail (Equisetum). **E. acicularis**, R. & S Hair-like, 3–6 in. high, making grass-like mats. **E. ovata**, R & S. Culms nearly terete, 12–15 in. high: head globose or ovate. Eleocharis has about 100 species, widely distributed, of which nearly half occur in Canada and the U. S. L. H. B.

ELEPHANT'S EAR is a name for begonias. The elephant-ear Caladium is a Colocasia.

ELEPHANT'S FOOT: *Testudinaria*.

ELETTÀRIA (East Indian name). *Zingiberàceæ*. CARDAMON. Hothouse perennial herbs, sometimes seen in collections of economic plants.

Differs from Amomum in technical characters, as in the slender tube of the perianth, the presence of internal lobes in the perianth, and the filaments not prolonged beyond the anther. Probably only 1 species, although more have been described. **E. Cardamòmum**, Maton (*Cardamòmum officinàle*, Salisb. *Amòmum Cardamòmum*, Linn.), affords the small or true cardamons of commerce, which are the dried capsules and which are used in medicine Species of Amomum yield other kinds of cardamon The elettaria is native to India, but is cult in Jamaica, and it will no doubt thrive in parts of S Fla., where plants have been offered The cardamon plant grows 5–10 ft. high, bearing a curving jointed, closely sheathed st and oblong-lanceolate acuminate entire nearly sessile lvs. often 2 ft. long rootstock horizontal: fls. purple-striped: caps oblong or nearly globular, with many thin vertical ribs, indehiscent; seeds small, angled. Gt. 62, p. 93 It is said to prefer shade and a moist soil. In three or four years plants give full crops, but they become more or less exhausted after bearing three or four crops. Prop by dividing the roots and by seeds. Under glass, handled the same as Alpinia. L. H. B.

ELEUSÍNE (Greek, *Eleusin*, the town where Ceres, the goddess of harvests, was worshipped). *Gramineæ* CRAB-GRASS YARD-GRASS Coarse tufted annual grasses, more or less grown as ornamentals, also for the grain in Africa.

The stout unilateral spikes digitate at the apex of the culm, spikelets several-fld., awnless, arranged in 2 rows along one side of a continuous rachis; rachilla articulate above the empty glumes; fls perfect or the upper one staminate: grain loosely inclosed by the lemma and palea —Species about 6 in tropical regions of the Old World. Some are valued as cereals in Afr., India, and some other eastern countries. For *E. ægyptiaca*, see *Dactyloctenium*.



1388. Eleusine indica. (×½)



1389. Eleusine coracana. (×½)

indica, Gaertn. WIRE-GRASS. GOOSE-GRASS. Fig 1388. Erect, or in open ground prostrate, 2–4 ft. high: culms flattened: spikes 5–7, about 2–4 in long, digitate, often with one or two lower down, spikelets 3–6-fld. Blooms from June to Oct.—A very common grass in cult. fields and dooryards in the S., often troublesome as a weed on lawns throughout the S. and in Calif.

coracàna, Gaertn. AFRICAN MILLET. Fig. 1389. Erect, 2–4 ft. high, closely related to and much resembling *E. indica.* Can be distinguished from it by its stouter habit, shorter, broader and larger spikes.—Cult. in S. E. Asia for the grain. Beer is brewed from the grain in Abyssinia. In cult. in Amer. as an ornamental grass. Coracana means "pertaining to crows."



1390. Elliottia racemosa. (×½)

tristàchya, Kunth (*E. barcinonénsis,* Costa). Culms tufted, 6 in. to 1 ft. high: lf.-blades short, about $\frac{1}{16}$ in. wide, obtuse at the apex: spikes broad, mostly 3, digitate, 1–1½ in. long, ½in. thick; spikelets closely imbricate, 5-fld. India.—Intro. into Amer. on ballast, and in cult. as an ornamental plant.

P. B. KENNEDY.
A. S. HITCHCOCK.†

ELEUTHERÌNE (Greek *free,* referring to the stamens). *Iridàceæ.* Two or three species in the W. Indies and S. Amer., perhaps forms of one; bulbous plants of warmhouse cult., allied to Cipura and Ixia. fls white, several on a naked scape, the perianth-tube none and the segms obovate and spreading; stamens attached to base of perianth-segms, the filaments short and free; ovary oblong, 3-celled; style very short, 3-branched· lvs. long, radical. *E. plicàta,* Herb. (*Galatèa plicàta,* Salisb.), has a large ovoid bulb: root-lvs. 1–2, linear to linear-lanceolate, plicate, 18 in. or less long: scape 6–12 in. high, perianth white, 1 in. or less diam., not lasting: something the general habit of Babiana. B.M. 655 (as *Marica plicata*).

ELEUTHEROCÓCCUS: *Acanthopanax.*

ELÍSMA (suggested from Alisma). *Alismàceæ.* One species in W. Eu., sometimes grown in water-gardens. It is known also as Alisma (p. 246, Vol. I) but has been separated from that genus because of its floating rather than erect habit, sub-solitary fls., and character of the ovules. **E. nàtans,** Buch, is a slender perennial, with the sts. and developed ovate or oblong lvs. floating: radical lvs. of the original tuft represented by a lf.-stalk which is only slightly or not at all widened at the top, every succeeding node producing the floating lvs. and roots: fls. 1–3 or 5, large, white, with 3 broad obtuse petals: carpels forming a globular head, each with many slender ribs: summer. Of easy cult.

L. H. B.

ELLIÓTTIA (after Stephen Elliott, South Carolina's early and excellent botanist. For a fine portrait and sketch of him, see G F. 7:204–6). *Ericàceæ.* Deciduous shrub cultivated for its handsome racemes of delicate white flowers.

Leaves alternate, entire, without stipules: fls. in terminal racemes; calyx small, 4-parted; petals 4, oblong; stamens 8, with short filaments; ovary 4-celled; cells 1-ovuled, style slender, exserted: fr. unknown — One species in S C. and Ga., very rare and local. The Japanese species formerly referred to this genus are well distinguished by the 3-merous fls. and by the many-ovuled cells of the ovary; they form the genus Tripetaleia. Like Cladothamnus, Ledum and Leiophyllum, the genus differs from most other Ericaceæ in having distinct petals, but is easily distinguished from the genera mentioned by its racemose infl. and other characters

Elliottia is very rare in cultivation owing to its difficult propagation; it is not hardy North and seems to grow best in a humid sandy or peaty soil. Propagation by suckers, which appear only occasionally

racemòsa, Muhl. Fig. 1390. Shrub, 4–10 ft high: branches slender lvs alternate, oblong, acute at both ends, glandular-mucronate, entire, thin, membranous, 3–4 in long, 1–1½ in wide; petioles slender, grooved, hairy, about 1 in long. racemes 6–10 in long, often branched at the base; calyx-lobes short, rounded; petals spatulate-oblong, ½in long. Wet, sandy woods of S C and Ga G.F. 7:205 (adapted in Fig. 1390). B M. 8413. G C. III. 51:11. Gn. 75, p. 471.

ALFRED REHDER.

ELM: *Ulmus*

ELODÈA (Greek, *marshy*). *Hydrocharitàceæ.* Aquatic herbs, one of which is grown in aquaria

The genus is known in horticulture as including the ditch-moss, an interesting hardy perennial plant found in slow streams and ponds nearly throughout N. Amer., except the extreme north and particularly desirable for home and school aquaria It is a slender, wholly submerged plant, with branching sts. 4 in to 3 ft. long, according to the depth of the water. The pistillate fls. are raised to the surface by their long calyx-tubes, and float there. The minute staminate fls., which are rarely seen, commonly break off below, rise to the surface, float about, open, and shed their pollen. The fr ripens below the surface, and the seeds rise. It reached England in 1841 and choked up many canals and waterways, notably the Cam. It was very abundant in 1852 and 1853, but declined in the next few years. Ducks, geese and swans are fond of it, and render great service in getting rid of it. It can be used for manure where it grows in sufficient quantities. Like many other water plants, it makes heavy buds in the fall (Fig. 1391), which drop to the bottom and grow in the spring. This genus contains perhaps 10 species.



1391. Winter-bud of Elodea. (Nat. size)

canadénsis, Mich. (*Anàcharis canadénsis,* Planch. *A. Alsinàstrum,* Bab. *Philòtria canadénsis,* Brit.). WATER-WEED. DITCH-MOSS. WATER-THYME. Lvs. in whorls of 3 or 4, or the lower ones opposite, linear, minutely toothed or not, 2–7 lines long, ½–2 lines wide: fls. white; calyx-tube of the pistillate fls. 2–12 in. long; spathes 5–7 lines long.

Var. **gigantèa,** Hort. GIANT WATER-WEED. A much stronger grower than the species and a desirable plant for the aquarium, and a good oxygenator. Now generally used in preference to the type.

WM. TRICKER and WILHELM MILLER.



1392. Elsholtzia cristata.

ELÒDES: *Hypericum.*

ELSHÒLTZIA (John Sigismund Elsholtz, author of unpublished Flora Marchica, the MS of which is in the Royal Library, Berlin) *Labiàtæ* Herbs or undershrubs grown chiefly for their blue or lilac flowers appearing in dense spikes late in summer.

Usually aromatic: lvs opposite, short-petioled, serrate: fls. in usually 1-sided, terminal spikes; calyx tubular or campanulate, 5-toothed, corolla 2-lipped or slightly so; lower lip 3-lobed, the upper undivided, emarginate, concave, stamens 4, exserted; anther-cells diverging: fr. consisting of 4 ovoid or ovoid-oblong nutlets.—Twenty species in E and Cent. Asia, south to Java, 1 in Eu. and 1 in Abyssinia. Of the cult species *E cristata* and *E. Stauntonii* are hardy N, while *E. polystachya* is tender. They are chiefly valued for their late-appearing fls, profusely produced in dense upright spikes; they do not seem particular as to the soil, but demand a sunny position to bloom well. Prop. is by seeds, sown in spring; also with the suffruticose species by greenwood cuttings in summer.

cristàta, Willd. Fig. 1392. Twelve to 18 in. high, with opposite, petioled, ovate-oblong toothed lvs. and small, light blue fls in crowded, more or less 1-sided spikes: calyx enlarging in fr. Asia. B M. 2560.—Hardy annual, with very aromatic foliage and attractive, upright habit. Said to be a good bee plant.

Staùntonii, Benth. Undershrub, to 5 ft.: branchlets terete, pubescent: lvs ovate-oblong to oblong-lanceolate, acuminate, serrate, bright green and glabrous above, lighter green and densely glandular below, 3–5 in. long. fls. lilac-purple, in dense 1-sided spikes 4–8 in. long, usually panicled at the end of the branches; stamens and style long exserted. Sept., Oct. N. China. B M 8460. G C III. 51:21. Gn. 75, p. 533. M.D.G. 1910:541–2; 1913:52.

E. polystachya, Benth. Undershrub, to 6 ft.: lvs elliptic-oblong to lanceolate, serrate, pubescent on the veins beneath and glandular, 3–5 in long. fls. white, in very slender spikes 2–6 in. long. Himalayas, W. China.

ALFRED REHDER.

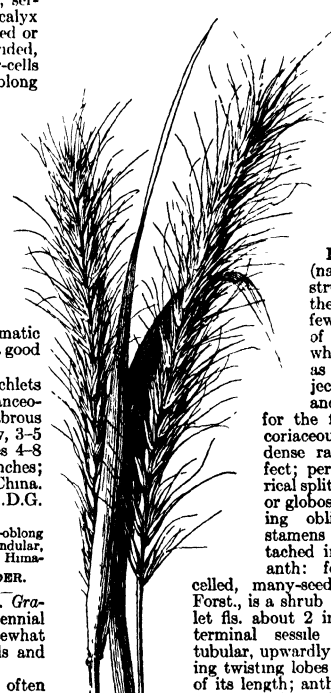
ÉLYMUS (Greek name for a kind of millet). *Gramineæ.* LYME-GRASS. WILD-RYE. Erect perennial grasses with terminal usually bristly spikes somewhat resembling rye, sometimes grown as ornamentals and having other uses.

Leaves flat or convolute: spikelets 2-6-fld., often long-awned, the uppermost imperfect, sessile, in pairs (rarely in 3's or 4's), at each joint of the continuous or articulate rachis, forming terminal spikes; glumes acute or awned, often placed at the front of the spikelet.—Species about 25, in the temperate regions of both hemispheres. For *E. Hystrix,* see *Hystrix.* See p. 3569

arenàrius, Linn. SEA LYME-GRASS. Stout, coarse perennial, 2–8 ft. high, with strong, creeping rootstocks: lvs long, rigid, smooth: spikes dense, terminal, 6–12 in. long; spikelets about 1 in. long and 3–4-fld., awnless. G 15:701. Dept. Agric., Div. Agrost., 7:319.—Sometimes used for binding the drifting sands of our Atlantic and Pacific coasts, especially when combined with beach grass, *Ammophila arenaria.* The seed is also used by the Digger Indians for food.

canadénsis, Linn. CANADA LYME-GRASS. TERREL GRASS. Fig. 1393. Rather stout, smooth perennial, 2–5 ft. high, with broad, flat lvs. 6–12 in. long: spikes 4–9 in. long, exserted, nodding; spikelets very rigid, 3–5-fld; lemmas long-awned. Common in low thickets and along streams in rich, open woods throughout the country.—Cult. as an ornamental plant. Var. **glaucifòlius,** Gray (*E. glaucifòlius,* Hort.), is pale and glaucous throughout, with usually more slender awns. Cult. as an ornamental grass.

condensàtus, Presl. GIANT RYE-GRASS. The largest of the native rye-grasses, growing to the height of 5–10 ft.: culms in dense tufts, stout: spikes 6–12 in. long, very variable, compact or interrupted, bearing branching clusters of spikelets at each joint; glumes subulate; lemmas awnless or mucronate. Rocky Mt. regions and the Pacific slope.—Cult. as an ornamental. A Pacific Coast form has large branched heads.



1393. Elymus canadensis. (×⅓)

E glaùcus, Regel. A glaucous-leaved, dense, cespitose, hardy perennial grass 3–4 ft. high, with very short, smooth lvs. and erect, elongated spikes: spikelets in 2's, erect, usually 5-fld, densely villous-pubescent, short-awned. Turkestan.—Rarely in cult. as an ornamental grass.

P. B. KENNEDY.
A. S. HITCHCOCK †

EMBÒTHRIUM (name refers to the structure of the anthers). *Proteàceæ.* A few trees and shrubs of S Amer., one of which is offered abroad as a greenhouse subject, grown from seeds, and apparently prized for the fls. Foliage sparse, coriaceous, entire: fls. in dense racemes, showy, perfect; perianth with a cylindrical split tube, the limb ovoid or globose in bud but becoming oblique or recurved, stamens 4, the anthers attached in lobes of the perianth: follicles oblong, 1-celled, many-seeded. **E. coccíneum,** Forst., is a shrub bearing bright scarlet fls. about 2 in. long in many-fld terminal sessile racemes: perianth tubular, upwardly curved, the 4 reflexing twisting lobes representing a third of its length; anthers imbedded in the concave apices of the perianth-lobes; pistil with an elongated cylindrical ovary and long-exserted red style: lvs.

oblong to elliptic, short-stalked, alternate, obtuse and mucronate, pale beneath. Chile. B.M. 4856.—Should be hardy in warm-temperate parts.

EMÍLIA (perhaps a personal name). *Compósitæ.* Flower-garden herbs, perennial or annual, with orange or scarlet bloom.

Related to Senecio (to which some authors refer it), but always without rays: heads rather small, the involucre very simple and cup-shaped, with no small outer scales, style-branches long or short: achenes with 5 acute ciliate angles: florets all perfect.—A dozen or more species have been described from warm parts of Afr, Asia to China, Polynesia and Amer. One species in common cult.

flámmea, Cass (*E sagittàta,* DC *E. sonchifòlia,* Hort, not DC *E sonchifòlra,* Linn., var *sagittàta,* Clarke. *Cacàlia coccínea,* Sims, B M 564 *C. sonchifòlra,* Hort, not Linn *C sagittàta,* Vahl *Senècio sagittàtus,* Hoffm). TASSEL-FLOWER FLORA'S PAINT-BRUSH. A neat annual, erect, 1–2 ft, glabrous or sparsely hairy, the long sts terminated by clusters of small scarlet (golden yellow in the form called *Cacalia lutea,* Hort) heads: lvs. lance-oblong or ovate-lanceolate, clasping the st, remotely crenate-dentate: involucre-scales much shorter than the florets Probably tropics of New World. H.F. 7:50.—This much-named annual is one of the commonest garden fls. It is of the easiest cult in any good soil. Blooms from July until frost, if sown as soon as weather is settled. Two species are sometimes recognized in this variable group,—*E. sagittata,* DC, with involucre shorter than the fls., and *E. sonchifolia,* DC., involucre as long as the fls

E purpùrea, Cass (E sonchifolia, DC, not Hort Cacalia sonchifolia, Linn Senecio sonchifolius, Moench). Radical lvs. often more or less lyrate, st -lvs broader and clasping, the heads fewer in the cluster and the involucre-scales nearly as long as the florets. Apparently not in cult. in this country. L. H. B.

EMMENÁNTHE (Greek, *enduring flower;* the persistent corollas retain their shape when dry). *Hydrophyllàceæ* A half-dozen low annual herbs from western North America, of which the most interesting species was introduced to cultivation in 1892, under the name of California yellow- or golden-bells.

Diffuse, depressed or erect: lvs. mostly alternate: fls. yellow or cream-color, the corolla campanulate and persistent; corolla-lobes 5; stamens 5; style 2-cut. The species named below belongs to a section of the genus, with calyx-lobes broader downward, and coarsely pitted seeds. All the others have the calyx-lobes broader upward and the seeds more or less wrinkled transversely.

pendulifl5ra, Benth. CALIFORNIA YELLOW- or GOLDEN-BELLS. Somewhat sticky, with long or short soft hairs. lvs pinnatifid, lobes numerous, short, somewhat toothed or sharply cut· ovules about 16; seeds 1 line long. Calif. G.C III 11:339—It grows 9–12 in. high, forming bushy plants, each branch loaded with broadly bell-shaped, pendulous, unwithering fls., about ½in. long, of creamy yellow The general effect of a branch suggests the lily-of-the-valley, but the foliage is pinnatifid. WILHELM MILLER.

EMMENÓPTERYS (Greek, *persistent,* and *wing;* referring to the wing-like calyx-lobe, persistent on the fruit). *Rubàceæ.* Ornamental tree grown for its large leaves and the handsome flowers.

Deciduous: lvs opposite, petioled, with caducous stipules, entire: fls in many-fld. terminal panicles; calyx small, 5-parted, deciduous, in some fls. 1 lobe leafy and changed into a petioled, oblong, obtuse whitish lf. persistent on the fr.; corolla campanulate-funnelform, tomentulose outside, with a narrow tube and 5 ovate lobes pubescent inside; stamens 5, included; ovary inferior, 2-celled; style filiform, not exceeding the stamens: fr. a spindle-shaped 2-celled caps., with numerous irregularly winged seeds.—One species in Cent. China. A tall tree, with large elliptic lvs. and showy yellow fls. in many-fld. dense terminal panicles. It will succeed in warmer temperate regions only and is yet little known in cult., as it has been only recently intro. Prop. is by seeds and possibly by softwood cuttings under glass.

Hénryi, Oliver. Tree, to 40 ft., quite glabrous: lvs. chartaceous, elliptic, acute, cuneate at the base, entire, 4–6 in. long; petiole 1–2 in. long· fls. in many-fld. panicles, yellow, about 1 in. long: caps. spindle-shaped, about 1¾ in. long, often at the apex with a persistent enlarged wing-like calyx-lobe 1½–2 in long on a petiole of equal length. Cent. China. H.I. 19:1823.

ALFRED REHDER.

ÉMPETRUM (Greek, *en,* in, *petros,* rock; growing often on rocks). *Empetràceæ.* CROWBERRY. Ornamental low shrubs sometimes grown for the evergreen foliage and attractive fruits.

Leaves linear-oblong, obtuse, thick: fls dicœcious or monœcious, axillary, 1–3, nearly sessile; sepals and petals 3; stamens 3, exserted; ovary superior, 6–9-celled with as many stigmas on a short and thick style: fr a 6–9-seeded drupe—Five species through the northern hemisphere in mountainous and arctic regions, also in Chile, antarctic Amer. and Tristan da Cunha.

The crowberries are hardy, evergreen, densely branched, prostrate or creeping, heath-like shrubs, with small, crowded leaves, inconspicuous purplish flowers, and globose, red or black, edible berries. They grow best in moist, sandy or peaty soil, and are especially handsome for rockeries Propagated usually by cuttings of nearly ripened wood in late summer under glass.

A. *Branchlets and margin of expanding lvs glandular, the latter not tomentose*

nigrum, Linn. Lvs linear to linear-oblong, divergent, soon reflexed, glabrous or nearly so, entire, ⅙–¼in. long. fls. purplish: fr. black, about ⅓in diam. April, May, fr. in Aug., Sept. N Eu., N. Asia, in N. Amer. south to N. H., N. Y., Mich. and N. Calif. B.B. (ed. 2) 2:479. S.E F. 8 1251.

AA. *Branchlets and margins of expanding lvs. white-tomentose.*

atropurpùreum, Fern. & Wiegand (*E. nìgrum* var. *andìnum,* Fern, not *E. andìnum,* Philippi *E nìgrum* var. *purpùreum,* Auth., not DC). Trailing: lvs. linear-oblong, soon loosely divergent, rarely becoming reflexed, those of the leading shoots ⅙–¼in long· fr. red to purplish black, opaque, ⅕–⅓in. across. Gulf St. Lawrence to Maine and N. H.

Eamesii, Fern. & Wiegand (*E. nìgrum* var. *purpùreum,* Auth, not DC. *E. rùbrum,* La Pylaie, not Vahl). Lvs. linear-oblong, crowded, ascending, becoming slightly divergent, those of the leading shoots ⅛in. or less long: fr. pink or light red, becoming translucent, ⅛in. or less across. S. Labrador, Newfoundland, E. Que.—Very handsome in fruit.

E. rùbrum, Vahl (*E nigrum* var. *rubrum,* DC) Closely related to E Eamesii. Lvs less crowded, spreading, somewhat larger. Antarctic Amer., Tristan da Cunha. B R. 1783.

ALFRED REHDER.

ENCÈLIA (Christopher Encel in 1577 wrote a book on oak galls). *Compósitæ.* Herbs or sub-shrubs, one or two of which have been sparingly introduced for planting in the southern parts of the United States.

Rather showy plants with mostly yellow-rayed naked-stalked heads (rays now and then absent), and yellow or brownish disk: lvs. alternate or opposite, entire, toothed or lobed, often white-tomentose: rays neutral, disk-fls. perfect; pappus none or an awn or scale for each margin or angle of the achene.—About 30 species, Utah and Calif. to Chile.

califórnica, Nutt. Woody at base, 2–4 ft. high, strong-scented, rather hoary, or becoming green: lvs. 1–2 in. long, ovate to broadly lanceolate, usually entire, indistinctly 3-ribbed from the base, abruptly stalked: heads 2½ in. across, the golden yellow rays numerous, 2–4-toothed: seeds obovate, with long, silky hairs on the callous margins and a shallow notch at the tip. Calif., Ariz.

adenóphora, Greenm. Stout almost woody herb, 3–6 ft, sometimes 10 ft., glandular-hairy throughout: lower lvs. opposite, stalked, ovate or deltoid, 2½–4 in long, 3-nerved; upper lvs. gradually smaller: fls cymose, the rays pale yellow, sometimes tinged with orange Autumn. N. Mex.—Not hardy north of Washington, D.C. N. TAYLOR.†

ENCEPHALÁRTOS (Greek combination, alluding to the bread-like interior of the trunk) *Cycadàceæ.* Excellent cycads from tropical and southern Africa, grown chiefly for their evergreen foliage.

The species are probably 20 or more, allied to Dioon and Macrozamia, with Stangeria, they constitute the peculiarly African representatives of the family. They are trees with stout cylindrical often fleshy trunks, and a terminal crown of stiff mostly spiny pinnate long lvs. or fronds. fls. dioecious, in cones; staminate cone oblong, ovoid or cylindrical, the scales in many series, imbricate, thick and often rough, broadly or elongate-cuneate, with anthers on the under surface, pistillate cone ellipsoid or oblong, thick, the scales numerous in many series and imbricated, peltate, with the ovule beneath. For differences between this and related genera, see Vol. I, p. 120 From Dioon it is distinguished by its pinnate rather than pinnatifid lvs, and from Cycas by straight rather than circinnate segms. in vernation, as well as by technical features of cones These plants are specially suited for large conservatories, the fronds being not easily injured They should succeed outdoors S. The trunks of some kinds grow only a few inches in many years. Most kinds prefer a sunny, tropical house, but *E. brachyphyllus* and perhaps others may be grown in a cool greenhouse if kept a little dry in winter. The cones are always interesting and often very decorative. Those of *E. villosus* are twice as large as a pineapple, orange-yellow, half revealing the scarlet frs. They are prop by seeds; also by offsets or suckers. Some other cycads frequently produce seed in conservatories, but Encephalartos seldom does, and plants are, therefore, usually imported. Dry trunks, weighing frequently 50–75 lbs. have been received from S. Afr They often remain dormant for a year or more, and do not make ornamental specimens for two or more years. They are slow-growing, except in very warm houses They like a strong, loamy soil. While making new growth they need plenty of water. See *Cycas.*

The woolliness of the stem and leaf-segments varies with the age of the plants and of the leaves. The pith and central portion of the cones of some species form an article of food among the Kafirs, hence the common name of Kafir bread. The most widely known species in cultivation are *E. villosus, E. Altensteinii* and *E. pungens.* Though very handsome cyads, they are by no means popular. They require much room for best results.

In the following descriptions "rachis" refers to the midrib of the leaf on which the leaflets or segments are borne, and "petiole" means the part of the leaf below where the leaflets begin.

A. *Lfts. toothed (sometimes entire in the first).*

B. *Petiole 4-angled: foliage glaucous.*

hórridus, Lehm. Trunk short and stout, woolly or not: lvs to 6 ft., reflexed at top; lfts. opposite or alternate, lanceolate, mostly entire, sometimes toothed, with a sharp spine at the apex. Var. **glauca,** is presumably more glaucous than the type. B.M. 5371. There is a var. *trispinosus.*

BB. *Petiole sub-cylindrical: foliage not glaucous.*

Áltensteinii, Lehm. Trunk stout, not woolly: lvs. 2–6 ft.; lfts about 6 in. long and 1 in. broad, oblong-acuminate, paler beneath, edges and apex spiny; petioles swollen at base, lfts mostly opposite, lanceolate B M 7162–3 G C II. 6·392, 393, 397; III. 2 281; 12:489–493; 40·206 (showing a specimen in Cape Colony over 100 years old, with a high trunk and an offshoot over half way up). G. 7:516.

villósus, Lehm. Trunk short and thick, woolly and scaly, 6 ft.: lvs. to 6 ft ; lfts, very numerous, opposite or alternate, linear-lanceolate, spiny-toothed and pointed. B M 6654 R H 1897·36 G C II 1·513; 3:400; 7:21; 13:181



1394 Encephalartos cycadifolius

AA. *Lfts. not toothed (except in young lvs of the last one).*

B. *Foliage glaucous.*

Léhmannii, Lehm. (*Cycas Léhmanni,* Hort.). Trunk not woolly: rachis and petiole obtusely 4-angled; lfts nearly opposite, narrowly or broadly lanceolate, to 7 in long, rarely 1-toothed, with brown spine at apex. Gt. 1865.477.

BB. *Foliage not glaucous.*

C. *Apex of lfts. mostly obtuse, pointless.*

longifólius, Lehm. Trunk not woolly, at length tall: rachis and petiole 4-cornered but flattish above; lowest lfts. often 1–3-toothed, margin somewhat revolute: wool soon vanishing from the rachis and lfts. S. Afr. G W 5, p. 404. Var **revolútus,** Miq., has the margins more distinctly revolute Var. **angustifólius** has narrower, flat lfts. Var **Hoókeri,** DC , has narrowly lanceolate lfts., not glaucous but intense green, and rachis not woolly. B M. 4903, erroneously named *E. caffer,* is referred to this place, though the lfts. are distinctly pointed in the picture.

CC. *Apex of lfts. always strong-pointed.*

D. *Form of lfts. linear.*

cycadifólius, Lehm. (*E Friderici-Guliélmi,* Lehm. *E. cycadifólius* var. *Friderici-Guilhélmi,* Rod). Fig. 1394 Trunk nearly globular, several inches in diam., woolly at first: rachis and petiole ashy-pubescent,

lfts opposite and alternate, linear, margin revolute. L.H. 29:459. G.F. 4:209 (adapted in Fig. 1394). G.W. 10, p. 377 (as *E. cycadifolius* var. *Friderici-Guilelmi*).

púngens, Lehm. (*Zàmia púngens,* Ait.). Rachis and petiole glabrous; lfts. long-linear, dark green, rigid, flat, striated beneath, margin not revolute. Var. **glaúca** is also sold.

DD. *Form of lfts. lanceolate.*

cáffer, Miq. (*E. cáffra,* Hort.). Trunk to 18 ft. and 1 ft. or more diam.: lvs. to 4 ft., very stiff, recurved; petiole 3-angled; rachis glabrous; lfts. alternate, narrower at the base, twisted, the younger ones with 1 or 2 teeth, to 6 in long. R H. 1869, p. 233. Not B.M. 4903, which is *E. longifolius* var. *Hookeri.*

Var **brachyphýllus,** DC (*E brachyphýllus,* Lehm.). Rachis and blades of the lower lfts. spidery pubescent: male cones sessile instead of peduncled. The pinnæ are erect, and longer and narrower than in *E. caffer.*

E Bdrteri, Carr St short, about 1 ft high and to 9 in diam · lvs to 5 or 6 ft long, and 10 in broad, erect or suberect, petiole and rachis with a gray tomentum that falls off, lfts. about 80 pairs, linear-lanceolate, sharp at the apex, few-toothed male cone to 9 in long, pale, female cone about 8 in long, oblong-ellipsoid, dark olive W Trop Afr B M 8232.—*E Ghellinckii,* Lem Spineless trunk stout, woolly-scaly lvs 3–4 ft, erect-spreading, pinnæ very narrow-linear, densely tomentose. S Afr I H. 15:567.—*E. Hildebrandtii,* A Br. & Bouché Trunk cylindrical lvs. pinnate, with numerous lanceolate toothed pinnæ which become 3-parted scales toward the end of the lf, woolly at least at first Trop. Afr. G C. III 27·120. R.B 29 196 G W 10, p 210 An attractive species.—*E Laurentianus,* Wildem. Large, the st reaching 30 ft or more and 2½ ft diam lvs. often over 20 ft long, lower lf.s. small, 3-toothed, middle lfts lanceolate, 12–16 in. long and 2 in. broad, spiny on both edges and at the apex Congo G. III. 35. 370. Named for Professor Laurent.—*E Lemarinelianus,* Wildem. & Dur. St 3–7 ft.: lvs. to 3 ft or more, petiole shaggy, lfts. 18–60 on each side, rigid, coriaceous, glaucous, lanceolate, the edge slightly recurved, more or less spiny male cone greenish, subcylindrical, female cone thick, green turning to salmon-color, short-peduncled, the scales triangular. Congo Named for Capt Lemarinel. G.C. III. 35.371 R.H 1904, p 59.—*E Woodii,* Hort. Allied to E. Altensteinii st 18 in high and 8 in thick, bearing about 25 lvs. which are gracefully curved and reach 5 ft lfts 8 in. long and 2 in. broad, spiny-toothed, the broadest ones pinnatifid. Zululand. G.C. III. 43:282. R B 34, p. 193 L H B †

ENCHOLÍRION: *Vriesia*

ENCHYLÆNA (name alludes to the soft or juicy character of the berry-like fructification). *Chenopodiàceæ* One procumbent or wide-branched very small-leaved shrub from Austral. recently intro. by U. S Dept Agric., and thriving well at the University of California *E tomentòsa,* R. Br., grows 3 ft or more high and makes a mass many feet across: branches mostly woolly or silvery: lvs. alternate, linear, usually under ½in long. fls. solitary in the axils, bracted, very small, perfect; perianth urn-shaped to globular, with 5 short teeth that close over the fr.; stamens 5, somewhat exserted: fr. inclosed in the perianth, which becomes red or yellow, fleshy and berry-like and the size of a small pea. The Australian aborigines are said to eat the berries in great quantities. The plant endures drought, and it is eaten by sheep when other herbage becomes scarce. The procumbent habit and the enduring color suggest its use in landscape work in dry mild climates



1395. Green curled endive tied up for blanching.

ENCKÈA: *Piper.*

ENDIVE (*Cichòrium Endìvia*). *Compósitæ.* A leaf-salad plant See *Cichorium.*

Until recently endive has been almost unknown in American home gardens, but it is gradually receiving favor with salad-lovers. Although more frequently a product of the amateur, during August and September, and possibly later, it is now freely offered in the larger markets It is especially the people of foreign descent who grow, buy and use endive In the hot weather of summer and fall, when lettuce plants are more likely to produce seed-stalks than good solid heads, endive, although of somewhat bitter flavor when unbleached, makes a good and acceptable substitute for lettuce as a salad plant. In the unbleached state it may even be used for "greens"

The requirements as to culture are simple, as the plant succeeds well on any ordinary well-enriched garden soil. Seed may be sown in the open ground as early as June, and as late as August, the rows to be a foot apart and the plants to be thinned early to a foot apart in the row; or seed may be started in flats and the young seedlings transplanted to open ground. The latter is the better way when the ground is very dry In extreme cases, it may be advisable for the home gardener to grow his seedlings in flats and pot them off in thumb-pots to become well rooted This gives a chance to grow good plants, while waiting for a rain to moisten the open ground To be tender, the plants should be forced into strong and succulent growth by high feeding and the free use of the hoe It is a waste of effort to plant endive on poor land that is deficient in humus, or naturally dry and exposed.

The originally bitter flavor becomes pleasant and acceptable when the leaves or hearts are well blanched. The blanching is accomplished by tying the outer leaves over the heart with bast (Fig 1395), or by placing a big flower-pot over each plant, or by setting boards, say 10 inches wide, on edge along each side of the row, in inverted V shape, and in somewhat the same fashion as for blanching celery, except that no opening is left on top. The light should be excluded from the hearts as much as possible. In any of these ways endive may be well blanched in about three weeks, and will come out with inner leaves showing a delicate whitish or creamy color, and being crisp, tender and of pleasant flavor.

If to be kept for winter use, sow the seed of Green Curled endive in August, or set the plants early in September; then take up the full-grown but as yet unblanched plants with a ball of earth adhering to the roots, and store them in a root-cellar as is done with celery. If kept in the dark, they will soon bleach and be ready for use.

Green Curled has long been the favorite variety in our markets and gardens. Its narrow curled leaves make the well-blanched plant far more attractive to the eye than the wider and plain leaves of Broad-Leaf. The latter, however, is gaining on the other in both growers' and consumers' favor. This is the only practical difference between the two varieties. The catalogues of European seedsmen list and describe several additional varieties, such as the Moss Curled and Rouen, none of which is often met with in American gardens. A few fungi and the spinach insects sometimes attack the plant.

T. GREINER

ENGELMÁNNIA (Dr. Geo Engelmann, eminent botanist of St. Louis, died 1884). *Compósitæ* One yellow-fld. herb, *E pinnatifida*, Torr. & Gray, allied to Parthenium and Silphium, Kans to La , Ariz. and Mex., that is likely to be planted in wild gardens. It grows a foot or two high, in dry places, from a stout perennial root, branching above, hirsute, with alternate and radical deeply pinnatifid lvs , and corymbose heads of golden yellow fls. on slender and naked peduncles: involucre hemispherical, somewhat double; receptacle flat and chaffy; ray-fls. 8–10, pistillate and fertile, the rays ½in. or more long; disk-fls. perfect and sterile: achene obovate, wingless, ribbed, with a persistent pappus-crown.

ENKIÁNTHUS (Greek *pregnant* and *flower*, referring to the colored involucre which subtends the flowers of *E. quinqueflorus*, giving the appearance of small flowers springing from a larger flower). Also written *Enkyanthus*. *Ericàceæ* Ornamental woody plants, chiefly grown for their handsome flowers and the brilliant autumnal tints of the foliage.

Deciduous, rarely evergreen shrubs with whorled branches lvs alternate, usually serrulate, crowded toward the end of the branchlets: fls in terminal umbels or racemes; sepals 5, small; corolla campanulate or urceolate, usually 5-lobed, stamens 10, anthers 2-awned at the apex, opening with short slits. fr a dehiscent caps , cells 1- to few-seeded, seeds 3–5-winged or -angled —About 10 species in China and Japan, Cochin-China and Himalayas Closely related to Pieris and Zenobia, chiefly distinguished by the few- or 1-seeded cells of the caps and the winged or angled seeds.

These are charming ornamental shrubs, with bright green, medium-sized leaves turning brilliant colors in autumn and with handsome white, red or yellow-and-red, drooping flowers appearing in spring; the flowers are not of the showy kind, but very graceful and of distinct appearance. Most of the cultivated species, as *E. campanulatus*, *E cernuus*, *E. perulatus* and *E. subsessilis*, have proved hardy in Massachusetts; they seem to grow well in any well-drained humid soil, but probably are impatient of lime, as are most Ericaceæ and in limestone regions should be grown in specially prepared beds of peaty soil Propagation is by seeds sown in spring, by cuttings of ripe wood under glass in spring, or by greenwood cuttings in summer; also by layers

A. *Fls. urceolate, gibbous at the base, white.*

perulàtus, Schneid (*E. japónicus*, Hook f. *Andrómeda perulàta*, Miq). Shrub, to 6 ft · lvs. petioled, obovate to elliptic-ovate, acute, sharply appressed-serrulate, glabrous and bright green above, pubescent on the veins below, 1–2 in long: fls in drooping umbels, slender-pedicelled; corolla urceolate, with 5 revolute lobes and with 5 sacs at the base, ½in long: caps. oblong-ovoid, about ½in. long, on straight pedicels. May. Japan. B M 5822. G C III. 21·357. R H. 1877, p. 467. S I.F. 2·62 —The foliage turns yellow and partly scarlet in autumn.

AA. *Fls. campanulate, not gibbous at the base, usually red or yellow-and-red.*

campanulàtus, Nichols (*Andrómeda campanulàta*, Miq.). Fig. 1396. Shrub, to 15 or occasionally to 30 ft.: lvs. petioled, elliptic or rhombic-elliptic, acute or acuminate, sharply appressed serrulate, glabrous except few scattered bristly hairs, particularly on the veins below, 1½–3 in. long· fls. slender-pedicelled, in drooping, 8–15-fld. puberulous racemes; corolla with short obtuse upright lobes, yellowish or pale orange, veined darker red, nearly ½in long· caps. oblong-ovate on pendulous stalks turned upward at the apex. May. Japan. B.M. 7059. Gn. 75, p. 287. G. 29:361. Gt. 22:747. M.D.G. 1900:550. S.I.F. 2:62.—This is one of the handsomest species and the strongest grower; the peculiar coloring of the gracefully drooping fls is very attractive; the foliage turns brilliant red in autumn.

cérnuus, Makino (*E. Meistèria*, Maxim. *Andrómeda cérnua*, Miq.). Shrub, to 15 ft.: lvs. short-petioled, obovate or rhombic-obovate, acute or obtusish, crenately serrate, bright green above, lighter below and pubescent on the veins, 1–2 in long: fls. in pendulous racemes, slender-pedicelled; corolla with irregularly laciniate limb, about ½in. long, white in the type: caps on pendulous stalks turned upward at the apex May. Japan. Var **rùbens,** Makino. Fls red —Only the red-fld. variety seems to be in cult. and is a very distinct-looking handsome shrub.



1396. Enkianthus campanulatus. (×½)

E chinénsis, Franch (E himalaicus var chinensis, Diels) Allied to E campanulatus Lvs quite glabrous, more crenately serrate racemes glabrous, corolla yellow and red, with darker red lobes Cent and W China J H F 1900: 212 — *E deflèxus*, Schneid (E himalaicus, Hook f & Thoms) Closely related to E campanulatus Lvs elliptic-ovate to elliptic-lanceolate, acute, slightly serrate, margin and petioles red while young racemes many-fld , corolla yellow, striped dark red, with darker lobes Himalayas. W China B M 6460 —*E. himalaicus*, Hook. f & Thoms =E. deflexus and E chinensis —*E nikoénsis*, Makino =E subsessilis — *E quinqueflòrus*, Lour (E reticulatus, Lindl) Lvs elliptic, long-petioled, entire, persistent fls about 5, in umbels, subtended by colored bracts, drooping, corolla campanulate, scarlet S China, Cochin-China B M 1049. B R 884, 885 L B C. 12 1101. P M 5 127 R H 1849 221 H F 1859 101 Tender Var *serrulatus*, Wilson (E serrulatus, Schneid) Lvs deciduous, membranous, finely serrulate fls smaller Cent and S W China —*E. reticulatus*, Lindl =E quinqueflorus —*E serrulatus*, Schneid = E quinqueflorus var serrulatus —*E subsèssilis*, Makino (E. nikoensis, Makino) Allied to E perulatus Lvs short-petioled, elliptic or obovate. fls in pendulous racemes, small, white, ½in. long June Japan S T S 1 25 S I F 2 62 —This is the least attractive in bloom, but the autumnal tints of the foliage are as beautiful as in the other species

ALFRED REHDER.

ENNEÁLOPHUS (name refers to the 9 crests on the style) *Iridàceæ*. A very recently described genus of one species, *E. amazónicus*, N E. Br , differing from Tigridia in the 3 style-branches being 3-crested rather than bifid or subulate. The perianth-segms. are free, unequal and clawed, the exterior ones much the larger, the blades of all of them more or less reflexed; stamens 3, the filaments connate into a tube. The bulb of the single known species is about 1 in. long, ovoid: lvs. linear-lanceolate, about 4, the upper one about 2 in. long and the others 6–12 in.: fls. about 1½ in. across, blue-violet with pale brown claws and a white spot at the base of the blade of the inner segms. Brazil; apparently not in the trade.

ENTÀDA (a Malabar name). Syn. *Pusætha*. *Leguminòsæ*. Tropical woody spineless climbers.

Leaves bipinnate, often cirrhiferous: fls. not papilionaceous, white or yellow, in slender spike-like racemes which are solitary or panicled; calyx campanulate, shortly 5-toothed; petals 5, free or somewhat coherent; stamens 10, free, short-exserted: pod straight or arcuate, flat-compressed, jointed, the joints separating and leaving a continuous border.—Perhaps 20 species of high climbers in Afr. and Amer. The genus is remark-

able for the jointed pods, which sometimes reach several feet in length. Two of the American species are mentioned as planted in S. Fla. Some of the species yield "sea beans" (G. F. 7:503)

polystàchya, DC. At length tendril-bearing: pinnæ in 4–6 pairs; lfts. in 6–8 pairs, oblong, rounded at apex, beneath glabrous or puberulent: racemes in terminal panicles: pod oblong, straightish, reaching 1 ft. in length W Indies to Venezuela and Guiana.—Makes a rapid growth.

scándens, Benth. Climbing to a great height, tendril-bearing, the sts. terete: pinnæ 1 or 2 pairs; lfts. 2–5 pairs, coriaceous, oblong or elliptic, usually unequal-sided, glabrous or nearly so beneath. racemes solitary or twin. pod twisted, sometimes 8 ft. long. W Indies, Afr., Asia, Pacific Isls. G.C. II 15 430.—Seeds 2 in. across, dark brown or purple, handsome, used in the making of trinkets and small receptacles. Lvs. long-stalked, the rachis commonly ending in a tendril. L. H. B.

ENTELÈA (Greek, *complete;* the stamens all fertile, a distinguishing feature). *Tiliàceæ.* A shrub or small tree from New Zeal., intro in S. Calif. Lvs. large, alternate, 5–7-nerved, cordate at base, toothed or crenate, stellate-pubescent: fls white, 1 in. across, in terminal cymes, sepals 4–5; petals 4–5; stamens numerous, free, ovary 4–6-celled; cells many-ovuled; style simple: fr a globose bristly loculicidal caps.

arboréscens, R. Br. Attaining 20 ft: the heart-shaped outline of the lf. broken on each side, about two-thirds of the way toward the tip, by a projection or lobe ½in. long or nearly as long as the tip of the lf.; blade 6–9 in long, 4 in. wide, doubly serrate. New Zeal. B M 2480.—Eaten by horses and cattle in New Zeal. Allied to Sparmannia, Aristotelia and Elæocarpus. L. H. B.

ENTEROLÒBIUM (name refers to the *intestine-form* pods) *Leguminòsæ.* Tropical trees.

Unarmed: lvs. bipinnate, the pinnæ and lfts. many: fls. not papilionaceous, greenish, in large heads or clusters; calyx campanulate, shortly 5-toothed; corolla 5-toothed, somewhat trumpet-shaped, the petals connate part way, stamens many, connate at base into a tube, exserted, purple or white: legume broad, circinate, attached at or near the middle, restricted between the large seeds, leathery, pulpy.—About a half-dozen species in the American tropics, 2 of which have been intro in S. Calif

A. *Pod bent back in a complete circle.*

cyclocárpum, Griseb. Tall tree, glabrous: pinnæ in 4–9 pairs, lfts. in 20–30 pairs, unequal-sided, oblong, pointed; the petiole with glands between bottom and top pinnæ: stamens white. Cuba, Jamaica, Venezuela.

AA. *Pod forming half or two-thirds of a circle.*

Timbouva, Mart Said to be a fine tree: pubescent or glabrous, glaucous: pinnæ 2–5-pairs; lfts. 10–20 pairs, falcate-oblong, mostly acute: pod coriaceous and indehiscent, reniform, fleshy within; seed elliptic. L. H. B.

EOMÈCON (Greek, *eastern poppy*). *Papaveracèæ.* Herbaceous perennial, with white flowers on a slender-branching scape.

Rhizomatous, with radical lvs., glabrous: "monotypic, intermediate between Stylophorum and Sanguinaria, differing from both in the scapose habit, racemose fls. and sepals confluent in a membranous, boat-shaped spathe, and further from Stylophorum in the form of the lvs. and color of the fls., and from Sanguinaria in the 4 petals and elongate style" (Hooker).

chionántha, Hance. Rootstock creeping, ascending, full of yellow sap: lvs. all from the root; stalks twice as long as the blades; blades 3–6 in. long, heart-shaped, concave, broadly sinuate, rounded at the apex, bright pale green above, almost glaucous beneath: scape 1 ft. or more high, reddish; fls. 2 in. across, white; petals 4. Spring; hardy near New York City. E. China. B M. 6871. Wilhelm Miller.

EOPÈPON: *Trichosanthes.*

ÉPACRIS (Greek-made name, *upon the summit;* referring to their habitat). *Epacridàceæ.* Heath-like shrubs of Australia and New Zealand, of which half a dozen or less are grown as cool greenhouse pot-plants.

Leaves small and entire, usually sharp-pointed, sessile or short-stalked, scattered or sub-opposite. fls. small and axillary, short-stalked, the flowering sts. being elongated leafy spikes, regular and perfect; calyx bracteate; corolla tubular, 5 toothed, white or shades of purple and red; stamens 5; ovary 5-loculed, ripening into either a fleshy or capsular fr. Distinguished from Erica by the bracteate or scaly calyx, and the anthers opening by slits rather than pores.—About 40 species In the Old World, epacrises are prized by those who grow heaths, and many good varieties are known. They bloom in early spring or late winter. The varieties of *E impressa* may be flowered for Christmas; perhaps others may be so treated. A carnation house, 50–55,° suits them well. There are double-fld. forms.

A *Corolla-tube decidedly longer than the calyx.*

impréssa, Labill. Three ft., erect, twiggy, downy: lvs horizontal or deflexed, narrow-lanceolate and sharp: fls. rather large (often ½in long), tubular, pendent, on very short stalks, red or white. B M 3407 There are many forms: var **parviflòra,** Lindl, B R. 25.19; *E. campanulàta,* Lodd, with broader fls, L.B C 20·1925; *E. ceræflòra,* Graham. B M 3243, *E. nivàlis,* Lodd, snow-white, L B C 19:1821 B.R 1531, *E variabilis,* Lodd., blush, L B C. 19:1816, var **longiflòra,** Cav., (*E. miniàta,* Lindl. *E grandiflòra,* Willd). Sts woolly, straggling: lvs. ovate-pointed or cordate-pointed, sessile or nearly so, many-nerved. fls long (nearly 1 in), red at base and white at the limb, cylindrical. B M. 982 B R. 31:5.—Handsome. Var **splèndens,** Hort, has brighter colors.

AA. *Corolla-tube shorter than the calyx or only as long as it.*

B. *Lvs. acute or acuminate.*

acuminàta, Benth Lvs. ovate, acuminate, clasping, ascending. fls small, red nearly sessile in the upper axils; corolla-tube not exceeding the calyx; sepals broad, ciliate.—Little known in U. S outside of botanic gardens, but of considerable worth.

breviflòra, Stapf (*E. heteronèma,* Hook). A graceful shrub, 1 ft, with many wavy branches, naked below, with many lvs. above: lvs. divaricate on upper part of st., reflexed below, elliptic-ovate, 3–6 lines long, sharp-pointed: fls. spicate at the ends of the branches, white; bracts and sepals whitish. New Zeal. Flowers in May in England. B.M. 3257.

purpuráscens, R. Br. Lvs. ovate-acuminate, trough-shaped, tipped with a long curved point or spine. fls. short, the calyx nearly equaling the corolla, white or pinkish. There is a double-fld. form. L B C. 3:237. G.C. II. 5:340.—Probably identical with *E pulchella,* Cav.

BB. *Lvs. very obtuse.*

obtusifòlia, Smith. An erect, much-branched shrub 1–3 ft. tall, the branches usually hairy: lvs. small, elliptic or linear, thick and obtuse: fls. small, white, in axillary racemes which are more or less one-sided. L.B.C. 3:292.

Other trade names are: *E. ardentissima.* Fls. crimson.—*E. hyacinthiflòra* var. *candidissima,* white, early, and var. *fúlgens,* pink.—*E. hýbrida supérba* is merely a catalogue name for mixed kinds of Epacris.—*E. rubélla.* Fls. bright red.—*E. salmònea* (?)

N. Taylor.†

EPHÉDRA (ancient Greek name, used by Pliny for the horse-tail). *Gnetàceæ* Woody subjects, rarely cultivated, usually found only in botanical collections, although the scarlet fruits of some species are very attractive.

Usually low much-branched shrubs, often procumbent and sometimes climbing, the green branches resembling much those of Equisetum, bearing minute, scale-like, sheathing lvs in distant pairs or whorls. fls dœcious, in small aments, forming usually pedunculed axillary clusters, staminate fl with a 2-4-lobed perianth and with the 2-8 stamens united into a column; pistillate fl with an urceolate perianth, including a naked ovule, developing into a nutlet; in some species the bracts of the ament become fleshy, and form a berry-like syncarp —About 30 species from S Eu., N Afr, Asia and in Trop Amer Latest monograph by O. Stapf, in Denkschr. Akad Wissensch Wien, vol 56 (1889), (in German and Latin) Curious-looking, usually low shrubs, with pale green apparently leafless branchlets, much resembling those of the horse-tail and with inconspicuous fls, but fr in some species decorative, berry-like and scarlet. They are but rarely grown, and most of them are tender, half-hardy N are *E distachya, E folvata, E nevadensis, E. trifurca* They can be used for covering dry, sandy banks or rocky slopes Prop is by seeds or by suckers and layers

E altissima, Desf Climbing shrub, to 20 ft, green lvs to 1 in long aments paniculate or solitary, fls with 2-3 stamens, pistillate fls 1-2 fr berry-like, ovoid, ⅓in long, scarlet N Afr B M 7670 G C III 7 702 —*E distachya*, Linn (E vulgaris, Linn) Low, often procumbent, 1-3 ft, pale or bluish green lvs one-twelveth in long aments usually clustered, staminate oblong, fls with about 8 stamens, pistillate 2-fld fr berry-like S Eu, W Asia R F G 11 809 Var *monostachya*, Stapf Aments usually solitary —*E folvata*, Boiss (E kokanica, Regel) Procumbent or erect, to 15 ft, bright or bluish green lvs to 1 in long aments usually clustered, ovate, staminate fls with 4-4 sessile stamens, pistillate 2-fld fr berry-like W Asia —*E kokanica*, Regel=E folvata —*E nebrodénsis*, Tinco Erect, with rigid, pale green branches lvs ¼in long aments solitary or few, staminate globular, pistillate 2-fld fr berry-like Medit region to Himalayas —*E nevadénsis*, Wats Erect, 2-3 ft, with pale or bluish green branches lvs ⅓in aments usually solitary, staminate ovate, 6-8-fld, pistillate 2-fld fr dry, with ovate bracts Calif, New Mex —*E trifurca*, Torr Erect, with rigid, yellowish or pale green branches lvs in 3's, connate, about ¼in long, aments solitary, pistillate 1-fld fr dry, the roundish bracts with transparent margins Ariz to Colo —*E vulgaris*, Linn =E distachya

ALFRED REHDER

EPICÁTTLEYA (compounded of *Epidendrum* and *Cattleya*) *Orchidàceæ*. A genus established to contain hybrids between Epidendrum and Cattleya

The following are some of these *E balarucénsis* (C. labiata × E eburneum) —*E. cándida* (C Skinneri × E. nocturnum) —*E decípiens* (C gigas × E ciliare) —*E. Lilianæ* (C Gaskelliana × E costaricense).—*E madeburgénsis* —*E Nèbo* (C Clæsiana × E O'Brienianum). —*E nemorále-gigas* (C Warscewiczii × E nemorale) —*E. O'Briennæ* (C. Bowringiana × E O'Brienianum) —*E Orpetii* (C. amethystoglossa × E. O'Brienianum) —*E. salmonicolor* (C. Mendelii × E aurantiacum) —*E. Sédenii* (C Bowringiana × E radiatum) —*E. Wolteriàna* (C. Schrœderæ × E aurantiacum).

GEORGE V. NASH.

EPIDÉNDRUM (*upon trees*, alluding to their epiphytal habit). *Orchidàceæ*. Epiphytic orchids, some requiring hothouse and some coolhouse conditions, although a large genus, of minor importance horticulturally

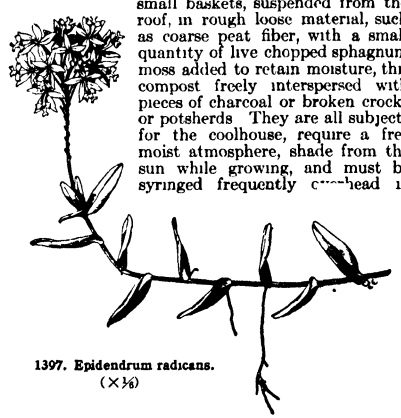
Inflorescence simple or branched, nearly always terminal; claw of the labellum more or less adnate to footless column, the blade spreading and usually deeply lobed, pollinia 4, 2 in each anther-cell, separated —Nearly 500 species discovered and described from the New World tropics, chiefly from Cent. Amer.

Cultivation of epidendrums.

Epidendrums are noted as the rankest weeds amongst the orchid tribes The remarkable success in the raising of hybrids, be it in the genus itself or with the related Cattleya and Lælia, has opened a wide field for the breeder Epidendrum seedlings grow freely; the time required to bring them to the flowering stage is little compared with other orchids, and it is but a question of a short time till the blood of the epidendrums will be infused into the weaker but more gorgeous flowers of genera more difficult to grow It is also the long stem and the grace of the racemes of the epidendra, as well as the odor of some of their species, which the hybridist will try to blend with the largeness of short-stemmed flowers, of cattleyas for example Therefore a list of the species but rarely found under cultivation is given below, the value of which, however, will call for and justify large importations of their kind before long.

It is scarcely possible to apply any one rule for the cultivation of this widely divergent and large genus, which includes many hundreds of variable individuals geographically distributed all over tropical America. For convenience they are treated under their several separate sections

Section I. BARKERIA embraces several deciduous small-growing species which generally deteriorate sooner or later under cultivation They succeed best in small baskets, suspended from the roof, in rough loose material, such as coarse peat fiber, with a small quantity of live chopped sphagnum moss added to retain moisture, this compost freely interspersed with pieces of charcoal or broken crocks or potsherds They are all subjects for the coolhouse, require a free moist atmosphere, shade from the sun while growing, and must be syringed frequently overhead in bright weather. After the plants have matured growth, they should be removed to a rather sunny location and be syringed overhead often enough to keep them in sound condition until they start new action. While resting during winter the temperature may range from 50° to 55° F at night, and a few degrees higher during the day They are increased by division. This should take place as the plants start growth action in early spring, allowing at least three pseudobulbs to each piece.



1397. Epidendrum radicans. (×⅙)

Section II. ENCYCLIUM, of which *E atropurpureum, E nemorale* and *E prismatocarpum* are good examples, may be grown either in pots or baskets in equal parts clean peat fiber and live chopped sphagnum, with a liberal amount of drainage, and excepting *E vitellinum*, which must be grown cool, they require a moist sunny location with a winter temperature of 58° to 65° F. by night and several degrees advance during the day. In February and March, many species will start root or growth action, such as need it should then be repotted or top-dressed, as occasion requires. The temperature should be increased several degrees, and a greater amount of water be allowed with frequent overhead syringing on bright days Ventilation should be given whenever the weather will permit, to keep the young growths from damping-off and the atmosphere active; at this time the plants will need light shading to pre-

vent sun-burning. The stock is increased by cutting nearly through the rhizome three or four bulbs behind the lead, when starting action; this will generally cause the latent eyes to grow, but the pieces should not be removed until the new growth is well advanced

Section III. AULIZEUM includes such species as *E. ciliare, E. cochleatum*, and the like, the several requirements being identical with the preceding.

Section IV. EUEPIDENDRUM These are mostly tall-growing species, some reed-like as in *E evectum*, and others rambling in an irregular way, producing aerial roots along the stems as they grow, a good example of this is seen in *E radicans*. All are best grown in pots and placed near a partition or end of a greenhouse where support may be given as the growth advances. There is, in fact, no better example of an epiphyte than *E radicans*, the roots often attaining several feet in length, and appearing from nearly every node. A structure in which 50° F is maintained in winter will be ample, and full exposure to sun should be permitted at all times This prevents immature growth, and flowers are produced very freely After flowering time, young shoots appear, often from the old stems, and when a few roots are formed and before they become too long to go into a small pot without injury, remove them and pot with care, place the young plants in a shady place for a few weeks; in this way propagation is easily accomplished. This section of epidendrums produce seeds the largest known among orchids. They are green in color, and under favorable conditions germinate very readily. It is, in fact, much easier to get the seeds to grow than to get the species to produce good seeds, for when flowering plants are produced from seed, there is an infinite variation that has not yet been understood.

Section V PSILANTHEMUM contains but one species, *E. Stamfordianum*, which requires the same general treatment as those in Section II.

ROBERT M. GREY.
E. O ORPET.

INDEX

atropurpureum, 20
aurantiacum, 23
bicornutum and bidentatum are Diacrium
Brassavolæ 21
Capartianum, 18
Catillus, 2.
ciliare, 22
cinnabarinum, 3
cochleatum, 27
crassifolium, 6
dichromum, 17
eburneum, 10
elegans, 11
ellipticum, 6.
Endresii, 5.
evectum, 8
falcatum, 24
fragrans, 26
Godseffianum, 18
imperator, 2, 9
leucochilum, 9
Lindleyanum, 13.
maculatum, 19
macrochilum, 20
majus, 15
nemorale, 16
odoratum is an Aerides
osmanthum, 18
paniculatum, 7
Parkinsonianum, 24
prismatocarpum, 19
radicans, 4
Randianum, 20
rhizophorum, 4
roseum, 20
sanguineum is a Broughtonia
Skinneri, 12
spectabile, 14
Stamfordianum, 1
tampense, 25
tibicinus is a Schomburgkia
venosum, 25
violaceum is *Cattleya Loddigesii*
vitellinum, 15

A *Infl radical* (*Psilanthemum.*)

1. **Stamfordiànum,** Batem. Sts. fusiform, 12 in. long: lvs. 7–9 in large panicles of yellow and green fls, crimson-spotted, fragrant. Mex to Colombia. B.M. 4759 G C. III 17.655 J F 3·251.

AA *Infl terminal*

B. *Sts. without bulbs: lvs distichous, alternate· only top of column free from lip* (*Euepidendrum.*)

c. *Fls. red, orange or vermilion*

2. **Catillus,** Reichb f. (*E imperàtor*, Hort.). Fls. cinnabar-red. Colombia I H. 21:162

3. **cinnabarinum,** Salzmann. Sts. 3–4 ft · fls. orange-red, 2 in. diam., lobes of lip deeply fringed. Brazil. B.R. 28:25.—A beautiful species

4. **radicans,** Pav. (*E. rhizóphorum*, Batem.). Fig. 1397. Sts. semi-scandent, up to 5 ft. long, long white roots from opposite the lvs · fls. up to 2 in. diam., numerous; most brilliant of the red-flowering species. Guatemala, amongst heavy grass Gn 24·390. O R. 5.273.

cc. *Fls. white.*

5. **Endresii,** Reichb. f. Sts. 6–9 in.: racemes 9–12-fld.; fls 1 in. diam., pure white, lip and column spotted purple. Costa Rica. G.C. II. 23:504. B.M. 7855. O R. 12 145

ccc. *Fls , at least sepals and petals, rose or purple.*

6 **ellípticum,** Graham (*E crassifòlium*, Hook.). Fls. on long scapes, clustered, rose or purple, ½in. diam. Brazil. B M. 3543

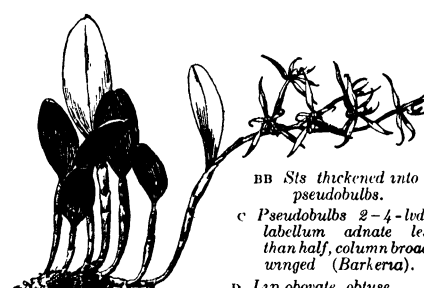
7. **paniculàtum,** Ruiz & Pav Sts. 3–4 ft.: fls. ¾in. across, lilac-purple, lip whitish yellow. Venezuela to Peru, high altitudes B M. 5731 I H. 22 211 —Most free-flowering and best of paniculate species

8 **evéctum,** Hook. Sts 3–5 ft peduncles nodding, 2 ft.; fls. rich purple, lip deeply fringed. Colombia. B.M. 5902 —Easily cult. and on account of its free-flowering habit deserves a place in the warm greenhouse.

cccc *Fls , at least sepals and petals, yellowish green.*

9. **leucochìlum,** Klotzsch (*E. imperàtor*, Hort). Sts 2 ft : fls 5-9, on long pedicels, greenish yellow, lip pure white Colombia, 6,000–9,000 ft

10 **ebúrneum,** Reichb f. Sts terete, 2-3 ft.: fls 3-4 in diam , yellowish green; lip ivory-white, with yellow calli; racemе terminal, 4–6-fld. Panama, in swamps B M 5643.



1398. Epidendrum ciliare (×½)

BB *Sts thickened into pseudobulbs.*

c *Pseudobulbs 2–4-lvd labellum adnate less than half, column broad-winged* (*Barkeria*).

D *Lip obovate, obtuse*

11 **élegans,** Reichb f (*Barkèria élegans*, Knowl. & West) Sts terete, 12 in pedicels 24 in ; fls 5–7, nodding, 1½ in. diam., lilac-purple; lip whitish, with purple blotch Pacific coast of Mex. B M. 4784.

DD. *Lip acute.*

E. *Fls about 1 in across.*

12. **Skinneri,** Batem. (*Barkèria Skinneri*, Paxt) Lvs. ovate-oblong, sheathing the slender st · peduncle terminal, bearing rose-lilac fls about 1 in across; petals and sepals nearly equal, petals so twisted at the base as to present dorsal surface to the observer; labellum ovate, with 3 raised lines Guatemala. B R 1881 P M 15·1 (var *major*).

EE *Fls 2–4 in across.*

13 **Lindleyànum,** Reichb. f (*Barkèria Lindleyàna*, Batem) Sts slender. fls numerous, about 2 in across, rose-purple; labellum with a white disk; petals broader than the sepals Cent. Amer 1839. J H. III 44:53

14. **spectábile,** Reichb f. (*Barkèria spectábilis*, Batem.) FLOR DE ISABAL. Sts. tufted, cylindrical, 4–5 in. high: lvs. 2. raceme about 6-fld.; fls. 3–4 in across, bright lilac; sepals linear-lanceolate; petals ovate-lanceolate; labellum white at base, red-spotted. Guatemala.

CC. *Pseudobulbs 1-2-, rarely 3-lvd.. labellum adnate at base, or not up to the middle, column not winged. (Encyclium.)*

D. *Fls. cinnabar.*

15. **vitellinum,** Lindl Pseudobulbs ovoid, 2 in. long: lvs. 6–9 in.: peduncles 15–18 in., 10–15-fld ; fls. cinnabar-red, lip and column orange. Mex., 6,000–9,000 ft B M. 4107. G.C III. 10:141

Var **majus,** Veitch. Pseudobulbs shorter· racemes denser; fls larger and more brilliant G.C. III 12:159. —Very superior to the species, type no longer imported.

DD. *Fls rose*

16. **nemorale,** Lindl. Pseudobulbs subglobose, 3-4 in. high: lvs 9–12 in . peduncles 2 ft long, covered with warts; fls. 3–4 in diam , rose-colored; lip rosy mauve, streaked with purple Mex B M. 4606 (as *E. verrucosum*). G C II. 24:332. A.F 6:633.

DDD *Fls. other than above.*

E *Sepals and petals white.*

17 **dichromum,** Lindl. Fls white, lip rose-colored, yellow and downy at base Brazil.

EE *Sepals and petals green*

18 **osmanthum,** Rodr (*E Godseffianum,* Rolfe. *E. Capartianum,* Lindl) Fls. 1½ in across, in large panicles, light green, suffused with brown, lip white, lined with rose-purple, fragrant Brazil. B M 7792 — One of the handsomest species

19 **prismatocarpum,** Reichb. f. (*E maculatum,* Hort) Pseudobulbs ovoid, tapering, 4–5 in lvs 12–15 in fls 1½ in across, pale yellow-green, with purplish black spots; lip pale purple, with yellow tip and white border Cent Amer , 5,000 ft B M 5336 G W 5, p 126 O R 12.57

EEE *Sepals and petals purple or brown*

20 **atropurpureum,** Willd (*E macrochilum,* Hook). Pseudobulbs ovoid, 3–4 in high lvs lanceolate, 12–15 in long, dull purple-colored. peduncle 6–10-fld , fls 2½ in diam., purplish brown upon greenish ground, lip yellowish white, with crimson stripes Mex to Venezuela B M 3534 A F 6·609. J H III 51 243, 401.

Var **Randianum,** Lind & Rod Sepals and petals margined with light yellowish green, the white middle lobe of lip with a red-purple-rayed blotch

Var **roseum,** Reichb f Sepals and petals purplish, lip bright rosy Guatemala P M 11·243

21. **Brassavolae,** Reichb f. Pseudobulbs pear-shaped lvs 6–9 in. racemes 18–24 in , 6–9-fld , fls. 4 in. across, sepals and petals narrow, yellowish brown, lip trowel-shaped, purple, white and green. Mex. to Guatemala, 8,000 ft B M 5664.

CCC. *Pseudobulbs 1–2-, rarely 3-lvd.: lip adnate up to apex of column. (Aulizeum)*

D. *Lip fringed.*

22 **ciliare,** Linn. Fig 1398 Pseudobulbs clavate, 4–6 in.· lvs 4–6 in , springing from sheathing bract: peduncles 5–7-fld.; fls yellowish green; lip white Trop. Amer , between 5th and 20th parallel of north latitude. B.R. 784.—Plant resembles a cattleya. Intro. to cult. in 1790.

DD. *Lip not fringed.*

E. *Fls. vermilion.*

23. **aurantiacum,** Batem. Once classed in the separate group of Epicladium, now often accepted as a species of Cattleya, where it was first referred by Don. The plant grows with, and much resembles *Cattleya Skinneri.* Fls 1½ in across, orange-red, appearing in Feb. and March and lasting several weeks Guatemala. Gt 5:130.

EE. *Fls. not vermilion.*

F. *The lip deeply 3-lobed, the middle lobe long and lanceolate.*

24 **falcatum,** Lindl (*E. Parkinsonianum,* Hook.). Pseudobulbs thin, rising from running rhizomes, monophyllous. lvs 6–12 in , fleshy, channeled on one side. peduncles 2–5, sheathed, 1-fld ; fls. 5 in. across, greenish yellow; lip white, greenish at apex Mex. to Guatemala B M. 3778. G C. III. 44.378.—Plants grow inverted.

FF. *The lip not as in* F.

25 **venosum,** Lindl Butterfly Orchid. Scape 1 ft , with white sheaths. lvs 3, 4–6 in. long, linear-lanceolate. scape tumid at base, 5-7-fld.; fls pink, chocolate and green, about 1 in long, lasting a long time. On oaks, etc , Mex —Of easy cult The Fla. representative of this species is *E. tampense,* Lindl. See 9th Rept. Mo. Bot. Gard 137, pls. 38, 39.

26 **fragrans,** Swartz. Pseudobulbs fusiform, monophyllous, 3–4 in · lvs 8–12 in.· fls inverted, 2 in. diam , very fragrant, pale greenish or whitish; lip crimson-streaked Guatemala, through the W. Indies to N Brazil B.M 1669

27 **cochleatum,** Linn Pseudobulbs 3–4 in.: lvs. 6 in . racemes 4–7-fld , fls. 3–4 in. across, greenish white; lip deep purple beneath, light green above, with maroon blotch on each side, column white. Trop. Amer. from Fla to Colombia B M 572.—Intro. 1787; first epiphytical orchid to flower in England.

Garden hybrids *E Bérkeleyi* (E Stamfordianum × E O'Brienianum) —*E Burtonii* (E O'Brienianum × E ibaguense) —*E. Clarrissa superbum* (E elegantulum × E Wallisii) —*E dellense* (E xanthinum × E radicans) —*E elegantulum* (E Wallisii × E Endresio-Wallisii) G C III 19 361 —*E Endresio-Wallisii* —*E kewense* (E evectum × E xanthinum) —*E O'Brienianum* (E evectum × E radicans) G C III 3 771 —*E Phabus* (E O'Brienianum × E vitellinum) —*E. radicanti-Stamfordianum* —*E. radico-vitellinum* —*E Wallisio-ciliare* —*E xantho-radicans*

Euepidendrum *E arachnoglossum,* André Sts 4–5 ft fls. rich purple-lilac lip fringed, with orange calli Colombia R.H 1882 554 —*E Clevianum,* Cogn Sts up to 2 ft tall racemes numerous, pendulous, fls pure white Colombia G C III 29 70 — *E cnemidophorum,* Lindl Sts 4–6 ft racemes ample, drooping fls purple, brown and yellow, fragrant Guatemala, 7,000 ft B M. 5656 —*E conopseum,* R Br Scape few- to many-fld lvs 1–3, thick. fls green, tinged with purple, the sepals spatulate and revolute, the petals narrower and obtuse S Fla and S Once offered by Reasoner —*E Cooperianum,* Batem Sts 2–3 ft fls yellow-green; lip bright purple Brazil B M 5654 —*E costatum,* Rich & Gal Raceme nodding, fls about 1 in across, the sepals and petals reddish brown, the lip whitish, purple-marked Mex G C III. 44 423 —*E decipiens,* Lindl Fls orange or vermilion Colombia. —*E Ellisii,* Rolfe Fls carmine-rose, very handsome Colombia *E fulgens,* Brongn Fls orange-scarlet in crowded racemes Guiana to Brazil —*E gracilis,* Lindl , was once offered by John Saul —*E ibaguense,* HBK Sts 2–3 ft fls orange-scarlet, lip yellow Colombia to Peru, 4,500 ft —*E Lambeauianum,* De Wild. Sepals and petals whitish, the lip claret G C III 44 228 —*E myrianthum,* Lindl Sts 3–5 ft enormous panicles of rich purple fls , lip with 2 yellow calli Guatemala B M 5556.—*E nocturnum,* Linn Sts 2–3 ft peduncles 8–10-fld , fls white and yellowish, 5 in across, very fragrant S Fla and Mex to Peru and W Indies. B M 3298 Once offered by Reasoner —*E palpigerum,* Reichb f Fls beautiful lilac Mex —*E Pfavii,* Rolfe Sts 4–6 ft high fls light purple, lip with white disk, in numerous racemes. Costa Rica —*E Pseudepidendrum,* Reichb f Sts 2–3 ft fls 3 in. diam , green, lip orange-red and yellow Cent Amer , 4,000 ft. B M 5929 —*E raniferum,* Lindl Sts 2–3 ft fls yellow-green, thickly spotted with purple Mex to Guiana B R 28 42 —*E rigidum,* Jacq , was once catalogued by Reasoner —*E Schomburgkii,* Lindl Sts 2–3 ft fls vermilion. Guiana, Brazil, Quito B R 24 53 —*E stenopetalum,* Hook Sts up to 2 ft fls 1½ in across, rosy mauve, the lip with a white blotch Jamaica B M. 3410 —*E syringothyrsus,* Reichb f. Sts 4–5 ft fls deep purple, lip and column with orange and yellow, crowded in long racemes. Bolivia, 8,000–9,000 ft B M 6145 —*E. Wallisii,* Reichb f Sts. 4–6 ft · fls. yellow, some purple spots, lip orange and purple, upon white ground Colombia 4,000–7,000 ft Has lateral as well as terminal racemes

Encyclium *E ditrena,* Reichb f. Fls. yellow, veined brown; lip yellowish white, purple-streaked Brazil —*E alatum,* Batem Fls 2 in across, purple and green, lip yellowish, streaked with purple, fragrant Cent Amer B.M 3898.—*E bifidum,* Aubl Fls pale green, dotted with purple, lip rose, orange and white W. Indies, Guiana B R 1879.—*E Friderici-Guilielmi,* Warsc & Reichb f Bulbs 4–5 ft fls. dark purple, base of lip white and yellow Peru, 6,000–8,000 ft. I.H 18 48 —*E. gallopavinum,* Reichb f. Fls. brown in large racemes, lip yellow Brasil.—*E. oncidioides,* Lindl Panicles up to 6 ft long, fls yellow and brown, sweet-

scented. Stately species. Guiana. B R 1623.—*E. phœnicèum*, Lindl Pameles 2–3 ft., fls deep purple, mottled green, lip rich violet, stained crimson Handsome Cuba.—*F. virgàtum*, Lindl. Scape up to 7 ft. high, fls. small, up to 20, greenish, stained brown. Mex

Aulæum: *E. variegàtum*, Hook Racemes many-fld , fls. fragrant, sepals and petals pale yellow, the lip rose or white-and-rose-spotted. S Amer B M 3151.

Other species mentioned in horticultural literature are *E. campylostàlyx*, Reichb f A curious species with glaucous green pseudobulbs and lvs fls yellowish tinged with chocolate color Cent. Amer.—*E. Lambda*, Lind Closely allied to E fragrans Sepals and petals light salmon-color, lip cream-yellow with violet lines, crest velvety Colombia.—*E lateràle*, Hort Infl. produced on a rudimentary pseudobulb as in E Stamfordianum. Cent. Amer.—*E. pterocàrpum*, Lindl Of diminutive growth, chiefly of botanical interest Mex.—*E. punctiferum*, Reichb f Fls. in erect spikes, green, the lip spotted with purple Brazil.—*E purpurachylum*, Rodr "Sepals and petals dull olive-green, tinged with brown, corrugated front lobe of lip deep purple, with whitish yellow margin, fls. fragrant, not unlike violets."—*E. saccharàtum*, Kränzl. Raceme 15–20-fld , fls green, marked with dark brown, lip white, rose-purple at apex Guiana.—*E Stallforthiànum*, Kränzl Sepals and petals dull brown, column ivory-white, fls have a peculiar and disagreeable odor Mex. G.C. III 51 114.—*E tripunctàtum*, Lindl. Intro. in 1881 and now reappearing in cult

GEORGE HANSEN
GEORGE V. NASH.†

EPIDIÀCRIUM (compounded of Epidendrum and Diacrium) *Orchidàceæ*. A genus established to contain hybrids between Epidendrum and Diacrium.

The following is sometimes found in collections. *E Còlmanii* (*E. ciliare* × *D bicornutum*)

EPIGÆA (Greek, *epi*, upon, *gaia*, earth; in reference to the trailing growth) *Ericàceæ*. Evergreen spring-blooming plants, herbaceous in appearance but with woody creeping stems, sometimes planted

Leaves alternate, petiolate, entire, leathery. fls. usually dœcious, sometimes perfect, in short terminal or pseudo-axillary spikes, each in the axil of a green bract and with 2 green bractlets; sepals 5, green; corolla pink or white, salver-shaped, with 5 lobes, stamens 10, attached to the base of the corolla-tube, the 2-celled anthers dehiscing by slits not, as is usual in the Ericaceæ, by pores; style columnar; stigma 5-lobed, ovary densely hairy, 5-celled, with many ovules fr depressed-globose, fleshy, dehiscent along the partitions, the many minute seeds set on the surface of the white succulent placentæ.—Two species, N. E Amer. and Japan.

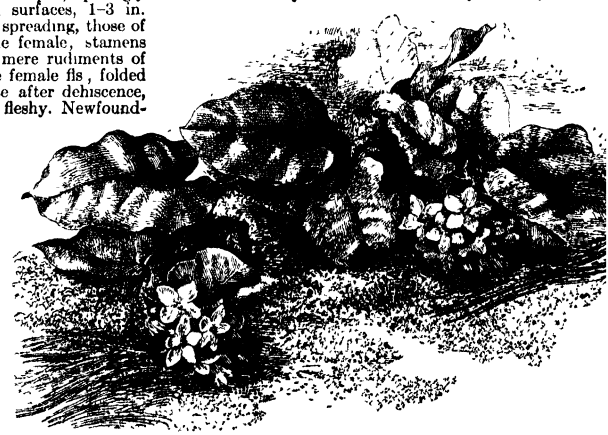
rèpens, Linn. TRAILING ARBUTUS MAYFLOWER. Fig. 1399 Spreading on the ground in patches sometimes 2 ft. diam , the hirsute sts rooting· lf -blades ovate-oblong to orbicular, cordate or rounded at the base, obtuse or broadly acute at the apex, sparingly hirsute on the margins and both surfaces, 1–3 in. long· fls fragrant, the corolla-lobes spreading, those of the male fls. much larger than the female, stamens in the female fls. often reduced to mere rudiments of filaments; stigmas spreading in the female fls , folded together in the male fr berry-like after dehiscence, the axis, dissepiments, and placentæ fleshy. Newfoundland to Sask , south to Fla., Ky , and Wis.—It grows only in acid soils.

Trailing arbutus, probably the best beloved of all the early wild flowers of the eastern United States, is rarely seen in cultivation Yet it thrives in the same acid peaty sandy well aerated soils as the blueberry, and like the blueberry it has in and on its roots a mycorhizal fungus upon which it probably depends for nutrition. One of the most satisfactory potting mixtures is nine parts finely sifted kalmia peat, one part clean sand, and three parts clean broken crocks. In watering the plants one should use rain-water, bog-water, or some other water free from lime

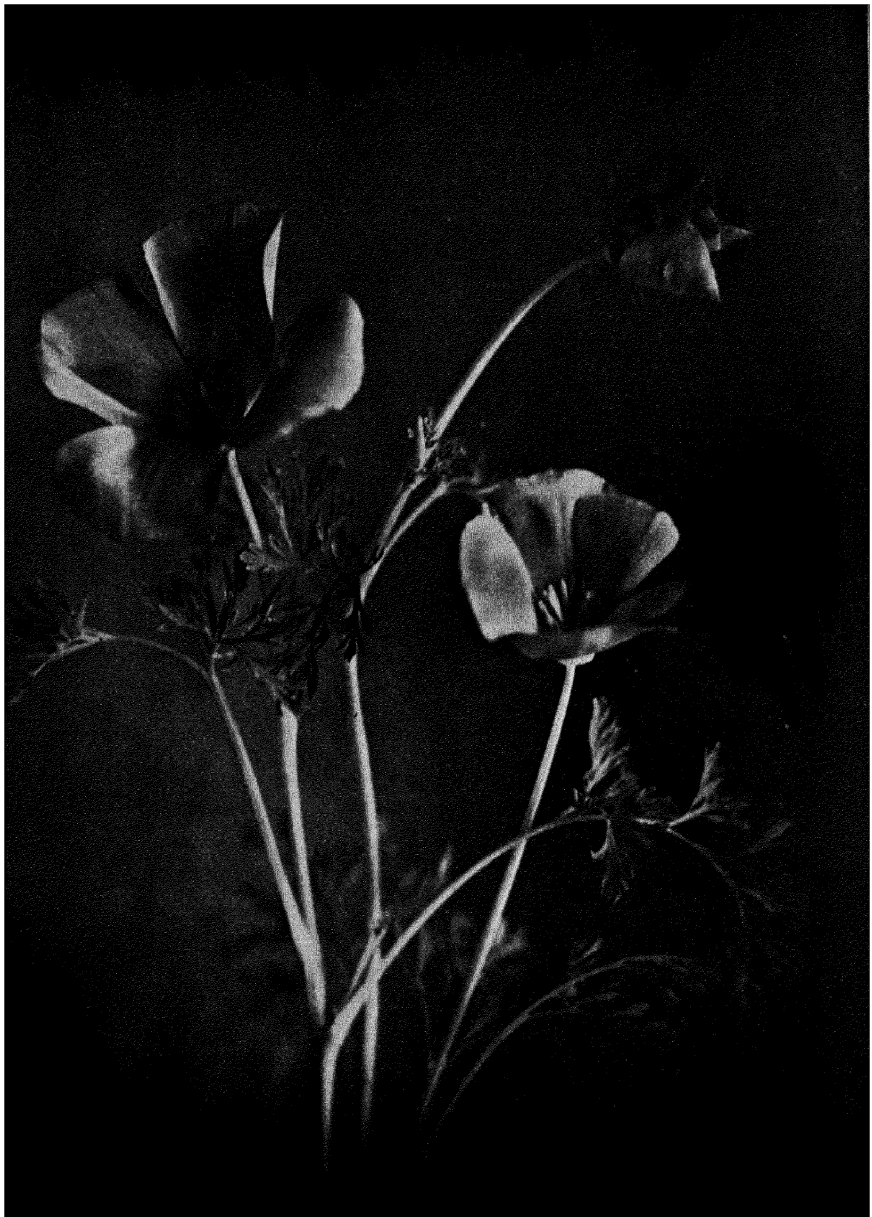
Wild plants may be transplanted, preferably in autumn or very early spring, care being taken to lift a large portion of the root-mat without disturbing the roots. Such plants should be kept in a coldframe or coolhouse and until abundant new roots are formed should receive little or no direct sunlight They may be propagated by division or by layers, but the resulting plants are seldom symmetrical

The best method of propagating trailing arbutus is by the seed The fruit, which is often borne in abundance on vigorous female plants, ripens at the same season as the wild strawberry At maturity and while still herbaceous the wall of the fruit splits from the center into five valves which turn backward in a green rosette exposing the white fleshy edible berry-like interior, ¼ to ⅓ of an inch in diameter and dotted with seeds The fruits disappear quickly after dehiscence, commonly within a few hours, being eagerly sought by ants, snails, and birds. A fruit bears usually 300 to 500 seeds The seeds, which are easily separated from the pulp by rubbing between the fingers, should be sown at once in a well-drained shallow box, in a mixture of two parts finely sifted kalmia peat and one part of clean sand, covered about ⅛ of an inch with the same material, and watered slowly but thoroughly with a very fine rose. If covered with a glass and kept away from direct sunlight a second watering may not be required before germination The seeds come up in three to four weeks, and in their earliest stages after germination often require protection from ants. This is best accomplished by setting the seed-boxes on pots inverted in saucers of water In the heat of summer young seedlings, and older plants as well, can not stand full sunlight A lath shade with spaces of the same width as the lath usually furnishes sufficient protection In the third or fourth month from germination, when the plants are about ⅜ of an inch in diameter, they should be potted in 2-inch pots in the mixture of peat, sand, and crocks already described, and the pots plunged in sand in shallow boxes.

If carried through the first winter in a greenhouse, with a night temperature of 55° to 60° and a day temperature of about 65° to 70°, the plants continue their growth all winter, and in the following summer some of them even without transfer to larger pots will lay down a few clusters of flower-buds, in preparation for the next spring's blooming, when they are a year and a half old Many of the plants, however, do not flower until they are two and a half years old, their



1399 Trailing arbutus or Mayflower.—Epigæa repens.



XXXVIII. The California poppy.—Eschscholtzia californica.

rosettes having reached a diameter of about 7 to 10 inches.

The flower-buds are formed from midsummer to autumn. If the plants are kept in a warm greenhouse during the winter the flower-buds seldom open. To make them open normally the plants must be subjected to a prolonged period of chilling Actual freezing is not necessary. The best chilling temperature for the greenhouse is a little above freezing, about 35° Alternate freezing and thawing, with strong sunlight, is likely to injure the foliage. Strong sunlight without freezing heightens the color of the flowers. After two to three months of chilling the plants may be forced, if early flowers are desired, by alternating the same low night temperature with a day temperature of 45° to 60°. Plants kept in a cool humid atmosphere often remain in flower three to four weeks, redolent with their well-known delightful fragrance The male flowers, with their yellow centers, are much larger and prevailingly much pinker than the green-centered female flowers In cultivated plants the corollas sometimes have a spread of ⅞ of an inch. The most robust plants have been secured by plunging the pot in moist sphagnum in a pot of 2 inches greater diameter. The roots then grow through the hole in the bottom of the inner pot and develop profusely in the moist, well aërated sphagnum of the outer pot. Old plants which have become ragged at the center may be revivified by cutting the stems back almost to the main root immediately after flowering They then throw out a new circle of branches with new and bright foliage and flower profusely the following spring.

FREDERICK V. COVILLE.

EPILÆLIA (compounded of *Epidendrum* and *Lælia*) *Orchidaceæ*. A genus established to include hybrids of these genera

E belairénsis (E ciliare × L autumnalis).—*E. Charlesworthii* (E radicans × L. cinnabarina).—*E. Fletcheriana* (E atropurpureum × L harpophylla) —*E. Hardyana* (E ciliare × L anceps). C O 1—*E heateriénsis* (E O'Brienianum × L cinnabarina) —*E. Lawrencei* (E vitellinum × L tenebrosa) —*E Lionétii* (E atropurpureum × L purpurata) —*E Margaritæ* (E Parkinsonianum × L grandis).—*E. Sylva* (L. cinnabarina × E Cooperianum)—*E Veitchii* (E. radicans × L purpurata) —*E vitellbrosa* (E vitellinum × L tenebrosa) GEORGE V. NASH.

EPILÒBIUM (Greek, *upon the pod*, referring to the structure of the flower). Including *Chamænerion*. *Onagràceæ* Border plants, with willow-like foliage, and large showy spikes of deep pink, rosy crimson or white or even yellow flowers borne from June to August

Herbs or sub-shrubs, sometimes annual, erect, sprawling or creeping: lvs alternate or opposite, toothed or entire: fls axillary or terminal, solitary or in spikes or racemes, rosy purple or flesh-colored, very rarely yellow, calyx-tube little, if at all, produced beyond the ovary; petals 4, obovate or obcordate, erect or spreading; stamens 8; ovary 4-celled; seeds comose; stigma often 4-lobed: caps. long and narrow, 4-sided and 4-valved —Species about 200 or more, in many parts of the world, mostly in temperate regions.

The taller species, like *E. angustifolium* and *E. hirsutum*, make very rank growth in moist places, and are therefore especially adapted for the wild garden or for naturalizing along the water's edge and in low meadows The underground runners reach far, and the plants spread fast when not kept in bounds. Propagation is by division or seeds.

angustifòlium, Linn (*E. spicàtum*, Lam. *Chamænèrion angustifòlium*, Scop.). GREAT WILLOW-HERB. FIRE-WEED. In cult. mostly branched and 3–5 ft. high; in the wild simple or branched, 2–8 ft. high: lvs. alternate, very short-petioled, lanceolate, entire or minutely toothed, 2–6 in. long, 4–12 lines wide, pale beneath, acute, narrowed at bases· fls. spreading, in long, terminal spike-like racemes, petals rounded at tip; stigma 4-lobed· caps 2–3 in long. Eu., Asia, N. Amer B B. 2.481 Var **álba,** Hort., has pure white fls. suitable for cutting; also occurs wild This variety was perfected in England It forms a compact bush

hirsùtum, Linn. Stout, 2–4 ft. high, with short but conspicuous soft straight hairs: lvs. oblong-lanceolate, usually opposite, sessile and often clasping, with many small, sharp teeth, 1–3 in. long, pubescent on both sides: fls. erect, axillary, about 1 in. across; petals notched: weed from Eu., showy, and sometimes found in old gardens

Dodonæi, Vill (*E rosmarinifòlium*, Haenke). Perennial, 1–3 ft., blooming in midsummer, mostly erect: lvs. linear, tapering somewhat toward either end, entire, smooth or somewhat soft-hairy: fls. red, the infl terminal on the branches Eu.

obcordàtum, Gray Glabrous perennial: decumbent, sts 3–5 in. long, 1–5-fld · lvs numerous, opposite, ovate, sessile, ¾in or less long. fls. bright rose-color, the petals ½in long and obcordate; stamens yellow, shorter than declining style. caps short and thick Calif in the high Sierras, and in Nev.—Offered as an alpine A handsome species.

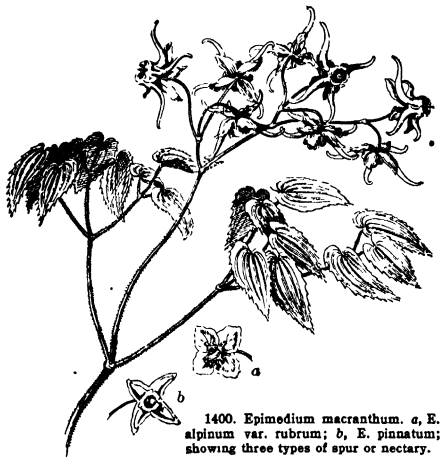
lùteum, Pursh Nearly simple, 1–2 ft., nearly glabrous. lvs ovate or elliptical to broad-lanceolate, toothed, slightly fleshy, 1–3 in long, sessile or with a short-winged petiole fls bright yellow, the petals ¾in long, style often exserted· caps long-stalked, somewhat puberulent Ore to Alaska

E abyssinicum album is offered abroad, as "pure white, pretty" the name does not appear to have botanical standing —*E latifòlium*, Linn (Chamænerion latifolium, Sweet) Erect, canescent, about 1½ ft lvs lanceolate or ovate-lanceolate, tapering at both ends, thick fls purple, showy, sometimes 2 in across Newfoundland to Ore and north. L H B

EPIMÈDIUM (Greek, *like Medion*, a plant said to grow in Media; a name from Dioscorides, retained by Linnæus) *Berberidàceæ*. Herbs suitable for rock-gardens and shady places.

This genus contains some of the daintiest and most interesting plants that can be grown in the hardy border, and *E. macranthum*, particularly, is as distinct, complicated and fascinating as many of the rare, tender and costly orchids. The whole family to which it belongs is exceptionally interesting, and is one of the most striking of those rare cases in which the cultural, botanical and artistic points of view have much in common Of the 8 or 9 genera of this family only Berberis and Nandina are shrubs, all the others being herbs, with creeping, underground sts, and all small, choice, curious, and cult to a slight extent, except Bongardia and Leontice. Podophyllum contains our mandrake; Caulophyllum the quaint blue cohosh; and the others are Aceranthus, Achlys, Diphylleia, Jeffersonia and Vancouveria. A collection of all these plants should make a charming study What appear to be petals in *E. macranthum* are really the inner row of sepals, colored like petals, and performing their functions, while the long spurs or nectaries are supposed to be highly specialized petals. Epimedium has 8 sepals and 4 petals, which are mostly small and in the form of nectaries· stamens 4· caps. opening by a valve on the back: lvs pinnately twice or thrice dissected. They grow a foot or two high. For *E. diphyllum*, see *Aceranthus*, which is distinguished by its flat, not nectary-like petals, and its lvs. with a pair of lfts. on each of the 2 forks of the petiole —There are 11 species, all natives of the northern hemisphere, but some are found as far south as N. Afr. There is none native in Amer. The Garden, 48, p. 486, shows what a charming picture can be made of the foliage alone when cut and placed in a bowl. The plants retain their foliage all winter, especially in sheltered spots under trees.

Epimediums thrive best in partial shade, and are particularly well suited for rockeries and the margins of shrubberies. Almost any soil will answer for them. The peculiar bronzy tints of the young foliage contrast well with the variously colored flowers. Propagation by division. (J. B. Keller.)



1400. Epimedium macranthum. *a*, E. alpinum var. rubrum; *b*, E. pinnatum; showing three types of spur or nectary.

A. *Spurs conspicuous, often 1 in. long, sometimes twice as long as the showy inner sepals.*

macrânthum, Morr. & Decne. Fig. 1400. Lvs. thrice ternate; lfts. cordate-ovate, unequal at the base, sharply toothed; petioles with short, spreading, conspicuous hairs; outer sepals sometimes colored bright red, remaining after the larger and showier parts of the fl. have fallen; inner sepals ovate-lanceolate, violet; spurs white. Japan. B.R. 1906. P.M. 5:151. Not Gn. 46:356, which is *E. pinnatum*. Var. **níveum,** Voss (*E. níveum*, Hort.), has pure white fls. G.W. 3, p. 591. Var. **rôseum,** Voss (*E. rôseum*, Hort. *E. níveum* var. *rôseum*, Hort.), has fls. white, tinged with pink or pale rosy red. Var. **violàceum,** Voss (*E. violàceum*, Morr. & Decne.), has violet spurs, shorter than in *E. macranthum*, but much larger than in the other species. B.M. 3751. B.R. 26:43. H.F. 4:168.—A very interesting species. The *E. lilàcea* advertised in some American catalogues seems to belong here. *E. lilacea* is a name unknown in botanical literature.

AA. *Spurs medium-sized, nearly as long as the inner sepals.*

B. *Inner sepals bright red.*

alpînum, Linn., var. **rûbrum,** Hook. (*E. rùbrum*, Morr.). Fig. 1400. Lvs. biternate (but Hooker's picture shows tendency to thrice ternate condition), minutely toothed: spurs white, marked with red, as in Fig. 1400, which shows the very distinct appearance of the fls. Japan. B.M. 5671. R.B. 3, p. 33.—Hooker says this differs in no way from *E. alpinum*, except in the larger and red fls., while the type which grows wild in England (though probably not native) has dull reddish yellow fls., and, though advertised, is probably not in cult.

BB. *Inner sepals whitish or pale yellow.*

Musschiânum, Morr. & Decne. Lvs. only once ternate, sharply toothed, as in *E. macranthum:* all floral parts whitish or pale yellow. Japan. B.M. 3745.—The least showy kind, but worth growing in a collection, its spurs having an individuality difficult to describe. Var. **rûbrum,** Hort., is presumably an error, as a red-fld. form would be very unexpected.

AAA. *Spurs much shorter than the inner sepals, being, in fact, merely small nectar-glands.*

B. *Lvs. once or twice ternate.*

pinnâtum, Fisch. Fig. 1400. Lvs. usually biternate, with 5 lfts., 3 above and 1 on each side, lfts. with a deeper and narrower basal cut than in *E. macranthum*, the whole plant densely hairy; scape about as long as the fully developed lvs.; fls. typically bright yellow; nectaries red, a third or a fourth as long as the inner sepals. Shady mountain woods of Persia and Caucasus. B.M. 4456. Gn. 46:356, (erroneously as *E. macranthum*), 48, p. 486. G. 18:706.—Best suited to the alpine garden.

Var. **élegans,** Hort., presumably has larger, brighter and more numerous fls. *E. sulphureum* of European catalogues is regarded by J. W. Manning and J. B. Keller as a pale yellow-fld. form of *E. pinnatum*, but by Voss as a variety of *E. macranthum*. A yellow form of the violet-fld. *E. macranthum* would be very surprising.

Var. **cólchicum,** Hort. (*E. cólchicum*, Hort.), has brilliant golden yellow fls. and nectaries 1–1½ lines long.

BB. *Lvs. always once ternate.*

Perralderiânum, Coss. This is the African representative of *E. pinnatum*, from which it differs in the key characters and also in the much more strongly ciliate-toothed lfts., when young the lfts. have rich bronze markings, making a handsome showing. Its fls. are a "paler yellow than the typical *E. pinnatum*. It is far from improbable that specimens connecting them will be found in S. Eu., if not in Afr." Algeria. B.M. 6509.—Lvs. remain all winter. Less desirable than *E. pinnatum*.

E. diphyllum, Lodd. See Aceranthus diphyllus.—*E. níveum* is catalogued by Van Tubergen as a synonym of E. Musschianum, but the chances are that all the plants advertised as E. niveum are E. macranthum var. niveum. The spurs are so obviously longer in E. macranthum that there is no reason for confusion.

WILHELM MILLER.
N. TAYLOR †

EPIPÁCTIS (Greek, *epipegnuo*, it coagulates milk). *Orchidàceæ*. Hardy terrestrial orchids of minor value.

Leafy orchids with creeping rootstocks and unbranched sts.: lvs. ovate or lanceolate, with plaited veins; fls. purplish brown, nearly white or tinged red; lower bracts often longer than the fls., sepals free, spreading, nearly as large as the petals, lip free, deeply concave at base, without callosities, narrowly constricted and somewhat jointed in the middle, the upper portion dilated, petaloid.—Ten or a dozen species in the north temperate zone. The first mentioned may be secured through dealers in native western and Japanese plants; the second is listed in the American edition of a Dutch catalogue. For other definitions of the name Epipactis, see *Goodyera*.

Royleàna, Lindl. (*E. gigantèa*, Douglas). Stout, 1–4 ft. high: lvs. from ovate below to narrowly lanceolate above, 3–8 in. long; fls. 3–10, greenish, strongly veined with purple. June, July. Wash to Santa Barbara, east to S. Utah and W. Texas, on banks of streams. Also Himalayas. Intro. 1883. Mn. 8:145.

atrórubens, Schult. (*E. rubiginòsa*, Crantz). Lvs. often reddish: fls. and ovary dark purple; lip oval, acute, or slightly notched; bracts equaling the fls. or rarely longer. July-Sept. Eu., W. Asia. L. H. B.

EPIPHRONÎTIS is a bigeneric orchid hybrid of Epidendrum and Sophronitis, for a picture of which see R.H. 1896:476. It has about 10 fls., chiefly a brilliant scarlet, set off with bright yellow. Gt. 46, p. 555.

Veitchii, Hort. (*Epidéndrum radicans* × *Sophronìtis grandiflòra*). Fls. like those of *Epidendrum radicans*, which it much resembles in habit, but the parts all broader. C.O. 1. GEORGE V. NASH.

EPIPHYLL. A plant that grows on a leaf. It is a kind of epiphyte. The epiphylls are algæ, lichens, liverworts, and mosses. The name is applied to those species or kinds that find their physical support on foliage leaves rather than to those that are parasitic on them as are the fungi. Epiphyllous plants are likely to be most abundant in the tropics.

EPIPHYLLÁNTHUS (*flower upon the leaf*). *Cactàceæ*. Epiphytic. sts. much branched, jointed, ribbed. areoles bearing setæ instead of spines· fls resembling those of Zygocactus; ovary angled —One species known. Native of Brazil. For cult, see *Succulents*.

obtusángulus, Berger (*Cèreus obtusángulus*, Schumann). Joints somewhat flattened, about 10-ribbed: stamens of two kinds —Although usually considered a Cereus, it is more closely related to Zygocactus, but from both it seems generically distinct Indeed Berger says it resembles certain Opuntias and seems to have a relationship with Rhipsalis. It is not grown in this country, and is still rare in Eu. J N. ROSE

EPIPHÝLLUM (*on a leaf*, refers to the leaf-like branches on which the flower grows) *Cactàceæ* Spineless upright branched flat-stemmed cacti with very large and showy flowers, some of them popular as house-plants.

Branches flat, 2-edged, crenate or serrate on the margins, spineless. fls usually large, mostly nocturnal, petals white, red, or yellow; stamens elongated, numerous: fr. oblong in outline, bearing a few bracts, red, juicy; seeds numerous, black. In the Cyclopedia of American Horticulture, the name Phyllocactus was used for this genus, but this is a much later name and hence it is given up The epiphyllums of the first Cyclopedia will be found under *Zygocactus*. For cult, see *Succulents*.

Several hundred hybrids are in the trade, the most common ones being with *E crenatum*, *E Ackermannii* and *E. phyllanthoides*. Fig. 1401. Crosses are often made with the various Cereus allies, such as *Heliocereus speciosus*, and with some species of Echinopsis

A. *Tube of fl. always elongated, usually much longer than the limb, petals white or yellowish: mostly night-bloomers.*

B. *Style white.*

C. *Branches thin, usually spreading in some plane: petals pure white.*

oxypétalum, Haw. (*Phyllocáctus grándis*, Lem.). Very large, sometimes 20 ft long, with numerous short side branches, and these in the same plane with the main st, thin and lf-like. fl large (nearly a foot long), white, night-blooming (sometimes described as day-blooming). Originally from Mex., but said to be found in Honduras and Guatemala; also reported from Cuba, but surely not native there. G.W. 10.560 (as *Phyllocactus latifrons*).—One of the commonest and best species in cult.

CC. *Branches thick, not spreading in the same plane: petals cream-colored or yellow.*

D. *Fls. large: sts. with shallow crenations.*

crenàtum, Don (*Phyllocáctus crenàtus*, Lem.). Sts. about 3 ft. long, erect, thick, strongly crenate, somewhat glaucous: midrib very thick: fl. large, 6–10 in. long, said to be a day-bloomer; petals white or cream-colored in life, drying yellow; tube 4–5 in. long; style said to be white; very fragrant. Guatemala and S. Mex., and said to come from Honduras

DD. *Fls. small for the genus: sts. with deeply cut margins.*

angùliger, Don (*Phyllocáctus angùliger*, Lem.). About 3 ft. high, much branched below: branches narrow, thick, with deeply cut margins: fls. 5–8 in long, with a slender tube; petals yellow.

BB. *Style red.*

C *Sts stiff, erect.*

strictum, Brit. & Rose (*Phyllocáctus strictus*, Lem.). Erect, branching, reaching a height of 10 ft., with long cylindrical branches and shorter, lf-like secondary branches· crenatures or teeth rather deep, unequal on the opposite sides bristles wanting. tube of the fl. very long and slender, outer sepals brownish, inner pure white; the fl opens late in the evening and closes before dawn; in full bloom the sepals are very strongly recurved. Said to come from Cuba —Often found in collections under the name of *P. latifrons*.

CC. *Sts rather weak, spreading*

D. *Petals very narrow· areoles bearing black bristles.*

látifrons, Zucc. (*Phyllocáctus látifrons*, Link. *P stenopétalus*, Salm-Dyck?). Branches very long and large, crenate or somewhat serrate, acute or acuminate midrib and usually side ribs evident. areoles with rather large scales and dark bristles fl 8–10 in long, spreading and in full bloom bent backward; petals narrow Supposed to be from Mex, but not known from wild material —Much advertised as the queen cactus

DD *Petals broader areoles without bristles.*

Hoòkeri, Haw (*Phyllocáctus Hoòkeri*, Salm-Dyck). Sts 6–10 ft high branches rather thin, light green, strongly crenate· fls night-blooming, 8–9 in long; fl-tube narrow, tinged with yellow, sepals narrow, lemon-yellow; petals pure white, narrow, 2 in long; stamens in a single series; style red Brazil and Guiana B M



1401. One of the many hybrid Epiphyllums.

2692 (as *Cactus phyllanthus*) —Although long in cult., the species is not now well known, there being 2 or more closely related species in cult. under this name.

AA. *Tube of fls. short, always shorter than the limb: day-bloomers.*

B. *Style reddish: fls. 4½ in. broad.*

Áckermannii, Haw. (*Phyllocáctus Áckermanni*, Salm-Dyck). Fig. 1402. Sts. numerous, sometimes reaching 3 ft., somewhat recurved: branches usually less than a foot long, with evident middle and side ribs areoles on the lower and younger shoots bearing short bristles: fls scarlet-red outside, carmine-red within,

the throat greenish yellow, tube very short, the limb wide-spreading, 4–6 in. diam. B.R. 1331.—Not known in the wild state.

BB. *Style white: fls. smaller than the last.*

phyllanthoides, Sweet (*Phyllocáctus phyllanthoides,* Link). Branches at length hanging, cylindrical at base, lanceolate above; serratures obtuse; middle and side ribs evident; bristles few· fl -tube 2 in long or less, with spreading scales, the limb somewhat longer, often striate. S. Mex. J. N. ROSE.

EPIPHYTES. Literally "air plants." those plants that do not grow in earth or water, but are supported in air on trees or other objects and usually drawing no organic nourishment from such object or support

True epiphytes are widely distributed in all climates, but it is in the moist tropics that they become so numerous and conspicuous as to arouse the special interest and enthusiasm of the serious student as well as of the traveler or casual observer. One thinks of epiphytes as growing upon trees, and trees are usually the supporting plants. The term merely signifies that ecological type that has the habit of growing upon other plants, although in this account it is not the purpose to discuss such seaweeds or other algæ as grow upon larger plants in the water The word epiphyte also involves a contrast with parasite, the latter denoting that nourishment and water are derived from the living tissues of the supporting plant or host The epiphytic habit implies no particular method of nutrition, and the epiphytes are entirely independent of the nutrition of the supporting plant. This habit is not restricted to a single class, or to a few families of plants, although in some families many representatives of the type have been developed, while in related families there may be none. The seed plants are represented by many species of tropical orchids, arums, bromeliads, and numerous others, lycopods, ferns, mosses and liverworts all contribute many examples; and in the lower groups of plants the lichens are in some regions dominantly epiphytic.



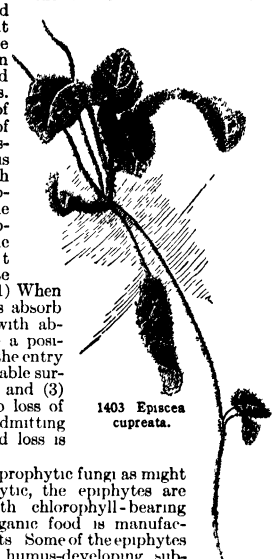
1402 Epiphyllum Ackermanni (×⅓)

The luxuriant tropical rain-forest is regarded as the climax in development of vegetation. In describing this type, Humboldt declared that "forest is piled upon forest." Under such conditions the trunks and branches are clothed with larger epiphytes, and the leaves of some species accommodate algæ and lichens It is in the South American tropical forests that the better known of our greenhouse epiphytes are native Orchids, bromeliads, and arums are among the most abundant In the Javanese forests, the wealth of species is great, but mosses, ferns and lycopods are particularly numerous, and these are accompanied by some interesting species of Ficus, epiphytic for a time, and by the striking *Rhododendron javanicum,* among others In the mountain forests of tropical regions there are, as epiphytes, representatives of several families of ferns, likewise many mosses and lichens The dicotylous and certain coniferous forests of Europe and America harbor a few mosses and liverworts and numerous species of lichens A conspicuous epiphyte of the southern states, as well as of tropical America is the long or Florida moss, *Tillandsia usneoides,* the extremest epiphyte among the Bromeliaceæ. Accompanying this, the common polypody fern is also found on trees Going northward, the total number of epiphytic lichens may decrease, but several of the larger forms seem to become more abundant and some of the moss-like usneas extend to the northernmost latitude of tree growth

The habit of growing upon trees renders epiphytes subject to an inconstant water-supply. On this account the larger and more delicate epiphytes are restricted to regions constantly moist Even in the moist forest, the species less resistant to drying out are found on the lower branches, and those more resistant maintain themselves higher up, so that there is a distribution in strata, analogous to the lateral distribution of species about the edge of a pond In general, however, there is exposure to drying out, and, as might be anticipated, these plants exhibit the structural characteristics of xerophytes (dry-land plants) Many of them are modified so that transpiration is reduced, and they are able to withstand considerable desiccation. Among greenhouse forms this is notably true of many orchids and lichens. Moreover, many species of orchids possess special tissues to which water is transported and there accumulated as a "reserve" supply. Leaf-tissues may function in this way, but usually more important are the bulb-like enlargements of the stems.

Of special interest are the organs of absorption of certain epiphytes Aerial roots are characteristic of tropical arums and orchids. The typical air-root is provided with an outer cylinder of tissue, the velamen, derived from the epidermis, consisting at maturity of dead cells capable of taking up liquid water and substances in solution like a sponge. From these roots as capillary reservoirs, the supply is gradu-

ally absorbed by the living tissues. Rain, dew, or moist substrata may furnish the water, but the view that these roots absorb water vapor is erroneous. The Bromeliaceæ are peculiar in the possession of certain absorbing leaf-scales or hairs. The Florida moss possesses such hairs over the entire surfaces of the thread-like stems and leaves, and the plant is rootless. There are all gradations between this and the soil-rooted pineapple-like forms. The arrangement of the leaves in many of the bromeliads possessing larger leaves is such as to establish after a rain a temporary reservoir about the leaf-bases. The absorbing scales of the bromeliads exhibit features worthy of note in three particulars (1) When dry certain dead cells absorb water greedily; (2) with absorption they assume a position making possible the entry of water to a considerable surface of living cells, and (3) with collapse, due to loss of water, the spaces admitting water are closed and loss is minimized



1403 Episcea cupreata.

Aside from such saprophytic fungi as might be considered epiphytic, the epiphytes are amply provided with chlorophyll-bearing tissue; therefore, organic food is manufactured as in other plants Some of the epiphytes growing upon such humus-developing substrata as the decaying bark of trees, or such as passively accumulate humus and other materials in the vicinity of their absorbing surfaces, might absorb some organic compounds as well as salts in this way; but this supply of organic matter is certainly inconsequential in most cases Water and salts are secured either through the air-roots, as described, or partially through normal roots, when such occur. Many species, epiphytic at first, ultimately send roots into the soil, and then secure water and salts largely through the terrestrial habit

In the forest, certain of the seed-bearing epiphytes are specialized with respect to supporting plants, often due to the special nature of the protection offered, or to the physical advantages of the substratum in regard to fixation of the plant. Most species are markedly unspecialized and may be grown in the greenhouse most successfully.

B M Duggar

EPIPRÉMNUM (*upon the trunk* of trees) *Aráceæ.* Resembling the genus Rhaphidophora but has fewer ovules, 2 or more 1-seeded berries not confluent, and albuminous kidney-shaped instead of almost terete seeds About 8 species from Malay and Polynesia. **E. gigantèum,** Schott A robust climber over 100 ft. high, the sts emitting long rope-like roots from every growth: lvs cordate-oblong, 6–8 ft long, including the petiole which is as long as the blade and winged throughout its length: spathe about 1 ft. long, ending in a curved beak-spadix as long as spathe. Malay Penins. B.M. 7952.

EPÍSCIA (Greek, *shady;* they grow wild in shady places) *Gesneriàceæ.* Choice and interesting warm-house plants, *E. cupreata* being much prized for baskets

Herbs, with long, short or no hairs· st from a creeping root, branched or not lvs. opposite, equal or not in size· fls pedicelled, axillary, solitary or clustered; corollas mostly scarlet, rarely whitish or purplish; tube straight or curved, more or less spurred at the base; limb oblique or nearly equal, lobes 5, spreading, rounded —Perhaps 30 species, all Trop. American.

Episcia cupreata is one of the standard basket plants, especially for the warmest greenhouses It can also be used in pyramids and mounds, as told under Fittonia As it does not require so close an atmosphere as the fittonias, it can be grown in some living-rooms and perhaps outdoors in summer in a shady place Its chief charms are the slender, trailing habit, the soft hairiness of the leaves, the coppery hue, which is often laid on like paint in two broad bands skirting the midrib, and the rarer and perhaps finer metallic bluish luster of which one occasionally gets a glimpse in a finely grown specimen Give very rich, fibrous loam, mixed with peat, leaf-mold and sand, in summer partial shade. (Robert Shore)

A *Fls. pale lavender to white.*

chontalénsis, Hook (*Cyrtodèira chontalénsis,* Seem). St. stout, more or less ascending, dark reddish purple, 6–10 in long lvs opposite and irregularly whorled, 3–4 in. long, oblong-ovate to elliptic-ovate, crenate, obtuse, rounded at the base, decidedly convex on both sides of the midrib and between the much-sunk veins, margins recurved, green, marked with regular purple patches, which advance from the margins between the veins toward the midrib and are more or less oblong fls solitary or in small clusters, corolla-tube with a sac at the base, the limb oblique, 1½–2 in across, with small and regular but conspicuous and beautiful teeth Chontales region of Nicaragua. B M. 5925. R B 22.241 F S 18:1924.

AA *Fls scarlet.*

B *Lvs usually not green, or only partially so*

cupreàta, Hanst (*Achimenes cupreàta,* Hook) Fig 1403 Sts slender, creeping, branched, rooting at the joints, with a main branch rising erect a few inches, which bears the fls and the largest lvs lvs copper-colored above. fls solitary, 9 lines wide, scarlet, with a small sac and denticulate limb. Nicaragua B M 4312 Var **viridifólia,** Hook , has green foliage and larger fls , 1 in across, B M. 5195.

coccínea, Benth & Hook (*Cyrtodèira coccínea,* Hort , B S Williams) Lvs dark metallic green, 3–4 in long, 2½–3 in wide —Free-flowering Some of the plants sold as *E metallica,* a name otherwise unknown in botanical literature, probably belong here.

BB *Lvs a rich dark green*

fúlgida, Hook. A beautiful, creeping, much-branched hothouse plant, covered throughout with soft villous pubescence lvs ovate to elliptic, wavy and serrate margined, ciliate· fls axillary, solitary, the calyx prominently 1-sided, the sepals with recurved tips; corolla bright red, the limb deeper colored than the tube which is about 1½ in long; corolla-lobes rounded and hairy toward the throat. N. S. Amer. B.M. 6136. G.W. 3, p. 161.

Wilhelm Miller.
N. Taylor.†



1404. Equisetum hiemale — Common scouring-rush.

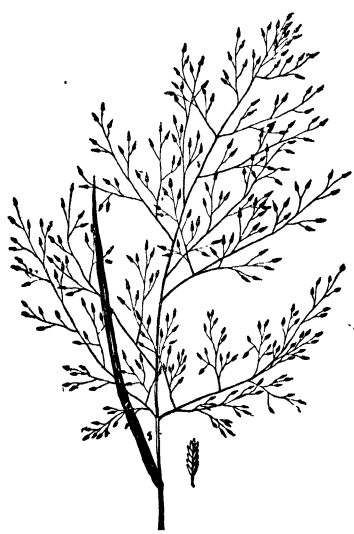
EQUISÈTUM (from the Latin *equus,* horse, and *seta,* bristle) *Equisetàceæ.* Contains the weeds known as horse-tails, or scouring-rushes which are suitable for naturalizing in waste

and wettish places and help to hold sandy banks. The following have been advertised by dealers in native plants. *E. arvénse, E. hiemàle* (Fig. 1404), *E. lævigàtum, E. limòsum, E praténse, E. robústum, E. scirpoìdes, E. sylvàticum, E variegàtum* For descriptions, consult the manuals of native plants. They grow usually in moist or swale-like places. They are flowerless plants, allied to ferns and club-mosses.

Of the species named above, *E. arvense* has been found to have a poisonous effect on grazing stock when it occurs in any quantity in hay or pasturage.

R. C. BENEDICT.†

ERAGRÓSTIS (Greek, *er*, spring, and *agrostis*, a grass). *Gramíneæ.* LOVE-GRASS. Annual or perennial grasses with more or less diffuse panicles of small several-flowered compressed spikelets. Some species grown in the open for ornament.



1405. Eragrostis suaveolens. (×½)

From 6 in. to several feet tall: culms simple or often branched; lemmas keeled, 3-nerved, the palea ciliate on the keels.—Species about 100 in warm and temperate regions of both hemispheres.

Some annual species are common weeds, such as *E. megastàchya*, Link (*E. màjor*, Host), STINK- or SNAKE-GRASS, with rather large, ill-smelling spikelets in a compact panicle. Dept. Agric., Div Agrost. 17:215. *E. pectinàcea*, Nees, a native of U. S, is a handsome perennial, with large open panicles of purple spikelets. Well adapted to cult. in sandy soils Ibid 17:261. *E. obtùsa*, Munro (*Brìza geniculàta*, Thurb.), an annual with showy spikelets, is cult. in Eu., but little known in U. S. V. 3:247.

abyssínica, Link (*Pòa abyssínica*, Jacq.). TEFF. A branching and spreading leafy annual, 1–3 ft : panicle large and open, 1 ft. long, the branches capillary; spikelets numerous, loosely 5–9-fld., 3–4 lines long; lemmas acuminate, scaberulous on the tip and nerves. Afr.—This and the following are cult. for ornament, the spreading panicles being used for bouquets. The abundant seed used for making bread in N. E. Afr.

suavèolens, Becker (*E collìna*, Trin.). Fig. 1405. A spreading leafy annual, 1–2 ft., differing from the preceding in the less diffuse panicles, the more compact spikelets and the less acuminate lemmas. W. Asia.

interrúpta, Doell (*E. élegans*, Nees). An erect annual, 1–2 ft.: panicle feathery, 1 ft. long, rather narrow, the branches ascending, closely fld. with numerous small spikelets. Brazil.

amábilis, Wight & Arn. (*Pòa amábilis*, Linn.). Erect or spreading annual, 1–2 ft.: panicles small, 4–6 in., rather compact; spikelets purple, many-fld., 3 lines long, 1 line wide. India.

máxima, Baker. An erect, robust annual, 2–3 ft.: blades lanceolate, cordate at base· panicle erect, lax, 6–9 in. long and broad, the pedicels capillary; spikelets oblong, ⅛–¼in. long. Madagascar.

A S HITCHCOCK

ERÁNTHEMUM (Greek, *lovely flower*). *Acanthàceæ.* Tropical shrubs and sub-shrubs, some of which are cultivated chiefly for their foliage and others for their flowers.

Leaves entire or rarely coarsely toothed fls. white, lilac, rosy or red, borne in various ways; bracts and bractlets narrow, small; corolla-tube long, slender, cylindrical throughout or rarely with a short throat, limb 5-parted; stamens 2; ovules 2 in each cell; seeds 4 or fewer —Perhaps 30 species The genus Dædalacanthus, although in a different tribe, is separated only by a combination of technical characters, but the garden forms of both genera described in this work are all distinguishable at a glance For cult, see *Justicia.* Consult *Dædalacanthus* for related species.

A. *Fls. purple*

laxiflòrum, Gray Height 2–4 ft : lvs. on the same plant varying greatly in size and shape, those near the fls 2–3½ in long, 8–15 lines wide; petioles 2–6 lines long, widest below, at or above the middle, more or less ovate-oblong, obtuse, narrowed at the base: fls. in cymes; stamens 2, perfect, sharp-pointed. Fiji. B.M. 6336.

AA. *Fls. pure white.*

tuberculàtum, Hook. Easily told while growing by the many small roundish and rough elevations on the branches: lvs. small, ⅜–⅝in. wide, rarely if ever 1 in. long, broadly elliptical, obtuse or notched, almost sessile fls numerous, borne singly in the axils, in summer; corolla-tube very long and slender, 1½ in. long; limb 1 in. across; stamens scarcely exserted. Habitat unknown. B.M. 5405

AAA. *Fls. white, speckled with red-purple.*

B. *Foliage netted with yellow.*

reticulàtum, Hort (*E Schómburgkii*, Lind.). Height 4 ft.: upper lvs 2–7 in long, ovate-lanceolate, characteristically netted with yellow; lower lvs. 6–10 in. long, not netted, but the veins prominent and yellow: fls. racemose; corolla speckled with blood-red at the mouth; anthers reddish brown, exserted. Possibly Austral. B.M. 7480. I.H. 26:349.

BB. *Foliage not netted with yellow.*

Ándersonii, Mast. Lvs. lanceolate or elliptic, narrowed into a short stalk: fls. in a spike 6 in. long; lower middle lobe of the corolla larger and speckled with purple. Trinidad. Gn. 45:11. G.Z. 25:49.

The following trade names belong to plants grown chiefly for their foliage Probably many of them belong in other genera. —*E. dìbo-marginàtum* Lvs. broadly margined with white and irregularly suffused gray —*E. atrosanguíneum*, Hort Intro by W. Bull, 1875 Lvs large, dark, wine-purple, or blackish crimson, ovate entire, opposite, stalked Said to endure the hottest sunshine —*E cultràtum* "Lvs shining, thick, deep-veined" —*E. Dutremblayànum*, Hort, is supposed to be a garden hybrid. Intro from France in 1907.—*E. Eldoràdo.* Lvs. greenish yellow, veins deeper yellow.—*E. ignéum.* G W. 3, p 159. See Chamæranthemum.—*E. Magneànum*, Hort, is recorded as a garden hybrid. Intro from France 1907. Scarcely known in U S —*E. nèrvum rùbrum* presumably a misprint for *nereum-rubrum*, has lvs. "irregularly shaped, shaded with light and dark green, and blotched

with yellow, which darkens to reddish purple." Possibly=Fittonia Verschaffeltii.—*E. nervósum*=Dædalacanthus nervosus, T. Anders. —*E. nigréscens* Presumably with blackish lvs.—*E. pulchéllum*, Hort and Andr.=Dædalacanthus nervosus, T Anders.—*E. purpúreum* "Lvs and sts. dark, lurid purple" Siebrecht & Wadley. —*E. Wáttii*, Stapf, is probably the correct name for the plant treated as Dædalacanthus Wattii, Bedd. See B M 8239. G.C. III. 45:89.

WILHELM MILLER.
N. TAYLOR.†

ERÁNTHIS (Greek, *er*, spring, and *anthos*, a flower; from the early opening of the flowers) *Ranunculàceæ*. WINTER ACONITE. Low perennial herbs, grown in open flower-beds because of the very early show of bright flowers; very desirable.

Rootstock tuberous: basal lvs. palmately dissected, 1 st.-lf. sessile or amplexicaul just beneath the large yellow fl.: sepals 5–8, petal-like; petals small, 2-lipped nectaries; stamens numerous: carpels few, stalked, many-ovuled, becoming follicles.—About 7 species, natives of Eu. and Asia. The earliest generic name is Cammarum which was given in Hill's British Herbal, p. 47, pl 7 (1756), but it is not accepted by the "nomina conservanda" of the Vienna code.

Winter aconites are very hardy, and at home in half-shady places, among shrubs or in the border.



1406. Eranthis hyemalis.

Propagated by division of roots. The place in which the tubers are planted should be marked during the summer, when the foliage is dead.

hyemàlis, Salisb. (*Helléborus hyemàlis*, Linn.). Fig 1406. Erect, 5–8 in.: basal lvs. long-petioled: involucre 12–15-parted, the bright yellow fls. always sessile; anthers oblong. Jan.–March, or as soon as frost is out of the ground. Naturalized from Eu. B.M. 3. Mn. 8, p. 43. G.C. II. 11:245. G. 1: 628; 34.277.

Var. **cilícica**, Huth. (*E. cilícica*, Schott & Kotschy). Much like the above: involucre of deeper and more numerous lobes; anthers ovate instead of oblong; sepals broader, being about ½in across: follicles always straight. Season a few weeks later. G C. III. 13:266. G.M. 49:180.—The sts., when grown in gardens, said to be red-brown. Roots of this were first sent to England from its native home near Smyrna in 1892. Rare in Amer.

sibírica, DC. Much dwarfer, seldom over 3–4 in. high: fls. bright yellow, a little smaller than those of *E. hyemalis*, 5-sepaled. Siberia.

K. C. DAVIS.

ERCÍLLA (Peruvian name). *Phytolaccàceæ*. One twining shrub from Peru and Chile, apparently not in the trade but sometimes cult. in this country for its dense spikes of pale purple fls. and dark purple berries. By some it is united with Phytolacca, from which it differs in habit, the coriaceous evergreen lvs., larger bracteoles and technical characters of the fl. **E. volúbilis**, Juss. (*E. spicàta*, Moq. *Bridgèsia spicàta*, Hook. & Arn. *Phytolácca volúbilis*, Heiml.), has alternate, petioled, ovate-cordate or oblong or orbicular lvs. 1–2 in. long: fls. perfect, in spikes 1–1¾ in. long, the perianth 5-parted, segms. oblong and obtuse; stamens 8–10, with filiform fleshy filaments, the alternate ones being shorter: carpels 4–8, somewhat impressed in the torus, becoming as many ovoid berries. G.C. II. 9:653. Said to be excellent for covering walls, and climbs by aerial rootlets. It is easily prop. by seeds and cuttings.

L. H. B.

EREMOCÍTRUS (Greek, *descrt* and *Citrus*). *Rutàceæ*, tribe *Citreæ*. AUSTRALIAN DESERT KUMQUAT. Spiny shrub or small tree lvs. small, simple or emarginate, thick and leathery, alike on both sides; spines single, long, slender, axillary: fls. small, 4- (rarely 3- or 5-) merous, white, fragrant, borne singly, or 2 or 3 together in the axils of the lvs.; stamens free, 4 times as numerous as the petals: frs. small, subglobose, oblate or pyriform, yellow, with a thin fleshy peel like that of a lime, 4- (rarely 3–5-) celled with 1 or 2 seeds in each cell; cells containing stalked subglobose pulp-vesicles filled with a pleasant acid juice.—Only 1 species of this subtropical Australian genus is known.

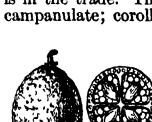


1407. Spiny twig of young seedling of Eremocitrus glauca. (×⅓)

glaùca, Swingle (*Triphàsia glaùca*, Lindl. *Atalántia glaùca*, Benth.). A shrub or small tree bearing edible frs and occurring in Queensland and New S. Wales, Austral., in subtropical regions subject to severe cold and extreme drought. The lvs. of this plant are small (1–1½ × ½–¼ in.), emarginate, and show marked drought-resistant adaptations; both faces of the lvs show palisade cells, and stomates at the bottom of deep pits; the long and slender spines are borne singly in the axils of the lvs. (see Fig. 1407): frs subglobose, flattened or slightly pyriform (see Fig. 1408), usually 4-celled and containing globose stalked pulp-vesicles (see Fig 1408); seeds small, with a longitudinally furrowed and rugose testa. Yearbook Dept. Agric., 1911, pl 45, fig. 1. Jour. Agric. Research, U S Dept Agric. vol 2, pp. 85–100, figs. 1–7, pl 8.—The frs of this species are used by the settlers in Austral. for jam and pickles and ade is made from the juice. The Australian desert kumquat is the hardiest evergreen citrous fr. known besides being the only one showing pronounced drought-resistant adaptations, it bears in the wild state edible frs. with a pleasant acid juice and a mild-flavored peel. These characteristics make this plant very promising for use in breeding new types of hardy drought-resistant citrous frs. It has been intro. into the U. S. by the Dept. of Agric., and is now growing in the greenhouse of the Dept. of Agric. and in the southern and western states. It can be grafted on the common citrous fruit trees, and can in turn be used as stocks for them.

WALTER T. SWINGLE.

EREMÓSPATHA (*solitary spathe*). *Palmàceæ*. Above a half-dozen Trop. African climbing palms, with long slender ringed sts. and pinnate lvs. Apparently none is in the trade. The fls. are perfect; calyx 3-toothed, campanulate; corolla urn-shaped, with 3 short lobes; stamens 6, with broad connate filaments; ovary 3-celled, and stigmas 3: fr. berry-like: lfts. alternate and opposite; rachis spiny, with a long tendril at end.



1408. Fruit of Eremocitrus glauca, entire and in cross-section, showing stalked globose pulp-vesicles and furrowed seeds. (Natural size)

EREMÓSTACHYS (*deserted* or *solitary spikes*). *Labiàtæ*. Outdoor perennial, apparently only 1 species of the 50 or so in the genus being in commercial cult. The genus is allied to Leonotis and Phlomis, and the species are from Cent. and W.

Asia Erect herbs, with the lvs. mostly radical, large, toothed or cut-pinnatifid; st.-lvs small, passing into floral bracts: fls. often ochroleucous, in many-fld. whorls in terminal and axillary spikes; corolla-tube included within the calyx; upper lip of corolla erect and hooded, bearded inside; lower lip 3-lobed and the middle lobe largest; stamens 4, with connivent anthers. **E. laciniàta,** Bunge, is catalogued abroad. Nearly simple, 12–20 in.. lvs pinnatisect, the lobes again pinnatifid: fls. yellow or ochroleucous, in midsummer. Asia Minor —Said to be an attractive perennial. *E. supérba,* Royle, reported from Eu , has a strict st , unbranched, 2 ft , root-lvs pinnatisect, with segms. lobed, forming a rosette· fls. deep primrose-yellow in woolly heads to 6 in. long and 4 in. broad, showy. W. Himalaya.

L. H. B.

EREMÙRUS (Greek name, probably referring to their tall and striking aspect in solitary and desert places) *Liliàceæ.* These hardy desert plants, when in flower with their great flower-stalks taller than a man and crowned with a spike of flowers from 1 to 4 feet long, are amongst the most striking objects in the choicer gardens of the North and East.

Root clusters of fleshy fibers. lvs. all from the root, in dense rosettes, long and linear· fls. white, yellow or rosy; perianth bell-shaped or more widely spreading, withering and persisting or finally dropping away; segms 6, distinct or very slightly united at the base, stamens 6; ovary 3-celled, seeds 1–4 in each cell, 3-angled —About 20 species, from the mountains of W. and Cent. Asia

Probably *E robustus* and *E himalaicus* are the hardiest of all the tall desert-inhabiting plants of the lily family—a family including the poker plant, the aloes, the yuccas, and many others that are not so tall and striking in appearance or else too tender to grow outdoors in the North. Large specimens of *E. robustus* will annually produce a flower-stalk 8 feet or more high, with racemes 4 feet long, remaining in bloom for a month After flowering the leaves disappear entirely, but early in spring they reappear, and should then be covered with a box or barrel, to protect the forming flower-stalk from late frosts. A mound of ashes over the crown in winter is advisable, or a box with water-tight top filled with dry leaves. Both species like a rich soil, moist but well drained, and plenty of water in the flowering period, but none afterwards. Propagation is by division, or slowly by seeds Large plants are expensive, but they can sometimes be secured large enough to flower within a year or so of purchase. It tries one's patience to wait for seedlings to reach flowering size. The flowers look like small stars. (W. C. Egan.)



1409. Eremurus himalaicus.

A. *Fls. rosy.*

B. *Lvs. linear-ligulate.*

robústus, Regel. Root-fibers thick and fleshy: lvs. glaucous, glabrous, linear-ligulate, 2 ft. long, 1½–2 in. wide, roughish on the margin, with minute recurved teeth: raceme 4–4½ in. wide; stamens about as long as the perianth. Turkestan. B.M. 6726. Gng 6:52, 324. Gn 46, p. 335. Mn 8, p. 123. J H. III. 29:267. Gt. 61, p. 366. G.C. III. 28:228, 30:426. Var. **álbus,** Hort. Stronger and pure white.—May be grouped in the hardy perennial border with bold effect.

BB. *Lvs. ovate-lanceolate.*

Élwesii, Mich (*E. Elwesiànus,* Hort) Lvs. light green, ovate-lanceolate, obtuse, flat, not at all rough at the margin, shorter than in *E. robustus,* nearly triangular, even more glaucous, and beginning to decay at the time of flowering: perianth-segms. with a band of deeper color down the middle. Habitat(?). R H. 1897:280 Gn. 54, p. 99. G C. III. 24:137; 33:381. G M 44:321.—Intro. by Leichtlin as *D. robustus* var. *Elwesii.*

AA. *Fls. white.*

himalàicus, Baker. Fig 1409. Root-fibers thick and fleshy: lvs. 9–12, ligulate, firm, persistent, 1–1½ ft. long, 6–15 lines wide above the middle: raceme 3–3½ in. wide; stamens about as long as the perianth. Himalayas. B.M. 7076. Gn. 49, p 131. G.C. II. 16:49. G.M. 44:321; 52:631 (as *E. Elwesii*)

Ólgæ, Regel Lvs. narrow, glabrous, but with rough margins, about 8–12 in. long and 7–8 lines broad fls. in a dense raceme, spreading; the white petals with a single brownish nerve down the center. Turkestan Var. **álbus,** Hort , a white-fld. form is known.

AAA. *Fls. some shade of yellow.*

B. *Color light yellow.*

spectábilis, Bieb. Root-fibers thick and fleshy: lvs 6–15, lorate, slightly glaucous, 12–18 in. long, 6–12 lines wide above the middle, noticeably narrowed at the base: raceme 1–1½ ft long, 2 in. wide; stamens orange, finally twice as long as the perianth. Asia Minor, Persia. B M 4870.

BB. *Color pure yellow or orange.*

Búngei, Baker. Lvs. contemporary with the fls , linear, 1 ft long, less than 3 lines wide raceme 4–5 in long, 2 in wide; stamens finally twice as long as the perianth Persia G 19 31. G L. 20:155 Gn 60, p. 53, 66, p 150. Var. **magnìficus,** Hort. A larger form than the type and with brighter yellow fls. Var. **prècox,** Hort An early flowering more slender form than the type, the fls. smaller and loosely scattered on the spike. Var **citrìnus,** Hort "More robust than the type and with larger citron-yellow fls."

BBB. *Color orange.*

aurantìacus, Baker. Closely allied to *E. Bungei,* but live plants have less acutely keeled lvs.: root-fibers tapering upward, and orange fls. and stamens Bokhara, Turkestan. B.M 113.

During recent years many beautiful hybrid plants have been intro into cult , often under some specific name which gives no indication of the parentage Of these the following are known and the parents are indicated when possible —*E isabellinus,* Vilm A hybrid between E Bungei and E Olgæ Fls. large, apricot-rose —*E Michelsiànus,* Hort , is supposed to be a hybrid between E Warei and E Bungei G C III 40 83, desc —*E. Tuberghii,* Hort A hybrid, crossed in Holland between E. himalaicus and E Bungei —*E vedrariénse,* Hort.—E. robustus × E. spectabilis? R H 1901, p. 229 —*E Wàrei,* Hort , is supposed to be a natural Eastern Asiatic hybrid between E. Bungei and E Olgæ. It is described as growing in ordinary seasons about 8 ft high. The fls. are less bright than in E. Bungei, and in rootstock it resembles the later-flowering E. Olgæ. Gn. W. 22: suppl May 27.

WILHELM MILLER.
N. TAYLOR.†

ÉRIA (from Greek for *wool,* as the leaves of some species are downy or woolly). *Orchidàceæ.* About 100 species of tropical Asian orchids allied to Dendrobium but with eight rather than two or four pollinia, of most diverse habit, and very little in cultivation outside the

collections of botanic gardens and fanciers, being mostly curious and botanical rather than beautiful. They require warmhouse treatment, after the manner of stanhopeas.

ERIÁNTHUS (Greek, *erion*, wool, and *anthos*, a flower). *Graminex.* PLUME-GRASS. Tall reed-like ornamental perennials with large woolly plume-like inflorescence.

Spikelets in pairs, one sessile, the other pedicellate, as in Andropogon, arranged in spikes, and these in a large terminal panicle, clothed with long hairs, especially around the base, the fertile lemma awned.—Species about 18, warmer regions of both hemispheres.

Ravénnæ, Beauv. PLUME-GRASS. RAVENNA-GRASS. HARDY PAMPAS-GRASS Fig. 1410. Three to 12 ft.: blades ½in wide, narrowed into a firm rough point: panicle or plume as much as 2 ft. long. S. Eu. Gn. 54, p. 496. R H. 1890, p. 546 V. 3:247.—This is one of the best of the stout and tall perennial grasses. It thrives in light and open places in well-drained soils, and makes great clumps, when well established sometimes producing as many as 40 or 50 heads. Hardy in latitude of New York City.

A. S. HITCHCOCK.



1410. Erianthus Ravennæ.

ERÌCA (practically meaningless; probably not from *ereiko*, to break, as commonly stated). *Ericdceæ.* HEATH. This is the genus that the gardener usually means by "heath." The heath or heather of English literature and history belongs to the closely allied genus Calluna The next most important group of cultivated "heaths" is Epacris, which, however, belongs to a different family

Ericas are perennial woody plants from 6 in to 12 ft or more, usually much branched: lvs. in whorls of 3–6, very rarely flat, usually 3-sided and with revolute margins that are sometimes connate with the under side: infl. usually terminal or sometimes axillary, very seldom actually, though often apparently, racemose; calyx free, 4-parted; corolla hypogynous, white, rosy or sometimes yellow, usually early deciduous, variously shaped, the commonest forms (in cult.) being bell-shaped, tubular and ventricose, usually 4-lobed; stamens 8; ovary sessile or rarely stalked, 4-celled, rarely 8-celled, with 2–∞ ovules in each cell: fr. a 4-valved caps., with minute seeds.—About 500 species, mostly from S. Afr. and the Medit. region, nine-tenths from the former There are many hybrids and horticultural forms. So far as the S. African species are concerned, the latest monograph is that of Guthrie and Bolus, which has served as the basis for the treatment below.

Only a few of the European heaths are hardy in America, and there are no native heaths at all in this hemisphere. Of about fourteen kinds of Erica grown outdoors in Europe to produce large showy masses, only three are hardy here, and it is safest to cover these with evergreen boughs in winter. Two others (*E. mediterranea* and *E. lusitanica*) are grown under glass somewhat but they are probably hardy, with protection, from New York southward. The tree heath of southern Europe (*E. arborea*) will probably never be a feature of our southern landscapes. The heath that is naturalized in places from Rhode Island to Newfoundland is *Calluna vulgaris* (which see); and this is sometimes advertised as *Erica vulgaris.*

The halcyon days of the heaths were from about 1806 (when the English took the Cape of Good Hope) until the middle of the century. Andrews' colored engravings of heaths (1809) marks the first flush of their popularity. Practically, if not absolutely, all the heaths that are grown on a large scale have been developed from the South African species. The old English gardeners still lament the glorious days when the hard-wooded plants of Australia and the Cape formed the chief feature of European indoor horticulture. They complain that the present generation is not willing to give them the care they deserve. This is especially true of America In America, heaths are of minor importance, even at Easter, and the kind grown most extensively for Christmas seems to be *E melanthera*

The great trouble with heaths is the immense amount of care they need. Few, if any, classes of plants require more attention. Hence the growing of heaths for the market is extremely specialized, and there the American retail catalogues only rarely offer more than one species. Nevertheless, all the kinds described below are grown commercially, and are of the first importance in the genus The stock is largely imported from England. Germany has a very different set of varieties, and France still another, and there are few cases among cultivated plants showing so great a difference in the three countries The risks of importation are considerable, and the tendencies toward American independence in this line seem to be gaining. Another difficulty in heath-culture is the poor quality of peat obtainable in America In England the peat is more fibrous, and has been formed in past ages largely by the decay of the native heather

The soft-wooded kinds are the ones most grown. The hard-wooded sorts require a longer period of growth and more thorough ripening of the wood. Apparently only one yellow-flowered heath is cultivated in America, *E. Cavendishiana* which is a hybrid species about which little is known. See supplementary list (p. 1132).

In general, the ericas do not grow well in this climate on account of the extreme heat of the summer months, but some varieties grow and flower even better here than in Europe. The choice of the soil is very important. A light peat, mixed with sharp coarse sand is about the best we can get here. After flowering, the plants should always be cut down to keep them bushy at the base and well shaped. They will then receive a good repotting, always using very clean pots and plenty of drainage. Cuttings are made from December to April, preferably from young plants, the tender shoots about 1 inch in length being best. These are planted firmly in a pan filled with clean fine sand, and covered with a bell-glass, or in a box covered tightly with a pane of glass. Bottom heat is not necessary . When rooted, the cuttings should be potted in small pots, and when well started should be given as much air as possible. It is well to bring the ericas out of the greenhouse as early in the spring as possible. The pots should be plunged in a good location, where plenty of air and

sunlight can be had. They should be wintered in a greenhouse extremely well ventilated, and a temperature not higher than 40° to 45° F. When in bud the plants should not be allowed to dry out too much. One drying might be enough to cause the loss of all the buds Very often the heaths are attacked by a disease similar to mildew, brought on by an excess of humidity in the air. As this disease is very contagious, it is well, as soon as noticed, to use sulfur in powder or sulfate of copper in solution until the plants are rid of it (Louis Dupuy).

INDEX.

alba, 3, 5, 6, 10, 11.
assurgens, 18.
autumnalis, 17.
Bothwelliana, 11.
breviflora, 11.
cafra, 18.
capitata, 5.
carnea, 3, 4, 11.
ciliaris, 1, 15.
cinerea, 6.
cintra, 11.
coccinea, 6.
codonodes, 8.
cupressina, 16.
flacca, 15.
formosa, 19.
fragrans, 21.
gracilis, 17.
grandiflora, 11.
grandinosa, 19.
herbacea, 4.
hiemalis, 10.
hirsuta, 11.
hispidula, 18.
hyemalis, 10.
lævis, 18.
Linnæana, 10.
lusitanica, 8.
magnifica, 11.
mediterranea, 3, 4.
melanthera, 20.
Parmentieri, 12.
persoluta, 18.
perspicua, 10.
præstans, 12.
propendens, 14.
pygmæa, 13.
regerminans, 18.
sicæfolia, 13.
stricta, 7.
subcarnea, 18.
superba, 11.
Tetralix, 2.
tricolor, 11.
turrigera, 16.
vagans, 5.
ventricosa, 11.
vernalis, 17.
verticillata, 9.

KEY TO THE SPECIES.

A. *Heaths hardy, European, or hardy with protection from New York southward.*
B. *Lvs. and calyx-segms. ciliate: stamens included.*
C. *Fls in spike-like clusters* . . . 1 **ciliaris**
CC. *Fls in umbel-like clusters* . . . 2. **Tetralix**
BB. *Lvs. and calyx-segms glabrous.*
C. *Anthers usually exserted well beyond the corolla-tube.*
D. *Fls. usually solitary and lateral, rose-colored.* . . . 3 **mediterranea**
DD *Fls clustered, pink, usually all lateral* . . 4. **carnea**
DDD. *Fls. all clustered at the ends of the branches* . . . . . 5 **vagans**
CC. *Anthers included in the corolla-tube.*
D. *Fls rose-violet or purplish.*
E. *The lvs. verticillate in 3's*... 6. **cinerea**
EE *The lvs. verticillate in 4's* 7. **stricta**
DD. *Fls pale rose, in broad panicles* 8 **lusitanica**
AA. *Heaths tender, S. African, always grown under glass in Amer.*
B. *Fls. mostly showy, petal-like, scarcely greenish or sepal-like.*
C. *Corolla tubular, the limb not spreading.*
D. *Length of fls usually more than 6 lines, in cvlt. specimens umbellate* . 9. **verticillata**
DD. *Length of fls. usually 10–12 lines, in 2's or 3's.* . . . . . 10. **hyemalis**
CC. *Corolla various, not tubular, the limb often spreading*
D. *The corolla-segms spreading, the tube mostly elongate.*
E. *Length of corolla 6–8 lines, segms. ovate, acute* .11. **ventricosa**
EE. *Length of corolla 3–4 lines; segms. ovate or sub-orbicular* . . . . .12. **præstans**
DD. *The corolla-segms. usually not spreading, the tube rarely over 4 lines long.*
E. *Lvs. channeled.*
F. *The lvs. in 3's*.....13. **sicæfolia**
FF. *The lvs. in 4's* ..... 14. **propendens**
EE. *Lvs. not channeled, more or less open-backed and spreading.*
F. *Infl variable, often terminal and axillary on the same plant* 15. **flacca**
FF. *Infl. always terminal*
G. *Sepals about as long as the corolla-tube.*
H. *Lvs rough or tuberculate* .....16. **turrigera**
HH *Lvs. not rough.*
I *The lvs. glabrous*...17. **gracilis**
II. *The lvs. usually pubescent*.....18. **persoluta**
GG. *Sepals about half as long as the corolla-tube* . . . . . .19. **formosa**
BB *Fls. not so showy, calyx-like, the calyx often colored also.*
C *Lvs in 3's sepals colored*.....20. **melanthera**
CC. *Lvs. opposite. sepals green*.....21. **fragrans**

1. **ciliàris,** Linn. A much-branched nearly hardy shrub, 10–20 in. tall, the branches usually glandular: lvs. small, but not as in typical heaths, ovate, mucronate: fls. about 4 lines long, or more, purplish, in spike-like, lateral clusters. Eu. June–Sept. B.M. 8443.

2. **Tetràlix,** Linn. BELL HEATHER. CROSS-LEAVED HEATH. Lvs. in 4's, margin folded back: fls rosy: sepals ovate-lanceolate, ciliate; anthers awl-shaped or awned, included, ovary with short, soft hairs. W. Eu.—Foliage grayish. Height in England 6–12 in. With Manning, at Reading, Mass., about 8 in.



1411. Erica mediterranea.

3. **mediterrànea,** Linn. (*E. cárnea* var. *occidentàlis*, Benth.). Fig 1411. This is considered by Bentham a western form of *E. carnea* (No 4), with a little smaller fls., corolla a trifle wider at the apex, and anthers shortly exserted instead of included. *E. mediterranea* of the trade is hardy in England, and perhaps second only to *E carnea* in popularity there. In Amer. it seems to be cult. only under glass but should be hardy from N. Y. southward with protection. B.M. 471. Gn 54:263, 55, p. 403; 61, p. 431. G.M. 45:261; 55:315. Var **álba,** a white-fld. form is known. Gn. 59, p. 94.

4. **cárnea,** Linn. (*E. herbàcea*, Linn). Height 6 in : lvs. in 4's: infl lateral; corolla broadly bell-shaped; anthers exserted; ovary glabrous. March–May. Alps. L.B C. 15:1452. B M. 11. Gn. 54:6 (a charming picture).—The bright rosy-fld. form is the best and most striking. There are pale red and pure white varieties. The most popular of all hardy ericas. Very easily prop. by division. *E. mediterranea* var. *hybrida*, Hort., is said to be a cross with *E. carnea*, and in England thriving almost as well in loam as in peat. See Gn. 54:262; 55, p. 127; 61, p. 399; 72, p. 176. G.M. 50: 39. J.H. III. 51:293.

5. **vàgans,** Linn. CORNISH HEATH Fig. 1412. Lvs. in 4's or 5's: sepals small, ovate, obtuse; corolla ovate-bell-shaped; anthers ovate-oblong, 2-parted, exserted; ovary not hairy. W. Eu. and Medit.—Fls. pale purplish red. Grows 3–4 ft in England; 1 ft. with J. W. Manning, Reading, Mass. Var **álba** has white fls. Var. **capitàta,** grows 1–2 ft. high with Meehan at Germantown, Pa., and has "small whitish fls. with a purplish tip." F.E. 22:685.

6. **cinèrea,** Linn. A twisted and much-branched shrub, 8–15 in. high: lvs. verticillate, in 3's, narrow, glabrous, and usually not over 3 lines long: fls. showy, rose-violet, in usually verticillate clusters; corolla much contracted at apex, the lobes reflexed. June–Sept. Eu. Var. **álba,** Hort., a white-fld. form, and var. **coccínea,** Hort., a scarlet form, are both in the trade. Gn. 61, p.

433.—Hardy in U. S., with a little protection, from N. Y. southward.

7. **stricta,** Don. CORSICAN HEATH. Lvs in 4's, a little more erect than in No. 2. sepals lanceolate, obtuse; corolla ovoid-oblong, narrowed at the throat; anthers awl-shaped or awned, included; fls rosy purple, ovary densely covered with long, rough hairs Corsica —Summer Attains 4 ft in Eng., but grows 1–2 ft high with Meehan, at Germantown, Pa Branches strict, rigid.

8 **lusitánica,** Rudolph (*E. codonòdes,* Lindl.) SPANISH HEATH. Branches tomentose-pubescent: lvs glabrous and ovary glabrous: fls pale rose, in broad panicles. W.Eu B R. 1698. G C II 7·463; III 19 487; 35 91 I H 43, p. 321 Gn 54 263; 55, p 125, 67, p 328 B M 8018 G 21.384; 30:130 —Hardy in England, but in U S only south of N. Y., and then must be protected.

9. **verticillàta,** Berg An erect shrub, 4–6 ft., with lvs 4–6 in a whorl lvs densely imbricate, erect or spreading· fls mostly in 4's in wild specimens, but, according to Andrews, umbellately 3–10-fld. in cult; corolla tubular, hairy, usually straight, bright rosy-scarlet, and very showy: caps unique in splitting into 8 valves. Andr. Heathery, 58.



1412. Erica vagans. (×¼)

10. **hyemàlis,** Hort. Fig. 1413 Written also *hiemalis* Watson thinks it may be a winter-flowering form of *E. perspicua,* figured in L B C. 2 102 and 18 1778 as *E. Linnæana* Fls rosy pink, tipped white Var **álba** has white fls With L Dupuy, Whitestone, L. I., it flowers in Sept G F 5:137. Gn. 41:420. G 25:567 H. D Darlington says it is very distinct from *E. perspicua.*

11. **ventricòsa,** Thunb Lvs in 4's, incurved to spreading, with pilose margins infl terminal; sepals keeled, anthers with 2 very short ears, or awned, included, ovary glabrous B M 350 L B C 5.431. G 9 565, 26 239 Var. **grandiflòra,** with tubes over ½in long L B.C. 10.945(as *E. prægnans*) The following varieties are reported. *Bothwelliana, breviflòra, cárnea ròsea, cintra, hirsùta, álba, magnífica, supérba, tricolor.* See R H. 1858, p. 450; 1880:50 Gn 45, p. 87. A F. 10.1111 F.E. 9:333

12. **præstans,** Andr (*E. Parmentièri,* Lodd.). Lvs. in 4's, somewhat incurved, bracts crowded: fls nearly sessile, white, faintly flushed pink at base, in terminal groups of 4 or more; sepals ovate, rough-margined; anthers scarcely acute. Sept. Varieties are pictured under various names in L B.C., plates 154, 197, 1695, and 1804.

13. **sicæfòlia,** Salisb. (*E. pygmæa,* Andr. and Hort.). Dwarf cushiony heath, perhaps best treated in the alpine garden, 4–8 in high: branches ascending, nearly glabrous· lvs. in whorls of 3, linear-acuminate, 2½–5 lines long; fls in 3's, the corolla dark purple, its segms. ciliolate. L.B.C. 5:468. B M. 2263.

14 **propéndens,** Andr An erect sub-shrub, 10–18 in. high, the branches nearly straight, the younger pubescent: lvs in 4's, linear and usually 3-sided, ciliate, or sometimes glabrous: fls. 1–4 in a cluster, the corolla red, broadly bell-shaped and hairy, about ⅛–¼ in. long; ovary 4–8-celled, rough but not hairy. L.B C. 1.63. B.M. 2140. Andr. Heathery, 141. G. 25:137. G.C. III. 32·278, 279. Gn W. 21:759. J H. III. 47.543.

15. **flácca,** E. Mey. (*E. ciliàris,* Thunb., not of Hort.). An erect shrub, usually branched, but not diffuse; the branches pubescent or glandular hairy: lvs. in 3's, rarely in 4's on the same plant, spreading, usually "linear, as if subterete," the margins revolute, 1½–2½ lines long· fls in 3's, the corolla bell-shaped to tubular, the segms. about a third as long as the tube; ovary sometimes hairy on the top.

16. **turrígera,** Salisb. (*E. cupressìna,* Forbes). Lvs. glabrous, subciliate or naked: infl terminal; fls pedicelled, in 1's to 4's, bracts remote; sepals finally reflexed; sinuses of the corolla acute, narrow. Probably a hybrid, cult. since 1802. F E. 9·333. A.F 15: 1175. Gng. 9:35 (the last two as *E. cupressina*).

17 **grácilis,** Salisb Lvs. in 4's, somewhat erect; bracts remote sepals smaller, lanceolated; anthers with a short, sharp point L B C 3 244 (pale violet) G 25·602 Gn. 76, p 11 "Fls purplish red." Var. **autumnàlis,** Hort. Fls Sept Var. **vernàlis,** Hort. Fls. in Oct and Nov



1413. Erica hyemalis. Great numbers of this heath are sold in London every Christmas.

18 **persolùta,** Linn. -Fig 1414. Essentially a white-fld and very variable species, particularly as regards hairiness: lvs. erect or spreading, hirsute or glabrous: corolla small, originally 1½ lines long, lobes ovate, 2–3 times shorter than the tube, the sinuses acute, narrow S Afr The numerous varieties Bentham found impossible to separate either in the wild or in cult. Var. **hispídula,** Benth. Slightly hirsute: lvs. 2½–3 lines long, rough: anthers subovate. Var **lævis,** Benth. Lvs. shorter, blunter, often appressed, glabrous anthers subglobose Var. **subcárnea,** Benth, has the corolla-lobes more evident. To this last variety Bentham seems to refer most of the horticultural varieties cult under the name of *E. persoluta E. assúrgens,* Link, he refers to the first variety; *E. cáffra* of Linnæus to the first, but of L B C 2·196 (and the trade?) to the second *E. regérminans* of Linnæus is a distinct species (figured in L B.C 17:1614 as *E. Smithiana*); of the trade=*E. persoluta* var. *hispidula,* of L B C. 18·1728=*E. persoluta* var. *subcarnea.* Flowers in Feb and March, while other related species mostly flower in March and April.

19. **formòsa,** Thunb. (*E. grandinòsa,* Hort). Erect shrub, 1–2 ft , the branches hairy, covered with lvs. in whorls of 3. lvs. glossy, channeled, the younger ciliate, about 1½ lines long: fls. in 3's, the corolla white, with 8 longitudinal channels, sticky. Andr. Heathery 265.



1414. A form of Erica persoluta.

20 **melanthèra,** Linn. Fig. 1415. Lvs. thick, obtuse, grooved on the back, younger ones often rough, with glands, bracts mostly crowded: fls. rosy; sepals obovate, keeled, colored; anthers black; ovary villous. Not L B C. 9·867, which may be a form of *E. nigrita* Flowers in Dec. and Jan. A F. 11 : 1133 ; 12 : 579 ; 29:1079 F.E. 9:333. C. L A 9.169; 15:170. G M. 49.56.

21. **fràgrans,** Andr , not Salisb. Lvs. opposite, erect-appressed, acute, always glabrous; bracts loose, sepal-like: fls in 2's; sepals ovate, keeled, green ; ovary glarous or slightly bristly at the tip. B.M. 2181. L.B.C. 3:288.

The following are mostly kinds that have been grown successfully in small quantities in this country but appear not to be advertised in American trade catalogues H=hard-wooded, the rest are soft-wooded S Afr , unless stated Aside from these, *E scopària,* Linn , of S Eu , is sometimes listed 2–3 ft , glabrous lvs in 3's fls greenish, in 1-sided racemes, calyx-lobes about half the length of the subglobose corolla *E capensis* also appears, but it is apparently only a catalogue name

E ampullàcea, Curt Lvs ciliate, mucronate bracts colored, fls mostly in 4's; corolla ventricose, very sticky, typically white, lined with red, limb spreading, white Var *rùbra* is the only form cult B M 303 L B C 6 508 H —*E arbòrea* var *alpina,* W I. Beau An alpine variety, grown only at Kew. It is a stiff erect bush with tiny white fls in plume-like clusters Gn 75, p 384 —*E aristàta,* Andr Readily distinguished by the long bristle which ends the lvs lvs. recurved fls in 4's, sepals keeled with red, corolla sticky, 1 in long, ventricose, but with not so long and narrow a neck as in E ampullacea B M 1249 L B C 1 73 H —*E barbàta,* Andr Bristly and glandular-pubescent lvs in 4's corolla urn-shaped, villous, ovary villous L B C 2 121 —*E Bowieàna,* Lodd Lvs in 4's to 6's infl axillary, corolla tubular, slightly inflated, limb erect or scarcely open L B C 9 842 —*E Burnettii,* Hort Hybrid F S 8 845 —*E Cavendishiàna,* Hort (E Cavendishu, Hort) Hybrid of E depressa × E Patersonii Lvs in 4's, margins revolute fls in 2's to 4's, corolla tubular, stamens included, anthers awned. P M 13 3. G C 1845, p 435, 11 18 213. 20 597 F S 2 142 A F. 12 1143 Gng 5 331 C.L.A. 7.180 G 6 489, 10 243 —*E conspicua,* Soland , is a species with club-shaped, villous fls and villous lvs in 4's Var *splèndens,* Klotzsch, with the lvs and sepals shining green and pubescent corollas, includes E elata, Andr L B C 18 1788 —*E cylindrica,* Andr and Hort Important hybrid of unknown parentage, cult since 1800 Lvs in 4's fls. nearly sessile, corolla 1 in. long, brilliant rosy red, with a faint circle of dull blue about two-thirds of the way from the base, anthers awned, included, ovary glabrous. L B C 18 1734 R H 1859, p 42 —Fls very showy and unusually long The oldest E cylindrica That of Wendland is a yellow-fld species unknown to cult —*E Devoniàna,* Hort Hybrid Fls rich purple H —*E elàta,* Andr = E conspicua var splendens —*E Irbyàna,* Andr Allied to E ampullacea, but with corolla narrower at the base and tapering with perfect regularity to just below the limb, where it has a prominent red bulge It is also distinctly lined with red, and the sepals are green, although the bracts are colored, as in E ampullacea. L B C 9 816 H —*E nigrèscens* is presumably E. melanthera (H D Darlington). —*E pallìda.* A confused name The oldest plant of this name is Salisbury's, which has an urn-shaped corolla, fls often in 3's, pubescent and hirsute branches and lvs in 3's L B C 1 72 (as E pura). *E. pàllida* of the trade is probably the tubular-fld. hybrid of Loddiges in L B C. 14 1355, which has axillary and terminal fls , and lvs in 4's to 6's —*E. perspicua,* Wendl , has a tubular or slightly club-shaped corolla, lvs in 4's, pubescent or rough-harry, and fls in 1's to 3's, but the plant in the trade is probably *E perspicuoides,* Forbes, a hybrid, with longer and woollier hairs, fls. somewhat in umbels, nearly 1 in long Only var. *erècta* is grown here.—*E. Syndriàna* is grown by Louis Dupuy — *E translùcens,* Andr. Perhaps the first of all the garden hybrids between E. tubiflora and E ventricosa Lvs rigid, with or without long, soft, red hairs. fls. in umbel-like heads, bracts remote, corolla rosy, 8–9 lines long, tube narrowly ventricose, pubescent limb short, spreading; ovary sessile Andr Heaths, 295 Bentham considers this a synonym of E. spuria, Andr. Heaths, 60. Schultheis says "it is the finest erica grown, a poor propagator but good grower. Takes 3 months to root "—*E. tricolor* is perhaps the most confused name in the genus, and apparently one of the important kinds abroad, where it has many varieties and synonyms In the trade it seems to stand for a handsome heath, with lvs in 4's, distinctly ciliate and terminated by a bristle fls in umbels of 8–10, 1 in long, a little too inflated at the base for the typical tubular form, rosy at the base, then white, then green, and then suddenly constricted into a short neck, pedicels red and exceptionally long. This description is from L B C 12 1105 (as E exima), one of the earliest pictures of these charming hybrids which Bentham refers to the hybrid E aristella, Forbes —*E Wilmorei,* Knowles & Weste (E. Wilmoreana and Vilmoreana, Hort) Hybrid. corolla tubular, bulged below the lobes, slightly velvety-hairy fls in 1's to 3's, rosy, tipped white R H 1892, p 202 A F 4 251 G C III. 19 201 A G 21 869 Var *glàuca,* Carr , has nearly glaucous foliage Var *calyculàta,* Carr , has a large additional calyx R.H. 1892, p 203.

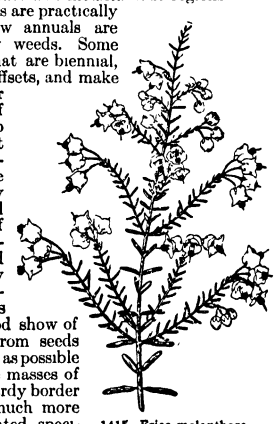
WILHELM MILLER.
N. TAYLOR.†

ERIGENÌA (Greek, *spring-born*). *Umbellìferæ* HARBINGER-OF-SPRING A monotypic genus of E N Amer. *E. bulbòsa,* Nutt , is low (4–10 in.), nearly stemless, hardy, from a deep-lying tuber, with ternately decompound lvs. and small umbels of minute white fls. A few plants may have been sold by collectors and dealers in native plants, but it is not a cult plant. It grows in rich deciduous woods and clearings.

ERÍGERON (Greek, *old man in spring,* some of the early kinds are somewhat hoary) *Compósitæ* FLEABANE Hardy border plants, suggesting native asters, but blooming much earlier, growing in tufts like the English daisy, though usually from 9 inches to 2 feet high.

Stem-lvs. entire or toothed. fls solitary, or in corymbs or panicles; rays in 2 or more series, mostly rose, violet or purple, rarely cream-colored or white, and one kind has splendid orange fls , involucre bell-shaped or hemispheric, the bracts narrow, nearly equal, in 1 or 2 series, differing from Aster in which the bracts are in many series —About 150 species scattered over the world, particularly in temperate and mountainous regions

The garden fleabanes are practically all perennials. A few annuals are harmless and pretty weeds. Some species have roots that are biennial, but they increase by offsets, and make larger clumps from year to year. They are of easy culture. They do best when somewhat shaded from the midday sun. They are easily propagated by seeds or division, and doubtless by cuttings, if there were sufficient demand. Small, divided plants set out in early spring produce good-sized flowering plants the first year. A good show of bloom may be had from seeds sown outdoors as early as possible in spring Some fine masses of these plants in the hardy border or wild garden are much more desirable than an isolated specimen or two of each kind. The most popular species is *E. speciosus* At present it is the best kind that has the rich soft colors, from rose to violet and purple. *E. aurantiacus* has dazzling orange flowers, and is unique in the genus.



1415 Erica melanthera.

INDEX.

alpinus, 8
arizonicus, 10.
aspèr, 10
aurantiacus, 1.
bellidifolius, 14.
Coulteri, 5
glabellus, 10.
glaucus, 7.
grandiflorus, 6.
Howellii, 3.
hybridus roseus, 11.
macranthus, 9.
major, 6.
mucronatus, 4
ochroleucus, 2
philadelphicus, 12.
pulchellus, 14.
roseus, 6
Roylei, 8.
salsuginosus, 13.
semperflorens, 7.
speciosus, 6.
superbus, 6
Villarsii, 11.

AA. *Fls. orange.*

1. aurantiacus, Regel. More or less velvety: height 9 in.: lvs. oval-oblong, clasping at the base, more or less twisted: heads 1 on a st.; involucral scales loose, reflexed. July, Aug Turkestan. R H. 1882. 78. Gn. 52, p. 485. G. 5:239. J.H. III. 52:303.—Perhaps the showiest of the genus. Sold as "double-orange daisy."

AA. *Fls. creamy or white.*

B. *Lvs. linear.*

2. ochroleùcus, Nutt. Height 9–18 in.: sts. mostly not branched: lvs. rather rigid: rays 40–60, white or purplish, never yellow. Gravelly hills and plains N. Wyo. and Mont. to Utah.—This and the next are rare kinds in cult., sometimes sold by collectors and dealers in native plants.

BB. *Lvs. broader, lanceolate to ovate, or obovate.*

3. Hòwellii, Gray. Height about 1 ft: root-lvs. obovate; st.-lvs. ovate, half-clasping, all thin: rays 30–35, 1–2 lines wide, white. Mountain meadows, Cascade Mts., Ore. and Mont.

4. mucronàtus, DC. (*Vittadinia triloba*, Hort., not DC.) Lvs. lanceolate, narrowed at base, ciliate, mostly entire, often with a long, callous mucro. Mex. This plant, grown in Calif., is a much-branched perennial with variable sometimes lobed lvs., and the white rays purple on the back. G.C. III. 48:203.

5 Coùlteri, Porter A slender equally leafy perennial about 15 in. high: lvs. thin, obovate or oblong, almost mucronate, and usually soft-hairy: fls. solitary on each stalk, sometimes 2 or 3 together, the white rays about 1 in long. July. Rocky Mts. G.C. III. 30:99. Gn.W. 3, p. 587, 16:440.

AAA. *Fls. rosy violet or purple.*

B. *Rays 100 or more, mostly narrow: lvs. entire.*

C. *Fl.-heads large.*

D. *Involucre hairy*

E. *Height about 2 ft. sts. several-fld.*

6. speciòsus, DC. (*Stenàctis speciòsa*, Lindl.). Height 1½–2 ft., the st more or less woody, hairs few, loose. st. very leafy at top: root-lvs more or less spatulate, st.-lvs lanceolate, acute, half-clasping Brit. Col. to Ore. near the coast B M 3606 B R 1577. Gn 52:484 G 21.15. Var **supérbus,** Hort., sold abroad, has lighter colored and more numerous fls. Gn. 75, p 118 G 31.81 Var **màjor,** Hort., has broader rays and brighter colors Var. **ròseus,** Hort. Ray-florets lilac; disk-florets yellow Var. **grandiflòrus,** Hort. Fls. larger and deeper in color than in var. *superbus*.

EE. *Height 9–15 in. or less: sts. usually 1-fld.*

7. glaùcus, Ker-Gawl Beach Aster. Lvs. slightly glaucous or often green in cult; root-lvs. rarely 2–3-toothed: rays not narrow, light lavender-blue. Pacific coast, where it flowers most of the year. B R. 10. Gn 52, p. 484. Var. **semperflòrens,** Hort. A dwarf floriferous form.

8. alpìnus, Lam. (*E. Ròyleì*, Hort ?). A dwarf species suitable for rockwork: sts. hairy, bearing a single head of purplish fls: lvs acute, lanceolate, sometimes ciliate but otherwise entire. Northern regions. L.B.C. 6:590. —Suitable chiefly for alpine gardens.

DD. *Involucre not hairy.*

9. macrànthus, Nutt Height 10–20 in.: hairs numerous and long or short, sometimes nearly absent: lvs. lanceolate to ovate: rays very numerous, at least ¾ in. long. Rocky Mts., Wyo. to New Mex. and S. W. Utah. Gn. 52, p. 484. G.C. III. 46:53.—A good species. Blooms later than the eastern species. Violet. Hardy. Can be used with good effect in mass plantings of autumn-flowering asters and goldenrods.

CC. *Fl.-heads (or disk) small*

10. glabéllus, Nutt (*E. asper*, Nutt.). Height 6–20 in., the st. simple or a little branched above: root-lvs. spatulate; st.-lvs. lanceolate, gradually narrowing into bracts. involucre bristly, or at least pubescent; rays violet-purple or white, very narrow. Minn to Rockies. Gn. 52, p 485. B M. 2923. B B. 3:385. L B.C. 17:1631.—Much cult abroad. Var. **arizónicus,** Hort. A variety from Ariz.

BB. *Rays 70 or less, wider: lvs. entire or toothed.*

C. *Lvs. almost or quite entire.*

D. *Sts with several fls. in a corymb.*

11. Villàrsii, Bell. Root biennial: height 1 ft.: lvs. with 3 or 5 nerves, roughish: fls corymbose. Eu. B.R. 583 L B.C 14·1390 —Not cult, but in I H. 43, p. 301, said to be a parent with *E. aurantiacus* of *E. hybridus ròseus*, Hort, Haage & Schmidt. This is said to resemble *E Villarsii* in habit, and *E. aurantiacus* in form of fls but not in color Said to bloom freely from May to autumn.

12. philadélphicus, Linn Perennial by offsets: a roughish, much-branched herb with spatulate or obovate lvs often st.-clasping along the upper part of the st.: heads several, corymbose, the numerous purplish white rays being attractive in June. N. Amer.—Almost a weed and easily grown in any ordinary garden.

DD. *Sts. mostly 1-fld.*

13. salsuginòsus, Gray Height 12–20 in.: upper st.-lvs. with a characteristic mucro: rays broad, giving an aster-like effect, purple or violet; the slightly viscid character of the involucre is particularly designative. Wet ground, on higher mountains, Alaska to Calif. and New Mex. C.L.A. 21. No. 11:40.

CC. *Lvs coarsely toothed above the middle.*

14. bellidifòlius, Muhl. (*E pulchéllus*, Michx.). Poor Robin's Plantain. Makes new rosettes by offsets from underground sts: height 2 ft: root-lvs. wider above the middle than in most species; st.-lvs fewer fls spring, clear blue, on long sts. Damp borders of woods Canada to Ill. and La. B.M. 2402. B.B. 3:388 —Weedy.

E. cæruleus, Hort =(?) —*E. diffrgens*, Torr & Gray. Diffusely branched with pubescent lvs. and white or purple fl.-heads W U S —*E flagellàris*, Gray. A spreading plant bearing a profusion of white or pale lilac fl.-heads W U S —*E grandiflòrus elatior*, Hort "Large solitary fls with purple disk June and July "=(?). —*E. leiomèrus*, Gray Lvs small, linear solitary fl.-heads with violet rays and a yellow disk Colo B M 7743 —*E multiradiatus*, Benth & Hook f Fl.-heads terminal, solitary, ray-florets purplish; disk yellow, height 6 in to 2 ft. Himalayas B M 6530.—*E. neomexicànus*, Gray Fl.-heads loosely panicled, ray-florets linear, white, disk-florets tubular, yellow New Mex —*E purpureum*, Hort, according to H A Dreer, "rarely exceeds 10 in height, and has medium-sized fls of soft, rosy purple, borne in graceful, spreading panicles" Form of E macranthus (?) —*E trifidus*, Schlecht. Fl.-heads white or pale lilac, daisy-like Rocky Mts *E. uniflòrus*, Linn Involucre hirsute, lanate, occasionally becoming naked, rays purple or sometimes white. Arctic regions

Wilhelm Miller.
N. Taylor.†

ERINÀCEA (Latin, *erinaceus*, hedgehog, alluding to the spiny nature of the plant). *Leguminòsæ*. A low almost leafless shrub forming dense spiny tufts covered in spring with numerous blue flowers.

Deciduous, very spiny lvs. simple or ternate, pubescent, only present at the end of young branchlets: fls. 1–3, axillary toward the end of the branchlets; calyx tubular, with 5 short teeth, inflated after flowering; petals narrow, long-clawed, claws of the wings and keel adnate to the staminal tube; standard ovate, slightly auriculate at the base; stamens connate: pod oblong, glandular-hairy, 2-valved, 4–6-seeded.—One species in S. W. Eu. Not hardy N.; likes limestone soil and a sunny position, best adapted to be planted in rockeries. Prop. by seeds.

púngens, Boiss (*Anthýllis Erinàcea*, Linn.). Shrub, to 1 ft.: lfts 1–3, oblong-obovate or spatulate, ⅓–½ in.

long, pubescent: fls. 1–3, nearly 1 in. long, violet-blue, the petals exceeding the large inflated calyx only about one-third; the short pedicels, bractlets and calyx pubescent: pod about ¾in. long. May, June. Mountains of S. France, Spain and Corsica. L.B.C. 4.318 B M. 676. G.C. III. 41:310. Gn. 62, p. 127; 64, p. 399.

ALFRED REHDER.

ERÌNUS (a name used by Dioscorides). *Scrophulariàceæ*. A hardy tufted plant 3 or 4 inches high, suited for steep sides of alpine gardens, where it produces in spring its racemes of small purple, rosy or white flowers.

One species, in the mountains of W. and Cent. Eu.: root-lvs. crowded, opposite; st.-lvs. alternate, oblong-spatulate, with a few coarse, rounded teeth: corolla-lobes 5, obovate, the 2 upper ones slightly smaller; stamens 4, in 2 groups, included; style very short, 2-lobed at apex: caps. ovate, obtuse, dehiscent.—Several species described in this genus belong in Zaluzianskya. Not to be confounded with *Lobelia Erinus*.



1416. Loquat. (×⅛)

Erinus should be planted in steep parts of the rockery where water cannot lodge on rainy days or in the winter and spring months It needs slight shade from midday sun. Divided plants are chiefly sold in America, but the amateur can soon produce a good carpet by the use of seeds. When well established, the seeds are self-sown and the offspring gain in hardiness. It may be safest to keep a pot or two in a coldframe over winter, until the plant can take care of itself. In England, seeds may be sown in earthy holes of brick walls, and grown as informal masses on old stone steps. (J. B. Keller.)

alpìnus, Linn. Racemes 2½ in long; fls. ½in. across, purple. April–June. B.M. 310. Vars. **álbus** and **carmíneus**, Hort., have white and crimson fls. respectively. Var. **hirsùtus**, Gren. (*E. hirsùtus*, Hort.). More vigorous: lvs. villous or hairy: violet-red.

WILHELM MILLER.

ERIOBÒTRYA (Greek, *woolly cluster*). *Rosàceæ*, subfamily *Pòmeæ*. Small tree, grown for its handsome large foliage and also for its edible acid fruits.

Evergreen trees or shrubs: lvs. alternate, short-petioled or nearly sessile, dentate, with strong veins running straight to the teeth: fls. in terminal, broad panicles; calyx-lobes 5, acute; petals 5, oval or suborbicular, clawed; stamens 20; styles 2–5, connate below; ovary inferior, 2–5-celled; cells 2-ovuled: fr. a pome with persistent incurved calyx-teeth, thin endocarp and 1 or few large, ovoid or angular seeds.—About 10 species in the warmer regions of China, Japan, Himalaya and S. Asia. Closely related to Photinia, from which it differs chiefly in the larger fr. with thin endocarp and few large seeds and in the lvs. having straight veins ending in the teeth. The only species known in cult. is *E. japonica*, an evergreen tree with large ornamental foliage, comparatively inconspicuous white fragrant fls. in terminal rusty-woolly clusters, followed by large pear-shaped yellow frs. It can be cult. only in warmer temperate regions, and if protected during the winter, may be grown as far north as Philadelphia; does not seem to be exacting as to the soil. Prop. by seeds.

japónica, Lindl. (*Photìnia japónica*, Gray). LOQUAT. Fig. 1416. Small tree, to 20 ft.: lvs. thick, evergreen, nearly sessile, oval-oblong or obovate, remotely toothed, bright green and lustrous above, rusty-tomentose below, 6–10 in. long: panicles 4–7 in. long; fls white, ½in. across, nearly hidden in the rusty-woolly pubescence: fr. pear-shaped, yellow, about 1½ in. long, with few large seeds, of agreeable acid flavor. Sept., Oct ; fr. April–June. Japan, China B.R 365 G C III. 26:660 (suppl); 52:318. H U 3, p. 97. A G. 1891, pp 19, 370. G W 3, p. 439; 8, p 314 —The loquat is native to China and Japan, but is much planted in the Gulf states and westward It blooms from Aug. until the approach of winter, and ripens its clustered fr. in very early spring. The fr. is often seen in northern markets. It is a profuse bearer in congenial climates See *Loquat*. Loquat is an excellent decorative plant, either as an evergreen lawn tree south of Charleston, or as a pot-plant in the N. It is a most satisfactory conservatory subject, resisting uncongenial conditions. Var **variegàta**, Hort. Lvs. variegated with irregular markings of pale green, dark green and white.

ALFRED REHDER.

ERIOCÉPHALUS (from *erion* wool, and *kephale*, head, in allusion to the woolliness of mature heads) *Compósitæ* A scarce little-known group of greenhouse shrubs, grown for their violet-white flowers and pleasantly scented leaves.

Leaves usually entire, sometimes 3-lobed, often in bunches. fls. in umbellate clusters in the only cult. species, in some others racemose; heads with white ray-fls and purplish disk-fls ; involucre in 2 series, the outer series of 4–5 bracts —Twenty species, all S. African, but only one seems to be grown and this is confined to fanciers' collections in Amer

It is best grown in the temperate house in a mixture of sand and peat. Propagated by cuttings, in sand, under a bell-jar.

africànus, Linn Lvs. opposite or tufted, silky-pubescent, about ½in. long, thickish, channeled heads umbellate at the ends of the branches, the white-rayed, purple-centered heads making attractive clusters. S. Afr. B.M 833.

E pectinifòlius, Linn. An attractive yellow-fld sort with smooth green lvs is perhaps referable to Hippia frutescens B.M. 1855. It is known only in botanic gardens in Amer.

N. TAYLOR.

ERIOCÈREUS (*woolly* and *Cereus;* referring to the wool in the axils of the bracts on the ovary). *Cactàceæ*. Usually slender plants, at first erect, but usually afterward clambering and creeping, often forming great clumps and thickets: fls. usually large; ovary covered with more or less enlarged bracts bearing hairs and spines in their axils: fr. red, spiny, flesh white; seeds numerous, black. For cult , see *Succulents*.

Jusbértii, Riccob. Ribs 6, usually low, with broad intervals; spines very short: fls. funnelform; petals white; stigma-lobes linear, green; bracts on ovary and fl.-tube filled with long hairs. It is now believed that this species is a hybrid between an Echinopsis and some Cereus.

See Cereus for descriptions of the following species: *Bonplándii*, Riccob, *Carendàhui*, Riccob. This is described under Cereus, but probably does not belong to either genus, *Martínii*, Riccob; *platygónus*, Riccob, *tephracánthus*, Riccob, *tortuósus*, Riccob.

J. N. ROSE.

ERIOCHÌLUS (*woolly lip*). *Orchidàceæ.* A half-dozen species of terrestrial orchids from Austral., with small subterranean tubers and a solitary lf. at the base of the st. or higher up: fls. pink or white, 1 or more and sessile on a scape or peduncle; labellum much shorter than lateral sepals, the margins often with small and erect lateral lobes. Some of the species have been mentioned as greenhouse subjects, but they are horticulturally little known.

ERIOCNÈMA: *Bertolonia.*

ERIODÉNDRON: *Ceiba.*

ERIODÍCTYON (*woolly net*, referring to the under surface of the lvs.). *Hydrophyllàceæ* Four species and many varieties (see Brand in Engler's Pflanzenreich, hft 59, 1913) of shrubs of Calif and the Great Basin, with alternate coriaceous entire lvs , and white, purple or blue fls. in scirpoid cymes. Apparently not cult. *E Parryi*, Greene=Nama.

ERIÓGONUM (Greek, *woolly joints*). *Polygonàceæ.* About 140 species, W. N American (with extension into Mex), herbs tufted sub-shrubs or slender annuals, mostly densely woolly. lvs crowded at the base of the st , alternate or whorled, entire. fls small, perfect, in an involucrate head, fascicle or umbel, mostly recurved or reflexed with age, mostly white, rose or yellow; perianth 6-parted, stamens 9; styles 3: fr. an achene, mostly 3-angled Now and then some of the species are listed by dealers in native plants, but they can hardly be regarded as cult subjects. *E. compósitum*, Douglas, perhaps the best known, has very many minute neutral-colored fls , dull white to rosy, borne in compound umbels 5–6 in deep and broad B R 1774 The following have been advertised, but are practically unknown in our gardens *E campanulàtum*, *E. compósitum*, *E flàvum*, *E heracleoìdes*, *E incànum*, *E microthècum* var *effùsum*, *E nìveum*, *E nìdum*, *E. ovalifòlium*, *E racemòsum*, *E sphærocéphalum*, *E. thymoìdes*, *E. umbellàtum* *E gigantèum* makes a mound or mat many feet across G C III 28·337 Descriptions of eriogonums may be readily found in the floras of the western part of the U. S.

ERIOGÝNIA: *Luetkea.*

ERIÓLOBUS: *Pyrus*

ERIÓPHORUM (*wool-bearing*, from the Greek, alluding to the heads of fr.) *Cyperàceæ* Perennial rush-like plants, growing in swales fls in dense heads, the perianth-bristles very numerous and often becoming greatly elongated in fr. and giving the head a woolike appearance None of them is known in cult., but the following names have been offered by collectors for bog gardens· *E alpìnus*, Linn , *E. cyperìnum*, Linn ; *E lineàtum*, Benth & Hook ; *E. polystàchion*, Linn ; *E vaginàtum*, Linn ; *E virginicum*, Linn All these are wild in the northern states, and descriptions may be found in the regular manuals Eriophorum comprises upward of a dozen species in the northern hemisphere.

ERIOPHÝLLUM (Greek, *woolly-leaved*). *Compósitæ.* Herbs, mostly woody, and commonly with yellow-rayed heads; one kind cult in a few hardy borders is a low, tufted, herbaceous perennial, with much-divided lvs., covered with wool beneath (each st. bearing about 5), and 8-rayed yellow heads 2 in across, borne in a loosely forking fashion on peduncles 3–7 in. long The genus was included in Bahia by Bentham & Hooker, but is now kept distinct largely because of the permanently erect involucral bracts: seeds mostly 4-angled, and pappus of nerveless and mostly pointless, colorless portions. Actinolepis is included in this genus by some authors. There are about a dozen species, in N. W Amer. **E. cæspitòsum,** Douglas (*Actinélla lanàta*, Pursh, not Nutt. *Bàhia lanàta*, DC.), described above, has been advertised. Either moist or dry ground, Mont. to Brit. Col. and S. Calif.; very variable.

ERIÓPSIS (Greek, *like Eria*, an orchid of the Epidendrum tribe, which it resembles when not in flower) *Orchidàceæ* Five or six South American orchids of the Vanda tribe allied to Acacallis and Warrea, requiring coolhouse treatment as given to Cattleya; epiphytes.

Leaves 2 or 3, long, plicate: racemes 2 or 3, basal; fls. open, small, but showy, maxillaria-like; lip 3-lobed, the lateral lobes broad and erect and inclosing the column, the middle lobe small and spreading and sometimes 2-lobed.—About half a dozen species in S. Amer.

bíloba, Lindl Pseudobulbs 3 in long. lvs lanceolate· fls. 1 in across, sepals and petals yellow, with orange-red margins, labellum yellow spotted with brown Colombia. B R. 33 18.

rutidobúlbon, Hook Stouter in habit than the above: pseudobulbs wrinkled, dark-colored: racemes drooping, sepals and petals orange-yellow, with deeper colored margins; labellum white, with purple spots. Antioquia, in exposed positions on the sts. of palms. Peru. B M. 4437.

Hélenæ, Kranzl Said to be the finest in the genus. It differs greatly in habit from the other members; the pseudobulbs (standing 16 in high) somewhat resemble those of *Epidendrum Brassavolæ*, but are much stronger, and bear 3 long, coriaceous dark glossy green linear-lanceolate lvs The fls. are twice as large as those of *E. biloba*, and are borne on tall, arching scapes The sepals and petals are orange-colored, margined with purple, the lip similar, but with a yellow blotch, spotted with purple at the base. Peru

E Fuerstenbérgii, Kranzl Racemes up to 12 in long, fls about 1¼ in across, sepals and petals brown outside, orange with brown border inside, lip whitish, densely dotted with purple

OAKES AMES.

ERIOSTÈMON (Greek, *woolly stamens*). *Rutàceæ.* Coolhouse evergreen shrubs from Australia, with starry, five-petaled flowers an inch wide, of white or blush-pink Very little known in America, but abroad considered amongst the finest of hard-wooded winter or spring-blooming Australian plants

Leaves alternate, entire, glandular-dotted. infl. axillary or terminal, solitary or in clusters; calyx and corolla 5-parted, rarely 4-parted; stamens 8–10, free, shorter than the petals; anthers pointed. fr. 2-valved, 1-seeded Much care is needed to produce well-trained specimens

Eriostemons are among the most beautiful of Australian hard-wooded plants. They are propagated from cuttings made of the points of half-ripened wood. Choose pieces about 3 inches long, and insert in a pot filled with one part finely sifted peat, and two parts sharp sand. Water them and set in a case in a temperature of 55° to 60°, shading them from the sun After they have rooted, pinch out the heart of the shoots, and when they show signs of breaking, transfer them singly into small pots in equal parts of peat and sand. When well rooted in these pots, give them a shift about two sizes larger, using good fibrous peat, in rather a lumpy state, and about a fifth part of good sharp sand, adding a little of finely broken charcoal. This compost may be used for all future pottings. If large plants are wanted quickly, it is better to grow them indoors all the year round, but they will not set flowers so well. Eriostemons flower in the smallest sized pot in spring, if they are grown outdoors all summer. The outdoor treatment ripens the wood thoroughly and the result will be seen when flowering time arrives These plants are liable to run into strong shoots to the detriment of the weaker ones. When this is observed, cut them well back, and this will preserve the symmetry of the plant. During their growing period they should be syringed freely. This helps to soften the wood and secure

plenty of breaks, and also keep red-spider in check. A favorite method of propagation in the British Isles is by grafting on small plants of *Correa alba*. This insures a quicker means of raising the plants and is practised largely by nurserymen. A winter temperature of 40° by night should be maintained. However, if plants are wanted to flower earlier, they may be subjected to 50° or 55° Eriostemons are sometimes attacked by brown and white scale. Fumigation with hydrocyanic gas is the best remedy. (George F. Stewart.)

A. *Foliage linear or narrowly lanceolate.*

B. *Lvs. linear*

scàber, Paxt. A shrub with minutely pubescent or glabrous branches: lvs covered with minute roughnesses, sessile, acute and mucronulate: petals white, tipped pink. P.M. 13.127.

BB *Lvs. narrowly lanceolate.*

linifòlius, Seghers. Lvs broadest at middle, tapering both ways. R.B 20:97.—Probably an old garden form of some well-known species.

affinis, Sprague Shrub, 1–2 ft, the branches glabrous and shining: lvs. sessile, linear-lanceolate, 1–2 in. long, glabrous. fls. in axillary slender clusters, quite like the next, but smaller.

AA *Foliage conspicuously wider.*

B. *Lvs. 10–12 times as long as broad.*

C. *Apex abruptly pointed.*

myoporoìdes, DC. Lvs. widest at the middle, tapering evenly both ways, 1–3, rarely 4 in. long. fls umbellate; petals white or sometimes pink, glandular on the back. B.M. 3180.

CC. *Apex blunt.*

salicifòlius, Smith This willow-leaved species has perhaps the handsomest foliage Lvs. widest above the middle, tapering more gradually to the base than to the apex: petals bright, soft pink. B M. 2854.

BB. *Lvs. 3–4 times as long as broad.*

intermèdius, Hook. Lvs 9–18 lines long, elliptical, abruptly pointed: petals lanceolate, white, but tipped with pink outside in the bud like the rest; ovary placed on a flat disk and not ringed at the base. Probably of garden origin Intermediate between *E myoporoides* and *E buxifolius* B M 4439.

buxifòlius, Smith. Lvs. as in *E. intermedius*, though perhaps smaller· petals obovate, white, tipped pink; ovary sunk into a double disk of 2 rings B M. 4101. G. 26:19 —*E densifòrus*, Seghers, R B 20:97, looks like a prolific horticultural variety of this species.

WILHELM MILLER.
N. TAYLOR.†

ERITRÍCHIUM: For *E. barbigerum*, see *Krynitzkia*. For *E nothofulvum*, see *Plagiobothrys*.

ERLÁNGEA (bears the name of the University of Erlangen). *Compósitæ*. One species of this genus, blooming in midwinter and spring, is offered in England.

The genus was long considered to be monotypic but Moore has recently (Jour. Bot. 46 1908) incorporated Bothriocline with it, and the new species have expanded the genus to 32 species, all Trop. African excepting 1 in New Guinea; it differs from Vernonia "only in the curious reduced achenes and the pappus of few, short, very caducous setæ." **E. tomentòsa,** Moore (*Bothriocline Schimperi* var. *tomentòsa*, Oliv. & Hiern). Shrub, to 5 ft.: st. and under sides of lvs. tomentose: erect herb: lvs opposite or at top of st. rarely alternate, oblong to ovate-lanceolate, 2–5 in. long, nearly or quite obtuse, rounded at base, serrate, villous· fls. all tubular, about 40 in the head, the heads about ⅔in. diam, short-peduncled and collected in corymbose panicles; involucre-scales ovate, acute, scarious-margined. Trop. Afr. B.M. 8269. Foliage scented: fls mauve or lilac, lasting 2 or 3 months in winter; habit of a eupatorium, and requires the treatment given the greenhouse members of that genus.

L. H. B.

ERÒDIUM (Greek, *a heron;* alluding to the beaked fruit) *Geraniàceæ*. HERON'S-BILL or STORK'S-BILL Annual and perennial, some of the perennials grown in flower-gardens and with alpines for their finely cut foliage and mostly purplish or white flowers.

The plants suggest the wild and hardy geraniums, from which they differ in having only 5 instead of 10 anther-bearing stamens, the other 5 being reduced to scales; also the tails of the carpels hairy inside and twisting spirally. Herbs, rarely somewhat woody or tufted: lvs. opposite or alternate, one often smaller than its mate, stipuled, toothed, lobed, or dissected· fls. regular or nearly so, mostly in umbels, of various shades, from crimson-pink to purple, with darker blotches on the 2 upper petals and the venation outlined in darker shades; sepals 5, imbricate, ovary 5-lobed, when ripe splitting into separate caps -lobes, each lobe 1-seeded· plants usually heavy-scented — The latest monograph (Knuth, in Engler's Pflanzenreich, hft 53, 1912) describes 60 species, widely dispersed in temperate and warm regions The self-planting of the seeds or carpels of some species is very interesting

These plants are chiefly for the front row of the hardy borders and the rock-garden, where they thrive in a gritty loam They like dry, sunny spots, and may be trusted with a conspicuous position, being chiefly valued for their steady succession of bloom from June to August Divided plants are chiefly sold here, but the species are easily propagated by seeds Some erodiums can be grown in chinks of walls Some of the annual kinds are widely spread in California and other parts of the West, and *E. cicutarium* and two or three others are grown for forage The garden species have not attained much prominence in this country.

INDEX.

absinthioides, 14
Botrys, 3
chamædryoides, 8
chrysanthum, 4
cicutarium, 1.
corsicum, 9
daucoides, 11.
glandulosum, 10
graveolens, 10
Guicciardi, 13
guttatum, 5
macradenum, 10
Manescavi, 12
moschatum, 2
olympicum, 14
pelargoniiflorum, 6.
petræum, 14
Reichardi, 8
Sibthorpianum, 14.
supracanum, 7

A *Plant annual (or biennial).*

1. **cicutàrium,** L'Her. ALFILARIA ALFILERILLA. PIN-CLOVER Tufted, low and spreading, more or less glandular, often with coarse, soft, short hairs lvs oblong, 1–2-pinnate; lfts. small, nearly sessile, the uppermost confluent, lower ones sharply and deeply cut and with narrower lobes stipules small, acute· sepals with 1 or 2 terminal bristles, filaments not toothed; fls. rose-purple. Abundantly run wild from the Rocky Mts to the Pacific, on dry or barren lands, and also grown for hay and utilized as wild pasture Feb.–Apr Old World; immensely variable

2. **moschàtum,** L'Her. FILAREE MUSK-CLOVER. Also ALFILERILLA Glandular and musk-scented, at first stemless and with a rosette on the ground but later sending up stout fleshy sts. to 1 ft · lfts. large, short-stalked, ovate to elliptical, serrate, broad-lobed· stipules large, rather obtuse: sepals not terminated by bristles; filaments 2-toothed; fls. rose-purple. Medit, Orient. Run wild in Calif. in the rich valley lands.

3. **Bòtrys,** Bertol. Branching from the base and usually prostrate, white-pubescent: lf -blades 1–2 in. long on petioles of similar or twice the length, oblong-ovate, pinnatifid, the lobes acute and serrate· sepals with 1 or 2 short bristles; fls. deep violet; filaments

widened upward and toothed. **Medit. region, now widely spread in Calif. and also grown for forage.**

AA. *Plant perennial.*

B. *Fls. yellow.*

4. **chrysánthum,** L'Her. Woody, 1–5 in. tall, silvery, the rhizome vertical: lvs. densely crowded at base, petiole and blade of equal length, broadly ovate, obtuse or nearly so, pinnate, the pinnæ cut; st.-lvs. few or none, subsessile: peduncles sometimes basal; fls. yellow, the petals exceeding sepals, broadly cuneate and retuse Greece. Gt 1, p 260.

BB *Fls. white, sometimes veined or spotted.*

5 **guttàtum,** Willd Woody, 3–6 in., the caudex vertical. lvs many at base of st , long-petioled, ovate-cordate or long-cordate, obscurely lobed, crenulate: peduncle 2–5 in. high, fls. clear white with a dark spot at base of upper petals, sepals lance-spatulate or obovate-spatulate, petals broadly obovate, rounded. S. W. Medit region; a good little rock plant. Gt. 3, p. 244.

6 **pelargoniflòrum,** Boiss & Heldr Woody, to 1 ft. or more, the caudex vertical basal lvs. rather numerous, long-petioled, hairy above, ovate-cordate, somewhat lobed, obtusely crenate-dentate peduncles 1–5 in. high, fls white, the 2 upper petals spotted with pink at base, sepals ovate, petals broadly obovate, rounded or retuse Asia Minor. B M. 5206 Gt 1:194. Gn. 59, p 448, 63, p 107

7 **supracànum,** L'Her Stemless, 1–4 in tall, the rhizome vertical lvs numerous, to about 2 in long, densely silky-canescent above, green beneath, ovate or oblong, bipinnatisect, the pinnules entire or dentate or incised fls white, spotless, red-veined, the petals obovate and rounded, and sepals broadly ovate and 5-nerved Pyrenees

8. **chamædryoïdes,** L'Her. (*E. Reichardii*, DC.). Stemless, 2–3 in tall lvs numerous, long-stalked, sparsely hairy, round-ovate, slightly cordate, crenate, apex rounded peduncles about 1-fld , about 2 in. tall; fls white, rose-veined, sepals ovate-spatulate or lance-spatulate, minutely mucronate, petals obovate, retuse. Balearic Isls , Corsica —An attractive alpine

BBB *Fls. rose, red or purple (sometimes white in No. 14).*

C. *Lvs. undivided or obscurely lobed.*

9 **córsicum,** Lem St. 2–6 in. high, the root vertical or oblique basal lvs many, long-petioled, grayish tomentose or becoming glabrous, ovate or broader, more or less obsoletely lobed, coarsely crenate-dentate. peduncle 1–2 in high, about 2-fld , fls ¾ in across, in shades of rosy pink veined deeper color, sepals oblong-spatulate or ovate, not mucronate; petals broadly obovate or cuneate. Corsica and Sardinia. G C. III. 48:210.

CC. *Lvs. all pinnatisect.*

D. *St. wanting*

10 **macradènum,** L'Her. (*E gravèolens*, Lapeyr. *E. glandulòsum*, Willd.). Remarkable for the great length of the roots when twisting among rocks, and strong odor of the foliage· 2–6 in lvs hairy, glandular, 1½–2 in. long, oblong, pinnate; segms pinnatifid, rachis with a toothed wing: fls. light purple, the 2 upper petals a shade darker, and the spots nearly black Pyrenees. B.M. 5665.

11. **daucoïdes,** Boiss. Plant 2–4 in , the rhizome vertical: lvs. many, tomentose, petiole exceeding blade, lanceolate or triangular in outline, the pinnæ pinnatisect and the lobes linear-lanceolate: peduncles standing above the foliage, about 4-fld.; fls. rose-color; sepals more or less ovate, 5-nerved; petals obovate, somewhat rounded. Spain.

12. **Manescàvi,** Coss. Height 10–18 in., the rhizome vertical or oblique: lvs. attaining 6 and more in. long, 2½ in. wide, lanceolate or ovate-lanceolate; segms. alternate ovate, short-stalked, dentate, with sometimes a deeper cut. fls at best 2 in. across, strong rosy purple, the spots of the upper petals only a shade or two darker. Pyrenees. Gn 55 292.—Colors stronger and more uniform than No. 10.

DD. *St. evident.*

13. **Guicciárdii,** Heldr Woody, to 8 in. tall, from a more or less vertical rhizome. basal lvs. many, densely clustered, petiole equaling the blade (upper st.-lvs sessile), silvery, broadly ovate or oblong-ovate, pinnate; pinnæ cut into linear or oblong-linear lobes: peduncle 1–3 in. tall, 4–7-fld ; fls rose-colored; sepals ovate, obtuse and mucronate; petals obovate, rounded. N. Greece.

14. **absinthioïdes,** Willd. (*E. petræum*, Sibth & Smith. *E. olýmpicum*, Clem *E. sibthorpànum*, Kotschy). Two to 8 in. tall: rhizome vertical· lvs many, crowded at base of st , the petioles very short (st.-lvs few and sessile), soft-hairy, oblong or triangular-ovate, obtuse or acutish, bipinnatisect, lobes linear-lanceolate, entire or dentate· peduncle 1–4 in , 2–8-fld.; fls. violet or rose (rarely white), the sepals ovate, obtuse and mucronate, the petals cuneate-obovate Asia Minor.

E. gruinum, L'Her Annual or biennial, 1½ ft. high, the sts 1 or few, white-hairy lvs cordate-ovate, undivided or obscurely lobed, dentate fls violet-blue, large, the petals broadly obovate and clawed, rounded at apex Sicily to Persia, N Afr —*E. Stephanidànum*, Willd Annual or biennial, villous, branched: lvs nearly glabrous, bipinnatifid, the lobes linear peduncles 2–3 in high, 2–5-fld , fls dark purple, petals scarcely surpassing sepals, very broad-ovate Temp Asia

L. H. B †

ERPÈTON: *Viola.*

ERÙCA (origin of name in doubt; probably from the Latin *to burn*, in allusion to the hot seeds) *Cruciferæ* Perhaps ten or a dozen herbs of Eu. and W. Asia, annual or biennial Allied to Brassica: differs in the shorter, more turgid silique, with keeled valves; style elongated, seeds in 2 rows in each cell. The lvs are pinnately lobed or dentate, and the fls. rather large, yellow to purplish **E. sativa,** Mill , Roquette, Tira or Rocket-Salad, is the only species cult. in this country. It is a weedy annual, resembling a mustard, 1–2 ft high, with lyrate-pinnatifid lvs and creamy yellow or whitish fls in a raceme (which elongates in fr). It is sparingly run wild in Canada, U. S., and Mex. See *Roquette*

L. H. B.

ERÝNGIUM (a Greek name for some sort of thistle). *Umbellíferæ* Eryngo Sea-Holly Annual and perennial herbs, chiefly valued for the steel-blue or purplish cast of their rigid stems, prickly foliage and teasel-like heads.

Rarely shrubby: lvs stiff or coriaceous, undivided, lobed or pinnatisect, the margin nearly always spiny: fls. small, white, greenish or blue, sessile or subsessile, bracteolate, in involucrate heads or spikes, calyx-teeth prominent, mostly rigid, sometimes ending in a spine-point, petals erect, disk expanded; styles slender fr ovoid or obovoid or more or less globose, scaly or tuberculate, without ribs, the carpels nearly terete and with usually 5 oil-tubes —Wolff estimates (in Engler's Pflanzenreich, hft. 61, 1913) 220 species, widely dispersed in warm and temperate regions with the greatest extension in the Medit region.

There are two very distinct groups of eryngoes, one with much-cut foliage, as shown in Fig. 1417, the other the "pandanus group" (of the New World), with long undivided leaves. The species are little grown in this country, but they are more used abroad They produce striking semi-formal and often somewhat bizarre effects. They are used in subtropical bedding, particularly the large pandanus-leaved kinds. They are excellent for borders and rock-gardens, being prized particularly for their colored stems and often brilliant in-

volucre. The stiff leaves of the pandanus group are little damaged by weather. The dried stems retain their color, and are sometimes hung in living-rooms. The plants mostly grow from 2 to 3 feet high and head out in July to September. A light rich soil and sunny situation are advised. Poor drainage is to be avoided. *E. amethystinum* is probably the most popular species in this country. *E. planum* is said to be much visited by bees. They are slow to recover from the shock of division. This makes it difficult to work up a stock at home sufficient to make an effective group. The only safe way to increase them is by seed The seed may be sown as soon as gathered They will germinate in the spring, and should be ready to plant out the following year Some of the species self-sow. The species described below are perennial.

INDEX.

agavifolium, 1.
alpinum, 9, 10
amethystinum, 21.
aquaticum, 4.
asperifolium, 12.
Bourgatii, 19
bracteosum, 7.
bromeliæfolium, 2.
cæruleum, 15
dichotomum, 14.
eburneum, 7
giganteum, 12
glaucum, 12.
intermedium, 13.
Lasauxii, 5
latifolium, 13
Leavenworthii, 16.
maritimum, 8.
multifidum, 21
Oliverianum, 10
pallescente, 21.
pandanifolium, 6
planifolium, 13
planum, 13
proteiflorum, 3.
roseum, 13
serbicum, 17.
Spinalba, 18
Tournefortii, 19
tricuspidatum, 14.
tripartitum, 11.
yuccæfolium, 4.
Zabelii, 20



1417 Eryngium amethystinum (×½)

A. *The pandanus-leaved group*

B. *Bracts of involucre long and prominent*

1. **agavifòlium,** Griseb. Becoming 6 ft. high in its native country: st. simple below and somewhat branched above, 3-forked at top: basal lvs. rosulate, ensiform, to 5 ft long, coarsely spinose-serrate: head cylindrical, about 2 in. long and half as thick; the involucral bracts 10–16, ovate at base and gradually narrowed, entire or sparsely spinulose; sepals round-ovate or nearly-orbicular; petals obovate or elliptic-oblong Argentina, blooming Jan.–March G W. 15, p. 477.

2. **bromeliæfòlium,** Delar. Becoming 9 or 10 ft. tall, the st. about 4-forked at top: basal lvs. numerous, 1½ ft and more long, narrow and very acute, the margins subulate-dentate, spine-pointed· head ovoid or ovoid-cylindrical, about 1 in. long; involucral bracts many, rigid, unequal, linear-subulate, pungent-pointed; sepals ovate-lanceolate, short-acuminate and mucronate. Highlands, Mex , Dec

3 **protæflòrum,** Delar Plant very stout, 3 ft. and more, the st. fistulose and sulcate: st.-lvs. very stiff, the upper ones 8 in. or more long, linear-lanceolate, long-acuminate and pungent-pointed, the margin subulate-spinose: head ovoid-cylindrical, 2½ in. long; bracts of involucre very many and very rigid, in several series, lanceolate and sharp-pointed, fls. very many; sepals broad-ovate, obtuse, short-mucronate; petals white, obovate-spatulate. Mex. Sept. G C. III. 41:248, 249. Gn. 75, p. 380.

BB. *Bracts of involucre scarcely prominent, not very stiff.*

C. *Nerves of lf. diverging.*

4. **aquáticum,** Linn. (*E yuccæfòlium,* Michx.). BUTTON SNAKEROOT. RATTLESNAKE MASTER Height 2–6 ft.: st. striate, unbranched or branched above: lvs. undivided, long and linear, rigid, mostly clasping, finely parallel-veined, lower sometimes 3 ft long, 1½ in. wide, all bristly margined: heads globose-ovoid. Wet soil, E. U. S.

CC. *Nerves of lf. parallel, prominent.*

5. **Lassaùxii,** Decne. Height 3–6 ft , the st fistulose, 3-forked at top: basal lvs. often slightly twisted, canaliculate, to 2 in. wide, long-acuminate, the margin spiny: heads in a broad corymb, each one small, about ½in. through, whitish green; involucre-bracts ovate-lanceolate, spinulose-ciliate; sepals nearly orbicular or 4-angled-orbicular, truncate and erose; petals rectangular-ovate S Brazil, Paraguay, Uruguay. G W 3, p 549.

6 **pandanifòlium,** Cham. & Schlecht. St. to 8 ft high, leafy, 3–4-forked above. basal lvs 4–5 ft long, spine margined above, st -lvs many, to 1½ ft. long, spiny heads colored, globose-ovoid, less than ½ in. long, in large panicles; involucral bracts broad-ovate, very acute, rough on the back; sepals nearly orbicular or oval, short-mucronate; petals dark purple, ovate or orbicular-oblong. S. Brazil, Argentina. Gn 61, p. 37. G.W 4, p. 197.

7. **ebúrneum,** Decne. (*E bracteòsum,* Griseb) Height 8 ft , from a thick rhizome, the st ivory-white· basal lvs crowded, canaliculate, 3 ft. and more long, acuminate, very spiny, the spines being slender heads not colored, ovoid or globose-ovoid, ¾in. long, involucral bracts triangular or lanceolate or linear, sepals ovate or oval, obtuse or short-acuminate, petals somewhat rectangular-oblong, fimbriate at apex. S Brazil, Uruguay, Argentina.

AA. *The cut-lvd. group (or lvs., at least on st, broader, more or less toothed, and not pandanus-like).*

B. *Lvs. fleshy*

8. **maritimum,** Linn Glaucous-blue, stiff, much-branched, about 1 ft high lvs. very stiff, broad, sinuate, more or less 3-lobed, handsomely veined, with coarse prickly teeth, those on the st clasping, the radical ones petioled: heads nearly globular, pale blue; involucral bracts 5–8, much smaller and narrower than the st.-lvs.; sepals ovate-lanceolate; petals oblong. Seacoasts of Eu. Gn. W. 15:489.

BB. *Lvs. not fleshy.*

C. *Basal lvs. usually not lobed (or not prominently so).*

9. **alpìnum,** Linn Height 12 ft., bluish above, from a thick root: radical lvs deeply cordate-triangular, acuminate, coarsely double-crenate; st -lvs round-cordate, often 3-lobed at the apex or palmatifid· head globose-cylindrical, about 1 in long; involucral bracts 12–18, lance-oblong, rigid, multifid; fls. many; sepals ovate-lanceolate; petals somewhat rectangular. Eu B.M. 922. G.C. III 53·139. G.M 46:136. Gn W. 21 278. G W. 3:576; 15, p. 478. R H 1876, p. 113. Gn. 46:523.—There is a white variety. Prized for the attractive blue color of the heads and upper part of the plant.

10. **Oliverìanum,** Delar. (*E. alpìnum* var. *Oliverìanum,* Spreng.). Hybrid, perhaps of *E. planum* and *E. giganteum,* or perhaps with *E alpinum*· plant strong,

3 ft.. lower lvs. long-petioled, broadly cordate-ovate, indistinctly 3-lobed at the apex, unequally spinulose-serrate; younger and the lower cauline lvs. 3-lobed or -parted and the lobes again more or less lobed or angled and the margins spinose-serrate: head blue, cylindrical-ovoid, or ovate, many-fld.; involucral bracts 10–15, subulate or linear, somewhat spinulose Gn. 45, p. 223; 60, p. 425. Gn. W. 20:791. G W. 15, p. 497.

11. **tripartìtum,** Desf. Probably a hybrid: radical lvs. unequally spinulose-serrate with a large obtuse middle lobe; st.-lvs. deeply 3-parted, the lobes lanceolate and rigid, spiny-toothed: head globular, small; involucral bracts 6–9, narrow-lanceolate, spiny margined.

12. **gigantèum,** Bieb. (*E. asperifòlium,* Delar. *E. glaùcum,* Hoffm). Stout, 6 ft , the root thick and turnip-shaped, the st. simple below and 4–5-forked above: lvs. coriaceous, the basal ones broadly cordate or cordate-triangular, toothed; st -lvs. more or less 3-lobed, spinulose-dentate: heads cylindrical or ovoid-cylindrical, 3–4 in long, in an ample infl , blue or pale green; involucral bracts lanceolate to obovate, very rigid, much cut; fls. very many; sepals ovate or ovate-lanceolate; petals obovate-lanceolate. Caucasus, Asia Minor. Gn. 46, p. 523; 70, p 111. G. 34:95. R.H. 1906, p. 379. G.W. 15, p 479

13. **plànum,** Linn. (*E. planifòlium,* Pall. *E. latifòlium,* Ghb. *E. intermèdium,* Weinm) Root thick turnip-shaped, very long. st 3 ft , mostly single, 3–5-forked at top: basal lvs cordate, oblong or oval or broadly obovate, obtuse, spinulose, usually palmately 7–9-nerved; lower st -lvs short-petioled, shaped like the basal lvs or 3-lobed, the lobes deeply serrate or cut, the upper ones sessile and 3–5-parted: heads blue, ovoid or nearly globular, about ½in long; involucral bracts mostly linear, rigid, somewhat spinulose-serrate; sepals lanceolate; petals ovate-oblong. Eu., Asia. G.L. 18 136.—A var. *ròseum* is offered.

14. **dichótomum,** Desf. (*E tricuspidàtum,* Tenore). Two ft or less, glaucous-blue, the st strong, few-lvd., branchy, 3–5-forked at top. lower lvs long-petioled, cordate-oblong or obovate, very obtuse, serrate or crenate, reticulated, upper lvs. rigid, 5-parted: head nearly globose or ovoid-globose, about ½in. long; involucral bracts 6–7, rigid, narrow-linear or subulate, somewhat spinulose, pungent-pointed, sepals ovate or ovate-lanceolate, spine-tipped; petals ovate-oblong. Medit. region.

15. **cœrùleum,** Bieb. About 3 ft , blue, the root thick and long turnip-shaped, the st. usually solitary, 4–5-forked above, the branches long: basal lvs. all long-petioled, cordate, cordate-ovate or cordate-oblong, crenate-serrate, outer ones undivided, inner ones 3-lobed: heads small; involucral bracts 4–6, rigid and wide-spreading, linear-lanceolate, spinulose; sepals narrow-lanceolate; petals oblong. Caucasus and E.

16. **Leávenworthii,** Torr. & Gray. Purple-violet above, 3 ft , the st. strict and full-lvd., at the top 3-forked: basal lvs. oblanceolate and mostly obtuse, spinose-dentate, the others deeply palmate-parted, the divisions cut-pinnatifid and the segms. spreading and pungent-pointed: heads ovoid-cylindrical, 2 in. or less long; involucral bracts 7–9, linear-lanceolate, spinose-pinnatifid; sepals pinnatifid. Dry soil, Kans. to Texas.

cc. *Basal lvs. on the flowering plant all lobed or divided.*

17. **sérbicum,** Panc. Height 1–1½ ft., blue above: root elongated, thick, somewhat woody: st. slender, sparsely lvd., short-branching and 3–4-forked above: basal lvs. long-petioled, fresh green, divided into 5–7 grass-like segms.; st.-lvs. more or less clasping or short-petioled, the segms. very narrow and remotely spinulose-cut: heads small, globose-ovoid; involucral bracts 5–7, rigid, narrow-linear, sharp-pointed; sepals broad-ovate, obtuse; petals broadly oblong-ovate. Servia.

18. **Spinálba,** Vill. Plant rigid, whitish green, more or less blue above: st. stout, at the top 3–4-forked: lvs. coriaceous, rigid, broadly cordate-ovate, palmately 4–5-parted, the margins undulate and spiny-toothed: head blue, ovoid-cylindrical; involucral bracts about 10 and very rigid, deeply pinnatifid, spine-pointed; sepals lanceolate or more or less ovate; petals oblong-linear. Eu , in the Alps.

19. **Bourgàtii,** Gouan (*E. Tournefòrtii,* Bub.). Low, usually about 1½ ft : root thick, somewhat turnip-form: st. mostly solitary, simple below, sparingly branched above, apex 3-forked: lvs. somewhat coriaceous, pale green, rigid, nearly orbicular or somewhat reniform, palmately 3–5-parted and again lobed, spiny-toothed; st.-lvs palmate, somewhat clasping: heads blue or rarely green, nearly globose or ovoid-globose; involucral bracts 9–15, spiny or not; sepals lanceolate, acute; petals spatulate Medit. region.

20. **Zabélii,** Hort. (*E. alpinum* × *E. Bourgatii*). Plant rather robust, 1½ ft : basal lvs. suborbicular, 3-parted; the segms. cuneate at base and deeply 3-lobed and again 3-lobed, margins strongly spinulose-serrate: head globose-cylindrical, 1 in. or more long; involucral bracts, 12–14, rigid, lanceolate, spinulose-dentate, blue or amethystine. G W. 15, p. 496.

21. **amethýstinum,** Linn (*E. pallescénte,* Mill). Fig. 1417. Stout, 1½ ft. and more, blue or amethystine above or sometimes whitish: root thick, long-cylindrical: st. remotely leafy, branched, 4–5-forked at top: lvs. rigid, obovate or oblong-ovate, bipinnatifid, spinose-dentate; upper st -lvs clasping, pinnately parted, spinulose-dentate: heads ovoid-globose, ½in. or more long, the peduncle thick and sulcate; involucral bracts 6–9, unequal, linear-subulate or lanceolate, sharp-pointed, sepals ovate-lanceolate; petals ovate-oblong or nearly rectangular. Eu Gn 46, p. 522; 55, p. 454. G.L 23.199. Variable. Var. **multífidum,** Wolff (*E. multífidum,* Smith) has much-cut lvs.

Any number of eryngiums may be expected to appear in the list, as they are likely to strike the attention of collectors They appear to hybridize rather freely *E hýbridum* is a trade name for garden forms, but it has no botanical standing.—*E. Röthenbergii* is a garden hybrid of E alpinum and E giganteum —*E. azùreum* and *E cœlestìnum* are garden names without botanical standing; the latter is said to be E amethystinum.—*E. Ebenèum*=E. eburneum (?) —*E. Wrightii* is said to be a free form of E. planum, blooming for a long period.

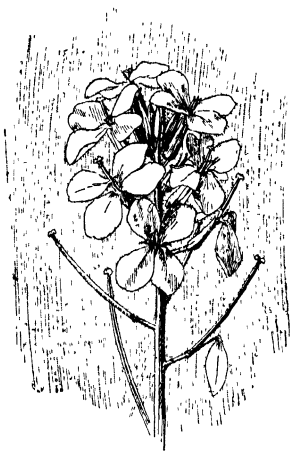
L. H. B.

ERÝSIMUM (probably means *blister-drawing*). *Cruciferæ.* Of this genus two brilliant yellow and orange, spring- and summer-blooming hardy "annuals," are cultivated, scarcely, if at all, inferior to the true wallflowers (Cheiranthus) for general purposes, and a few rock-garden and wild-garden plants.

Biennial, annual and perennial herbs, with long soft appressed 2-parted hairs: lvs. narrow, linear or oblong, entire or variously toothed: fls. orange or yellow, rarely purple, often fragrant; petals 4, usually large, clawed; stamens 6, free and without appendages; style persistent: pod broad-linear, strongly compressed or sometimes 4-angled; seeds many, various.—Species 80–90 in the north temperate zone, being most numerous in Eu. and Cent. Asia. Some of the species are said to hybridize with Cheiranthus. Numbers of species are likely to be mentioned as good subjects for alpine-gardening.

Although some of the popular kinds are biennials, the gardeners think of them as annuals. Their seeds can be sown in the fall and produce bloom earlier than if sown in spring. The rock-garden kinds do well also in the front row of the border and on dry banks. They like full exposure to sunlight, and in the spring months are completely covered with bright flowers. Divided plants, as well as seeds, are offered by American dealers.

In general, no special difficulty is experienced with erysimums In Gn 24, p 462, it is said that *E ochroleucum* on level ground is likely to lose its lower lvs. and to perish on heavy soils in hard winters It thrives best when frequently divided, and may be propagated by cuttings *E Barbarea*, Linn, with forms having double fls and variegated lvs, is *Barbarea vulgaris*.



1418. Erysimum asperum. (×⅔)

ásperum, DC Fig. 1418 Biennial or perennial, height 1–3 ft. in the wild, 12–18 in. in gardens, the sts. erect lvs lanceolate to linear, either canescent or thin and green, dentate or entire, upper ones mostly entire, the lowest sometimes pinnatifid. fls ½in. or more across, orange or yellow, seldom purple. pods rough, 1½–3 in. long, 4-sided, nearly erect Que to Texas and Calif. Var **arkansànum,** Gray (*E arkansànum*, Nutt). Lvs thin, repand-dentate, lanceolate.

capitàtum, Greene (*E grandiflòrum*, Nutt *Cheiránthus capitàtus*, Douglas) COAST WALLFLOWER. Biennial or perennial, probably usually perennial, erect and leafy and finely pubescent, 1 ft or less to 2 ft. high, nearly simple or sand often to make a much-branched woody plant, with lvs oblong, oblanceolate or linear and either entire or repand-dentate fls light yellow or cream-colored, the petals about 1 in long with a rounded blade caps to 4 in Seacoast, Calif. to Ore.

Perofskiànum, Fisch & Mey. Fig 1419 Excellent hardy annual, 1–2 ft, erect: lvs oblong, acute or nearly so, strongly toothed fls large, bright orange or reddish orange pods standing out nearly at right angles, constricted below the narrower style Caucasus, Afghanistan B M 3757. P M. 6 215.—There are compact and dwarf strains suitable for edgings (*E. Perofskianum nanum E nanum compactum aureum*, Gt. 46, p. 194. *E compactum aureum*, Hort). Seeds may be sown at different times for succession

pulchéllum, Boiss (*E lacinìatum*, Boiss). Perennial, green, often cespitose, the sts. ascending 2–6 in or more (even to 2 ft) lower lvs oblong-spatulate, dentate or lyrate; upper lvs. sessile, oblong or lanceolate, dentate, lvs on the suckers lanceolate and often entire: fls medium, deep orange. caps erect-spreading, slender Greece, Asia Minor —Used as rock-garden plant. There are dwarf forms in the wild.

ochroleùcum, DC. (*E rhæticum*, DC. *E. helvéticum*, DC) Perennial, 4–12 in · sts. yellowish, creeping. lvs. oblong-lanceolate, dentate, usually more or less hairy: fls fragrant, pale yellow, the petals obovate. Eu. Gt 2, p. 162.—Variable Forms a turf on rocks and mountains

E Marschallianum, Andrz Biennial perennial, 6–8 in high· lvs lance-linear fls large, bright orange-yellow used as an alpine Siberia —*E murale*, Desf Spring-flowering biennial or perennial, 6–8 in, forming a tuft lvs deep green, narrow fls. golden yellow Eu

WILHELM MILLER
L H B †

ERYTHÈA (one of the Hesperides, Daughter of Evening). *Palmàceæ*, tribe *Coryphеæ*. Palms with solitary, often robust, spineless caudices, ringed at the base, clothed above with dead leaf-sheaths.

Leaves terminal, the younger ones tomentose in some species, glabrous in others, orbicular, flabellately many-parted, the lobes lacerated at the apex, intermingled with fibers, infolded; rachis short, ligule long; petiole stout, slender and arching in some species, smooth or spiny along the margins spadices usually paniculate, long, white tomentose, branches stout; spathes many, sheathing the peduncle, thick-coriaceous, densely tomentose, bracts and bractlets distinct; fls pale· fr. globose or ovoid —Species 5, Mex

This small group of American palms includes *E. armata*, which is known locally as the "blue palm," and *E edulis*, the latter commonly known as the "Guadaloupe palm," from the fact that it has been found in a wild state only on the island of Guadaloupe, off the coast of Lower California Erytheas bear much resemblance to Brahea, the segments of the leaves bearing whitish filaments In the gardens of Santa Barbara, the erytheas in a few years form very handsome trees, but in less-favored latitudes they may be cultivated in the same manner as kentias or latanias, flourishing in a night temperature of 50° to 55° when grown in a rich and open soil and abundantly supplied with water.

A. *Fr more or less globose.*

B *Lvs distinctly glaucous.*

armàta, Wats (*Brahèa armàta*, Wats *B glaùca*, Hort. *B. Roézlii*, Lindl). BLUE PALM Tall and slender, 40 ft high. lvs very glaucous, petiole narrow, deeply channeled, margined with numerous stout, more or less hooked, slightly spreading spines, segms 30–40, sublacerate at the apex, slightly filiferous spadix 18 ft. long or somewhat less, sparingly branched. frs reddish brown at maturity Low Calif G C III 20 425

BB *Lvs green, not glaucous.*

edùlis, S Wats (*Brahèa edùlis*, Wendl). St 40–50 ft high, 15 in thick, with thick, corky bark sheaths fibrous, petioles stout, 1 in wide, plano-convex, unarmed on the acute margins, fibrous-pubescent or glabrate above, ligule 2–3 in long, densely silky-tomentose, blade 3 ft, segms 70–80, at first tomentose, laceiate at the apex and fibrous on the edges spadices numerous, 5–6 ft long, branched fr shining black Calif R H. 1893, p 297, 1897, p 77 G C III 13.507; 22·157



1419 Erysimum Perofskianum (×⅔)

Brándegeei, Purpus In nature 125 ft high and having slender trunk: petioles slender, armed with recurved spines; lvs bright shining green, composed of 10–12 fronded, flabellate lfts. spadix slightly branched frs as in *E armata*, but somewhat streaked Low Calif Gt. 52, p 12 —Intro by Franceschi in 1912, who says, "Appears to grow much faster than other kinds and is not less hardy."

AA. *Fr. shaped like inverted pear.*

élegans, Franceschi. Dwarfer and slower-growing than any other kind. trunk very short: petioles slender, glaucescent, edged

with small spines; lvs. somewhat glaucescent on both sides: fl.-spadix 3–4 ft., branched: frs. about ¾in. diam., yellowish, at first waxy.—According to Franceschi it was first intro. and distributed by the late John Rock of San José, about 1880, and never found again in the wild state, while only one of the plants raised is known to have ripened. N. Taylor †

ERYTHRÆA (Greek, *red;* alluding to the fls. of some species) *Gentianàceæ* Two outdoor species are in cultivation, with bright deep rose flowers, one of which is a rockery plant from the Azores, the other a Californian annual Centaurium is name now used.

Small or low herbs, annuals, biennials and perennials with simple and entire sessile opposite lvs, and small or medium-sized 5- or 4-merous, mostly red or pink fls: calyx-lobes narrow and keeled, corolla salver-shaped, filaments 4 or 5, slender, the anthers becoming twisted, style filiform. caps. oblong or elongated.—About 30 species in the Old and New Worlds; interesting, but little known in cult Three or 4 small species have been naturalized from Eu

A light sandy loam, in a protected nook of the rockery, with partial shade, is required for *E. Massonii* (or *E diffusa*), which is a charming little alpine plant It must be planted in a well-sheltered position and requires protection from sun and severe frost in winter, but the little plant is well worth all the extra care one may have to expend on it in winter Propagated by cuttings, seeds or division. (J. B Keller.)

Mássonii, Sweet (*E diffùsa,* Woods) Height 4 in. sts ascending, tufted, not branched above, 1–3-fld: lvs fleshy, usually concave, shining fls lateral Azores.—Annuals in Azores, biennial in W Eu The plant cult. under this name is considered perennial by our nurserymen.

venùsta, Gray. Height 6–10 in. sts erect, 4-angled, cymosely branched: lvs ½–1 in long, oblong or ovate-oblong, very blunt: corolla-lobes oval or obovate or oblong, ½in or less long, deep pink; corolla-tube yellowish, about the length of the calyx. Dry hills Calif. B M 6396. L. H B †

ERYTHRÌNA (from Greek for *red*). *Leguminòsæ.* Coral-Tree Herbs, shrubs or trees, with large and showy papilionaceous flowers, for planting out and for greenhouse bloom; and open-ground subjects in Florida and California

Erect, or the herbs more or less reclining, usually spiny lvs alternate, pinnately 3-foliolate, with small glanduliform stipules. fls. mostly red and in dense racemes, calyx 2-lipped or oblique, standard free or very nearly so, erect or spreading, tenth stamen free, or united only half its length fr a slender, more or less twisted pod; seeds mostly ovoid.—Known species about 50, in tropical and warm temperate regions around the world

Erythrinas are much prized garden plants. Some of them, particularly the herbaceous kinds, are frequently planted out in the summer In the house they demand an intermediate temperature. Give rich soil and frequent waterings In the woody species, aim to have well-ripened wood for flowering, for the bloom is produced on wood of the preceding year The herbaceous species are propagated by division of the rootstock; also by cuttings from shoots springing from the old roots. Woody species are propagated by cuttings of growing wood. All species are propagated by seeds, whenever these are obtainable. Many species have been more or less grown or tried within the limits of the United States; some of them fail to bloom in southern California, probably because of insufficient summer heat. The forms more or less in cultivation are likely to be imperfectly or doubtfuly determined botanically. Some of the erythrinas are used as shade for coffee and cacao plantations.

A. *Herbaceous species (or treated as such).* These die down at the end of the season, and the roots may be stored after the manner of dahlias. It is best to start the roots before planting them out, particularly in the N In their native countries, these species are more or less woody.

Crísta-gálli, Linn (*E. laurifòlia,* Jacq) Common Coral-Tree Bushy and woody, sometimes developing a very short trunk, but the flowering branches dying back after blooming, the stronger branches coming annually or periodically from near the root. st. and petioles somewhat spiny: lfts. ovate-oblong or lance-oblong, acuminate, entire: fls large, brilliant crimson, the keel nearly as long as the down-folding standard, the wings rudimentary Brazil. B M 2161. B R 313 L B C 3 296 G 4 451. G.W. 3, p. 437; 6, p 281 F.E 16.637 (var *compacta*).—Runs into many forms, varying in the shade of red, some of them with variegated lvs South of Washington, it stands out-of-doors if protected. In the N. the fleshy roots are taken up and stored. Valuable for summer bloom Fls. in large, terminal racemes Madame Belanger is a popular garden form **E. compácta,** Bull, of very compact habit and fls rich crimson is probably a form of this species

speciòsa, Andr Bush-like, reaching 8–12 ft, but usually cut back as *E Crista-galli* is sts and lvs. prickly lfts broad and more or less 3-lobed, pointed, veiny: fls in pubescent racemes, rich crimson. W. Indies B R 750.—St green, very prickly.

herbàcea, Linn Perennial sts. several and herbaceous, from a very thick root, 2–4 ft high, the flowering ones nearly leafless lfts 3, ovate to hastate, petioles long, more or less prickly fls 2 in long and very slender, deep scarlet, in loose racemes 1–2 ft long seeds scarlet N C to Texas and W Indies Common on Gulf coast of Ala and Miss B M 877 **E. Bídwillii,** Lindl, is a beautiful hybrid of this species and *E Crista-galli* (the latter the pollen parent), with herbaceous shoots and an ascending vexillum B R 33.9. H F 2:48.

AA. *Woody or tree-like species* Greenhouse plants, or planted in the open in S. Calif and S Fla

Humeàna, Spreng (*E cáffra,* Ker-Gawl, not Thunb) Often tree-like and 30 ft or more, the st and petioles very spiny petioles long, lfts rhomboid-ovate, acuminate: peduncles axillary and strictly erect, longer than the lvs, white-warty; fls verticillate-spiked on the ends of the peduncles, long and slender, deflexed, brilliant scarlet fading to purple. S. Afr B M. 2431 B R 736

Corallodéndron, Linn Coral-Tree Tree, prickly. petioles not armed, lfts. ovate-rhomboid calyx campanulate, the teeth obsolete, standard erect, linear-oblong, scarlet: seeds scarlet, usually with a black spot W. Indies L D 3 170.—The handsome deep scarlet large fls are borne in long racemes after the lvs. fall

velùtina, Willd. Prickly tree lfts scurfy-tomentose beneath, broadly ovate, obtuse, the terminal deltoid-ovate calyx split nearly to base, the 5 teeth minute, standard orbicular, reflexed (1–1½ in long), the wings nearly as long as calyx, the keel-petals distinct and small. pod velvety, few-seeded Jamaica to Brazil. B.M. 3227.

índica, Lam (*E cárnea,* Blanco) Tall tree with very small usually black prickles and thin gray back: lfts rhomb-ovate, membranous and glabrous. fls showy scarlet, in dense short racemes; calyx split nearly to base; standard ovate-oblong and blunt or nearly so, slightly recurved, 2–2½ in long, and about half as broad, much exceeding the wings and keel; wings and keel nearly equal, not more than half so long as the calyx pod 6–12 in. long, torulose India, Polynesia, W. Indies Variable Var. **pícta,** Hort (*E. pícta,* Linn.), has variegated lvs. Var **Parcéllii,** Hort (*E Parcéllii,* Bull), has lfts. with variable yellow varie-

gation: fls. bright cinnamon-red. G.C. II. 1874 (2): 393. G Z. 18:64; 21, p. 2. By some, *E. picta* is accorded specific rank and *E. Parcellii* is united with it. Var. **marmoràta,** Hort. (*E. marmoràta,* Veitch), has large lvs. attractively spotted with white. · G.Z. 24, p. 73.

fúsca, Lour. Tree-like, 8 ft., the bark fuscous (brownish), bearing short prickles, the branching diffuse: lvs. unarmed; lfts. lanceolate, entire, glabrous: fls. brown-red, in terminal racemes; calyx somewhat bilabiate, the lips entire and erect; standard very long, obtuse, convolute in a tube; stamens long, connate at base: pod long, terete, articulate, pilose; seeds oblong. Cochin-China.

Poeppigiàna, Cook (*Micrópteryx Poeppigiàna,* Walp. *E. Micrópteryx,* Poepp.) Bucare. Used for shading coffee and cacao in the W. Indies: tree 40–60 ft., the prickles short. lvs. large, apparently not prickly; lfts. broad, entire, with nectaries at base of the 2 lower petiolules: fls. cinnabar-red; calyx truncate; standard plane, elliptic or narrow-oval, to 1⅛ in. long; wings small, about twice exceeding the calyx, obovate or oval-elliptic; keel scarcely shorter than standard, arctuate. Probably Peruvian.—Offered in S Fla. The *E umbrosa* of the W. Indies is probably this species.



1420. Erythronium americanum. (×½)

flabellifórmis, Kearney. Shrub or small tree, to 10 ft.: sts velvety white when young, bearing stout curved prickles below the lf.-axils: lvs. canescent when young, usually prickly; lfts. firm, fan-shaped or deltoid-ovate, usually broader than long, rounded at apex: fls. bright scarlet, crowded in short terminal racemes, numerous, pedicels velvety-canescent; calyx campanulate, truncate, usually somewhat oblique, white-tomentose; standard exceeding the calyx, about 1½ in. long, linear-oblong, narrowed at both ends; wings and keel short: pod linear, torose; seeds oval, bright scarlet with whitish hilum. S. E. Ariz.—Offered in S. Calif.

E. arbòrea, Small (E herbacea var arborea, Chapm.). Shrub or small tree, to 20 ft., armed· lvs. with wire-like petiole and rachis; lfts deltoid or hastately 3-lobed. fls. scarlet in racemes 4–8 in. long: pod 3–5 in. long, constricted between the seeds. Fla. Likely to be planted.—*E bogoténse* appears in a European trade list of greenhouse plants.—*E constantiàna,* Mich. Tree, soft, the trunk thick and spiny. fls large, scarlet, in racemes. Eu.—*E. insígnis,* Tod. Tree, sparingly prickly: lfts. ovate, tomentose when young: fls. scarlet, in short and dense racemes. Origin unknown. Gt. 28. 988. —*E. vespertìlio,* Benth. Shrub, for a warm greenhouse. glabrous, branches prickly: lvs. not prickly; lfts broad-cuneate at base, 3 or 4 in. broad, usually 3-lobed, and the middle lobe of various shape and sometimes absent: fls. showy (red?) and many in racemes; standard ovate, recurved at top, nearly 1½ in. long, wings small, oblong: pod long, torulose, seeds few, large and red. Austral. G.Z., 30, p. 1. —*E. vìdrum,* Tod. Tree, prickly. lfts. rhombic-ovate, tomentose when young, terminal one long-stalked. fls. scarlet, in many-fld. short racemes, the standard obovate. Origin unknown.

L. H. B.

ERYTHROCHÆTE, or **ERYTHROCHÆTON:** *Lagunaria japonica.*

ERYTHRÒNIUM (from the Greek word for *red,* applied to the purple-rose European species). *Liliàceæ.* Dog's-Tooth Violet (although in no sense a violet) Adder's-Tongue. Small spring-flowering hardy scapose bulbous plants.

Erythroniums have bulbs standing erect and from oblong to linear in form, 2 radical lvs., which in most species are handsomely mottled. scape slender and leafless, producing from 1 to many nodding very attractive fls.; perianth of 6 similar divisions, usually recurved; stamens 6 and a single 3-lobed style: fr an oblong or obovoid more or less 3-angled loculicidal caps.—Handsome plants of the north temperate zone. One belongs to the Old World, 4 to E. N. Amer., 2 are found in the Rocky Mts., while in the cool woods and high mountains from N. Calif. to the British possessions the genus is represented by about 9 species and a number of well-marked varieties. The species are confused or variable. The first and perhaps second year from seed, the plants bear a single lf. and do not bloom. Some of the species spread in large patches, by means of underground stolons. The bulb is scaly outside but with a solid interior, being really a corm.

The erythroniums are most interesting spring flowers. They succeed in any light soil, particularly in partial shade. In common with all herbaceous perennials, especially those that produce bulbs or corms, they profit by a winter mulch of leaves or litter.—The western erythroniums are all plants of the cool woodlands, except a few that grow at such altitudes as to reach like conditions. They thrive best in shade, a thoroughly drained soil, moist and rich in mold, a surface covering of half rotten leaves tending to equalize conditions. Any good fibrous material, as fibrous peat, coconut fiber or spent tanbark, or even well-rotted sod, will answer the purpose to lighten the soil and give that abundance of mold they delight in. Pockets in shaded rockwork give ideal situations. They will thrive naturalized on cool wooded slopes; and where the drainage is good they will thrive in grass. The leaves ripen before the grass is cut and the effect is very good. Simply planted in boxes in a loose soil, rich in mold, and left year after year in a shaded spot, they sometimes give splendid bloom. *E. Hartwegii* flowers very early, and stands more heat and dryness than any other variety. *E. purpurascens* and *E. montanum,* from high altitudes, tend to throw up their growth very late, and are on that account rather difficult to cult. All of the western species are very satisfactory garden plants. —The propagation of *E Dens-Canis* and varieties, the eastern American species and *E. Hartwegii,* is by offsets. All of the other western species can be increased only by seeds. The eastern species should be planted at least 5 inches deep. When planting erythronium bulbs, cover with 2 inches of earth; as the bulbs themselves may be 2 inches long, this means that the holes should be 4 inches deep.

INDEX.

albidum, 3.
albiflorum, 10.
album, 6.
americanum, 2.
angustatum, 2.
Bolanderi, 10.
bracteatum, 2
californicum, 8.
citrinum, 12.
Dens-Canis, 1
giganteum, 6, 10.
grandiflorum, 6, 10.
Hartwegii, 9.
Hendersonii, 13.
Howellii, 15
Johnsonii, 10.
lanceolatum, 2.
longifolium, 1.
majus, 1.
mesachoreum, 4
minor, 6.
minus, 6.
montanum, 6, 11.
Nuttallianum, 6.
parviflorum, 7.
præcox, 10.
propullans, 5.
purpurascens, 14.
revolutum, 10.
robustum, 6.
sibiricum, 1
Watsonii, 10.

A. OLD-WORLD ERYTHRONIUMS. *Fls. always solitary, and without a crest near base of inner petals: lvs. handsomely mottled: offsets few.*

1. **Déns-Cànis,** Linn. St. 4–6 in. high: lvs. oval-acuminate, rounded at the base, blotched or patched with reddish brown: fls. drooping, rose-colored, rose-purple or lilac; segms. strongly reflexed, narrow, long-pointed. Cent Eu., Japan, in several forms. Gn. 76, p. 649.—Variations are white, rose-colored or flesh-colored. Var. **longifòlium,** Hort., varies in its narrower lvs. and larger fls; var. **màjus,** Hort, is apparently a form of this. Var. **sibíricum,** Hort., from the Altai Mts, is taller. The species thrives in a moist open garden soil, and exposed to the sun Often used in rock-gardens. Little known in American gardens.

AA. EAST-AMERICAN ERYTHRONIUMS.—*Fl. solitary, without a crest on inner petals: mostly producing offsets.*

2 **americànum,** Ker. COMMON ADDER'S-TONGUE. Fig 1420. Scape 6–10 in, from an ovoid bulb that produces offshoots· lvs. elliptic- or oblong-lanceolate, mottled with purple-brown and whitish: fls. yellow, the segms. recurved, the 3 inner ones auricled at base; stigmas united E Canada, to Fla and Ark, in rich low grounds, particularly in or near woods. Runs into many forms The following names belong with it: *E. lanceolàtum,* Pursh; *E. angustàtum,* Raf; *E. bracteàtum,* Boott.

3 **álbidum,** Nutt WHITE ADDER'S-TONGUE. Producing offshoots· lvs not mottled, narrow. fls pinkish white, yellow at base; segms recurved, not auricled; stigmas spreading. Ont and N. Y. to Minn. and Texas.

4. **mesachòreum,** Knerr. Without basal offshoots: lvs not mottled, narrowly oblong to linear-lanceolate: fls lavender, the segms not recurved, stigmas spreading, earlier than the last. Iowa to Kans and Mo.

5 **propúllans,** Gray. Bulb ovoid· offshoots arising from near middle of the st.: lvs small, green or slightly mottled. fls rose-colored, with yellow base; style slender and stigmas united S. Ont and Minn.

AAA. WEST-AMERICAN ERYTHRONIUMS.—*Fls 2–4, sometimes more (rarely only 1-fld)* —The lvs are richly mottled, except in *E grandiflorum* The corms do not produce offsets, except in *E. Hartwegii* Inner petals with auricles, except in *E. Howellii.* All except *E. purpurascens* have large and showy fls.

B. *Style 3-cleft*

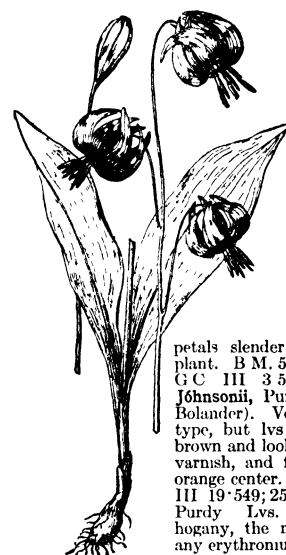
6 **grandifiòrum,** Pursh (*E gigantèum,* Lindl.). Scape 1–2 ft high. lvs broadly lanceolate, to 6 in long, acute and short-cuspidate, unmottled scape slender, 3–5-fld ; fls very bright yellow, petals recurved; anthers yellow E Ore to Brit Col Var. **álbum,** Hort. (*E. montànum,* Hort). Like the type, except the fls are white, yellowish at center, and with a slight greenish cast Var **minus,** Morr, is smaller.—*E grandiflorum* grows from very high mountains to (at one point) little above the sea-level In cult the high mountain form starts very late and is difficult to grow, while the sea-level form (var. **robústum,** Purdy) is an easy subject. In some localities the anthers are red, as in var. **Nuttallànum,** Purdy (*E. Nuttallànum,* Schult.), in others both red and yellow, but as a rule yellow. The so-called var. *mìnor* is small merely from less favorable situation. By some, the *E. giganteum,* Lindl., is kept distinct. G C III. 43.212. J H. III 58.397. G M. 53.359.

7. **parvifiòrum,** Goodd. The Cent. Rocky Mt. form of *E. grandiflorum.* scape 4–12. lvs. oblong, tapering both ways: fls. usually solitary, bright yellow, greenish in the bottom; segms. lanceolate-acuminate, about 1 in. long, strongly recurved; anthers pale yellow.—A subalpine species.

8. **californicum,** Purdy. Lvs. richly mottled: **fls.** few to as many as 16; petals revolute and broader, creamy to light yellow, deeper at the center and often marked maroon at base. In the Coast Ranges of Calif., San Francisco Bay to Humboldt Co.—In cult. the most satisfactory East The description of *E. revolutum* var. *Watsonii* in Cyclo. Amer. Hort., also covers *E. californicum.* G. 32:424

9. **Hártwegii,** Wats. Bulb-bearing offsets freely on filiform stolons from the base· lvs. mottled· fls. 1–6, mostly in a sessile umbel, large, light yellow-orange at center and white or cream-color above. Foothills of the Sierra Nevada Mts. in Calif G.C. III 20.361, 43·215.—The plant appears to have several scapes because the umbel is sessile but each fl is on a pedicel.

10 **revolùtum,** Smith Lvs 1–4, mottled in white and light brown· fls. nearly always 1 or 2, petals narrow and curved, style large and stout, filaments from subulate (awl-shaped) to deltoid, opening from white flushed with pink to pinkish purple, becoming purple. J H. III 35 523; 43: 268. Var. *Bolanderi* is not separable from the type. *Pink Beauty* is a soft pink form found in Humboldt County, Calif Var **albifiòrum,** Hort (var *Wàtsonii,* Purdy *E. gigantèum* var *albiflòrum,* Hort. *E grandiflòrum* var *albiflòrum,* Hook.) Fls pure white with a greenish cast, often banded maroon at base; petals slender; a very beautiful plant. B M. 5714 F S 20.2117. G C III 3 556; 15 621 Var. **Jóhnsonii,** Purdy (*E Jóhnsonii,* Bolander). Very similar to the type, but lvs mottled in dark brown and looking as if coated in varnish, and fls dark rose with orange center. Gn 51·136 G C. III 19·549; 25·253 Var **præcox,** Purdy Lvs. mottled in mahogany, the most beautifully of any erythronium. the fls, usually 2–4, are creamy white with orange center.



1421. Erythronium Hendersonii. (×½)

11. **montànum,** Wats. Scape slender, to 18 in, 1–3-fld . lvs not mottled, broad-lanceolate to nearly ovate, contracted into a winged petiole; perianth pure white, orange at base. On high mountains of Ore and Wash.—Very difficult to cult. as the bulbs start very late; one of the most beautiful.

BB. *Style not divided.*

12. **citrìnum,** Wats. Rather stout, to 10 in., 1–9-fld., the fls. close together and opening at about the same time: lvs. mottled, very broad-lanceolate, obtuse and short-apiculate, attenuate to a very short petiole: petals broad, strongly recurved, light yellow, orange at center, the tips becoming pink S. Ore. Gn M. 6:65.

13 **Héndersonii,** Wats. Fig. 1421. Slender, to 12 in., 1–3-fld.: lvs mottled in dark brown, lanceolate to oblong, obtuse and short-apiculate, narrowed to a short petiole. petals strongly recurved, pale purple, with a very dark purple, almost black, center. S. Ore G.F

1:317 (adapted in Fig 1421) G C III. 3·653; 15:623; 43:213. Gn. M. 6.65. Gn.W. 22.375. B M. 7017.

14 **purpurascens,** Wats. Lvs. undulate, not mottled but shaded in dark metallic tints. fls. small, spreading, crowded in a raceme, light yellow (almost white), center orange, becoming purplish Sierras —A very small-fld erythronium, with 1–8 fls. crowded together. This species grows at 5,000–7,000 ft altitude in the Sierras. While under some conditions it is low-growing, under other conditions it equals in size and height the most robust species At the lower altitudes of its habitat snow covers the ground until early May and this plant flowers shortly afterward; it remains very dry in summer and fall.

15 **Hŏwellii,** Wats Rather slender, to 18 in., 1–3-fld . lvs mottled, lanceolate to oblong-lanceolate, usually acute and short-apiculate: fls pale yellow with orange base, becoming pinkish S Ore —Of the Pacific coast erythroniums, this alone is destitute of the ear-shaped appendages at inner base of petal.

CARL PURDY and L. H. B

ERYTHRÓXYLON (Greek, *red wood;* true of some species). Written also *Erythróxylum Erythroxylàceæ.* COCA A genus famous for the coca plant, the leaves of which are of vast importance in medicine, yielding cocaine, grown slightly in the extreme south of Florida and California, and rarely cultivated under glass in the North for its economic interest

Erythroxylon comprises about 90 species of shrubs or small trees widely distributed in tropical and subtropical countries but most abundant in Trop Amer : lvs. alternate, entire, often coriaceous. fls small, whitish, on bracteolate pedicels, solitary or fascicled; sepals 5 (or 6), petals of same number, deciduous, appendaged on the inner face; stamens twice the number of petals, connate at base· fr. a 1-seeded drupe.

Cŏca, Lam Shrub, 5–6 ft high, with rusty brown, slender branches, on the extreme tips of which the lvs. are borne: below the lvs , on the wood of the preceding year, which is reddish, clusters of 3–5 yellow 5-lobed fls ¼in across spring from the protection of the small scales that line the branchlets, and which are colored like the bark· lvs oval, obovate or elliptical, differing in different cult strains or varieties, about 1½–2½ in. long and marked on the under side with 2 lines extending on either side of the midrib from base to apex Native country uncertain; the earliest described form, which happens to be Peruvian. was named by Lamarck *Erythroxylum Coca,* and figured in B M. 7334 The lvs of this form are about 2½ in. long, oblong-obovate, tapering to a short stalk, rounded at the apex, the midrib extending beyond into a short, sharp point. Coca is grown commercially on a large scale throughout S Amer , and also in Java and Ceylon. There are 2 leading commercial varieties, according to Kraemer,—the Bolivian or Huanco, and the Peruvian or Truxillo. The lvs. are picked when fully grown, and quickly dried in the sun. The shrub is said to require for its best development a very humid atmosphere and comparatively high elevation. Coca should not be confused with cocoa and cacao, which are discussed under Theobroma.

L. H. B.†

ESCALLÒNIA (named for Escallon, a Spanish traveler in South America). *Saxifragàceæ* Mainly evergreen shrubs or small trees, widely dispersed in South America, especially in the mountains.

Leaves alternate, glandular-serrate (rarely entire): fls strongly odorous, white or of a pink or red color, in terminal racemes or panicles, or axillary; calyx-lobes 5; petals 5; stamens 5; style simple, the stigma obscurely 4–5-lobed and peltate, or 2-lobed and reniform or peltate Noteworthy in the genus are the glands, stalked or not, which may occur almost anywhere on the plant Lvs often with resinous dots on one or both surfaces.—About 45 or 50 species, a number of which have been intro. in the S , and in Calif. They are of easy culture; rapid growers; and often artificially trained as vines. Several will probably prove half-hardy as far north as N. Y.



1422. Escallonia langleyensis

A. *Lvs. large, hairy, especially below, or in one variety glabrous but very shiny.*

pulverulénta, Pers. Shrub· lvs very thick, oval or elliptic, obtuse, serrate, rough-hairy below, with scattered hairs above: fls white, in long densely fld. terminal racemes; stigma distinctly 2-lobed, reniform fr a glandular-warty caps : branches hairy. Var **glàbra,** Engler. Differs from the species in being almost or quite glabrous. Handsomer than the type Not in cult in this country.

AA. *Lvs. glabrous or nearly so.*

B. *Fls. red or pink.*

rùbra, Pers var. **glabriúscula,** Hook. & Arn. (*E rùbra* of many authors) Dainty fld shrub, with numerous stalked glands lvs ovate, often deltoid-ovate, acute, finely and irregularly doubly-serrate, glabrous, with brown resinous dots below, rather small fls. red, tubular, borne in 2's or 3's (or rarely singly) on lateral pedicels, grouped near the ends of the branches; calyx densely glandular, petals long-clawed, stigma obscurely 5-lobed fr a top-shaped caps B M 2890.

macrántha, Hook & Arn. Shrub: lvs thickish, broadly ovate, acutish or obtuse, bluntly serrate, essentially glabrous: fls red, long-tubular, in a stocky, often branching, terminal raceme, calyx-lobes with marginal glands, stigma peltate, obscurely 5-lobed: fr. a glabrescent caps F S 6 632.—Excellent Var. **sanguínea** is a horticultural variety with fls more crimson.

organénsis, Gardn Half-hardy S , 2–5 ft , glabrous throughout· lvs thick, oblong, acutish, serrulate, with tiny resinous dots: fls pink, in close, terminal clusters. B.M. 4274.—Excellent Organ Mts , Brazil.

BB. *Fls. white, or, in E. langleyensis, rose-tinted.*

C. *Width of lvs. more than ½in.*

chlorophýlla, Cham. &. Schlecht. (*E. cándula,* Lem.). Shrub, to 3 ft.: lvs oblong-ovate or obovate, obtuse, apiculate, or more rarely acute, with a few blunt teeth on upper part, or wholly entire· fls white, in a terminal, many-fld panicle. J.F. 403

montevidénsis, DC. (*E floribúnda,* Reichb. *E floribúnda,* HBK. var. *montevidénsis,* Cham. & Schlecht). Shrub, to 9 ft · lvs thick, elliptic, obtuse, finely serrate, glabrous, shiny above: fls white, in a terminal, many-fld. panicle; petals clawed; stigma obscurely 4–5-lobed: fr a top-shaped caps., crowned by the obviously longer style G 25:576; 27:465

floribúnda, HBK Shrub· lvs oblong-ovate, obtuse, very minutely crenulate-serrate or entire, glabrous or nearly so: fls. white, in many-fld , compound, axillary or terminal panicles; petals clawed; stigma peltate, 2-lobed: fr a caps., crowned by the equal or barely longer style G C III. 47.53.

cc. *Width of lvs not over ½in*

leucántha, Remy. Densely lvd shrub: lvs. obovate, obtuse or nearly so, finely serrate, at least on upper part, glabrous, small: fls. white, in very dense racemes; petals spatulate, clawed. fr an obovate caps.

virgàta, Pers (*E. Philippiàna,* Mast *E. virgàta* var. *Philippiàna,* Engler. *E. stricta,* Gay). Densely lvd. shrub, half-hardy south of Washington lvs. stiff, lanceolate or obovate, obtuse to acute, tapering at base, with minute rather distant teeth on upper part, glabrous or nearly so, small: fls white, axillary, scattered, or sometimes massed near the tips of the branchlets, petals spreading, scarcely if at all clawed. fr a globose caps. G 27, p. 464 Gn 66, p 64.

langleyénsis, Vilm. & Bois. Fig. 1422 A graceful shrub (artificial hybrid of *E. macrantha* and *E virgata*): lvs. linear-ovate, obtuse or acutish, minutely serrulate, small, in short racemes at the ends of the branchlets.

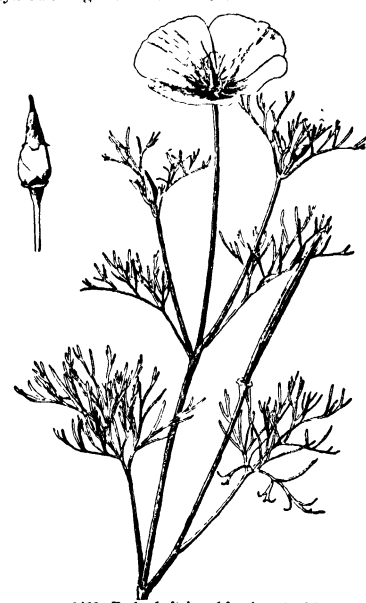
E dlba, a name found in some of the catalogues, is not determinable —*E pèndula,* Pers Shrub with red fls , in narrow racemes to more than 1 ft. long, and lvs resembling those of tobacco Desirable —*E rósea* An unidentified catalogue name which in at least one instance, certainly does not refer to E rosea, Griseb , a very little known species.

ALBERT HANFORD MOORE.

ESCHSCHÒLTZIA (J F Eschscholtz, of Kotzebue's scientific expedition) *Papaverdceæ* Brilliant and popular garden flowers

Low, pale or glaucous herbs, annual or perennial, with ternately dissected alternate lvs , and large, showy yellow or whitish long-peduncled fls · sepals 2, petals 4, stamens numerous, stigmas 4–6 caps long and slender like a silique, 1-loculed, elastically dehiscent at the instant it separates from the receptacle The calyx forms a hood which is pushed off over the bud as the petals expand (see detail at the left in Fig 1423) The torus or receptacle (from which the caps arises) is prominently hollowed and surrounds the base of the pistil —Few genera have been more diversely interpreted as to the limits of species Gray accepted about a dozen species, and something like this view of the genus is commonly held Greene, however, in Pittonia, V (1905) recognized 112 species and separated one of the described species under the new genus Petromecon Fedde in Engler's Pflanzenreich, hft 40 (1909), separates 123 species These many species are segregated largely from the multifarious group to which the name *E californica* has been applied On this treatment Jepson writes "This species is highly variable, especially so in trivial details of leaf-segmentation and of shape of calyptra and in habit It is also variable in the size and color of petals and so runs into an extensive concourse of forms, many of which seem obviously seasonal or due to soil or moisture conditions Some of these highly marked plants in the Sacramento Valley have two seasonally dimorphic forms, an erect vernal flowering form with very large golden corolla and huge torus rim, and an autumnal flowering form with small straw-yellow corolla and reduced or no torus rim It has been found impossible thus far, after several trials, to reproduce this sequence in cultivation on the coast The flower is not like either the vernal or autumnal form but approximates the coast form. A large number of the wild forms have been collected but probably only a small proportion of those in existence. Yet the number of specimens distributed to herbaria has been sufficient to form the basis for nearly 100 new species. It does not seem hopeful that the solving of the problem of *Eschscholtzia californica* in just this way will lead either to permanent results or afford a satisfactory basis for the kind of work most needed, namely the prosecution of combined field and cultural studies." Studies of growing plants under conditions of observation and control, both of wild and horticultural material, are awaited. Where the abundant garden material falls, in the segregations, is yet unknown. The cult forms are derived from the old *E californica,* and *E tenuifolia* appears also to be in the trade. Eschscholtzia is a genus of W. N. Amer., ranging both on the coast and in the interior valleys, and in the Sierras It occurs from Low. Calif. to the valley of the Columbia River, in New Mex , Ariz , Nev , Utah. It has run wild in parts of Cent. Eu.

califórnica, Cham. CALIFORNIA POPPY Fig. 1423. Perennial, but cult as an annual, 10–24 in high, forming mats. lvs. long-petioled and divided into linear parts, those on the sts smaller and shorter-petioled. fl. saucer-shaped, opening in sunshine, 2–3 in across, yellow or orange or cream-colored pod 3–4 in long, strong-ribbed torus large and funnel-shaped Calif and Ore , mostly along the coast —One of the most popular garden fls It is treated as a hardy annual, the seeds being sown where the plants are to stand, and they should be sown very early. It stands considerable cold, and blooms after the first frosts If well protected, plants of one season's growth will pass the winter and give some bloom the following spring. It sometimes self-sows Very attractive as an edging, because of its interesting bluish foliage There are double-fld forms. Very variable, and cult under a variety of names, as *C maritima,* Hort. (not Greene), *C vària,* Hort. (trade name for mixed varieties), *C. aurantiaca,* Hort., *C álba,* Hort , *C Thórburnii,* Hort In color forms are offered yellow, golden yellow, white, rose-white, carmine, rose Var **crócea,** Hort (*E crócea,* Benth) Fls deep orange torus very widely expanded calyx-bud long-attenuate B R 1677 B M 3495 Var.



1423. Eschscholtzia californica. (×½)

Doùglasii, Gray (*E. Doùglasii,* Benth.). Rather more slender, and blooms earlier fls. pure yellow: torus rim narrow.

tenuifòlia, Hook Lower, with narrow lvs. in a radical tuft, the long divisions being almost capillary: fls. small (1 in. across), light yellow, overtopping the lvs : torus less prominent. seeds muricate. Foothills of the Sierra Nevadas. B.M. 4812.

L. H. B.

ESCÓNTRIA (named for Señor Don Blas Escontria, of Mexico). *Cactàceæ*. Large, much-branched cacti. Ribs few: areoles narrow, bearing pectinate clusters of spines: fls. small, yellow, diurnal: fr. and ovary covered with chartaceous, translucent, persistent scales, without hairs or spines; fr. fleshy, edible; seeds black. For cult., see *Succulents*.

chiotilla, Rose (*Cerèus chiotilla*, Web.). Sixteen ft or more high: ribs mostly 7: radial spines 10–15; central 1–2, the upper one 2 in long, curved downward: fr. 1 in. diam. Mex.—Rare in cult. J N ROSE.

ESPALIER, a trellis or open support on which a tree or woody plant is trained in formal shape and to a given number of branches, usually in a vertical plane; and also the plant so trained. Apple trees and others are often trained as espaliers in Europe, the tree may be transplanted and subsequently attached against a wall or building, or it may be kept permanently on the trellis or open support. Sometimes espalier-training is employed only when the tree or bush is young, for the purpose of bringing it into shape and to prepare it for a wall or other support. Trees are trained on espaliers also to give them full exposure to the sun on all sides, to regulate the fruit-bearing and to provide easy means of controlling insects and diseases. Espalier-training is most frequent in cool and cloudy regions, in those in which space must be utilized to the utmost, and where hand-skill is obtainable or is relatively cheap.

There are many forms of training. The plant may be trained to a single shoot, or to two shoots lying in opposite directions, mostly horizontal, in which case it is called a cordon; or the top may be spread fan-shaped on the trellis, or in other forms, and it may then be called an espalier. The training is begun when the plant is very young—perhaps only a year or two from the graft or bud—and before it has produced a stiff trunk and unmanageable head. Usually the branching is started within a foot or so of the ground by heading back the main stem; and as many shoots as may be desired on the trellis are allowed to grow. These shoots are tied to the trellis or posts as they grow, and the side shoots are pinched out except such as are desired for further arms in the framework or for fruit-spurs. The trellises themselves may be of wire strung on posts, or the tree may be tied from post to post or stake to stake set close together. Espaliers are little used in this country, and then only in small gardens, and mostly when a trained gardener is employed. L. H. B.

ÉSULA: *Euphorbia*. The *E cristata* of the trade is probably the cristate form of *Euphorbia lactea* or similar species.

ETHERIZATION OF PLANTS. Etherization, as applied to plants, means strictly the forcing of a dormant plant into growth by subjecting the plant to ether vapors at certain concentrations in a closed chamber for a definite period of time, usually twenty-four to seventy-two hours. The plant after such treatment is placed under environmental conditions favorable for growth. Since in practice the use of chloroform is similar in its application and effects, it will be discussed here. The general nature of etherization was first noted by Johannsen in 1890, and following his investigation a wide stimulus was given to the commercial forcing of flowering shrubs. For other methods of forcing a dormant plant, see *Rest-period*.

Before discussing the method of etherization, its effects and application, it is necessary first to have some idea of what is meant by the term rest-period or the condition of dormancy.

Rest-period.

Perennial plants, especially those in the temperate regions, in general have a season of growth and active metabolism followed by a period of quiescence as regards any outward manifestations of metabolism. During this period, not all of the vital processes are at a standstill and changes in the reserve food may be in progress, but the plant appears to be at rest and is dormant. The rest-period begins with the advent of the unfavorable growth conditions of the autumn, and normally continues until the favorable conditions of the spring.

One might reasonably assume that growing perennial plants removed from out-of-doors at the approach of autumn conditions to a greenhouse, would continue growth and not pass into the rest condition. One might assume, also, that if a plant in a dormant condition be brought into favorable conditions it would resume growth immediately. But experience and investigations show that many plants will not immediately continue growth, and, provided they do continue growth, it is at a slower rate. Dormant plants, that is those in the rest-period, may require considerable time before resuming growth. There are some plants that during dormancy respond quickly when brought into the greenhouse; there are others that remain dormant despite the most favorable environmental conditions. The rest-period in various species of Acer (maple), of Quercus (oak), of Fraxinus (ash), and of *Fagus sylvatica*, as well as other plants, is so well fixed as to make it almost impossible to force the dormant plants into growth by warmth and moisture alone. Special treatment is necessary, such as etherization. There are other plants in which the rest-period is not well established. These quickly respond to favorable growth conditions normally prevailing in a greenhouse. In many plants this rest-period has attained an almost habit-like character. The following table with data taken from results secured by Howard with branches brought into the greenhouse at Halle, Germany, is instructive:

GROWTH RESPONSE OF BRANCHES WHEN BROUGHT INTO GREENHOUSE.

Species	Collected Oct 20–Nov. 4, 1905 No of days for beginning of growth	Collected Jan 8–10, 1906 No of days for beginning of growth
Acer negundo var versicolor	63	20
Acer pseudoplatanus. .	0*	0
Azalea mollis .	26	0
Æsculus Hippocastanum	0	20
Betula nigra	62	12
Berberis vulgaris	10	3
Celastrus scandens. . . .	0	17
Cercis canadensis . . .	0	10
Cydonia japonica	6	7
Deutzia gracilis. . . .	10	3
Fagus sylvatica	0	38
Lonicera tatarica	7	3
Magnolia acuminata. . . .	29	25
Populus canadensis	61	20
Quercus macrocarpa. . . .	59	0
Spiræa sorbifolia. . .	1	

*0=No growth

In the investigation made by Howard, 234 species were collected from October 20 to November 4, and of these only 125 grew; and of the 125, only 18 per cent began growth within a period of nine days. Between January 8 to 10, another collection was made including practically all the species of the first lot and others in addition, so that the number totaled 283 species. Of this number 244 grew, of which 50 per cent began growth within the first nine days. The species that did not grow when brought into the greenhouse January 8 to 10 made growth when brought into the greenhouse on February 26. From these and the results of other experiments the conclusion is drawn that plants in general tend to pass out of the rest condition as the

season advances toward the spring. Dormancy is less stable in January than in November. This condition holds true not only for woody plants but also for bulbs and other herbaceous plants.

Method of breaking the rest-period.

The one method which has been largely employed for forcing dormant plants into growth is the etherization method. An air-tight chamber is provided, the size depending on the quantity or size of the material to be treated. The plants being placed in the chamber, it is tightly sealed except for a small opening through which ether may be introduced. Usually just below this opening is placed a sponge on which the ether is poured and then the opening is again sealed. If one desires to etherize a few bulbs, a wide-mouth bottle of two quarts capacity may be employed and the ether added in a small vial and the bottle then tightly stoppered. Special etherizing chambers are described for commercial work. The main desideratum is to have a chamber that will not permit of leakage of the ether vapor. The stopper must be securely fastened or weighted down.

Quantity of ether.—The quantity of ether best employed in forcing plants may vary with the nature of the plant, the season of the year, and the temperature of the etherization chamber. In general, the quantity to be added varies from 5 to 15 cubic centimeters per cubic foot of space (10 cubic centimeters equal about one-third fluid ounce). Early in the rest-period at 60° F., one should use about 15 cubic centimeters per cubic foot of space In the middle of the rest-period, one should employ less and the amount should be further decreased toward the end of the rest-period. If the relative humidity of the chamber is high, a slight increase in the quantity of ether may be made. If chloroform is used, the quantity should be one-fourth to one-third of the quantity of ether recommended. The following figures are from Stuart:

TREATMENT RECOMMENDED FOR PLANTS AT DIFFERENT SEASONS

Cubic centimeters per cubic foot

	Ether		Chloroform	
	Cc used	Exposure hours.	Cc used	Exposure hours.
Lilac—				
October	15	48–24–24	4	48–24–24
November	12	48–24–24	3 ½	48–24–24
December	10	48–24–24	3	48–24–24
January				
Astilbe—				
October	15	48–24–48	4	48–24–48
November	15	48–24–24		48–24–24
December	12	48–24–24		48–24–24
January	10	48	3	48

Time of exposure.—The time of exposure is also variable, being of greater duration in the early part and shorter in the latter part of the rest-period. In the early rest-period, a long exposure is given, varying from forty-eight to seventy-two hours to even as much as ninety-six hours. In case of long exposure, the practice is usually followed of making a forty-eight-hour exposure, after which the plant is removed from the etherization chamber for a day and then re-etherized for another twenty-four-hour period. Toward the middle and late rest-period, the time of exposure may be shortened as well as the quantity of ether.

The results.

The effect of etherization is to shorten the rest-period of the plant. Etherized plants come into bloom earlier and may be forced at lower temperature than unetherized plants. Howard found that seventy species of woody plants collected December 17 to 24 and etherized for forty-eight hours, opened their buds fully in an average of 20 3 days, while the untreated plants required an average of 28 1 days for the same development. Many experiments have been made with lilacs. Jannvek states that lilacs etherized August 24 were in bloom September 18.

The following table compiled from results secured by Stuart show conclusively the value of etherization with lilacs:

INFLUENCE OF ETHER AND CHLOROFORM ON LILACS

Date of treatment	Substance employed	Dosage cc per cubic foot	Expos hours	Full bloom in days	
				Charles X	Marie Legraye
Nov. 18–22	None			51	30 5
Nov 18–22	Ether	12	48	31	29 5
Nov. 18–22	Chloroform	3 6	48	31	28 5
Dec. 17–21	None			31	29 5
Dec. 17–21	Ether	15	48	31	29 5

In the foregoing table it is noted that treatment in the middle of December resulted in no beneficial effect. The plants at the time were in the middle rest-period, when growth-response requires no strong stimulation outside of normal growth conditions.

In general it may be stated that lilacs if etherized before December 1 will respond markedly to the influence of etherization. General results show that etherized lilacs blossom in seventeen to twenty-five days. The saving in time may be eight to twenty days

Favorable results have been secured with flowering shrubs. Positive results have been reported frequently for *Azalea mollis*, for Viburnum and Astilbe. Negative or slight results have been reported for *Deutzia gracilis*, *Prunus triloba*, roses, and *Spiræa prunifolia*. Similar results have been reported for lily-of-the-valley.

The method of action of the ether is not understood and any discussion of the subject is yet hypothetical.

Etherization of bulbs.

On the forcing of bulbs the evidence is unsatisfactory. At the Cornell Station, positive results were reported (see Bailey, "Cyclopedia of Agriculture," Vol. II: 29), but more recently Stuart has reinvestigated the forcing of bulbs and finds conflicting results. He states that the etherization of bulbs is not commercially practicable Some unpublished data on the etherization of bulbs at the Cornell Station sustain this conclusion. Theoretically, those results are to be expected because the bulbs in practice are gathered in the late spring or early summer and then stored for months. After planting, the bulb is allowed to remain in a cold-frame for several months so that when brought into forcing conditions it is well over the rest-period and, indeed, has probably passed through its period by the time it is first planted.

Effect on rhubarb.—Some positive results have been secured at the Vermont Agricultural Experiment Station with etherization of rhubarb. Different lots of rhubarb were etherized on December 9, January 9 and February 24. The first gave an increase over the control of 34.4 per cent, the second 89.7 per cent and the third 5 7 per cent.

General conclusions.—Certain general rules may be applied to the practice of etherization:

1. Etherization shortens the rest-period.
2. The more resistant a dormant plant is in growth-response to favorable environmental conditions, the greater will be the advantage of etherization.
3. Etherization becomes of less value as the end of the rest-period is approached.

4. It is wasted effort to etherize a plant that readily responds in growth to the normally favorable growth condition.

Bibliography.—Howard, W. L., "Winter Rest-Period in Plants" Missouri Experiment Station, Research Bulletin No. 1 (1910) Johannsen, W., "Das Aetherverfahren beim Fruhtreiben mit besonderer Berucksichtigung der Fliedertreiberei." Jena, 1900 Zweite wesentlich erweiterte Auflage. Jena, 1906. Stuart, W., "The Rôle of Anesthetics and Other Agents in Plant-Forcing," Vermont Experiment Station, Bulletin No. 150 (1910). LEWIS KNUDSON.

ETROG. This name is applied by the Jews to a citron (*Citrus Medica*, Linn), which is imported and used by them for religious ceremonies connected with the Feast of the Tabernacles. The etrog and the lulab (palm leaf with myrtle and willow branches) are carried and waved during the services, especially those of thanksgiving Since the time of the anti Jewish demonstrations in Corfu in 1891, the etrog is imported more largely from Palestine than from that island In addition to the use of the etrog by orthodox Jews for religious ceremonials, the natives of Palestine make salads of the fruit See *Citron*

WALTER T. SWINGLE.

EUCALYPTUS (Greek, *eu*, well, *kalypto*, to cover as with a lid: the petals and usually also the calyx-limb fused and covering the flower before anthesis, then falling off in the form of a lid, or cover). *Myrtàceæ.* GUM-TREE. Plate XXXIX. Mostly trees, frequently of immense size, a few of the alpine and sub-alpine species shrubby, much grown in California and the Southwest for their ornamental value, as windbreaks and avenue trees, for fuel, and especially for their timber.

Leaves simple, entire; in the seedlings and on young shoots of many species horizontal, opposite, sessile, and cordate, in the adult mostly vertical, alternate, petiolate (rarely opposite and sessile), and varying from roundish to lanceolate-acuminate and falcate, always rigid, penninerved, glabrous except rarely on the young shoots, sometimes covered with a glaucous wax: fls. white, rarely yellowish or some shade of red, in umbels of 3 to many, rarely solitary, the umbels solitary and axillary or paniculate or corymbose; calyx-tube obconical, campanulate, ovoid, or oblong, adnate to the ovary at the base; petals and calyx-lobes connate, forming a lid, or cap, which separates from the calyx-tube by a circumscissile dehiscence; lid sometimes plainly double, the outer cap then derived from the calyx-limb, the inner cap from the petals; stamens numerous; anthers small; style undivided. fr a caps. partially or wholly inclosed in the adherent calyx-tube, opening at the top by 3–6 valves; seeds numerous, small, mostly angular.—About 300 species, all native of Austral and the Malayan region. Related to Angophora and to Syncarpia, but distinguished by the absence of distinct petals.

The genus Eucalyptus was monographed in part by Baron von Mueller in his Eucalyptographia (cited here as F. v. M. Eucal.), in which 100 species are illustrated (1879–84). The genus is now receiving exhaustive treatment by J. H. Maiden in his "Critical Revision of the Genus Eucalyptus," appearing in parts, with numerous plates. This author also furnishes the best information regarding the uses and timber of the various species, in his "Native Useful Plants of Australia" Bentham described 135 species in his "Flora Australiensis," vol. 3 (1866). The Australasian Association for the Advancement of Science published a very useful key by J G. Luehmann in 1898. The most exhaustive American work on the genus is United States Forestry Bulletin No. 35, "Eucalypts Cultivated in the United States," by A. J. McClatchie. University of California Agricultural Experiment Station Bulletin No. 196, by Norman D. Ingham, is a practical guide for planters, with descriptions of the more important species. The United States Forest Service, the California Station, and the California State Board of Forestry have all issued smaller bulletins on this subject. Inflated claims have been made for eucalyptus culture, and authentic publications should be secured if one contemplates planting them extensively.

Eucalyptus is a group adapted to semi-tropical and warm temperate regions But few species are really hardy *E. globulus* has been very widely distributed over the globe through the persevering efforts of the late Baron von Mueller; it is frequently planted in the malarial regions of warm climates, as at the Campagna at Rome, with very beneficial effect. (Sanitarians will be interested in "Eucalyptus in Algeria and Tunisia, from an Hygienic and Climatological Point of View," by Edward Pepper, Proc. Amer. Phil Soc. 35·39–56.) In England, the same species is grown extensively for subtropical gardening, on account of its distinctive glaucous hue and symmetrical growth, but in that climate it needs the protection of glass in winter.

This is by far the most important genus of timber trees introduced into California. The ordinary blue-gum, *E. globulus*, has been grown in large numbers and is still the favorite for general planting. Its hard and durable wood is replacing oak and hickory to some extent for insulator pins, wheel-wrights' work, flooring, tool-handles, and furniture Although pale in color, it takes a good polish, possesses a beautiful grain, and is readily stained Furniture made from blue-gum wood and properly stained has every appearance of mahogany The chief drawback to the use of eucalyptus for lumber is the tendency of its logs to end-check while curing, thus involving considerable waste As a windbreak and fuel tree it is unsurpassed, since it is of rapid, erect growth and the timber is easily split Its foliage has been distilled in large quantities for the oil it contains, practically all of the eucalyptus oil now sold in the United States coming from home-grown trees.

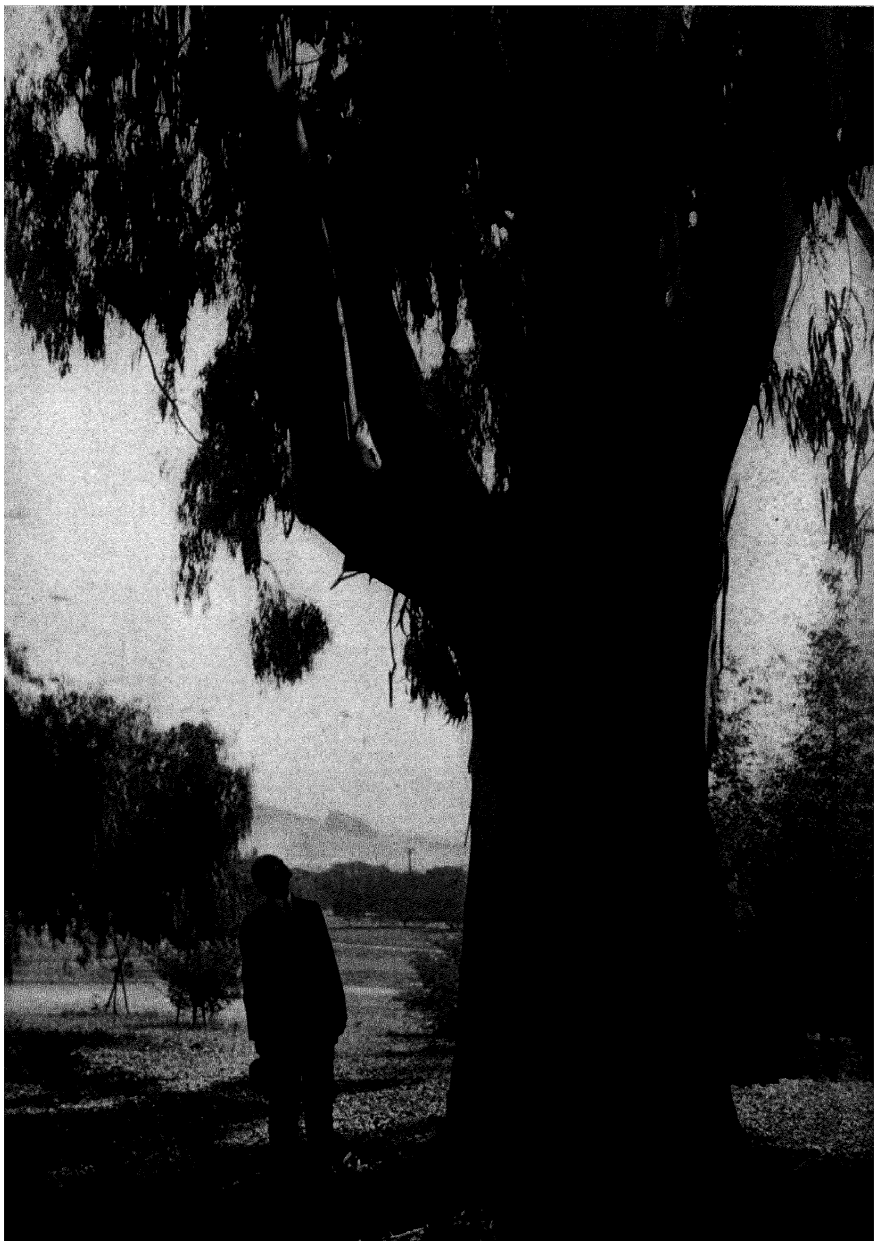
In addition to the blue-gum, *E. rostrata* and especially *E teretícornis* are grown for railroad ties, piling, interior finish and furniture. *E. resinifera* is a hardy eucalypt yielding a good timber not so liable to check as that of some others; it has been but little grown in America thus far *E. corynocalyx* is a good drought-resistant species for districts with mild winters, and its wood is of the best *E crebra* will grow under a greater range of conditions than perhaps any other and is especially suited to the hot and dry interior valleys. Other drought-resistant eucalypts are *E microtheca* and *E polyanthemos*, while the most resistant to frost are *E. crebra, E rostrata, E. teretícornis, E globulus, E. viminalis, E rudis, E. robusta*, and *E. resinifera*. The species most cultivated as ornamentals are *E. ficifolia, E. leucoxylon, E. sideroxylon* var. *rosea, E. Risdoni, E. erythronema* and *E polyanthemos*. Persistently repeated accounts of heights ranging from 325 to 500 feet for certain eucalypts are erroneous, as indicated under *E. amygdalina* var. *regnans*

Although the eucalypti are not exclusively, and some species not even prominently horticultural, yet because of the great general interest attached to them and because of their varied uses, it is thought best to discuss them rather fully in this Cyclopedia.

Culture of eucalyptus in California.

The following directions for the propagation of Eucalyptus are adapted very largely from Bulletin No. 196 of the California Experiment Station, entitled "Eucalyptus in California," by Norman D. Ingham (1908).

The necessary conveniences for the propagation of



XXXIX. Eucalyptus viminalis in California.

the seedlings are: seed-boxes or flats, a good soil, seed true to name, plenty of convenient water, and in most localities shade for the young plants. The seeds of most species may be gathered at all times of the year, although the greater amount mature during the summer and fall. The seed-cases should be gathered from the trees when the valves begin to open and placed on sheets of canvas in the direct rays of the sun, which will open the valves, allowing the seed and chaff to fall out. The number of fertile seed to the pound is very high, the average number of transplanted plants raised to the pound is 12,000 Eucalyptus seed will germinate and grow in nearly any soil but the best results are secured when the seeds are sown in a light loam, while a medium loam mixed with about one-quarter well-rotted horse-manure should be used in the transplanting flats

The time to sow the seed varies somewhat with the locality, but as a general rule the seed should be sown in May or June and the seedlings from these sowings will be large enough to be set out in the field the following spring, if they receive proper care while young. The seed is usually sown broadcast in the seed-flats



1424. Eucalpytus ficifolia (×⅓) No 2

and the young plants transplanted once before being set in the field. Some persons take the trouble to sow one seed in a place and space them in the flats, by this method transplanting is unnecessary. Others sow the seeds in hills and practise thinning, instead of transplanting before setting out in the field This last method is used in the warmer districts with good success, because of the great trouble experienced in transplanting during the hot summer months. Whichever method is used, fill the flats to a depth of 3 or 4 inches with the prepared soil, pressing it down firmly in the boxes, then sow the seeds and cover them to a depth of about ⅛ inch with the same soil, sand, or sawdust, pressing this covering firmly over them. The seed-flats should be kept damp through the heat of the day, until the young plants break the ground, then care must be taken not to use too much water and that there is a good circulation of air over the flats, or damping-off is liable to occur. This disease can be prevented by using practically no water on cloudy days and only in the mornings on clear days. If the seeds are sown broadcast in the flats, when the young plants have reached a height of 2 to 3 inches, they can be transplanted to other flats of prepared soil and spaced from 1¼ to 2 inches apart. The best results in transplanting are secured if the plants are hardened-off for a few days beforehand by checking the water supply, allowing them to become quite dry. The soil into which the young plants are tranplanted should be kept damp, and the plants should be protected from the direct rays of the sun for a few days. The lath-house or the screens are necessary to supply shade for the young plants and will also protect the seeds in flats from the ravages of birds and the young plants from the frosts during winter months, before the time for setting in the field.

The time to set the plants in the field varies with the climatic conditions or localities and whether the plants are to receive irrigation or not. In localities in which frosts are common through the winter months, it is advisable to set the trees out as early in the spring as possible without endangering them to a late frost and still have them receive the benefit of the late rains, so that they will have a full season's growth to withstand the frosts of the following winter If the trees are to be irrigated, they may be set out later in the season without danger of loss from want of moisture. To insure a good stand, the plants should not be under 6 or over 20 inches in height when set in the field; to a certain extent, the smaller the plants when set out, the better the results afterward, although the size varies somewhat with the species and the locality. In many species the roots are as long if not longer than the plant's own height above ground. This is a family of plants that will not stand a large amount of mutilation to the root-system; consequently better results are secured from setting out small plants.

If the soil is heavy rich loam, the trees may be planted as close as 6 by 6 feet apart unless irrigation is to be practised. In the latter case, 4 by 8 feet would be the right distance, thus leaving an 8-foot space for plowing out the irrigating-ditches each year. If it is a lighter soil on which the planting is to be made, 8 by 8 feet is the proper distance, or 6 by 10 feet, if irrigation is to be practised The close planting has a tendency to sacrifice the diameter growth in favor of the height, also making more erect trees and forming a perfect canopy with their crowns that will shade the soil, nearly preventing evaporation, as well as any vegetable growth on the forest floor Close planting matures a greater number of perfect trees, and is especially recommended when straight poles are desired The plants should be blocked out in the flats before being brought into the field, by drawing a sharp knife between the rows If care is taken to set out the young plants with this small amount of soil around the rootlets, the shock caused in transplanting is reduced to a minimum. Each planter should carry a trowel, to make the holes that are to receive the young plants at the intersection of the marked lines These holes should be of such a depth that the plants can be set from ½ to 1 inch lower in the soil than they originally were in the flats. Each plant should have the soil pressed firmly about it and receive a small amount of water, unless the soil is moist from recent rains

In order to provide a mulch, thus checking evaporation and also to kill the weeds, cultivation should be conducted in the new plantation as long as possible without danger of injuring the young trees by driving a horse between them The plantings generally may be cultivated for the first season and part of the second before the limbs of the trees spread out and interlap so that it is impossible to drive between the rows. It is an acknowledged fact that the only way to secure a good stand, and give the trees a start, is to cultivate and take care of the plantings from the time of setting out. However, a number of groves have been set out on land that is too hilly or rocky to cultivate and the trees have made fair growths.

Thinning of the young trees is an important practice, as it is not good management to set out just the number of trees that one expects to mature. A planting upon any good soil may with advantage be set out 6 by 6 feet apart (1,210 trees to the acre), and at the end of the first year a rigid thinning should be started, removing with a grub-hoe all weak, inferior, or injured trees. This thinning should be conducted until only the strong and healthy trees, or a certain number

remain to the acre. By this method some trees will stand at the original distance that they were planted, while others will stand at multiples of that distance. The extra cost of close planting will never be noticed when the largest possible stand of healthy trees is guaranteed, which is practically the case under this method. If thinning is carried out by a set plan, removing every other one or two trees, many strong and healthy trees will be sacrificed. All limbs that have a tendency to deform the trees should be removed each year. After the third or fourth year, the trees will have grown to such a height that to remove the limbs may prove impractical in most cases. At this period (the fourth or fifth year) there enters a new problem: the removal of the poorer trees for wood and stakes to allow the remainder a larger area of soil to draw upon and a greater space above ground to extend their branches. At this time the trees on an acre can be reduced to a certain number, leaving these to grow for telephone poles, ties, and lumber, or the entire grove may be cut for stakes and wood

Second-growth eucalyptus. — In three to six weeks after the trees have been felled, the sprouts will start out from the stumps. These sprouts are produced in abundance and if properly thinned will soon replace the cut forest, thus providing a second growth of fuel or timber in much less time than was required with the original grove. These remarks apply probably to all species of eucalyptus, certainly to all sorts experimented with in California up to the present time.

Taxonomy of the cultivated eucalypti.

All of the keys used for the identification of species are more or less artificial No satisfactory natural classification has yet been devised While the following key is designed to aid in the making of determinations rather than to express relationships, species known to be closely related are placed near each other in the text so far as this can be conveniently done. For the ready determination of species in this critical genus, it is necessary to have adult leaves, buds, flowers, and mature fruit; immature fruits are often very misleading Allowance should always be made for extreme forms, since only normal specimens are here described. This applies particularly to size of leaves. Unless otherwise stated, the leaf description is drawn from foliage on mature stems. The juvenile foliage, i.e , on young seedlings and on suckers, is usually very different, the leaves often broader, blunt, sessile, and of a different color.

INDEX.

acervula, 67.
acmenioides, 39.
albens, 16
alpina, 19
amplifolia, 65
amygdalina, 55.
Andreana, 55.
angulosa, 46
angustifolia, 55.
Baileyana, 72.
bicolor, 15
botryoides, 34.
buprestium, 61.
cajuputea, 69.
calophylla, 1
Cambagei, 33.
citriodora, 5.
coccifera, 28.
collosea, 62
compacta, 18.
conoidea, 73.
cordata, 22
cornices, 59.
cornuta, 24, 25.
corymbosa, 3.
corynocalyx, 60.
cosmophylla, 21.
crebra, 13.
decipiens, 51.
diversicolor, 62.
doratoxylon, 70.
drepanophylla, 14.
erythronema, 73.
eugenioides, 45.
eximia, 4.
ficifolia, 2
fissilis, 57
floribunda, 71
globulus, 18.
gomphocephala, 49
goniocalyx, 32
gracilipes, 74
grandiflora, 43.
Gunnii, 67.
hemastoma, 30
hemiphloia, 16.
incrassata, 46
largiflorens, 15.
Lehmannii, 25.
leptophleba, 14.
leucoxylon, 74, 75.
linearis, 55.
longifolia, 76.
Macarthuri, 54.
macrocarpa, 17.
macrocera, 25.
macrorhyncha, 66.
maculata, 5.
marginata, 71.
megacarpa, 48.
melanophloia, 8.
melliodora, 68
microcorys, 40.
microtheca, 12.
montana, 67.
Muelleriana, 38.
numerosa, 55.
obcordata, 26
obliqua, 57
obtusiflora, 29.
occidentalis, 27.
odorata, 69
pallens, 75
paniculata, 10.
pauciflora, 59
pilularis, 37, 39.
piperita, 44.
Planchoniana, 47.
platypus, 26.
polyanthemos, 6.
populifolia, 7.
pulverulenta, 23.
punctata, 41
purpurea, 74
Raveretiana, 11.
redunca, 36
regnans, 55.
resinifera, 43.
Risdonii, 56.
robusta, 35.
rosea, 75.
rostrata, 64.
rudis, 50.

INDEX, CONTINUED.

saligna, 42.
salmonophloia, 63.
siderophloia, 9.
siderоxylon, 75.
Sieberiana, 31.
stellulata, 58.
stricta, 29.
Stuartiana, 53
symphiocarpa, 25.
tereticornis, 65.
tetraptera, 20.
triantha, 39
undulata, 67.
viminalis, 52.
virgata, 29.

KEY TO THE SPECIES.

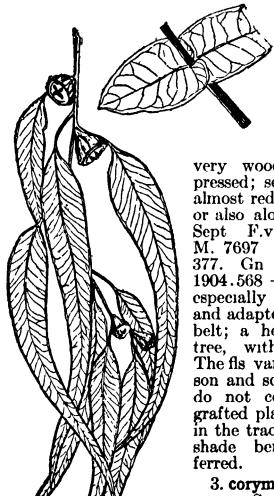
A. *Fls mostly in panicles or corymbs, not simple umbels (occasionally the infl. appears to be paniculate in section* AAA *also, owing to dropping of lis., so that it is well to look for lf.-scars in doubtful cases).*
- B. *Fr. 1½–2 in. long, valves inclosed: fls large.*
  - C. *Seeds black, not winged fls. white or pink* — 1 **calophylla**
  - CC. *Seeds brown or red, winged fls red (pink to crimson or scarlet)* — 2 **ficifolia**
- BB. *Fr. ½–1 in long (¼–½in in E maculata), valves inclosed fls medium*
  - C. *Lvs paler beneath. fls. in terminal corymbs* — 3 **corymbosa**
  - CC. *Lvs of nearly equal color on both sides fls in lateral and terminal panicles*
    - D. *Caps slightly ribbed fls nearly or quite sessile in the clusters* — 4 **eximia**
    - DD. *Caps smooth fls distinctly stalked* — 5. **maculata**
- BBB *Fr ¼in or less long (nearly ½in in var of No 16), valves various· fls small*
  - C. *Shape of lvs orbicular to ovate, often nearly as broad as long*
    - D. *Petioles slender, lvs alternate.*
      - E *Fls. stalked lvs dull grayish green* — 6 **polyanthemos**
      - EE *Fls nearly sessile lvs. lustrous and dark green* — 7 **populifolia**
    - DD. *Petioles none, lvs. opposite* — 8. **melanophloia**
  - CC. *Shape of lvs lanceolate or oblong, elongated*
    - D *Lvs distinctly paler beneath than above*
      - E *Fr -valves included in the calyx-tube* . . . — 10 **paniculata**
      - EE. *Fr -valves exserted* — 11. **Raveretiana**
    - DD *Lvs of equal color on both sides*
      - E *Lid ¼in or more long, beak-like* . . . — 9. **siderophloia**
      - EE *Lid shorter, not beak-like.*
        - F. *Fr -valves much exserted, spreading* . — 12. **microtheca**
        - FF. *Fr.-valves about reaching the rim. lf -veins very diverging* . . . . . — 13 **crebra**
        - FFF. *Fr -valves wholly included in calyx-tube· lf.-veins very oblique* — 14 **leptophleba**
        - G *Lid hemispheric* . . . . — 15. **bicolor**
        - GG *Lid conic* . . — 16 **hemiphloia**
- AA. *Fls. solitary in the lf -axils, or in strictly sessile umbels, large.*
  - B. *Lvs all opposite, cordate at base. shrub.* — 17. **macrocarpa**
  - BB. *Lvs mostly alternate, not cordate*
    - C. *Peduncles ascending, or fls entirely sessile, lid warty*
      - D. *Plant a tree: lvs. acute* . . . . . — 18. **globulus**
      - DD. *Plant a shrub· lvs. obtuse, very oblique at base* . . — 19. **alpina**
    - CC. *Peduncles recurved, flat; lid smooth: shrub* . . . . . — 20. **tetraptera**
- AAA. *Fls. in stalked umbels.*
  - B. *Fl.-stalks (either pedicels or peduncles) flattened.*
    - C. *Fr.-valves with teeth projecting well beyond calyx-rim.*
      - D. *Teeth connivent into a cone· lid 1–1½ in. long.*
        - E. *Fr not embedded in receptacle.* — 24. **cornuta**
        - EE. *Fr. partly embedded in receptacle* . . — 25. **Lehmannii**

DD. *Teeth distinct. lid ¾in. or less long.*
E. *Fr. ½–¾in. long lid about ½in. long.*
F. *The fls sessile in the umbels: lvs. obtuse* . . . . . 26. **platypus**
FF. *The fls. pedicellate: lvs. acute* . . . . . 27. **occidentalis**
EE. *Fr. smaller· lid shorter.*
F. *The fls. more than 3 in each umbel.*
G. *Lid much longer than calyx-tube* . . . . . 43. **resinifera**
GG. *Lid about as long as calyx-tube* . . 41. **punctata** 42. **saligna**
GGG. *Lid much shorter than calyx-tube fls sessile..* 33. **Cambagei**
FF. *The fls usually 3 in each umbel* . . 52. **viminalis**
CC. *Fr.-valves included or scarcely exserted beyond the calyx-rim (exserted but closely incurved in E. megacarpa and E gompho-cephala).*
D. *Breadth of fr less than ½in.*
E. *Lid less than half as long as calyx-tube, depressed-hemispheric, blunt*
F. *Lvs mostly 2–4 in long· lid very short*
G. *Fr. 3–6 lines diam.· lid granular* . . . . . 28 **coccifera** 29 **virgata**
GG *Fr about 2 lines diam* . 40. **microcorys**
FF. *Lvs mostly 4–8 in long*
G. *Veins very oblique, lvs mostly under 1 in wide*
H. *Calyx not angular; outer stamens sterile* 30. **hæmastoma** 31. **Sieberiana**
HH. *Calyx very angular in bud, stamens all perfect* 32. **goniocalyx**
GG. *Veins at nearly a right-angle to midrib, lvs thick, more than 1 in wide* 34 **botryoides**
EE. *Lid at least half as long as calyx-tube, mostly conic and acute*
F. *Lvs ovate-lanceolate, 1½–3 in wide, lateral veins widely spreading* 35. **robusta**
FF. *Lvs lanceolate, ½–1½in. wide, lateral veins oblique.*
G. *The fls short-stalked*
H. *Arrangement of lvs. opposite umbels bent downward* . . 70. **doratoxylon**
HH. *Arrangement of lvs. alternate.*
I. *The lid narrowly conic, twice as long as calyx* 36. **redunca**
II. *The lid broader, not so long*. . . . . 37. **pilularis** 38. **Muelleriana** 39 **acmenioides** 41. **punctata**
GG. *The fls. sessile in the umbel lvs paler beneath.* 42. **saligna**
DD. *Breadth of fr over ½in*
E. *Lid not or scarcely broader than calyx-tube.*
F. *Lvs roundish, obtuse*. . . . . 26. **platypus**
FF. *Lvs lanceolate, acute*
G. *Calyx-tube and lid very warty* . . . . 18. **globulus**
GG. *Calyx-tube and lid ridged or nearly smooth.*
H. *Caps. sunk in the calyx-tube* . . . . . 46. **incrassata** 47. **Planchoniana** 21. **cosmophylla**
HH. *Caps. protruding from calyx-tube.* . . . 48. **megacarpa**
EE. *Lid much broader than calyx-tube* . . . . . 49. **gompho-**
BB. *Fl.-stalks cylindric or angular but not flattened* **[cephala**
C. *Caps. sessile or nearly so in the umbels*
D. *Fr.-valves with conspicuous projecting teeth.*
E. *Lid 1–1½ in long, cylindric*. . . . 24. **cornuta**
EE. *Lid mostly ¼–½in , conic*
F. *The fr -valves merely acute* 50. **rudis**
FF. *The fr -valves ending in needle-like points* . . 51. **decipiens**
EEE. *Lid short, rarely ¼in. long.*
F. *Buds ovoid, smooth*
G. *Fr mostly 4-celled: fls. usually 3* . . 52. **viminalis**
GG. *Fr mostly 3-celled· fls. usually more than 3* . . 53. **Stuartiana** 54. **Macarthuri**
FF. *Buds club-shaped, slender, often rough* . . . . . 55. **amygdalina**
DD. *Fr.-valves included, or barely exceeding the rim.*
E. *The fls. 4 or more.*
F. *Lvs of equal color on both sides*
G. *Venation of lvs feathered.*
H. *Fr ¾–1in. wide shrub* 61. **buprestium**
HH. *Fr. ¼–½in. wide trees*
I. *Buds club-shaped (the widest above the middle), obtuse*. . . . . 55 **amygdalina** 56 **Risdonii** 57 **oblique**
II. *Buds ovoid, acute. fr. contracted at orifice* 44 **piperita** 45 **eugenioides**
GG. *Venation of lvs. longitudinal and almost parallel* . . . . . 58 **stellulata** 59. **coriacea**
FF. *Lvs. paler beneath.*
G. *Lid broader than calyx: fr. streaked lengthwise.* 60. **corynocalyx**
GG. *Lid not broader than calyx fr not streaked* 62. **diversicolor**
EE *The fls. 1–3 in each umbel.*
F. *Lvs opposite, heart-shaped at base*
G. *Calyx obtuse at base lvs. crenate* . 22. **cordata**
GG. *Calyx tapering at base· lvs entire* . . . 23. **pulverulenta**
FF. *Lvs scattered, narrowed at base.*
G. *Fr scarcely contracted at orifice* . . 21. **cosmophylla**
GG. *Fr much contracted at orifice* . 61. **buprestium**
CC. *Caps plainly stalked in the umbels.*
D. *Umbels with more than 3 fls.*
E. *Fr -valves plainly exserted.*
F. *Fr flat-topped, valves awl-shaped* . . . 63. **salmono-**
FF. *Fr rounded to the valves; valves triangular, acute.* **[phloia**
G. *Diam of fr 2–3 lines*. . . 64 **rostrata** 65. **tereticornis**
GG. *Diam. of fr. 4–6 lines.*
H. *Anthers reniform.* . . . . 66. **macrorhyn-**
HH *Anthers oblong* . . . . . 50. **rudis** **[cha**
EE. *Fr.-valves included*
F. *Fr. scarcely or not at all contracted at orifice.*
G. *Lvs thick, odorless: fr. ¼in across* . . . . . 67. **Gunnii**
GG. *Lvs. thin: fr. slightly smaller*. . . . . 68 **melliodora** 69. **odorata**
FF. *Fr. contracted at orifice.*
G. *Lvs. opposite* . . . . . 70. **doratoxylon**
GG *Lvs mostly alternate.*
H *Breadth of fr about ½in*

I. *Lid as long as calyx-tube. lf-veins diverging.* . .71. **marginata**
II. *Lid shorter than tube· veins oblique* . 72 **Baileyana**
HH. *Breadth of fr. about ¼in.* .. .. 44 **piperita**
45. **eugenioides**
DD. *Umbels only 2- or 3-fld, rarely 4- or 5-fld* (*Ironbarks.*)
E. *Peduncles becoming deflexed. fr. pendent* .. 73 **erythronema**
EE. *Peduncles not deflexed*
F. *Bark smooth, light-colored* 74 **leucoxylon**
FF. *Bark rough, persistent*
G *Lf-veins very oblique· bark red* 75 **sideroxylon**
GG. *Lf-veins widely spreading bark grayish* . ...76 **longifolia**

1. calophýlla, R. Br Medium-sized umbrageous tree, with dense foliage· bark dark, corky, deeply furrowed: lvs ovate-lanceolate, firm and thick, veins nearly parallel and very spreading. fls large, white or cream-color, rarely pink, in large clusters, lid thin, nearly flat. fr. 1–1½ in wide, ovate-urnshaped, very thick and woody; seeds large, black, the edges acute but scarcely winged July–Oct B M 4036 (as *E. splachnicarpa*) F. v M Eucal 10·2 G C III. 20.661 —Ornamental tree of rather slow growth, not enduring frost or dry atmosphere Good shade tree for avenues in the coast districts. The fall bloom is valuable for bees Bark rich in kino The wood is tough, useful for wheelwrights' work and for building, but not durable underground. The frs of this and the next have been polished and used for pipe-bowls.

2. ficifólia, F. v. M. CRIMSON-FLOWERED EUCALYPT. Fig. 1424. Handsome small tree, rarely to 50 ft bark dark, furrowed lvs ovate-lanceolate, firm and thick, veins almost transverse· fls red, large and in large clusters; lid thin, nearly flat: fr 1–1½ in wide, broadly urn-shaped, the walls very woody; border compressed; seeds pale brown or almost red, winged on one end or also along one side Aug, Sept F.v.M Eucal. 7.3 B. M. 7697 G C III 42 376, 377. Gn 71, p 441. R H. 1904.568 —Very ornamental, especially in bloom. Tender and adapted only to the lemon belt; a heat-resisting avenue tree, withstanding drought. The fls vary from pink to crimson and scarlet and the forms do not come true to seed; grafted plants are now offered in the trade, the bright scarlet shade being generally preferred.



1425 Eucalyptus globulus, showing spray of mature foliage (×⅓) and two leaves of sucker foliage. No. 18.

3. corymbósa, Smith. BLOODWOOD. Small tree: outer bark persistent, gray and turning somewhat black; inner yellowish or reddish brown; of upper branches smooth and often reddish: lvs. lanceolate, somewhat leathery; lateral veins very numerous, fine, parallel and nearly transverse: fls. yellowish white, fragrant, in large corymbs, the peduncles and pedicels long; lid depressed-hemispherical, short-pointed; stamens becoming 5 or 6 lines long. fr. somewhat urn-shaped, about ½in. wide. Aug.–Dec. F v M. Eucal 5 2.—Tree suitable only for the coast districts. Wood brown or red, durable, and serviceable underground or in water, but rendered inferior by the many gum veins. (Ingham.)

4. exímia, Schau. MOUNTAIN BLOODWOOD. Large tree: bark scaly, brownish or yellowish, smooth only on the younger branches: lvs falcate-lanceolate, thick; lateral veins parallel and widely spreading but scarcely visible. fls. sessile, in small heads of a panicle, the peduncles angular or flattened; lid nearly hemispherical, pointed; stamens 3–4 lines long. fr urn-shaped, with thin rim, about ½in wide through the middle Oct – June F v M Eucal. 9 2.—A stately species with abundant showy bloom. Wood soft; useful only for fuel.

5 maculàta, Hook SPOTTED GUM Handsome tree, to 150 ft, the foliage mostly near the summit: bark smooth, whitish or reddish gray, deciduous in patches, thus exposing lighter areas and giving the trunk a spotted appearance· lvs lanceolate; veins parallel, rather oblique to the midrib lid hemispheric, double, fls short-stalked, stamens 4–5 lines long· fr globular-urnshaped, thin-rimmed, scarcely ½in. thick May–July F v M. Eucal 3·4. Hook Icon 619 Maiden, For. Fl N S W. 7.27.—Timber valuable for shipbuilders and used especially in coach factories and for handles; wood hard, light-colored, close-grained: growth fairly rapid

Var **citriodòra,** Bailey (*E. citriodòra,* Hook). LEMON-SCENTED GUM Like the species but foliage strongly lemon-scented.—A favorite ornamental tree in the warmer parts of Calif · subject to frost young plants useful for window or cool greenhouse cult The oil is clear white and of a pleasing, penetrating odor, used especially as a perfume for soap

6 polyánthemos, Schau RED BOX. AUSTRALIAN BEECH Well-branched often irregular and picturesque tree, 40–150 ft bark brown or gray, persistent, rough on old trees lvs orbicular to ovate, mostly 2–4 in. long by 1½–3 in. wide, rarely oval-lanceolate and scarcely 1 in. wide, dull and grayish green on both sides. fls small, white, stalked, in close panicles; stamens 1 or 2 lines long, the outer ones sterile fr. goblet-shaped, not contracted at orifice, 2–3 lines across, the valves not exserted Jan –April F v M Eucal 3.9. Maiden, Crit Rev Eucal 58, 59 (figs 1–3) —Useful for ornamental planting, because of its spreading habit, characteristic silvery foliage, and profuse bloom, also for windbreaks, for fuel, and for bees. timber exceedingly hard and durable, but sts. become hollow in age in Austral A drought- and heat-resistant species: endures minimum temperatures of 15–20°: of only fairly rapid growth

7 populifólia, Hook. POPLAR BOX Compact straight-growing tree. bark rough to the branchlets: lvs ovate or roundish, rarely lanceolate, 4 in. or less long, very lustrous and intensely green on both sides: fls. small, white, on very short stalks, the umbels paniculate; stamens 1–2 lines long, all fertile: fr. very small, semi-ovate, the valves inclosed Hook. Icon. 879 Maiden, Crit. Rev. Eucal 58 (figs. 11–18).—Probably as useful and adapted to as wide a variety of conditions as the closely related *E polyanthemos.*

8 melanophlòia, F. v. M. SILVER-LEAVED IRONBARK. Small tree: bark persistent, dark, furrowed lvs. sessile, orbicular to ovate-lanceolate, glaucous or white-mealy: fls small, in terminal or axillary corymbs: fr truncate-globular, 2–3 lines across; rim thin; valves included or slightly exserted.

9. siderophlòia, Benth. BROAD-LEAVED IRONBARK. Tall tree: bark wholly persistent on old trunks, rough and deeply furrowed; furrows yellowish or dark brown;

ridges broader than in other ironbarks: lvs. 4–7 in. long: lid beak-like, very acute, ¼–½in long; stamens about 3 lines long; anthers minute, globular, opening by oblong slits: fr. obovoid, truncate, about ¼in across, the valves slightly protruding. Oct., Nov. F.v M. Eucal 4 8 Maiden, Crit. Rev. Eucal. 47 (figs. 19–33). —Wood heavy, strong, and durable, useful for wagon work, tool-handles, building, posts, poles, and the like. Fls. provide honey for bees Tree of rapid growth and resistant to extremes of temperature: grown in the San Joaquin Valley.

10. **paniculàta,** Smith. WHITE IRONBARK RED IRONBARK. Tall or medium-sized tree: bark hard, persistent, deeply furrowed, of a grayish brown color: lvs lanceolate, acuminate, 3–5 in long. fls in panicles or sometimes in axillary umbels, lid variable, stamens 2–4 lines long, the outer ones sterile; stigma dilated: fr truncate-ovate, pedicelled, 2–4 lines wide, with thin rim. Summer F v M Eucal 5 8 Maiden, Crit Rev. Eucal 57 (figs 8–21) —Wood usually very pale, but variable, the hardest of ironbarks, "cuts almost like horn." valuable for railroad-ties, fencing, and building purposes Does not endure heat and drought: much prized in Austral, but trees in Calif. are not promising

11 **Raveretiàna,** F v M Tall tree with thin angular branchlets: bark deciduous, leaving the branches smooth and gray, but often persistent on the trunk: lvs lanceolate, opaque, 3–5 in long. fls exceedingly small, white, short-stalked, lid slenderly conic, under 2 lines long, stamens not 2 lines long; anthers reniform, opening by longitudinal slits fr little over 1 line wide, low-cup-shaped, the protruding valves forming a hemispheric summit F v M Eucal ¹:8. Maiden, Crit Rev Eucal 53 (figs 1–3)

12 **microthèca,** F v M Tree, becoming 80 ft. high bark rough, gray, persistent, or the outer layers deciduous, leaving the trunk smooth lvs narrowly lanceolate, 4–6 in long. lid broad-conic, stamens very short, anthers minute, roundish, opening by longitudinal slits fr scarcely ¼in wide, valves fully half-protruding F v M Eucal 10 6 Maiden, Crit Rev Eucal 52 (figs 16–22) —Not yet fully tested in Amer.: endures frost and heat recommended as a forest cover for the hot dry region of the S W. the roots yield water to natives and travelers on the Australian deserts Wood beautifully colored but perhaps too hard for cabinet work

13 **crèbra,** F v M NARROW-LEAVED IRONBARK. Small to large tree, with slender drooping branchlets: bark persistent throughout, hard, dark, ridged and deeply furrowed lvs pale, narrow, linear-lanceolate; lateral veins fine, nearly parallel, widely diverging from the midrib lid conical or nearly hemispheric, not over 2 lines long, stamens 1 or 2 lines long, inflexed in bud; anthers globular, opening by longitudinal slits fr. obovoid-truncate, not over 2 lines wide, the tips of the valves not or scarcely exserted F v M Eucal 5.3. Maiden, Crit Rev Eucal 53 (figs 4–9) —A rapidly growing frost-resistant tree of picturesque habit endures minimum temperatures of 18–20° and maximum temperatures of 110–118° (McClatchie), not very resistant to alkali (Loughridge) Grown in Calif for its hard durable wood, of a reddish color. Bark sometimes described as grayish and deciduous.

14. **leptophlèba,** F. v. M. Characters as in *E. crebra,* but fls somewhat larger and fr 3 or 4 lines wide: lvs. of a silky sheen —This has been classed as a var. of *E. drepanophylla,* F v.M , but the two are now known to be identical and *E. leptophleba* is the older name.

15. **bícolor,** A. Cunn (*E largiflòrens,* F. v M). BLACK BOX Shrub or small tree, with drooping branches: bark persistent, rough and hard: lvs lanceolate, 5 in. or less long; lateral veins at an acute angle to midrib: lid double, the inner one hemispheric; stamens 1 or 2 lines long, anthers opening by lateral pores: fr. truncate-ovate, about 2 lines wide, the valves inclosed but not distant from the thin rim. F.v.M. Eucal. 5:7. Maiden, Crit Rev Eucal 49 (figs. 5–13), 51 (figs. 9–19).—Timber hard, tough, and durable, rather



1426. Eucalyptus globulus. Shoots on a young plant. (×⅓) No. 18.

easily worked suitable for ties, piles, shafts, poles, cogs, and the like.

16 **hemiphlòia,** F v M AUSTRALIAN GRAY BOX. Tree, 90 ft or less high bark of trunk persistent, solid, grayish and somewhat wrinkled, of branches deciduous in flakes or long strips lvs lanceolate-falcate to ovate-lanceolate, 3–5 in long, thick and rigid, often ashy gray, lateral veins distant, diverging at a very acute angle lid conical, stamens pale, about 2 lines long; anthers globular, opening by lateral pores fr ovoid-oblong, truncate and slightly contracted at orifice, about 3 lines wide F v M Eucal 5 5. Maiden, Crit. Rev Eucal 50 (figs 1–6) —Useful as a shade tree because of its dense foliage; also for fuel and as pasturage for bees Wood hard, tough, and durable.

Var **álbens,** F v M (*E álbens,* Miq.). WHITE BOX Bark dull green, persistent lvs glaucous or white-mealy buds chalk-white fr larger.

17 **macrocárpa,** Hook Stout shrub, 6–15 ft , usually white-mealy lvs all opposite, sessile, cordate-ovate: fls orange-colored to crimson, very large, solitary; calyx-tube smooth or obscurely ridged; lid conical, longer than the tube; stamens about 1 in long: fr depressed-hemispherical, 1¼–3 in across, with raised rim and broad protruding valves Hook. Icon. 405–407 B M 4333 F v M Eucal 8·4 Maiden, Crit Rev Eucal 77 (figs 1–3) —Desirable ornamental because of its glaucous foliage and brilliant bloom: grown sparingly in S Calif

18 **glóbulus,** Labill BLUE GUM Figs. 1425–1427. Tree, 300 ft. or less high: bark deciduous in long thin strips or sheets, leaving the trunk smooth and grayish or bluish white except at base: lvs lanceolate, thick, often ½–1 ft long, those on young shoots and seedlings opposite, sessile, broad, and white-mealy fls solitary or 2 or 3 together, closely sessile or on a short peduncle; calyx-tube and lid warty, covered with bluish white wax; stamens above ½in. long: fr. angular, ¾–1 in across, the flat valves not pro-

truding. Dec.–May. F.v.M. Eucal. 6:2. G.C. II. 15:661; III. 2:777, 784; 10:737. Gn. 71, p. 18; 75, p. 606. Maiden, Crit. Rev. Eucal. 79 (figs. 1–12) —The best species for general planting: extensively used in Calif. Its combination of rapidity of growth, straightness of trunk, great strength of wood, and its known ability to flourish under a wide range of conditions in Calif., give it a great advantage over any other species (Ingham). Wood stronger than that of *E. rostrata* and *E. tereticornis*, yellowish white, easily stained, not durable in the soil in Calif · used there for insulator pins, spokes, felloes, whiffle-trees, handles, flooring and interior finish; a good species for fuel: logs check badly in curing, this much less in the so-called "San José bluegum" or "re-enforced gum" which, however, is thought by some to be only a selection of the best trees of ordinary blue-gum Lvs distilled for oil: fls. yield much honey to bees, but because of its pronounced flavor there is little or no demand for it in retail trade (Richter). Endures minimum temperatures of 25° and high temperatures of the San Joaquin and Sacramento Valleys but not of the desert districts: resists considerable drought when once established but best development is attained only on good and fairly deep soil. Fig 427 shows the stamens and the structure of the bud Nos 1–4 are half natural size; 5 is on a larger scale No. 4 is a section of a bud.



1427. Eucalyptus globulus. No. 18.

Var **compácta,** Hort. Dwarf Blue Gum Densely branched from the ground, forming a symmetrical rounded compact tree: lower foliage as in young growth of *E. globulus* but smaller with the longer narrower lvs. only near the top — Said to have originated near Niles, Calif., from seed of the ordinary blue-gum (Calif. Nursery Co).

The specific name *globulus* is sometimes written with a capital G, because it is a noun rather than an adjective; but the initial letter is here written in lower case in accordance with a recommendation of the International Botanical Congress.

19 **alpina,** Lindl. Shrub, 12 ft. high: lvs inequilaterally semi-ovate, blunt, acute on young shoots, 2–4 in. long, thick and leathery: fls. sessile in the lf.-axils, solitary or few: fr. hemispherical, ¾–1 in. wide, not angular; rim broad; valves protruding. Sept.–Nov. F.v.M. Eucal 2:1.

20 **tetráptera,** Turcz Shrub or small tree· branches often sharply angled: lvs. very thick, oblong-lanceolate. fls. solitary, on flat recurved peduncles; lid 4-angled, much shorter than calyx; stamens not over ½in. long. fr. prominently 4-angled, 2–3 in. long, ¾–1 in. wide, the valves well inclosed. F.v M. Eucal. 2:10. —Highly ornamental; once grown at Santa Monica, according to Kinney who says that the calyx-tube and stalk just before the lid falls become a brilliant crimson and are by far the most striking part of the fl.

21. **cosmophýlla,** F v.M. Tall shrub or small tree: bark smooth, ash-colored: lvs. broad-lanceolate, 3–5 in. long, very thick and rigid: peduncles almost 0; lid hard, low-hemispheric, blunt or short-pointed; stamens 4–6 lines long; anthers ovate, opening by distinct parallel slits· fr. globose-truncate, not contracted at orifice, smooth, 7–8 lines across; rim thick. F.v.M. Eucal. 7:2.

22. **cordàta,** Labill. Small tree, to 50 ft.: lvs. opposite, sessile, orbicular to ovate, somewhat crenate, rarely over 3 in. long, usually white-mealy, as also the infl.: calyx broadly campanulate, obtuse at base, smooth; lid low-hemispherical, obtuse or with sharp tip, shorter than tube; stamens 3–4 lines long; anthers opening by parallel slits: fr. globular-truncate, hard, 4–6 lines thick; valves rarely protruding. F.v.M. Eucal. 8:1. B.M. 7835. G.C. III. 3.803; 30:456; 47:168.— Useful mainly as an ornamental.

23. **pulverulénta,** Sims. Lvs. always entire: calyx-tube turbinate, tapering to the base; lid variable, mostly conical: otherwise about as in *E. cordata*. F.v M. Eucal. 8:7. B.M. 2087. Gn. 75, p. 140.—The very blue foliage supplies a pleasing contrast for ornamental planting.

24. **cornùta,** Labill. Yate Tree. Moderate-sized or large tree, usually low-branched and spreading: bark either deciduous in irregular sheets or persistent and rough: lvs oblong or broad-lanceolate, often obtuse, 2–5 in. long: fls. greenish yellow, numerous, in dense heads; lid cylindric, horn-like, 1–1½ in. long; stamens 1½–2 in. long: fr short-cylindric, 4–5 lines wide, valves much exserted and connivent into a beak-like projection. June–Oct. F.v M Eucal. 9.1 B M 6140 (lid too highly colored) —Used successfully as a roadside tree in S. Calif.: especially good as a shade tree· adapted to the lemon belt, and tolerating alkaline and saline soils (Franceschi). Timber hard, heavy, tough, and elastic.

25. **Léhmannii,** Preiss (*E cornùta* var *symphocárpa,* Auct. *E. macrocèra,* Turcz) Perhaps only a form of *E. cornuta*· lvs more often short and obtuse. fr. half immersed in the receptacle, forming a solid woody mass. June–Oct.

26 **plátypus,** Hook. (*E. obcordàta,* Turcz). Tall shrub or small tree. bark smooth, grayish lvs petioled, oval to obcordate, very obtuse, 1–2½ in. long, leathery and shining: peduncles winged, recurved; fls dull red or yellowish white, not conspicuous; lid conic-cylindric, much narrower than the prominently angled calyx-tube; stamens ½–¾in long: fr. truncate-ovate, very angular, 4–7 lines thick. F.v.M Eucal 7 6. Hook. Icon. 849.

27. **occidentàlis,** Endl Flat-topped Yate Spreading shrub or medium-sized tree bark deciduous, smooth, or somewhat persistent and rough· lvs. lanceolate, acuminate, 1½–5 in. long· lid cylindric-conic, ½–¾in. long; stamens yellowish or orange, ½–¾in long· fr bell-shaped, with spreading rim, 5 lines wide; valves exserted, sharp Oct.–May F v.M. Eucal. 6.5.—Suited to the coast districts; subject to frost.

28. **coccífera,** Hook. Small glaucous tree with smooth white bark· lvs lanceolate, thick and shining, often tipped by a slender curved mucro fls nearly sessile, in close terminal clusters; calyx prominently angled; lid very short and flat, rugose; stamens about 3 lines long, all perfect; anthers reniform, opening by divergent slits: fr. obovoid-truncate, 4–6 lines across B M. 4637. G C. II. 12·113; 13 395; III 2·787, 789; 3:799, 801; 9.169 Gn 71 p. 591. Maiden, Crit Rev Eucal. 28 (figs. 3–5) —A high-mountain form compared by some to *E amygdalina* but recognized by the depressed lid and longer calyx Of value as an ornamental: a very hardy species suitable for the foothill districts.

29 **virgàta,** Sieb. Shrub or small tree with stringy bark: lvs. lanceolate, thick and shining: calyx not angled; lid conical, granular-roughened, as also the tube; stamens scarcely 2 lines long; anthers reniform, opening by pores which extend into oblong slits: fr. globose-truncate, smooth, 3–6 lines across. Maiden, Crit. Rev. Eucal. 43 (figs 1, 2).

Var. **stricta,** Maiden (*E. stricta,* Sieb.). Lvs. linear or linear-lanceolate: lid often shortly pointed. Maiden, Crit. Rev. Eucal. 43 (figs. 12–17). F.v.M. Eucal. 10·9 B.M. 7074.

Var. **obtusiflòra,** Maiden (*E. obtusiflòra,* DC.). Lvs. rather broad: lid depressed-hemispheric, very obtuse. Maiden, Crit. Rev. Eucal. 43 (figs. 3–11).

30. **hæmástoma,** Smith. Large tree: bark smooth, mottled, with a few ribbony flakes near the butt: lvs. lanceolate, usually oblique at base, falcate, coriaceous: fls. pedicelled, clavate in bud; lid very short; stamens 2–3 lines long; anthers of the perfect ones reniform, opening by short divergent slits. fr. ovate-truncate, with reddish rim, 3–4 lines across, valves sometimes slightly protruding, but soon deciduous. F v.M. Eucal. 2:3. Maiden, Crit. Rev. Eucal. 46 (figs. 10–17), 47 (figs. 1–18).—Said to thrive on poor, sandy soil: perhaps not suited to dry interior valleys. Timber of inferior quality.

31. **Sieberiàna,** F. v M. Scarcely distinguishable from *E. hæmastoma* save by the bark, which on the trunk is furrowed, becoming dark, rugged, and stringy: foliage emits a slight peppermint-like odor when crushed in the warm hand. F.v M. Eucal. 2:9. Maiden, Crit Rev. Eucal. 45 (figs. 10–15).—Bark yields a very soluble kino.

32. **goniocàlyx,** F. v. M. MOUNTAIN GUM. BASTARD BOX TREE. Tall tree: bark rough, tardily deciduous: lvs. lanceolate, usually falcate, of pale color: pedicels very short and angular, or fls usually sessile; lid conical or hemispherical, stamens about 3 lines long, inflexed in bud; anthers ovate, opening by parallel slits: fr ovoid-truncate, 3–4 lines across; valves about on a level with the rim July, Aug F.v M. Eucal. 1 3. Maiden, For. Fl N S W. 19.—Timber especially esteemed for wheelwrights' work. also used for house-building, fence-rails, railroad-ties, and so on. excellent for fuel. Grows well in the coast districts of S. Calif. A promising species for the mountains of the S. W., at moderate altitudes

33 **Cambàgei,** Deane & Maiden. BUNDY. Small or medium-sized tree bark fibrous and matted throughout. lvs. lanceolate, elongated: fls sessile; calyx-tube with 2–4 prominent angles; lid shortly pointed or hemispherical, stamens about 3 lines long fr ovoid-truncate —A recently intro. species related to *E goniocalyx* but with plainly exserted valves and thicker, flatter peduncles Aside from shape of buds and peduncles it resembles *E Stuartiana.*

34 **botryoides,** Smith Tall handsome tree: bark rough, furrowed, persistent on trunks. lvs lanceolate, acuminate with very diverging parallel veins, paler beneath fls sessile or nearly so, lid variable, stamens about 3 lines long, inflected in the bud; anthers ovoid-oblong, with parallel cells: fr. obovoid-oblong, slightly contracted at orifice, 4–5 lines long, 3–4 lines wide, valves wholly inclosed. Sept, Oct. F.v.M. Eucal 4:2.—This tree has beautiful dark green horizontal foliage Useful for windbreaks and as a shade tree. Suited to the coast districts only. Timber hard, tough, and durable, used in Austral. especially for felloes.

35. **robústa,** Smith. SWAMP MAHOGANY. Handsome symmetrically branched tree of moderate height: bark of trunk persistent, rough, dark brown; of the branches reddish: lvs. oval-lanceolate, long-pointed, 3–7 in. long, 1½–3 in. wide, dark green, coriaceous; veins spreading almost at right angles to midrib: lid acute, about as long as calyx-tube; stamens 4–6 lines long; anthers with parallel cells: fr. goblet-shaped, becoming nearly ½in. across, the rim thin and caps. much sunk. Oct.–March F.v.M. Eucal 7:8.—Formerly much planted in Calif. as a street tree, but the tops break down in strong winds, due to the heavy foliage and brittle wood; now almost discarded for this purpose: a profuse bloomer, especially valuable for bees: wood brittle but durable. Best adapted to moist coast districts but also flourishes in the interior valleys when given sufficient water: suggested for the coast of the Gulf of Mexico in districts free from heavy frosts.

36. **redúnca,** Schau. Shrub or small tree, to 120 ft.: bark smooth, white: lvs. oblong-lanceolate, rather obtuse, 3 in. or less long, not paler beneath: lid conical, acuminate, about twice as long as calyx-tube; stamens 3–4 lines long; anthers opening by parallel slits: fr. obovoid, about 3 lines thick. F.v M Eucal 10:7.—Grows on cold flats of comparatively poor soil in Austral. Timber tough, heavy, and durable; prized for wheelwrights' work.

37. **pilulàris,** Smith. BLACKBUTT. Slender tree, averaging 100–150 ft bark of trunk persistent, or flaking off above, blackish gray outside, somewhat fibrous and brownish inside, of branches smooth, gray or whitish: lvs. mostly lanceolate, falcate, acuminate, 3–6 in long, rather less shining below than above. lid broadly conical at base, attenuate; stamens 2–3 lines long; anthers reniform, opening by divergent slits: fr. subglobose, truncate, 4–5 lines thick; valves completely inclosed to slightly exserted F.v M Eucal. 3:7 Maiden. Crit. Rev. Eucal 1, 3, 4.—Timber strong and durable useful for general building and especially for telegraph poles, posts, and the like. reported as a good honey-producer. Does not thrive in the hot dry interior valleys. subject to extremes of temperature.

38 **Muelleriàna,** Howitt. YELLOW STRINGYBARK Perhaps only a var of *E pilularis* bark more fibrous or stringy, the inner bark yellow and imparting a yellow stain to the wood juvenile lvs often with tufts of hairs; adult lvs. glossy above: lid blunt or slightly pointed: fr typically 6 lines thick Maiden, Crit Rev. Eucal 2, 38 (in part) —Forms with scarcely flattened peduncles approach *E. eugenioides.*

39 **acmenioides,** Schau. (*E. triántha,* Linn. *E. pilulàris* var *acmenioides,* Benth.) WHITE MAHOGANY GUM Tall tree. bark persistent and fibrous on trunk and branches: lvs paler beneath, sinuate: peduncles not much compressed, slender; pedicels sometimes 2 or 3 lines long: fr not exceeding 3 or 4 lines in diam.; rim thin: otherwise as in *E pilularis* F v M. Eucal. 10 1 Maiden, Crit Rev Eucal 42.—Grows in poor, well-drained soil in Austral Timber heavy, strong, and durable; good for palings, rails and floor-boards.

40 **microcòrys,** F. v M TALLOW-WOOD GUM. Tall tree bark persistent, wrinkled. lvs. broadly lanceolate, acuminate, thin, copiously dotted with oil-glands, much paler and opaque beneath: fls distinctly pedicelled, the buds club-shaped; lid depressed-hemispherical; stamens about 3 lines long, outer ones sterile; anthers minute, almost heart-shaped, opening by divergent slits: fr scarcely 2 lines across F.v M. Eucal. 2:6 Maiden, Crit Rev. Eucal 41 (figs. 6–9).—Timber yellowish; one of the most valuable after ironbark: strong and durable, under or above ground; used by wheelwrights and for flooring, especially for ballrooms; suitable for this latter purpose because of its greasy nature.

41. **punctàta,** DC. LEATHER-JACKET. HICKORY GUM. Beautiful spreading tree, 100 ft. or more high: bark smooth and dark, thick, the outer deciduous in flakes: lvs. thin, narrowly lanceolate, acuminate, lustrous above, slightly paler and marked with oil-dots beneath; lateral veins moderately spreading: peduncles broad, much compressed; pedicels evident, angular, thick; lid ovate-conical; stamens about 3 lines long; anthers opening by parallel slits. fr. 3 or 4 lines wide, not contracted at orifice; valves barely exserted. Aug.–Oct. F.v.M. Eucal. 6 7.—Timber remarkable for its extreme hardness and durability. Grown in S. Calif.; too tender for the San Joaquin Valley.

42. **saligna,** Smith. Tall tree: bark gray and smooth: lvs. lanceolate, with close parallel transverse veins

much paler beneath: pedicels very short or fls. usually sessile; lid hemispherical, short, pointed; stamens 2–3 lines long, all fertile; anthers ovate, opening by parallel slits fr. subglobose-truncate, not contracted at orifice; rim narrow; valves more or less protruding, separated from the rim by a narrow groove. F.v.M. Eucal. 2:8. Maiden, For. Fl. N.S.W. 13.—Timber of the best, usually pale red, straight-grained, comparatively easy to work. Prefers rich alluvial soil: probably will not endure severe conditions.

43. **resinifera,** Smith. KINO EUCALYPT. RED MAHOGANY. Erect symmetrical tree: bark of trunk persistent, rough, and fibrous; of branches deciduous: lvs lanceolate, thick, and almost leathery; oil-dots quite obscure; veins widely spreading from midrib: lid conical; stamens 4–6 lines long, anthers ovate, opening by parallel slits. fr. about ¼ lines wide, not contracted at orifice; valves acute, well exserted. F.v.M. Eucal. 1:9.—Apparently endures both cold and drought better than *E. globulus;* requires a rather moist climate. Wood strong and durable, red, but bears no real resemblance to true mahogany; not liable to shrink; lasts well underground.

Var. **grandiflòra,** Benth. Fls. larger, the ovoid buds about 4 lines diam.: fr. 4–6 lines wide, with a raised rim.



1428. Eucalyptus corynocalyx. (×½) No. 60.

44. **piperita,** Smith. PEPPERMINT STRINGYBARK. Tall tree: bark of the trunk persistent, gray, rough and fibrous; of the branches smooth: lvs. oblique, 2–6 in. long, thin; veins very oblique but obscure; oil-dots copious, transparent: lid broad-conical, acute, about as long as calyx-tube; stamens about 2 lines long; anthers kidney-shaped, opening by divergent slits: fr. globular, ovoid, or urceolate, contracted at orifice, ¼in. across; rim thin, depressed. F.v.M. Eucal. 3:8. Maiden, Crit. Rev. Eucal. 45 (figs. 1–9).—The young foliage emits a strong odor of peppermint when bruised.

45. **eugenioides,** Sieb. Closely related to *E. piperita* but seedlings rough-pubescent: lvs. thicker, with more divergent veins and not peppermint-scented: bark strongly fibrous even on the small branches: rim of fr. flat or raised. July, Aug. F.v.M. Eucal. 3:8. Maiden. Crit. Rev. Eucal. 39 (figs. 1, 2), 40 (figs. 2–22).

46. **incrassàta,** Labill. Shrub or small tree, to 25 ft.: lvs lanceolate or ovate-lanceolate, rather obtuse, mostly 2–4 in. long; veins inconspicuous: calyx-tube ribbed in the common forms, lid thick, hemispheric or short-conic, often abruptly beaked; stamens all inflected in the bud; anthers ovate-oblong, opening by parallel slits: fr. ovoid-cylindric, about ¾in. across; valves often slightly exserted. F.v.M. Eucal. 5:6. Maiden, Crit. Rev. Eucal. 13, 15.—Australian deserts: one of the "mallee."

Var. **angulòsa,** Benth. (*E. angulòsa,* Schau.). Calyx-tube and lid prominently angled or ribbed, but varying much in this respect as well as in size of fls. and frs. Maiden, Crit. Rev. Eucal. 14.

47 **Planchoniàna,** F. v. M. Tree, to 100 ft., with angular branchlets: lvs. lanceolate, acuminate, elongated. lid conical, about as long as the tube, both longitudinally streaked; outer stamens flexuous in bud but only the inner ones incurved; anthers broadly ovate, opening by parallel slits: fr. ovoid-cylindric, truncate, about ¾in. across, the caps. sunk and valves well inclosed. F.v.M. Eucal. 4:6.—A profuse bloomer. Timber heavy, hard, and durable; well adapted for sawing but not easily split.

48. **megacárpa,** F. v. M. Tree, 100 ft or less high: bark deciduous, smooth, grayish white: lvs lanceolate, falcate, mostly 4–6 in. long: fls. only 1–3 and sessile in the umbels; lid shortly conical; stamens about ½in. long; anthers ovate-oblong, opening by parallel slits: fr depressed-globular, thick and hard, ¾–1 in across; rim convex, continuous with the thick obtuse incurved valves F.v.M. Eucal. 6:3. Maiden Crit Rev. Eucal. 78 (figs. 4–8).

49 **gomphocéphala,** DC. TOOART TREE. Tree, 120 ft or less high. bark persistent, rough but not stringy, becoming dark: lvs thick, narrowly acuminate, pale green fls usually 3–5, sessile, lid globose, very hard and thick; stamens 3–4 lines long, anthers opening by parallel slits. fr. turbinate, rim broad and convex, rounded to the incurved valves F.v.M. Eucal. 7.4.—Easily distinguishable by the broad lid. Wood of a pale yellowish color: remarkable for hardness and strength, heavy, the grain close and twisted. shrinks but little and does not check while seasoning: suitable for large scantlings and for use where exposed to great heat, as in engine-rooms: one of the strongest woods known. Grows both along the coast and in the dry interior valleys: one of the most alkali-resistant species.

50. **rùdis,** Endl. DESERT GUM. Tree, 100 ft or less: bark gray, persistent, rough, but not deeply furrowed: lvs. broadly to narrowly lanceolate, mostly ¾–2¼ in. wide. peduncles ½–1 in long, pedicels short; lid conical, not beaked, about as long as calyx-tube; stamens 3–4 lines long; anthers opening by parallel slits: fr. broadly turbinate, 4–5 lines across; rim only slightly ascending. F.v.M. Eucal. 10:8.—Stands drought and extremes of temperature better than most other species: endures minimum temperatures of 15–18°: suitable for most situations in the S. W.: successfully used as an avenue tree and for windbreaks at Fresno, Calif. Timber probably of value only for posts and for fuel.

51. **decípiens,** Endl. Straggly shrub, or tree to 70 ft.: bark rough, persistent, fragile. lvs. ovate to lanceolate, 2¼–4½ in. long, seldom over ¾in wide: peduncles ¼–½in. long; pedicels 0; lid conical, often twice as long as calyx-tube; anthers very small, globular, opening by pores which become longitudinal slits: fr broadly turbinate or globose, 3–4 lines across; valves awl-shaped. F.v.M. Eucal. 10:3. Maiden, Crit. Rev. Eucal. 63 (figs. 1–12).

52. **viminàlis,** Labill. MANNA GUM. Plate XXXIX. Graceful tree, to 300 ft., the branchlets pendulous: bark either persistent, roughish, and dark-colored (never fibrous), or deciduous, very smooth, and grayish white: seedling lvs lanceolate; mature lvs lanceolate, acuminate, somewhat falcate: fls usually 3, rarely 6–8, sessile or on very short pedicels; lid semi-ovate, mostly short-pointed; stamens about 3 lines

long; anthers ovate, opening by parallel slits: fr. subglobose-truncate, 3–5 lines across; rim flat or rounded; valves triangular, acute. May–Aug. F.v.M. Eucal. 10:10. G.C. III. 4:597.—A hardy species, grown as far north as Chico, Calif.: ranks next to *E. globulus* in rapidity of growth. Timber not so strong as that of many other sorts but of average value for fuel, and can be grown under conditions in which more valuable species would not survive or would make only an inferior growth. A good bee tree.

53. **Stuartiàna,** F. v. M. Apple-scented Gum. Tall branching tree, with dense drooping foliage: closely related to *E. vmminalis*, and distinguishable from the latter, when this has more than 3 fls in an umbel, by the fibrous bark, roundish seedling lvs. and somewhat smaller fls.: pedicels almost 0; buds angular; lid almost hemispherical, or shortly and bluntly conical. Feb.–May. F.v.M. Eucal 4:9.

54. **Macárthuri,** Deane & Maiden. Bark rough, "very woolly:" seedling lvs. linear-lanceolate, slightly cordate, strictly opposite; mature lvs. narrow, lanceolate. fls. 4–8, distinctly pedicelled; buds ovoid, smooth, very small· fr. semi-ovate, scarcely 3 lines across.—Related to *E. vmminalis* and to *E. Stuartiana:* distinguished from the latter by the smooth slender-pedicelled buds and from both by the smaller fls. and frs.

55. **amygdálina,** Labill. Peppermint Gum. Tree, the tallest of the genus (var *regnans*): bark persistent on trunk and lower branches, fibrous: lvs. lanceolate, not noticeably oblique at base, 2–4 in. long; veins oblique; oil-dots large, not very numerous: fls. many and crowded in the umbels; buds clavate, often rough; lid hemispherical, very obtuse, shorter than the calyx-tube; stamens under 2 lines long, anthers kidney-shaped, opening by divergent slits: fr. hemispheric or shortly ovate, truncate, about ¼in across; rim flat or slightly concave; valves flat or slightly protruding. F.v.M. Eucal. 5:1. B M. 3260. B.R. 947 (as *E longifolia*). G.C. III 6.16. R H. 1902, p. 83.—Timber of inferior durability and strength Foliage with odor of peppermint; far richer in oil than any other eucalypt.

Var **numerôsa,** Maiden (*E. Andreàna*, Naudin). Fls. very numerous, often over 20 in the umbel.

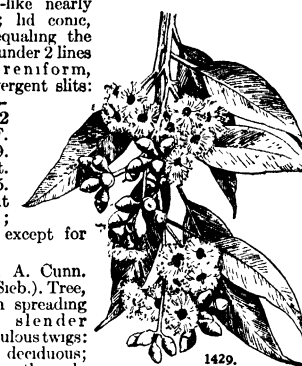
Var. **régnans,** F. v. M. (*E. régnans*, F. v. M.). Giant Gum. Very tall tree (325 ft. or less high): bark usually smooth, whitish, fibrous only near the base: lvs. large, broad-lanceolate, especially those on seedlings broader than in typical *E. amygdalina*, oil-dots very fine, numerous: fr usually conoid. Maiden, Crit Rev. Eucal. 33.—Earlier reports of 400–500 ft. for this tree were erroneous (see Melbourne Argus for March 23, 1904, Maiden, Crit. Rev. Eucal. p. 183, and G.C. III. 47, p. 69).

Var. **angustifôlia,** F. v. M. (*E. lineàris*, Dehnh.). Graceful, spreading tree· branchlets drooping· lvs. very narrow fls numerous in the umbel. Jan.–Apr., and more or less throughout the year. Maiden, Crit. Rev. Eucal. 30 (fig. 5).

56. **Risdonii,** Hook f. A beautiful glaucous-foliaged tree 20–50 ft. high, the branches somewhat pendulous: bark flaking off, smooth, not fibrous· early lvs. cordate, connate in pairs; later lvs. either opposite and ovate or alternate and broadly lanceolate, not very oblique at base; veins oblique: buds, fls., and fr. as in *E. amygdalina* but slightly larger. Maiden, Crit. Rev. Eucal. 32 (fig. 1).—A valuable ornamental: all the lvs. commonly opposite and connate.

57. **obliqua,** L'Her. (*E fissilis*, F. v. M.). Tall tree: bark persistent even on the branches, grayish, very stringy but rather soft and fragile: lvs. thick, very oblique at base, 4–6 in. long, veins very oblique: lid hemispherical, depressed or somewhat pointed, shorter than the tube; stamens fully 3 lines long, opening by diverging slits: fr. somewhat pear-shaped, truncate, slightly contracted at orifice, ¼–½in. across; rim broad and concave: caps. well sunk March–Aug. F v.M. Eucal. 3:5. Maiden, Crit. Rev. Eucal. 5–8.—Will grow on poor soil but does not endure severe drought. Much valued in Austral. for bees: wood used only for cheap, rough work.

58. **stellulàta,** Sieb. Small tree: bark becoming black and furrowed, deciduous in layers, smooth above: lvs. elliptic or lanceolate, 2–4 in. long, principal veins almost parallel to the midrib fls very small, numerous; buds ovoid, in star-like nearly sessile umbels; lid conic, acute, about equaling the tube; stamens under 2 lines long; anthers reniform, opening by divergent slits: fr. nearly globose, about 2 lines thick. F. v M. Eucal 6:9. Maiden, Crit. Rev. Eucal 25. —Timber of but little value; scarcely used except for fuel.



1429.
Eucalyptus diversicolor (×½)
No 62.

59. **coriàcea,** A. Cunn. (*E paucifl5ra*, Sieb.). Tree, often tall, with spreading branches and slender somewhat pendulous twigs: outer bark deciduous; inner bark smooth, pale gray. lvs. ovate-lanceolate or lanceolate, 4–8 in long, thick, smooth; lateral veins almost parallel to the midrib· fls 5–10; buds club-shaped; umbels distinctly peduncled, lid hemispheric, obtuse or with a short point, twice or thrice shorter than the tube; stamens 2–3 lines long; anthers reniform, opening by divergent slits fr pear-shaped, truncate, 3–4 lines thick Nov.–Feb F v M. Eucal. 3·6 (as *E pauciflora*) Maiden, Crit. Rev. Eucal 26, 27, 28 (figs. 1, 2) —A high-mountain tree and one of the hardiest species Cattle browse on the foliage in seasons of drought: timber used for fuel and fences; warps badly. Trees sometimes badly affected with scale.

60. **corynocàlyx,** F v M Sugar Gum Fig 1428. Tree, to 120 ft : bark smooth lvs elongate-lanceolate; veins oblique· lid almost hemispheric, projecting beyond the calyx-tube, stamens 2–3 lines long, anthers short-oblong, opening by distinct parallel slits fr. almost egg-shaped, nearly ½in long by 3–4 lines thick; rim thin; caps deeply sunk June–Nov F v M Eucal 2·2. G C. II. 12 593 —A valuable drought-resistant species but does not endure temperatures below 20–25°. Timber close-grained and hard, of a yellowish white color: very durable underground. grown in Calif. for railway ties An ornamental tree used for roadside planting in S. Calif · affords much bee pasturage.

61. **bupréstium,** F v M Shrub, to 20 ft.: lvs. narrow, acute, 2–3 in long· lid hemispherical, obtuse, shorter than calyx-tube; stamens 2–3 lines long; anthers opening by short divergent slits: fr. nearly globular, the orifice much contracted, ¾–1 in. across; rim depressed. July–Oct. F.v.M. Eucal. 6:1.—Valuable for bees.

62. **diversícolor,** F. v. M. (*E. collôsea*, F. v. M. *E. diversicolor* var *collôsea*, Hort.). Karri. Fig. 1429. Very tall symmetric tree: bark smooth, white: lvs. dark green and shining above; veins very diverging: lid obtusely conical, not wider than calyx-tube; stamens 4 lines long; anthers ovate, opening by parallel slits: fr ovoid-truncate, about ½in. long by 4–5 lines thick;

rim rather thick; caps. deeply sunk. Feb.–May, and again in Nov. F.v.M. Eucal. 5:4.—Thrives near the coast but does not endure well the dry heat of the interior: too tender for the San Joaquin Valley. A rapid grower, profuse bloomer, and considered a good tree for bees. Timber very hard, durable, of a light red color, and takes a fine polish: suitable for furniture, wagon work, ties, and general construction.

63. **salmonophlòia,** F. v. M. Finally tall: lvs. narrowly lanceolate, 2–5 in. long, shining; oil-dots copious: lid broadly conical, slightly longer than the tube; anthers roundish, opening by parallel slits: fr. semi-ovate, narrowed at base, 2 lines thick; valves much exserted, long-pointed. F v.M. Eucal 9:6.

64. **rostràta,** Schlecht. Red Gum, Fig. 1430. Tree, to 200 ft.: bark of mature trunks dark gray, either smooth and deciduous or somewhat persistent near the base and then checking into thick scales or even furrowed; bark of seedlings and twigs reddish: lvs narrowly lanceolate, acuminate, 4–6 in or more long; calyx-tube hemispheric; lid usually hemispheric and provided with a narrowed point or beak, sometimes merely conical and not beaked, rarely over 3 lines long; stamens 2–4 lines long; anthers oblong, opening by parallel slits: fr. nearly globular, rarely above 3 lines thick; rim broad, prominent; valves entirely protruding, even before they open April–July. F.v.M. Eucal. 4:7.—One of the most valuable species; next to the sugar gum and forest gray-gum perhaps the most drought-resistant; withstands frosts better than blue-gum; endures the intense heat of Imperial Valley, on the Colorado Desert; grows where the ground is inundated for a considerable time; makes a good growth in alkali soils, yet best results are secured only on good soil, especially if moist and with a clayey subsoil A slow-growing species in regard to height, but one of the first in regard to diam.-growth (Ingham). Timber



1430 Eucalyptus rostrata (×½) No. 64.

very durable, both above and below ground: heavy, takes a good polish: light red to deep red in color: not so strong as sugar and blue-gums and trees more irregular in growth: suitable for railroad-ties, piles, fence-posts, and the like: difficult to work when dry, therefore scarcely suitable for furniture. Blossoms supply honey to bees.

65. **tereticórnis,** Smith. Forest Gray Gum. Flooded Gum. Bark and the general characters as in *E. rostrata:* lvs. rather broadly lanceolate: calyx-tube turbinate; lid slenderly conical, acuminate, rarely abruptly beaked, 3–6 lines long, always much longer than the tube; stamens 3–6 lines long: fr. obovoid or nearly globular, 3–4 lines thick; rim very broad and prominent; valves protruding. April–July F.v.M. Eucal 9:8.—Closely related to *E. rostrata;* usually coarser, the lvs. broader, peduncles and pedicels stouter, and fr. larger, yet variable in all these characters. According to Ingham, this species has an erect habit of growth, while *E. rostrata* grows very crookedly. Withstands fully as wide a range in temperature, moisture, and soil conditions as does *E. rostrata:* timber similar but usually paler in color; more valuable because of its more regular growth. *E. amplifòlia,* Naudin, known in Calif. as the "Cooper" or "round-leaf tereticornis," is a form with large roundish lvs. when young.

66. **macrorhýncha,** F v. M. Tall tree: bark dark gray, furrowed and fibrous: lvs lanceolate, acuminate, 3–5 in. long; lower ones broader, thick, and coriaceous; veins very oblique, prominent: calyx-tube turbinate, the edge forming a prominent ring with the conical lid; anthers reniform, opening by divergent slits: fr. depressed-globose, 4–6 lines thick; rim broad, convex. F.v.M. Eucal. 1:5. Maiden, Crit. Rev Eucal. 39 (figs. 3–21).

67. **Gúnnii,** Hook. f. Cider Gum Small, often scrubby tree: lvs thick, shining, less than 3 in long: lid shining, hemispherical, short-pointed; stamens 2–3 lines long; anthers nearly oval, opening by parallel slits: fr. pear-shaped, truncate, 3–4 lines across, rim thin; valves sometimes slightly protruding. April–July. B M. 7808. G.C. II 19 437, III. 2 781; 11.787. —A very hardy species. cattle readily browse on the foliage, as it lacks the peculiarly pungent eucalyptus odor Fls only 3 in the typical form, but this apparently not cult in Amer.

Var. **acérvula,** Deane & Maiden. Buds and foliage often of a yellowish cast: fls. usually 4–8 in the umbel: fr. ¼–½in across. F.v M Eucal. 4.5 (main fig.) —The form commonly grown in Calif Sapwood yellowish.

Var **undulàta,** Auct (*E undulàta,* Luehm., not of F. v M.) Swamp Gum. Tall tree: lvs longer (over 3 in.), often 2 in. broad, somewhat undulate or plane: fr. top-shaped.—Yields much nectar: flowers earlier than *E viminalis.* Timber strong and useful.

Var. **montàna,** Auct A mountain form of *E Gunnii,* the only species which withstands the climate of the east of England

68 **melliodòra,** Cunn Honey-scented Gum Yellow Box. Spreading tree with somewhat drooping habit, to 150 ft high bark somewhat persistent below, roughish, brownish gray without, yellowish within, flaking off above, leaving the branches smooth: lvs. narrow, acuminate, 3–5 in. long. fls small, the calyx about 2 lines across; lid conic-hemispherical; stamens 2–3 lines long, outer ones sterile; anthers minute, truncate, opening by terminal pores or short slits: fr. distinctly stalked, truncate-globular, under 3 lines thick. Feb.–Aug. F.v.M. Eucal. 2.5. Maiden, Crit Rev. Eucal. 61 (figs. 1–14).—Will grow on poor hillside soil but best growth is made in the valleys Timber used in Austral. by wheelwrights and shipbuilders: makes excellent fuel: fls particularly rich in nectar and much sought by bees.

69. **odoràta,** Behr. (*E. cajupùtea,* Miq.). Differs from *E melliodora* chiefly in the more erect habit and fr. which is often nearly sessile, obconic, not or scarcely contracted at orifice. F.v.M. Eucal. 2:7. Maiden, Crit. Rev. Eucal. 51 (figs. 9–19).—Grown at Fresno, Calif.: may be of value for its oil.

70. **doratóxylon,** F. v. M. Spear-Wood. Beautiful shrub or small tree: bark smooth, greenish white: lvs. all opposite or nearly so, narrowly lanceolate, acumi-

nate, mostly under 3 in. long: fls. 4–7 on each recurved nearly terete peduncle; lid terminating in a rather long beak; stamens 2–3 lines long; anthers ovate-oblong, opening by parallel slits: fr ovoid, about 3 lines long, scarcely as wide F.v M Eucal. 4:4 Maiden, Crit. Rev. Eucal. 70 (figs. 3–5).—Of ornamental value because of its slender, graceful habit.

71. **marginàta,** Smith (*E. floribúnda,* Hueg.). JARRAH Tall tree under favorable conditions, often low: bark persistent and somewhat fibrous or flaking off in strips. lvs. lanceolate, 3–6 in. long; veins widely spreading: peduncles sometimes a little flattened; lid oblong-conical, longer than calyx-tube; stamens 3–4 lines long, all fertile, the outer not inflexed in bud; anthers cordate-reniform, opening by divergent slits: fr subglobose, narrowed to the stalk, ½in or more thick, hard, and smooth April, May. F v M Eucal. 7 5 —Valuable hardwood tree requiring a warm climate: not yet a success in Amer. Timber easily worked, takes a fine polish, not attacked by teredo, almost incombustible: used in England for street-paving and in Austral for piles, underground work, telegraph-poles, ties, flooring, shingles, and general construction.

72 **Baileyàna,** F. v M. Tall tree: bark persistent throughout, fibrous: foliage dense and shady: lid hemispheric; anthers cordate, opening by divergent slits. fr globular-urnshaped, scarcely ½in. thick, 3-celled F.v.M Eucal 3 1.—A "stringybark:" will grow well on sandy soil. Timber very tough: suitable for tool-handles little known

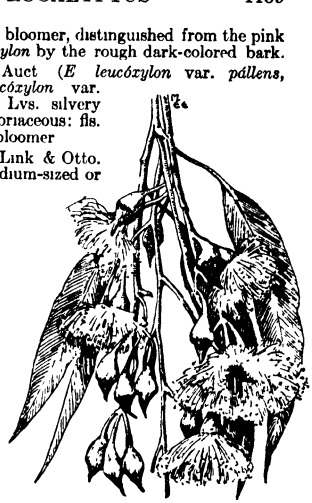
73 **erythronèma,** Turcz. (*E. conoídea,* Benth.). Small tree bark rough, reddish: lvs. lanceolate, 1–3 in long, thick and shining; veins very oblique, obscure: fls 2–3, red, distinctly stalked in the usually recurved umbels, lid hemispheric, acute; stamens about ½in. long, raised above the border of the calyx by the thick disk, anthers oblong, opening by longitudinal slits. fr top-shaped, truncate, 4–6 lines across, rim raised above the calyx-border, showing externally as a smooth ring Spring F.v M Eucal 8.2.—A highly ornamental species of recent intro

74 **leucóxylon,** F v M (*E gracilípes,* Naudin) WHITE IRONBARK. Fig 1431 Tall tree, usually branching below. bark mostly deciduous in irregular strips, smooth, pale juvenile lvs ovate-lanceolate, sessile; adult lvs narrow-lanceolate, grayish or dull green: fls 2–5, mostly 3, long-stalked, white or rarely pink; lid semi-ovate, pointed, about as long as calyx-tube; stamens very unequal, outer ones often ½in long and usually sterile, anthers truncate, opening by apical pores; stigma much dilated fr obovoid, truncate, scarcely contracted at orifice, 4–5 lines across; rim thick. Nov.–April F.v M. Eucal 1 4. Maiden, Crit Rev. Eucal. 56 (figs 1–12) R H 1901, p 500 —Grows best near the coast and where there is plenty of rain but will endure considerable drought and poor soil: withstands minimum temperatures of 15–20°. Valuable bee tree, yielding an excellent honey Timber superior to that of almost any other eucalypt for certain purposes: hard and durable, pale brown or white: used in carpentry and wheelwrights' work; also for ax-handles, railroad-ties, and underground work. The form with pink fls is highly ornamental. Var **purpúrea,** Hort, has bright purple fls

75 **sideróxylon,** Cunn. (*E leucóxylon* var. *sideróxylon,* Auct.). RED IRONBARK. Characters mostly as in *E. leucoxylon*· usually not branched below· bark persistent, rough, dark red or black: juvenile lvs. linear-lanceolate; adult lvs. green. fls. white or yellowish except in the vars. Maiden, Crit. Rev. Eucal. 55 (figs. 5–13).—Wood dark brown or reddish, otherwise similar to that of *E. leucoxylon* and climatic requirements the same.

Var. **rósea,** Hort. (*E. leucóxylon* var. *rósea,* Hort.). Lvs. green: fls. rose-colored. Dec.–June.—A handsome form and profuse bloomer, distinguished from the pink form of *E. leucoxylon* by the rough dark-colored bark.

Var. **pállens,** Auct (*E leucóxylon* var. *pállens,* Benth. *E. leucóxylon* var. *pállida,* Hort.). Lvs. silvery gray, not very coriaceous: fls. red.—A profuse bloomer



1431. Eucalyptus leucoxylon (×½). No. 74.

76 **longifólia,** Link & Otto. WOLLYBUTT Medium-sized or tall tree: bark of old trunks persistent, gray, rough or wrinkled, somewhat fibrous· lvs. elongated-lanceolate: fls long-stalked; lid broadly conical, acute, pale; stamens fully ½in. long, inflected in the bud, all perfect, anthers ovate-oblong, opening by parallel slits; stigma not dilated. fr. bell-shaped or turbinate, truncate, angular, about ½in. thick; rim prominent, ascending. F.v.M Eucal. 2:4 —Flowering almost continuously: valuable for bees.

E annulàta, Benth Shrub or small tree with characters of E cornuta, except as follows lvs narrow-lanceolate, acuminate lid 6–8 lines long, usually incurved fr depressed-globose, 4 5 lines thick, the convex rim protruding as a thick rim —*E Bosistoàna,* F v M Next to E pilularis in the key but perhaps related to E melliodora Lvs narrow-lanceolate copiously dotted, of equal color on both sides, veins very divergent fls few and pedicelled in the umbels, peduncles somewhat compressed, lid fully as long as tube, narrow-hemispheric fr small, with narrow rim, valves inclosed Maiden, Crit Rev Eucal 49 (figs 1–4) —*E californica,* used by Abbot Kinney in his book entitled "Eucalyptus," has not been recognized by botanists also listed as E occidentalis var. californica, Kinney —*E cinèrea,* F v M Related to E viminalis Bark persistent, fibrous lvs oppsite, sessile, cordate, more or less white-mealy fls 3–7, pedicellate fr 3 lines thick, with protruding valves —*E dealbàta,* A Cunn Small tree, near E viminalis lvs glaucous, often broad and obtuse fls 3–6, small fr.-rim flat, valves protruding even before they open Mt. in Cuba —*E Deánei,* Maiden very close to E saligna, distinguished chiefly by its broad sucker lvs —*E Fáeli Bay* (?), Naudin, is a horticultural form either of E rostrata or of E tereticornis branchlets pendulous —*E jugàlis,* Naudin, is a cult form not yet identified —*E Maideníi,* F v M Appearance and bark of E goniocalyx but peculiar warty buds and caps of E. globulus branchlets quadrangular —*E McCláthie,* Kinney, is a horticultural name for the large-fld form of E Gunnu var acervula —*E minúta,* A Cunn Placed after E ficifolia in the key fls. sessile in ample umbels, brilliant orange-color· fr truncate-ovate, nearly 2 in long F v M Eucal 6 4 —*E Mortoniàna,* Kinney, is a horticultural species probably referable to E Maideni Maiden, Crit Rev Eucal 79 (figs 13–14), 80 (figs 1–12).—*E pàtens,* Benth Next to E pilularis in the key peduncles only slightly flattened, bearing 3–7 fls , lid hemispherical, short-pointed, about half as long as tube fr truncate-ovate, 5 lines wide, rim narrow; caps sunk. F v M Eucal 9 5 —*E phaeanthòlia,* listed by Richter in Calif. Exp. Sta Bull No 217, p 1011, is probably a misprint for E ficifolia —*E pinnata,* a garden name J H Maiden suggests that Californian specimens under this name may be E. coccifera (Crit Rev Eucal , p 143) —*E rùbida,* Deane & Maiden. Characters of E viminalis, but bark always smooth and white, often with reddish patches, and the sucker lvs broad —*E uncinàta,* Turcz Near E decipiens in the key and, like it, a shrub bark deciduous, smooth· lvs very light green, narrow, copiously dark-dotted, veins fine, widely divergent· filaments kinked, anthers opening by terminal pores fr 2–3 lines across, valves little if at all exserted F.v.M. Eucal 4 10 Maiden, Crit Rev Eucal 62. —*E. urnígera,* Hook f Shapely tree with drooping branchlets and glaucous bluish foliage bark smooth, pale brown lvs. 2–4 in. long, obtuse fls mostly 3 in each umbel, peduncles often recurved fr. nearly globose but somewhat urn-shaped, 4–5 lines wide, caps. much sunk and valves inclosed. Maiden Crit Rev. Eucal. 80 (Figs. 13–15).

Other names offered in foreign catalogues are. *E capsellata, E. considenensna, E delegatensis, E dives, E. gonipho-cornuta, E loxophleba, E. paludosa, E. Smithii.*

HARVEY MONROE HALL.

EUCHARÍDIUM (from the Greek for *charming*). *Onagràceæ*. Pretty small annuals, one of which (*E. concinnum*) is well known in gardens.

Three Californian herbs allied to Clarkia (and often referred to it), but differing in the calyx-tube being much prolonged beyond the ovary, and the stamens 4 and opposite the sepals and not appendaged at the base; petals lobed. Cult. simple, as for Clarkia.

concínnum, Fisch. & Mey. (*Clárkia concínna,* Greene), is a graceful garden annual, growing 1–2 ft high, simple or very nearly so, pubescent or glabrous. lvs. small, oblong, petioled, entire fls regular, rose-colored, nearly or quite an inch across, calyx-tube filiform, an inch or more long; filaments filiform; petals 3-lobed, the middle lobe not much exceeding the others. B R. 1962. B.M 3589.—Of easy cult. in any garden soil; a useful annual.

grandiflòrum, Fisch. & Mey. (*Clárkia grandiflòra,* Greene). Differs from above in being diffusely branched from the base, corolla larger, irregular, 3 upper petals approximate and the other separate and declined, all the middle lobes long-clawed. There is a var. *álba* advertised.

Bréweri, Gray (*Clárkia Bréweri,* Greene. *C. Saxedna,* Greene). 1–2 ft. high: lvs. 1 in or more long, lanceolate, entire, short-petioled: corolla irregular; petals broadly obcordate with the middle lobe narrow-spatulate and much exceeding the other lobes; filaments club-shaped: has a honeysuckle fragrance. L. H. B.

EÙCHARIS (*very graceful,* from the Greek). *Amaryllidàceæ*. Amazon Lily. Hothouse bulbous plants of great beauty and delightful fragrance, blooming in late winter and spring and at other times if the requisite treatment is given.



1432. Eucharis. Leaf of E. grandiflora, and fls. of *a*, E. subedentata; *b*, E. Sanderi; *c*, E. grandiflora; *d*, E. candida.

Bulb tunicated, 1–2 in. diam.: lvs. broad-ovate, narrowed into distinct petioles, prominently parallel-ribbed, radical: fls. white, in umbels, very showy, standing on long stout scapes; perianth-tube straight or curved, the throat dilated; segms. broad and spreading; perianth-cup either entire or toothed between the filaments: ovules 2 to many in each of the 3 locules.—Six or 8 handsome species from Colombia. The species are confused. *E. grandiflora* (known to gardeners as *E. amazonica*), *E. candida* and *E. subedentata* are the well-marked types. The fls. in Fig. 1432, adapted from authentic plates, will distinguish the types. Hybridizes with Urceolina (see *Urceocharis*)

The Amazon lilies, as eucharis are popularly called, are among the most desirable of warmhouse bulbous plants, being not only very beautiful but also very free in the production of flowers. When grown in pots, they require a coarse fibrous soil, composed chiefly of rotted sod, and enriched with about one-fourth of dry cow-manure and a sprinkling of bone-dust. The pots should be well drained, for much water is needed during the growing season, but frequent potting should be avoided as the roots are impatient of disturbance Shading from full sunshine is required, except during the winter months, and a night temperature of 65° to 70° is best for these plants By drying off the eucharis to some extent for a few weeks, a crop of flowers may be had at almost any season, providing the bulbs are strong and healthy, but they should never be dried to such a degree that all the foliage is lost, else the bulbs will be much weakened. Good results are also had from planting out the eucharis on a bench in a warmhouse, the soil and treatment being much the same as for pot-grown specimens. The only insects liable to give much trouble in connection with these plants are mealy-bugs and thrips, and these may be controlled by thorough syringing. (W. H. Taplin)

grandiflòra, Planch (*E. amazónica,* Lind) Amazon Lily. Star of Bethelhem (a name also applied to Ornithogalum). Fig 1432. Bulb globular, 2 in diam · lvs. 2–4 to each stem, the petiole about 12 in long; lf.-blade 1 ft. or more long and 5–6 in broad, oblong· scape 1–2½ ft., bearing an umbel of 3–6 large (4 in. across), very fragrant star-like fls on pedicels nearly or quite 1 in. long, segms. spreading, oblong and obtuse; tube of perianth cylindrical and curved, 2 in long, cup forming a distinct projecting tube. B M. 4971. F S 9.957; 12·1216–17. Gn. 48, p 217, 59, p. 25; 61, p. 125; 63, pp. 71, 131; 66, p 412; 76, p 67, 77, p 418 G C. III 7·193; 16:665; 28 115; 35 117; 41:71; 51·141. R H. 1912, p 115 G. 3·407; 9.301 (*E amazonica* var. *grandiflora*); 10:5. G.L 21·476 G M. 46·83 G.W. 2, p. 87. G Z 2:1. A F. 5·363; 8:445. F E. 8:1000 F.R 1:11; 2:364 Var. **Moòrei,** Baker, has smaller, rounder and thicker lvs, and smaller fls with the cup lined with yellow —Of all warm greenhouse bulbous flowering plants, *E grandiflora* (*E amazonica* of the gardener) stands without a rival in the purity and beauty of its bloom.—Prop by offsets, but one must always bear in mind that these plants do not like to be disturbed much at the roots, and it will be some time before they recover from the operation of being divided The spring is the best time to separate the bulbs. Turn the plant out of its pot, and take a hose with a gentle pressure on it and wash all the loam carefully away from the roots, care being taken to break as few as possible.—It thrives well in a good turfy loam. Add about a third of dried cow-manure, with as much sand and charcoal to keep the whole porous. The pots should be well drained with crocks, as these plants will never do well if the soil gets into a "sour" condition. Three bulbs to a 6-inch pot are enough, but if large specimens are desired for exhibitions, increase the number and the size of pot, having in view what is desired. Do not give much water after plants are divided, until growth has begun. When they are growing vigorously, a copious supply of water is required. A temperature of 65° by night should be maintained, and during the day it may run to 80° or 85°. The air should never be allowed to become "stagnant." This applies, of course, to all kinds of plants grown in glass structures. It must be remembered that in their native place the plants grow outdoors, and in heating greenhouses allowance should be made for the free admission of fresh air at all times. Eucharis like a light shade over them during the brightest part of the day, but from about the end of Sept. until March they will stand all the sun possible *E. grandiflora* can be flowered 2 or 3 times during the year —When the lvs. are fully matured, cease watering until signs of flagging of the

foliage is noticed, then water again to freshen them up. Keep this treatment up for a month, that is alternately drying and watering. The temperature may be lowered 5° during this resting-period. Start the plants by giving them a thorough soaking of water, and raise the temperature again to not less than 65° by night. The fl.-sts will soon appear, and they may be watered with manure water, as advised for Dipladenia, until they begin to open, when it should be withheld until they have finished flowering. When the fl.-sts have all been removed, a new set of lvs will be meanwhile pushing up, and they may be again fed as advised above, until they are fully developed; and again treat them in every way as before. All the insect pests are liable to thrive on Eucharis, and the plants may be fumigated as advised for other greenhouse plants. Red-spider may be kept down by the syringe. (George F. Stewart.)

Mástersii, Baker. Bulb globose, often smaller: lf.-blade 8–9 in. long and 4–5 in. broad, oblong, rounded at the base, exceeding the petiole. scape 1 ft. high, bearing 2 nearly sessile fls. (2½–3 in. across) in the umbel, the perianth-segms. ovate and spreading and shorter than in *E. grandiflora*, tube slightly curved, 2 in. long, cup forming a shallow frilled or notched collar. B.M. 6831. G.C. II. 24: 721. G.Z. 31, p. 217.—Possibly a hybrid of *E. grandiflora* and *E. Sanderi*.

cándida, Planch. Fig. 1132 *d*. Bulb globose, bearing stolons 2 in. diam. lf.-blade 9–15 in. long, 4–5 in. broad at the middle, oblong, gradually narrowed both ways, about as long as petiole. scape somewhat flattened, glaucous, 1–1½ ft. high, bearing 6–10 short-pedicelled fls. in an umbel, segms. oblong, acute, more or less reflexed, tube 1½–2 in. long, curved; winged yellow filaments projecting, united at the base only. F.S. 8: 788. G. 6: 5, 15.289. J.H. III. 61.443. G.Z. 21, p. 194.—Smaller-fld. than *E. grandiflora*.

Sánderi, Baker. Fig. 1432 *b*. Bulb ovoid, 1–2 in. diam. lf.-blade 10–12 in. long and 5–6 in. broad, oblong, cordate at base, twice longer than petiole. scape terete, 1 ft., bearing 2–3 nearly sessile fls., segms. ovate, 1 in. or more long, tube curved, 2 in. long, yellowish cup, very narrow, like a collar or rim, and bearing the short, curved filaments on its edge. B.M. 6676. G.C. II. 19: 349. G. 6: 277. J.H. III. 52: 9. G.Z. 28, p. 145.—By some thought to be a hybrid of *E. grandiflora* and *E. candida*. Var. **multifiðra,** Baker. Fls. smaller, 4–6, striped green. B.M. 6831.

subedentàta, Benth. (*Calliphrùria subedentàta*, Baker.) Fig. 1432 *a*. Bulb ovoid, 1½ in. diam. lf.-blade 6–8 in. long, 3–4 in. broad, oblong, triangular at base, about as long as the channeled petiole: scape slender, 1 ft.; fls. 6–8 on pedicels 1 in. or less long, tube 1 in. long, funnel-shaped above, segms. oblong, ascending, 1 in. long, cup wanting or represented only by obscure teeth on the filaments. B.M. 6289. I.H. 28: 415.—A small-fld. species.

E. Bakeriàna, N.E. Br. Has the perianth of *E. grandiflora* and stamens of *E. candida*. fls. 4–6 in the umbel, 2½ in. across, pure white, tube not enlarging emphatically at the top, cup projecting from the bases of the segms., not toothed. lvs. 4 or 5, elliptic, 10–18 in. long, very dark green and closely striate. scape 12–18 in. B.M. 7144. G.C. III. 7: 417, 12: 209.—*E. burfordensis*, Hort. Supposed hybrid between *E. Mastersii* and *E. Stevensii*. fls. bell-shaped, over 3 in. across, about 2 in. long.—*E. Elmeàna*, Sander. Hybrid of *E. Sanderi* and *E. grandiflora*. Easier to grow than *E. Sanderi*. G.C. III. 26: 345.—*E. Lehmannii*, Regel. Fls. about 4 in. an umbel, 1½ in. across, the spreading corona with 12 long, narrow teeth, the perianth-segms. spreading or reflexed. lvs. 2, elliptic-oblong. Gt. 38: 1300.—*E. Lòwii*, Baker. Robust. fls. 4 in. across, the spreading outer segms. 1 in. wide and the 3 inner ones incurved. lvs. larger than those of *E. candida*, long-stalked. Perhaps a natural hybrid of *E. grandiflora* and *E. Sanderi*. G.C. III. 13.539. J.H. III. 28: 111; 43: 276. Gn.W. 10: 7.—*E. Stèrnesii*, N.E. Br. Free-flowering. fls. 3–3½ in. across. about 7 in the umbel, pure white with yellow on the outside of the cup or corona. lvs. 12–14 in. long, very like *E. Sanderi*, and a garden hybrid of that species and *E. candida*. J.H. III. 30: 253. Gn. 46: 128. G.C. III. 17.365.

L. H. B.

EUCHLÆNA (Greek *eu*, well, *chlaina*, covering). *Graminex*. Annual or perennial grasses, with stout stems, broad blades and monœcious inflorescence, occasionally grown in the South for forage and sometimes for ornament.

Staminate infl. in a tassel at the top, the pistillate in small ears in the axils of the lvs.; spikelets 1-fld.; pistillate spike slender, the several joints producing 1-seeded frs. trapezoidal in shape, the surface smooth and hard. The aspect is that of Indian corn (Zea) from which it differs in having free slender-jointed pistillate spikes that are not united into a cob.—Only one species is generally recognized, but there are probably others, all Mexican or Cent. American.

mexicàna, Schrad. (*E. luxùrians*, Dur. & Aschers. *Reàna luxùrians*, Dur.) TEOSINTE. Annual: sts. strongly cespitose, decumbent and spreading at base, erect above, 5–10 ft. or even more, leafy. Dept. Agric., Div. Agrost. 20: 11.—Occasionally cult. for forage in the Gulf states. The seed rarely matures north of S. Fla. See Cyclo. Amer. Agric., Vol. II, pp. 638–9.

A. S. HITCHCOCK.

EUCNÍDE (Greek-made word, referring to the sharp nettle-like hairs). *Loasàceæ*. Several N. American annual or biennial herbs, by some authors referred to Mentzelia. Plants with stinging hairs. lvs. alternate or the lower ones opposite, cordate or ovate, more or less lobed. fls. yellow or white, calyx-tube oblong, the limb persistent, 5-lobed, petals 5, united at the base and inserted on the throat of the calyx, stamens numerous, the filaments filiform, ovary 1-loculed, bearing a 5-cleft style. **E. bartonioides,** Zucc. (*Mentzèlia bartonioàdes*, Benth. and Hook.), is sometimes cult. It is a pretty summer-flowering annual, thriving in warm garden soil. Sts. about 1 ft., somewhat succulent, more or less decumbent, hispid-hairy. lvs. alternate, petioled, broad-ovate and toothed-lobed. fls. large, on long pedicels, opening in sunshine, the petals ovate-pointed, the numerous yellow hair-like stamens projecting and brush-like. Mex., New Mex., and Texas. B.M. 4491 (as *Microsperma bartonioides*). Gt. 5: 320.

L. H. B.

EUCODÒNIA is referred to *Achimenes*. *E. Éhrenbergii*, Hanst. =*A. lanàta*, Hanst. (See p. 208, Vol. I.) It is offered abroad. *E. nægelioides*, Hort. =*Eucodonópsis nagelioides*, Van Houtte, being a hybrid between *Eucodonia Ehrenbergii* and *Nægelia zebrina splendens*. Fls. single on the summits of the peduncles, declined, rose-purple. F.S. 16: 1608. Var. *lilacinélla*, Van Houtte, has large fls. white at the throat and striped and pointed with purple, and lilac-marbled on the limb. F.S. 18: 1858–9.

EÙCOMIS (Greek, *beautiful hair* or *topknot*). *Liliàceæ*. Cape bulbs, half-hardy, producing radical rosettes of long leaves and a strong peduncle or scape bearing a raceme of greenish or whitish flowers more or less tinged with color, the cluster crowned or topped with a coma of leafy bracts (it is from this coma or crest that the generic name is taken).

Bulb tunicated: peduncle simple: lvs. lorate or oblong, often tinged or spotted with purple: fls. regular, 6-parted, rotate; stamens 6, ovary broad and short; style cylindrical and stigma capitate: caps. 3-valved.—Species about 12, African, nearly all from S. Afr. Prop. by offsets. The bulbs may remain in the open if in a warm place and well protected; some of them stand considerable frost, and bloom in spring. Of easy cult. Let the bulbs remain where planted. In the N. treated as glasshouse plants.

A. *Scape club-shaped.*

règia, Ait. Bulb globose, 2–3 in. diam.: lvs. 6–8, obtuse, not undulate toward the edge, to 1½ ft. long and 3–4 in. broad: scape 3–6 in. long, bearing a dense

oblong raceme 3–6 in. long; fls. green, ½in. long, the segms. oblong, and stamens half as long as perianth: crown of 12–20 oblong, acute, crisped lvs. S. Afr.

nàna, Ait Bulb 2 in. diam.: lvs. about 8, obtuse, firm, purplish on back toward the base, to 2 ft. long, 3–4 in. broad above the middle: scape short, 1 in. thick at top, spotted purple; raceme with more or less purple, 3–4 in. long, dense, the fls. nearly sessile: perianth green, ½in. long, the segms. oblong; crown of 12–20 oblong acute lvs. S. Afr.

Jàcquinii, C. H. Wright. Differs from the above, with which it has been confused, in broader and shorter lvs. less tapering at base, and no purple in the infl. S. Afr.

AA. *Scape cylindrical.*

B. *Pedicels short.*

undulàta, Ait. Bulb globose, 2–3 in. diam.: lvs. 6–9, strap-shaped, to 1½ ft. long, 2–3 in. broad, thin, not spotted on back, spreading or recurving, undulate: scape 1 ft. or less, bearing a dense raceme 3–6 in long; perianth green, ½in. long, the segms. oblong or oblanceolate: crown of 12–30 crisped lvs. S. Afr. B.M. 1083. G.W. 15, p. 305.

BB. *Pedicels long, erect-spreading.*

punctàta, L'Her. PINEAPPLE FLOWER. Bulb globose, 2–3 in. diam : lvs. 6–9, erect-spreading, long and narrow, to 2 ft. long and 2–3 in. broad, channeled, not undulate, brown-spotted beneath: scape 1 ft., spotted; raceme lax, cylindrical, to 1 ft. long; fls. green, ½in. long, the ovary brown: crown of 12–20 oblong acute lvs. S. Afr. B M. 913. F.S. 22 2307. G W. 5, p. 121; 9, p. 5. J H III. 52·141. Gn 70, p. 295. G. 19:291; 22:520; 27:409; 32:675. F.E. 31:1080 —A form with lvs. striped beneath with brown is var. *strùta,* Sims. B M. 1539.

bicolor, Baker. Bulb large and globose: lvs. 5–6, strap-shaped, thin, not spotted, undulate, to 2 ft. long by 3–4 in. broad: scape 1–1½ ft. long; raceme to 1 ft. long, dense at top; stamens and margins of perianth-segms. bright purple, otherwise close to *E punctata:* crown of 12–20 oblong acute lvs. usually margined with red-purple. S. Afr. B.M. 6816. G.W. 14, p. 468.

L. H. B.

EUCÓMMIA (Greek, *eu,* well, and *kommi,* gum; alluding to the fact that the plant contains rubber). *Eucommàceæ.* Deciduous tree grown for its handsome foliage and also for its possibility as a hardy rubber-producing tree.

Branches with laminate pith: winter-buds conspicuous, with imbricate scales: lvs alternate, petioled, serrate, without stipules: fls dicœcious, without perianth, solitary in the axils of bracts at the base of the young shoots and precocious; staminate fls. pedicelled; stamens 6–10 with very short filaments and elongated linear anthers; pistillate fls short-pedicelled with a 1-celled, 2-ovuled stipitate ovary, bifid at the apex, the lobes stigmatic on the inside: fr. a compressed winged nutlet.—One species in Cent. China, not closely related to any other genus; it was first placed with the Trochodendraceæ or Magnoliaceæ and afterward with the Hamamelidaceæ, but is now generally considered as representing a distinct family allied to the last named.

Eucommia is an upright-growing vigorous tree with rather large elliptic dark green foliage, inconspicuous precocious flowers and winged fruits; in habit and foliage it resembles somewhat an elm tree. In China the bark is a most valued medicine. The tree contains rubber in all its parts, particularly in the young growth and in the bark. Though the rubber has proved to be of good quality, it is apparently difficult of extraction and not present in sufficient quantity to make the commercial exploitation of the tree pay; therefore the hopes which have been set in this "hardy rubber tree" will probably never realize. The tree has proved perfectly hardy as far north as Massachusetts and grows well in a loamy humid soil. Propagation is by seeds and by greenwood cuttings under glass.

ulmoìdes, Oliver. Tree, to 60 ft.: lvs elliptic to elliptic-ovate, acuminate, broadly cuneate at the base, serrate, glabrous, glossy and dark green above, pubescent below when young, 3–7 in. long: samara oblong, bifid at the apex, 1¼–1½ in. long. April; fr. in Oct. Cent. China. H I. 20:1950. R.H. 1909, p. 226. M.D G 1912:11, 613.

ALFRED REHDER.

EUCRŸPHIA (Greek for *well covered*). *Eucryphiàceæ;* formerly referred to *Rosàceæ.* A very few southern hemisphere resinous trees or shrubs, with opposite evergreen simple or pinnate lvs and showy white fls.: sepals 4, free; petals 4, broad; stamens very many; ovary free, 5–8-celled: fr a hard dehiscent caps. *E. pinnatifòlia,* Gay, is a shrub or small tree, hardy in parts of England, with large white hypericum-like 4-petaled fls. and rose-like foliage, from Chile B M 7067. G C. II 14·337; III. 9.613; 10 217; 15.109, 23.15 (fr); 30.351. Gn 63, p. 281; 77, p 423 G 29·96; 33.25. F.S R. 1, p. 41. Gn.W. 9.821. G M 53.203 *E. cordifòlia,* Cav., has simple serrate lvs B M. 8209 G. 33.607. G.C. III. 22:247; 42 259, 44 129 Gn 70, p 190; 73, p. 471.—Neither of these is in the American trade Worthy of trial in the S. There are 2 species (*E Billardieri,* Spach, and *E. Mooreì,* Muell) in Tasmania and New S Wales.

Plants of *E. pinnatifolia* give much satisfaction in the open in England although not much known, the pure white fls. 3 in diam., and borne more or less in pairs, being produced in great profusion in late summer; it grows 8–10 ft. high.

EUGÈNIA (named in honor of Prince Eugene of Savoy) *Myrtàceæ* A large group of trees and shrubs, grown chiefly for their ornamental foliage and berries Many tropical species yield edible fruits which are both eaten out of hand and made into jellies or confections A number of these have been recently introduced into the warmer parts of the United States, where they give promise of attaining much importance The clove of commerce belongs to this genus.

Evergreen trees and shrubs. lvs. opposite, mostly entire and finely penniveined: fls white or creamy or the numerous stamens yellowish: fr a drupe-like berry, usually globular or pear-shaped, 1–5-seeded. Habit and infl of *Myrtus,* which see for cult. and prop.

INDEX.

aromatica, 8.	*Dombeyi,* 1.	microphylla, 4.
asperifolia, 4.	jambolana, 9.	myrtifolia, 5.
australis, 5.	Jambos, 6.	Pitanga, 3.
brasiliensis, 1.	*macrophylla,* 7.	uniflora, 2.
caryophyllata, 8.	malaccensis, 7.	*vulgaris,* 6.
Caryophyllus, 8.	*Michelii,* 2.	

A. *Fls. solitary on axillary peduncles; petals not united.* (*Eugenia proper.*)

1. brasiliénsis, Lam. (*E. Dómbeyi,* Skeels). GRUMIXAMEIRA of Brazil. Tree, to 50 ft., glabrous or the infl obscurely puberulent: lvs. oval or obovate-oblong, tapering at base, obtuse, 2½–5 in. long, 1–2½ in. broad: peduncles 1–2 in. long, much exceeding the scales which subtend them: fr. edible, scarlet, black at maturity, the size of a cherry. Brazil. B.M. 4526. R.H. 1845:425.—Cult. in S. Calif. The frs. are candied and eaten in the tropics.

2. unifiòra, Linn., not Berg. (*E. Michèlii,* Lam.). PITANGA. SURINAM CHERRY. Shrub, 5–20 ft., glabrous: lvs. ovate-lanceolate, obtuse at base, glossy, 1–2 in. long, exceeding the peduncles: berry ½–1 in. diam., ribbed, resembling a miniature tomato, edible, with a spicy acid flavor. Trop. Brazil. R H 1889, p. 532 — Hardy in S. Fla. and in S. Calif. Much esteemed for

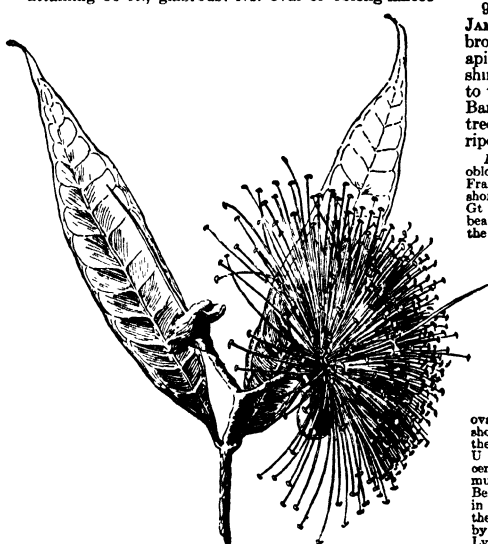
jellies. Useful also as a pot-plant, producing an abundance of showy red frs.

3 **Pitánga,** Kiaersk. PITANGA. Low shrub, young foliage and branchlets reddish pubescent: lvs. elliptic-oblong, acute at base, 1½–3 in. long: berry red, subglobose, obscurely 8-nerved, about ½in. diam. S. Brazil and adjacent Argentine.—Intro. into S. Calif. by Franceschi.

4. **microphýlla,** A Rich., not Bedd. nor Rich ex Berger (*E asperifòlia,* Berg). Branchlets and infl. pilose: lvs. small, oval, acute, glabrous, longer than the peduncles: fr. unknown. Cuba.—Species other than the true *E. microphylla* apparently have been intro. under this name.

AA. *Fls. in cymes or panicles; petals spreading, not united.* (*Jambosa. Caryophyllus.*)

5. **myrtifòlia,** Sims (*E. austrális,* Wendl. *Jambòsa myrtifòlia,* Ndz.). AUSTRALIAN BRUSH CHERRY. Tree, attaining 80 ft., glabrous: lvs. oval or oblong-lanceo-



1433. Flower of rose-apple, Eugenia Jambos. (Natural size)

late, mostly acute, 1½–3 in long: fls. white: fr red, ovoid, nearly 1 in long, with an acid taste Austral. B.M 2230. Univ Calif Pub. Bot 4:8.—Hardy in the S Much used in Calif. as an ornamental tree and for clipped hedges. The foliage is dense and glossy, green when mature, tinged with wine-red on the gracefully spreading young shoots. Frs. sometimes used in jelly-making.

6. **Jámbos,** Linn. (*Jambòsa vulgàris,* DC. *Jambòsa Jámbos,* Millsp.). ROSE-APPLE. JAMROSADE. JAMBOS. Fig. 1433. Tree, 20–30 ft., glabrous: lvs. lanceolate, very acuminate, 5–8 in. long, 1–2 in. broad, thick and shining: fls greenish white: fr. pyriform, 1½–2 in. thick, white or yellowish, tinged with rose-color, edible but rather insipid, fragrant. E. Indies. B M. 1696. Gn. 75, p. 616.—Hardy in Calif. as far north as San Francisco. Grown for its rich foliage and showy fls. Frs. much used in the tropics for jelly-making and in confectionery.

7. **malaccénsis,** Linn. (*E. macrophýlla,* Lam., not Berg. *Jambòsa malaccénsis,* DC.). LARGE-FRUITED ROSE APPLE. JAMBOS. Glabrous tree: lvs. oblong to elliptic, acute, 5–10 in. long, 2–4 in. wide: fls. purple: fr fragrant, red, obovoid, about 2 in. diam., with apple-like flavor Polynesia.—More tender than *E. Jambos,* but the foliage more luxuriant and the frs. larger.

8. **aromática,** Baill, not Berg (*Caryophýllus aromáticus,* Linn *E. caryophyllàta,* Thunb *Jambòsa Caryophýllus,* Ndz.). CLOVE TREE Lvs. ovate-oblong, acute, strongly tapering to the conspicuous petiole, 2–5 in. long, coriaceous, dotted; lateral veins numerous, parallel, the cross-veinlets obscure: fls. in terminal trichotomous cymes, pale purple, only ¼in. across. Moluccas.—Widely cult. in the tropics. Apparently not suited to even the warmer parts of U. S. The fls. are the cloves of commerce. See *Cloves*

AAA. *Fls. in cymes or panicles; petals united into a calyptra.* (*Syzygium*)

9. **jambolàna,** Lam. (*Syzýgium jambolàna,* DC.). JAMBOLAN, or JAMBOLAN PLUM. Tall shrub or tree: lvs. broadly oblong, very broad at summit but often shortly apiculate, 2½–5 in. long, 1¾–4 in. wide, thick and shining: berry edible, varying from the size of a cherry to that of a pigeon's egg E Indies.—Grown at Santa Barbara, Calif, where, according to Franceschi, the trees become large and flower profusely but never ripen fr.

E dilba, Roxbg, Malaya, may be known by its sessile ovate-oblong lvs. and branched peduncles Intro into S Calif. by Franceschi —*E. apiculàta,* DC, Chile, has oval apiculate lvs. shorter than the mostly 1-fid peduncles, and a pubescent infl Gt 890 Perhaps not now grown in N Amer —*E cauliflóra,* DC, bears fls and frs. in sessile clusters along the woody branches and the main trunk down nearly to the ground fr about ¾in diam, purple Brazil Intro by Franceschi, and by U S Dept. Agric (as Myrciaria cauliflora, Berg) —*E costaricénsis,* Berg, Lvs. oblong, 2–3 in long fls in sessile axillary umbels; pedicels ¼in long fr. obovoid, glabrous, small Cent. Amer —*E edulis,* Vell. Branchlets, petioles, and young foliage ferruginous-pubescent lvs willow-like, slenderly acuminate fr orange-color or yellow, downy, the size of an apple Brazil Intro by Franceschi, and by the the U S. Dept Agric (as Myrciaria edulis, Skeels) Stands drought well —*E littoralis,* Panch Lvs spatulate, obtuse, subcordate at base fls sessile, fasciculate-congested, infl pubescent. fr. puberulent, subglobose, about ½in diam, fragrant, sweet to the taste New Caledonia Intro into Calif by Franceschi. —*E Lúma,* Berg=E apiculata.—*E Máto,* Griseb. Lvs. ovate, obtuse, about 1½ in long fls. solitary on peduncles much shorter than lvs. Argentine. Intro by Franceschi, who describes the fr as orange-colored, ribbed, and about 1 in diam, and by the U S Dept Agric —*E myrtophylla,* Casar Growing parts pubescent lvs. mostly ternate, very narrowly linear, ¾–1½ in long, much exceeding the solitary peduncles Brazil —*E púngens,* Berger. Young parts pilose lvs elliptic-oblong, spine-tipped, 2–3 in long, ¾–1 in broad, much exceeding the simple peduncles in their axils fr. depressed-globose, puberulent, small Brazil. Intro. by Franceschi, and by the U. S Dept Agric.—*E pyrifórmis,* Camb. Lvs. myrtle-like but white tomentose beneath, about equaled by the branched peduncles fr pear-shaped, yellow, puberulent, edible Brazil Intro. in Calif by Franceschi.—*E Úgni,* Hook & Arn =Myrtus Ugni —*E. Uvalha,* Camb, not Miq Growing parts and infl pubescent lvs oblong, narrowed at base, obtuse, 1–2 in. long, much exceeding the simple peduncles fr yellow, size and shape of a small pear, edible Brazil Intro by Franceschi.

HARVEY MONROE HALL.

EULÀLIA: *Miscanthus.*

EULÒPHIA (Greek, *handsome crest*). *Orchidàceæ.* Terrestrial orchids, requiring warmhouse conditions.

Rather small plants with membranaceous lvs. and conspicuous pseudobulbs: scape basal, several-fld.; sepals and petals spreading, similar, ascending; labellum 3-lobed; pollinia 2.—About 50–60 species, in the tropics of both hemispheres The cult. of Calanthe will apply to this genus

maculàta, Reichb. f. Pseudobulbs ovate, compressed: lvs ovate, spotted or blotched fls. small; upper sepal hood-shaped, lateral ones acuminate, reddish brown; petals broader, white or pale rose; labellum cordate, with 2 crimson spots, triangular in outline, near the base, otherwise white. Brazil B.R 618 (as Angræcum).

scrípta, Lindl. Lvs. linear, subdistichous: fls. purple and yellow; sepals and petals linear-oblong; labellum 3-lobed, lateral lobes rotund at the apices Madagascar.

E. Cólax, Rolfe. A slender-growing species with aloe-like lvs.—*E Lubbersiána*, Laurent & Th Dur Allied to E maculata· lvs. dark green, marbled with white Afr —*E. núda*, Lindl Scape about 2 ft tall, many-fld , fls ranging from rose-purple to pink, or yellowish green, lip nearly entire, recurved. India and China B M 8057 —*E paniculàta*, Rolfe Pseudobulbs tufted, bearing 2 strap-shaped lvs fls numerous, petals and lip yellowish green dotted with purple Madagascar —*E undulàta*, Rolfe Scape about 1 ft high, of slender growth, petals and lip pale green, the latter with 3 prominent keels on the disk Rhodesia —*E Woodfordii*, Rolfe With tall many-fld infl , fls green with dull claret-purple lip Old Calabar

GEORGE V. NASH †

EULOPHIÉLLA (a diminutive of *Eulophia*). *Orchidàceæ* Orchids in habit resembling a small cyrtopodium. Flowers in many-fld. racemes, sepals and petals similar, concave; lip 3-lobed, spurless; column with a curved foot; pollinia 2 —Species 2. They require the conditions and treatment given Cyrtopodium

Elísabethæ, Hook. Lvs. nearly 2 ft. long, plicate: scape stout; raceme many-fld.; fls about 1½ in across; sepals and petals white, the former marked with rose on the outside, lip white with a golden disk. Madagascar. B M. 7387. G C. III. 45·407 C O. 1. O R. 6: 177; 20 137.

Peetersiàna, Kranzl Bulbs 1 ft long· raceme dense, fls nearly 3 in. across, rose-purple; lip with a golden blotch. Madagascar. G.M. 51:267. C.O. 2. O R. 6. frontispiece; 20:138

E. Hámelinii, Rolfe Resembling E Peetersiana in habit but lvs narrower and fls smaller Madagascar

GEORGE V. NASH.

EUÓNYMUS: *Evonymus*

EUPATÒRIUM (named for an ancient king of Pontus said by Pliny to have employed one of this group of plants in medicine). *Compósitæ* JOE-PYE WEED THOROUGHWORT BONESET. HEMP AGRIMÒNY. MIST-FLOWER Chiefly perennial herbs, a few species annual, many of the tropical ones shrubby or even arborescent; some of them hardy border plants, others grown in coolhouses as florists' plants, and others in warmhouses for the attractive foliage

Heads rayless, mostly in dense flat-topped or rounded clusters, less frequently in open panicles, the florets (rarely 1–4) mostly 5 or more in each head, perfect, the 2 style-branches long, threadlike or club-shaped, protruding far out of the tube of the floret; involucre cylindrical to hemispherical, its scales in 2 to many overlapping ranks. achenes 5-angled, crowned with a well-developed pappus of hair-like mostly white bristles: lvs. mostly opposite: fls purple, rose-colored or white, more rarely lilac or bluish violet, never yellow. —At least 600 species, chiefly of Mex , the W. Indies, and Trop S Amer Certain species, now botanically placed in Eupatorium, still appear in trade catalogues and seed-lists under the names Hebeclinium and Conoclinium Others have been confused with Ageratum.

Of this large and varied genus relatively few species have been brought into cultivation. Of these, there are two classes, namely certain warm-country species adapted only to glasshouse culture, and on the other hand a few native North American species (as well as the hemp agrimony of Europe), more or less tractable in cultivation, especially as components in making up mixed hardy borders. The glasshouse species are seen only in the larger or amateur collections, as a rule, although a few have been long in European cultivation. Of the hardy species, some, reputed medicinal, are found in old gardens. The glasshouse species demand the general treatment of Piqueria (Stevia of florists)—a cool or intermediate temperature and pot culture. They are easy to grow, and propagate readily by cuttings. They are useful for winter bloom, the heads, though individually small, being aggregated in showy masses

INDEX.

adenanthum, 11.
adenophorum, 11.
ageratoides, 25
album, 23
altissimum, 22.
americanum, 11.
amœnum, 18
araliæfolium, 8
aromaticum, 26
atrorubens, 1
cannabinum, 19.
cœlestinum, 20.
conspicuum, 10.
cordifolium, 26.
elegans, 16.
folis variegatis, 11.
foliosum, 18
Fraseri, 26.
glabratum, 16.
glandulosum, 11.
glechonophyllum, 14.
grandiflorum, 1
grandifolium, 10.
Haageanum, 14.
hecatanthum, 7.
ianthinum, 4.
Kirkwoi, 19.
Lasseauxii, 5.
latifolium, 16.
ligustrinum, 9.
maculatum, 18.
megalophyllum, 2.
melisoides, 26
micranthum, 9.
monticolum, 3.
Morsei, 9.
omphalæfolium, 8.
pazcuarense, 15.
perfoliatum, 21.
petiolare, 3
probum, 12.
purpureum, 18, 21.
Purpusii, 3
riparium, 17.
serrulatum, 6.
sessilifolium, 24.
trapezoideum, 11.
trieste, 13.
triste, 13.
truncatum, 21
urticæfolium, 25.
vernale, 13
Wenmannianum, 9

KEY TO THE SPECIES.

A. *Glasshouse or warm-country species.*
B. *Florets pink, purple, lilac, or violet*
C *Involucral scales not ending in hairy tails*
D. *Shape of lvs ovate, lf -stalks long.*
E *Lvs heart-shaped*
F. *Sts covered with dense red-dish wool* . . 1 **atrorubens**
FF. *Sts green*
G *Panicle dense, terminal lvs mucronate-toothed* 2 **megalophyllum**
GG. *Infl lax, partly axillary lvs crenate-toothed* 3 **Purpusii**
EE. *Lvs pointed or blunt at base* 4 **ianthinum**
DD *Shape of lvs lanceolate or oblong, lf -stalks short*
E. *Lvs alternate heads many-fld* 5 **Lasseauxii**
EE *Lvs opposite heads 5–12-fld* . 6 **serrulatum**
CC *Involucral scales ending in hairy, colored tails* 7 **hecatanthum**
BB. *Florets white or nearly so (the pappus sometimes colored)*
C. *Lvs leathery, lance-oblong, glabrous, entire* 8. **araliæfolium**
CC *Lvs not leathery, usually somewhat toothed and hairy*
D. *Lf -blade elliptic-lanceolate, decurrent and crisped on short stalk* . 9 **micranthum**
DD *Lf -blade round-ovate, toothed even to the decurrent base* 10 **conspicuum**
DDD *Lf -blade not decurrent on petiole*
E *Plant glandular-sticky*
F *Heads about ¼in diam* 11 **glandulosum**
FF *Heads about ½in. diam* 12 **probum**
EE. *Plant not glandular-sticky*
F. *Lvs velvety beneath infl broad rounded corymb* 13. **vernale**
FF. *Lvs sparingly hairy or soon glabrate*
G *Shape of lvs round- or triangular-ovate; margins toothed*
H. *Lf -blade small, ½–1½ in. long* . 14. **glechonophyllum**
HH *Lf -blade larger, 2-4 in. long* 15. **pazcuarense**
GG. *Shape of lvs. elliptic-ovate; margins nearly or quite entire* . 16. **glabratum**
GGG. *Shape of lvs narrowly lanceolate..* 17. **riparium**
AA. *Hardy or border plants*
B *Florets flesh-colored, reddish or blush-purple.*
C. *Lvs. lance-oblong, merely toothed, mostly whorled* . . . . . 18 **purpureum**
CC. *Lvs. deeply 3-parted, opposite* 19 **cannabinum**
CCC. *Lvs. broadly ovate, opposite, merely toothed* . . . . . 20 **cœlestinum**
BB *Florets white or nearly so.*
C. *Lvs. perfoliate (united around the st.)* . . . . . 21. **perfoliatum**
CC. *Lvs. not perfoliate.*
D. *Lf -blade lanceolate, the base narrowed and scarcely stalked.*

E. *Scales of involucre blunt, gray-velvety* . . . . . 22. **altissimum**
EE. *Scales sharp, smoothish, with thin white edge* . 23. **album**
DD. *Lf.-blade ovate-lanceolate, sessile by a rounded base* . 24. **sessilifolium**
DDD. *Lf.-blade broadly ovate, usually well stalked.*
E. *The lvs taper-pointed, sharply toothed* . . . 25. **urticæfolium**
EE. *The lvs mostly blunt and bluntly toothed* 26. **aromaticum**

1. atrórubens, Nichols. (*Hebeclínium atrórubens*, Lem.) Lvs large, ovate, short-stalked, heart-shaped at base, opposite, toothed, covered on the edge and veins with long reddish or claret-colored hair: heads red or purple, in a very large red-rayed truss. S Mex. I H. 9 310.—A stately species with fine foliage and richly colored fls., but said to be difficult to grow. Rare in cult. Closely related, if not identical, is *E grandiflorum*, André, though figured with smaller heads of redder color. R H 1882.384.

2 **megalophýllum,** Klatt (*Hebeclínium macrophýllum*, Lem., not DC. *H. megalophyllum*, Lem.) Half-shrub, robust. lvs opposite, round, more or less heart-shaped, very large, the lower sometimes more than a foot in diam., veiny. heads in large clusters (1–1½ ft. broad), florets rose, the long hairlike styles conspicuous, bluish. S Mex. R H 1866, p. 351. Gt 16 548.—Fine showy species with rich foliage, but apparently rare and not recently in trade. Needs richly manured soil, much light, and frequent replanting.

3 **Purpúsii,** Brandegee (*E petiolàre*, Hort., not Moc & Sessé) Smoothish or (var **montícolum,** Brandegee) sticky-hairy, loosely branched. lvs round-ovate, commonly heart-shaped, shortly taper-pointed, bluntly and rather coarsely toothed. heads slender-stalked, ½in. diam.; florets at first white, changing rapidly to pinkish lilac. Low Calif. G C III 35 163.—Attractive, rapid-growing, herbaceous, tender. Weak and needing support.

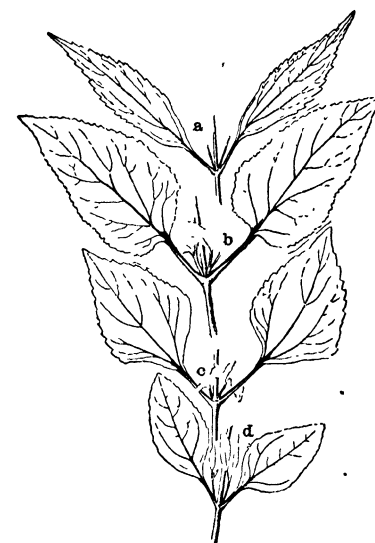
4. **iánthinum,** Hemsl. (*Conoclínium iánthinum*, Morr. *Hebeclínium iánthinum*, Hook.) Somewhat shrubby, the thickish round sts. at first covered with a rusty purplish pubescence. lvs. large, ovate, long-stalked, opposite, pointed or blunt (but not heart-shaped) at base, somewhat hairy on both surfaces, serrate. fls. light violet, in a large compound terminal corymb. S Mex. B M. 4574.—A luxuriant species with heavy foliage, of easy pot cult. in a warmhouse.

5 **Lasseàuxii,** Carr. (*Agératum Lasseàuxii*, Carr. *Conoclínium Lasseàuxii*, Dur.) Habit of Ageratum, densely covered with short glandular hairs: lvs. alternate, oblong-lanceolate, narrowed at each end, bluntly toothed. heads in small compact unequally stalked clusters; florets very numerous, at first white, at maturity a vivid rose-color. Temp. S. Amer. R H 1870.90.—Intro. to European hort. in 1870. Attractive bedding plant, but apparently rare. Probably not fully hardy though less tender than most of the glasshouse species. Prop. easily and flowers continuously; 1–2 ft. high.

6. **serrulàtum,** Hort. Shrub with lance-shaped, pointed, sharply and unevenly toothed, short-stalked lvs., very unequal involucral scales, and showy reddish lilac heads in large dense flat-topped clusters; florets 5 in each head. In European hort., and said to come from S. Brazil. R H. 1894·304. Gt. 44, p. 570. G C. III. 18·265.—Three to 6 ft. tall. Choice, but certainly not the true *E serrulatum*, DC., which has much narrower finely and evenly serrulate lvs. and 11–12-fld. heads.

7. **hecatánthum,** Baker (*Hebeclínium Urólepis*, DC.). Robust annual, like a large ageratum· lvs. opposite, stalked, round-heartshaped. heads showy, bluish purple; florets numerous (about 75); involucral scales ending in similarly colored hairy appendages. Temp. S. Amer.—Promising species, worthy of trial as a bedding plant.

8 **araliæfòlium,** Less. (*E. omphalæfòlium*, Kunth & Bouché) Soft-wooded shrub with thick and shining oblong-lanceolate lvs 3–8 in. long. heads loosely panicled; involucral scales conspicuously unequal, the outer short and calyx-like, the inner 3–4 times as long; florets white. S Mex. and Guatemala. Gt 2, p. 4, t 39.—From low and moist tropical habitat and presumably very tender. Rare in cult. and not noticed recently in trade. Needs rich leaf-mold, moist air, and high temperature. Prop. by cuttings. Flowers in March.



1434. Leaves of glasshouse Eupatoriums. *a*, E riparium, *b*, E. vernale; *c*, E glandulosum; *d*, E. glabratum. (×⅓)

9 **micránthum,** Less. (*E ligustrìnum*, DC. *E Mórisii*, Hort. *E Weinmanniànum*, Regel & Koern. Many other hort. names, for which see Gt. 22, p. 36.) Lvs. opposite, elliptic-lanceolate, pinnately veined, the blade somewhat toothed and slightly decurrent in narrow crisped wings upon the short lf.-stalk: heads small and few-fld. but very numerous in large round-topped terminal corymb, florets white, but pappus pink-tinged to deep rose. Mex. Gt 16, p. 260, t 555, figs 1–3. Gn 47, p. 444. G C II 5, p. 53.—Upright shrub rather widely cult. since about 1830 under a great variety of names, but chiefly as *E. Weinmannianum*.

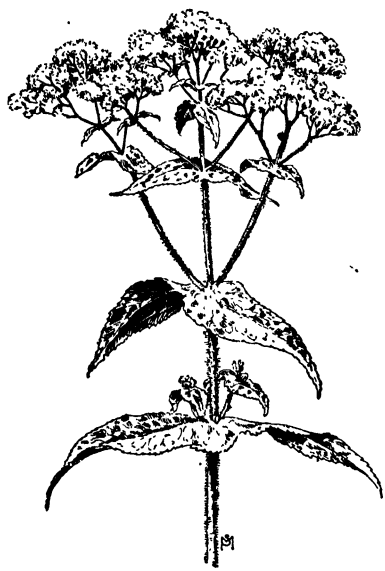
10. **conspícuum,** Kunth & Bouché (*E. grandifòlium*, Regel) Shrubby. lvs. opposite, large, thin, triangular ovate, finely and sharply toothed to the very base, which is somewhat decurrent upon the long lf.-stalk. fls. white, in ample lax panicles, almond-scented. Guatemala. Gt 1, p. 102, t 12.—Planted out in summer forms a luxuriant shrub, attractive on account of its excellent foliage. Best prop. by cuttings placed in warm bed about the end of August. Winter-bloomer in glasshouse.

11. **glandulòsum,** HBK. (*E adenóphorum*, Spreng. *E. adenánthum*, Hort., not DC. *E. trapezoídeum*, Kunth.

E. americànum, Hort.). Fig. 1434. Diffuse and often decumbent herb, the slender round branches, petioles, and pedicels finely glandular-puberulent: lvs. triangular-ovate or rhombic-ovate, thinnish, slender-stalked, taper-pointed, coarsely and sometimes unevenly crenate-dentate, sparingly puberulent beneath: heads pure white, ageratum-like, in close clusters. Mex. B R. 1723.—Easy in pot cult. and not very tender, flowering in late autumn or early winter Cuttings strike root readily. Var. **fòliis variegàtis,** Hort. Lvs. variegated.

12. **prôbum,** N. E. Br. Very viscid like the preceding, probably more tender: lvs. similar: heads decidedly larger, ½in. diam. Peru. G C. III. 7:321.—Recommended as promising and cult in a few English conservatories. Apparently not yet in the trade.

13. **vernàle,** Vatke & Kurtz. (*E. triste*, Hort., not DC. *E triéste*, Hort.). Fig. 1434. Strong herb (slightly woody in the wild), with hairy sts.: lvs. oblong-ovate, long-stalked, taper-pointed, serrate, finely hairy above,



1435. Eupatorium perfoliatum. (×⅛)

paler and grayish velvety beneath, veiny, 3–5 in. long: fls. bright white, the heads in an ample terminal corymb, involucral scales long, narrow, green. Mex. Gt. 22:750.—Easy in pot cult. becoming popular for cut-fls.

14. **glechonophýllum,** Less. (*Agératum conspícuum*, Hort.). Low, branching half-shrub, very leafy: lvs. small, ½–1 (rarely 2) in. long, triangular-ovate, sharp-pointed, bluntly few-toothed, thin and nearly glabrous, on slender stalks: heads borne on threadlike pedicels in small or medium-sized flattish clusters. Chile.—Tender greenhouse perennial, but flowering in the open the first year if seeds are sown early. Closely related, if not actually identical was the *E. Haageanum*, Regel & Koern. intro. into European hort. in the middle of the 19th century (see Gt. 16, p. 260, t. 555, figs. 4–6).

15. **pazcuarénse,** HBK. Puberulent but not glandular: lvs. opposite, stalked, round-ovate, light green, 2–4 in. long, taper-pointed, sharply or bluntly toothed: heads very numerous in a wide (3–10 in.) flattish corymb. Uplands of Mex.—Essentially herbaceous, 1–3 ft. high. Recently intro. in cult. in S. Calif. Promising for cut-fls. and as a window plant.

16. **glabràtum,** HBK. (*E. élegans*, Hort. *E. latifòlium*, Hort.). Fig. 1434. Shrubby, erect, with slender hard glabrous brown sts.: lvs of firm texture though scarcely leathery, small, lance-oblong or ovate-oblong, tapering into a strong rather short petiole, blunt or pointed, wavy-margined or small-toothed. fls. (sometimes blush) in ascending cymose clusters, together forming a long terminal leafy panicle. Uplands of Mex.

17. **ripàrium,** Regel. Fig 1434 Diffuse, becoming woody at base, 2 ft., the sts. slender, puberulent and usually reddish: lvs. opposite, long-lance-shaped, taper-pointed and at base narrowed to a long petiole, prominently 3-ribbed, toothed: heads in rather compact long-stalked clusters. Mex. Gt. 15:525. Gn 40, p. 134 —Good winter bloomer. Best for florists Readily cult. in coldhouse.

18 **purpùreum,** Linn. Joe-Pye Weed. Lvs. whorled, commonly in 5's and 6's, oblong or lanceolate, taper-pointed, coarsely serrate: heads in large compound clusters, pale purple or flesh-colored, rarely almost white N Amer.—Common and variable. Tall, rank plant of low grounds (reaching 8–9 ft), good for bold effects in border or against shrubbery. Var. **maculàtum,** Darl. Of lower growth lvs commonly in 4's, ovate-oblong, roughish-pubescent: heads in smaller clusters, more deeply colored Var **foliôsum,** Fern. Similar but with the infl. surpassed by the long upper lvs Var. **amœnum,** Gray Still lower (2 ft. high), smoothish: lvs sometimes merely opposite.

19. **cannabìnum,** Linn Hemp Agrimony Resembling Joe-Pye weed in general habit and with similar pale purple heads in terminal clusters. lvs opposite, but deeply 3-parted in a manner to suggest verticillate lvs. Eu.—Common. May be used like the preceding species but less desirable Thrives best in limy alluvial soil. Eng. Bot 6.428 —The Asiatic *E Kurilòvi*, Turcz, is a very nearly related plant of lower growth (1–3 ft), with narrower (linear-oblong) coarsely toothed lf-segms, the lateral often much reduced. Strict herb with dense terminal corymb of dull greenish purple heads Gt. 24:850.

20. **cœlestìnum,** Linn. (*Conoclínium cœlestínum*, DC) Mist-Flower. Somewhat pubescent. lvs opposite, stalked, triangular-ovate, somewhat cordate, thin, coarsely toothed: heads as in Ageratum in compact clusters, many-fld., light blue to violet. N J to Mich, Kans., and southward —Perennial herb, late-blooming, heliotrope-fld. Appropriate to low borders.

21. **perfoliàtum,** Linn. Boneset. Thoroughwort Fig 1435. Hairy: lvs. lance-oblong, the pairs united at base about the st., wrinkled, remotely toothed or entire, taper-pointed: heads in dense terminal compound cymes. N. Amer, common in low rich soil —Stout, slightly rank-smelling plant, 2–3 ft high, long used in domestic medicine and found in old gardens. Excellent for striking effects, especially in low grounds Fls grayish white or in a comparatively rare variety (forma **purpùreum,** Brit.) bluish purple In var. **truncàtum,** Gray, the lvs. (at least the upper ones) are rounded or truncate at the sessile base, not united about the st A peculiar form apt to be encountered occasionally in large cultures.

22. **altíssimum,** Linn. Grayish green, downy, much branched: lvs. opposite, narrowly lance-shaped, tapering to both ends, short-stalked, remotely toothed or entire: heads only 5-fld. Pa. to Minn., Neb., and southward.—Tall, vigorous herb, 4–8 ft. high, in open places and dry soil. Not very ornamental See page 3568

23. **álbum,** Linn. Rough-hairy: lvs. opposite, lance-oblong, coarsely serrate, essentially sessile, veiny: involucral scales scarious-margined: florets white. L. I., southward near the coast.—Somewhat attractive for border planting and specially suited to poor sandy soil.

24. **sessilifólium,** Linn. UPLAND BONESET. Lvs. oblong-lanceolate, gradually tapering almost from the rounded sessile or nearly sessile base to the apex: heads 5-fld., white. Vt. to Mo. and southward.—A trim, smooth highly attractive hardy species. Thrives best in limy alluvial soil.



1436. Eupatorium urticæfolium (×⅓)

25. **urticæfólium,** Reichard (*E. ageratoides,* Linn. f.). WHITE SNAKEROOT. Fig. 1436. Lvs. opposite, thin, long-stalked, ovate with broad base, acuminate, coarsely and sharply serrate, green on both sides: heads small in loose but ample clusters, florets bright white. E. N. Amer. Mixed woods, common.—Neat, smoothish, branching herb, 2–4 ft high. One of the best of the perfectly hardy summer-blooming species.

26 **aromáticum,** Linn Much like the preceding but usually hairy. lvs thickish and blunt or scarcely pointed, blunt-toothed. later-flowering, not aromatic Mass. and southward near the coast —Suited to very sandy soil Var **melissoides,** Gray (*E. Fràseri* and *E. cordifòlium,* Hort.). Slender, roughish, strict: heads 5–12-fld : lvs subcordate, ovate or oblong, obtuse, the petioles often very short. S. E U. S.—Also suited to poor and sandy soil, but more tender than the typical form

The following species are said to have been recently intro into European horticulture and to promise well *E deltoideum,* Jacq A soft-wooded half-shrub with opposite triangular-hastate crenately toothed lvs. 3–5 in long and somewhat pale and slightly velvety beneath, the basal lobes widely spreading acute lf -stalks 1–3 in long heads of rosy purple fls in thyrsoid panicles, involucral scales linear, very sharp, scarcely imbricated S Mex A glasshouse species with striking foliage —*E herbáceum,* Greene (*E arizonicum,* Hort). An erect smooth or merely pulverulent perennial 1–3 ft high, with opposite triangular-ovate pale green lvs 1–3 in. long with rounded basal lobes, toothed sides, and rather short but slender stalks fls white, heads in broad rounded terminal clusters. S W U S Half-hardy and suited to dry places. *E. japónicum,* Thunb Erect perennial resembling E. cannabinum, with dull purplish to greenish white fls in flat clusters. lower lvs. deeply 3-parted, the upper simple not very attractive.

B. L. ROBINSON.

EUPHÓRBIA (classical name; said by Pliny to be in honor of King Juba's physician; possibly from the Greek for *fat*). *Euphorbiàceæ.* MILKWEED (improperly) WOLFS-MILK SPURGE. The last name, most often applied to the genus as a whole, belongs more properly to the common herbaceous species and especially to *E. Lathyris.* Of very diverse habit, from succulent cactus-like trees to low or prostrate herbaceous weeds; planted mostly in the open, but some kinds grown under glass as oddities and some as florist's plants

The genus is characterized by the single pedicellate, pistilate fl. without floral envelopes, or with only a rudimentary calyx, surrounded by numerous staminate fls , each consisting of a single stamen separated from its pedicel only by a joint; the whole infl. surrounded by a more or less cup-shaped involucre with 5 lobes and 1–5 glands is called a cyathium. The involucre is regular or nearly so; the glands free from one another: the fr. an explosive caps , with 3 carunculate seeds; the staminate fls. are usually subtended by minute bracts.—One of the largest plant genera, of not less than 700 and probably over 1,000 species, occurring in most temperate and tropical regions. Many are desert plants and the greater number grow in dry and sterile places. Euphorbia is distinguished from the nearest related genera, Pedilanthus and Synadenium, by its regular or nearly regular involucre, which in Pedilanthus is protuberant on one side of the base and contains the glands, and by the free involucral glands which in Synadenium are united into a ring. Some of the fleshy species are very similar to succulent cacti and Asclepiadaceæ. One long grown under the name of *E. pendula,* Boiss., is a Sarcostemma according to N. E. Brown. For *E. tithymaloides,* see *Pedilanthus;* for *E Grantii,* Hort., and *E arborea,* Hort , see *Synadenium.*

Monographed by Boissier in DeCandolle's Prodromus, 15, pt. 2 (1862) See local floras and Norton, Rept. Mo. Bot. Gard. 11, for native species. See also Fobe, in Monatsschrift für Kakteenkunde, 8:42 (1898) and Berger, Sukkulente Euphorbien, a manual of the cactus-like species in cultivation. The recent work of N. E. Brown of Kew in Flora of Tropical Africa and Flora Capensis describes and gives keys to practically all the African species, which include nearly all the succulent ones, both wild and cultivated. Although the vegetative form varies remarkably, so that the various sections of the genus are considered of generic rank by many authors, the floral characters are very similar and so inconspicuous as to be of little importance generally in a horticultural work.

Most of the species have abundant milky juice, and the cactiform kinds have been thus distinguished from cacti, but many cacti also have milky juice. The juice of many species is acrid-poisonous, especially if it comes in contact with mucous membranes or open sores The juice from some of the species is used in medicine as a purgative.

Many of the fleshy species are cultivated by lovers of succulents for their curious shapes; and a few are valuable for their ornamental foliage. The flowers are usually too minute to be noticeable Some, like *E. corollata* (Fig 1437), *E maculata, E Cyparissias* and *E marginata,* are weeds in America, but not troublesome The great majority of the species are insignificant herbs. The species are remarkably free from injurious insects, and are rarely attacked by a few fungi.

The fleshy species are grown much the same as cacti, but the culture is less difficult, and they do well with warmer treatment In winter they are kept in a dry and cool house, 50° to 55° F , with good light and little water Drips must be carefully avoided In summer the pots should be plunged outdoors in hot dry situations, with a moderate supply of water and especially good drainage. It is better to protect them from continued rain, but most species do well without this. The more fleshy species, like *E. Caput-Medusæ, E mammillaris,* and *E meloformis,* require more heat and better care than the others. They have to be watered with great care in winter The air of most greenhouses is too damp for them if the requisite low temperature is maintained. The winter conditions of air and temperature in ordinary living-rooms make them ideal for the succulent euphorbias. Species like *E. neriifolia* need water in the growing season and dry conditions after the



1437. Cyathium of Euphorbia corollata (×2). The pistillate flower is at 8, surrounded by several staminate flowers arising above the involucral glands with their five oblong spreading petaloid appendages. No 3.

leaves fall. The shrubby species, like *E. atropurpurea* and *E. dendroides*, do well with the treatment of the more fleshy kinds. See D. A. W. and F. S. Curtis, in Sharon Cactus Guide, March and May, 1897.

The few hardy species of ornamental value make good border plants or are suitable for the rockery. *E. epithymoides* usually known in gardens as *E. polychroma*, is one of the best herbaceous perennials, forming a hemispherical clump with beautiful yellow foliage of different shades when in bloom. *E. palustris* and related species are similar but erect and not compact.

The succulent species can nearly all be propagated by cuttings. These are taken best in early summer, allowed to dry somewhat and then planted in sand, charcoal or a mixture of these. Coal-ashes are used effectively by some. When seeds can be procured, they may be used in propagation. Grafting, as is sometimes practised with cacti, is possible. Potting soil need not be rich. A coarse sandy loam, or, some say, any kind of soil will do.

E. pulcherrima and *E. fulgens* are good winter-flowering greenhouse plants, and require special treatment. *E. fulgens* succeeds well in the warmest parts of the house, in pots, or best planted out like roses and trained upon the wall or strings. It is propagated from cuttings taken in June, when the old plants have started to grow, kept in a warm frame until rooted, and then kept growing with heat, any transfers being made with as little root disturbance as possible. If stocky show plants are wanted, several cuttings may be planted in one pot and checked two or three times during summer by repotting, and kept pinched back freely to secure branches They are best kept cooler when in flower, but are very sensitive to cold or sudden changes in temperature. After flowering they are kept dry for a few months For the cut sprays they are best grown from cuttings each year. They last very well when cut.



1438. Euphorbia marginata (×⅓) No 1

The culture of the poinsettia is very similar. To secure plants with large heads, the general plan is to grow from cuttings annually, but the old plants may be continued. Old plants that have been resting may be introduced to heat and moisture in late spring, and will soon give a liberal supply of cuttings, which are usually taken from the young wood. Successive sets of cuttings may be made at later periods if different-sized plants are wanted. When well started, the potted plants are plunged outdoors till September, with plenty of water, light and sunshine and good drainage. They do well in rich heavy loam in 5–7-inch pots. They are liable to drop their leaves if exposed to cold or other unfavorable conditions. In autumn they are transferred to the greenhouse, with moderate temperature. When the bracts begin to appear, give more heat and some manure water to expand them. When in flower, reduce the temperature to preserve them longer. After flowering the pots may be stowed away in a dry warm place till spring,—under the benches will do. When the buds are cut the great objection is that they wilt easily. This may be obviated by keeping them in water for a few days before using. See Grieve, G.C. III. 9:106, and Hatfield in Garden and Forest 9:496. See article *Poinsettia* for further treatment



1439. Euphorbia fulgens (×⅓). No 5.

Euphorbia splendens is another winter bloomer, and may be treated as the succulents, with more heat and water. It will do well in living-rooms, and bears some flowers all the year It bears rough treatment well, and is propagated by cuttings from the young growth, which root with the greatest ease.

In tropical and subtropical regions many of the tree-like or succulent euphorbias make fine outdoor ornamentals The poinsettia is a magnificent landscape ornament in California, West Indies and so on. In Southern California the poinsettia is propagated by sticking canes 3 feet long in the ground from April on, these growing and blooming, often profusely, the first season. In the West Indies and Florida, some of the thorny tree-like forms, especially *E. lactea*, are grown as hedges, their thick, erect thorny branches making an almost impenetrable barrier. This and other species are grown also as specimen plants. See *Succulents*.

INDEX.

abyssinica, 32.
alba, 8.
alcicornis, 19.
anacantha, 47
antiquorum, 20
antisyphilitica, 7.
atropurpurea, 53.
Beaumierana, 35.
biglandulosa, 62
bupleurifolia, 51.
canariensis, 31.
candelabrum, 24, 34.
Caput-Medusæ, 48.
cereiformis, 40, 43.
clandestina, 51.
clava, 50.
cœrulescens, 26.
colletioides, 14.
Commelinii, 48.
Cooperi, 29.
corollata, 3.
coronata, 50.
cotinifolia, 2.
cristata, 23.
cyathophora, 9.
Cyparissias, 60.
dendroides, 55.
disclusa, 34.
drupifera, 17.
Echinus, 27.
elastica, 56
enneagona, 40.
epithymoides, 57.
Fournieri, 13.
fruticosa, 37.
fulgens, 5.
fulva, 56.
geniculata, 4.
globosa, 45
glomerata, 45
grandicornis, 22.
grandidens, 21.
grandifolia, 17.
hæmatodes, 2.
havanensis, 9, 23.
heptagona, 39.
Hermentiana, 24.
heterophylla, 9.
Hystrix, 50.
imbricata, 43.
inermis, 49.
Ipecacuanhæ, 4.
Jacquiniæflora, 5.
lactea, 23.
lathyris, 52.
loricata, 50.
major, 58.
mammillaris, 42.
mammillosa, 18.
marginata, 1.
marmorata, 25.
meloformis, 44.
mexicana, 43.
misera, 6.
monstrosa, 23.
myrsinites, 65.
natalensis, 33.
neglecta, 32.
neriifolia, 16.
officinarum, 36.
ornithopus, 46.
Palmeri, 64
palustris, 59.
pandurata, 9.
parvimamma, 48.
Pfersdorfii, 38
pilosa, 58
pinea, 63

INDEX, CONTINUED

piestora, 54.
plenissima, 8.
Poinsettiana, 8.
polychroma, 57.
polygona, 41
Pseudocactus, 25.
pteroneura, 14.
pulcherrima, 3.
Regis-Jubæ, 54
resinifera, 30.
rhipsaloides, 11.
robusta, 64.
sanguinea, 2.
San Salvador, 30.
serpentaria, 49.
similis, 33.
spinosior, 42.
splendens, 15.
submammillaris, 43.
tessellata, 25
Tirucalli, 10.
triangularis, 28.
variegata, 1.
viperina, 49.
virosa, 26
Wulfenii, 61.
xylophylloides, 12.

A. *Glands of the involucre with petal-like appendages (almost none in 4): slender-branched herbs or rarely shrubs not spiny: lvs. entire.* Section ADENOPETALUM. The Section ANISOPHYLLUM, genus *Chamæsyce* of some, differs in having small opposite lvs., unequal at base, stipules present, fls. small, glands 4. It contains most of the low herbaceous wild euphorbias of U. S., such as *E. maculata*, Linn., *E. Preslii*, Guss., *E. serpens*, and *E. capitata*; names from this group occur in American catalogues, but the species to which they properly belong are inconspicuous weeds. *E. lorifolia*, Hillebr., of Hawaii, has recently been investigated as a possible source of rubber. (Descriptions of these species will be found in the floras.)

B *Stipules present.*

1 **marginàta**, Pursh (*E variegàta*, Sims). SNOW-ON-THE-MOUNTAIN. GHOST-WEED. Fig. 1438. Annual, about 2 ft high, pubescent, dichotomously many-branched: lvs. numerous, light green, ovate-subcordate to oblong-lanceolate, 1–3 in. long, the upper white-margined, often entirely white: involucral glands with large white appendages July–Oct. Plains from Dak. to Texas and extending eastward. B.M. 1747. Gt. 30:218. V. 2, p. 281, 5, p. 64. G.W. 13, p. 305.—Hardy annual, used for its white foliage in bedding and mixed borders in sunny situations.

2 **sanguínea**, Hort. (*E hæmatòdes*, Boiss.?). A tall shrub. lvs. ovate, obtusely pointed, in whorls of 3, red when young to deep bronze or purplish red later.—This handsome plant of unknown nativity is cult. in S. U. S. While it is not possible to classify it exactly without fls. and fr., the foliage characters indicate its relationship to *E. cotinifolia*, Linn.



1440. Euphorbia pulcherrima (×⅓). No. 8.

BB *Stipules absent or microscopic.*

C *Plant a perennial herb.*

3. **corollàta**, Linn. (*Tithymalópsis corollàta*, Klotzsch & Garcke). FLOWERING SPURGE. Fig. 1437. Plant 1½–3 ft. high, usually glabrous, slender and diffusely branched above: lvs. ovate-oblong to lanceolate, 1–2 in. long, those of the infl. much smaller and opposite: involucral glands 5, with conspicuous white appendages. July–Oct. On rather dry soil. E. U. S. B.M. 2992. L.B.C. 4:390. F.R. 1:969.—A hardy herbaceous perennial used like gypsophila for cutting, and as a bedder in light soil. There are many variations in size, shape, color and pubescence of plant, lvs. and infl.

4. **Ipecacuánhæ**, Linn. (*Tithymalópsis Ipecacuánhæ*, Small) IPECAC SPURGE. Only the forking infl. (3–6 in.) above ground, with its red or green glabrous, opposite lvs. varying from oval to linear on different plants, the alternate lvs. of the short st. usually subterranean and scale-like: cyathia long peduncled; appendages of glands rudimentary. April. Sandy soil. E.U.S.L.B.C. 12: 1145. B.M. 1494. —*E. geniculàta*, Ort., is sometimes cult. under this name. It is a plant of Trop. Amer., related to *E. heterophylla*, but with broader lvs. the upper whitish at base.



1441. Euphorbia heterophylla (×⅓) No. 9.

CC *Plant a shrub.*

5. **fúlgens**, Karw. (*E. jacquiniæflòra*, Hook.). SCARLET PLUME. Fig. 1439. Small shrub with slender drooping branches: lvs. long-petioled, lanceolate, bright green. cyathia in small axillary cymes, with the conspicuous appendages to the 5 involucral glands bright scarlet. Mex. B.M. 3673. R.B. 39:41. F.C. 2:55. R.H. 1905:440. Gn. 33:486; 39, p. 239; 67, p. 73. V. 2, p. 74. A.F. 16. 1551. G.M. 53:89. G. 4:593. P.M. 4:31. Gng. 10:76.—A handsome winter-blooming plant, used for cut-fls. or for specimen plants.

6 **mísera**, Benth. Lvs. small, obovate, pubescent, clustered at the end of crooked branches: fls. inconspicuous. S. Calif. and Mex.—Recently catalogued in the Calif. trade.

7. **antisyphilítica**, Zucc. (*Tricherostigma antisyphilítica*, Klotzsch & Garcke). CANDELILLO. Slender, erect, rod-like branches 1–3 ft. high, almost leafless. Mex.—The plants yield a useful wax and are sometimes grown in collections of succulents.

AA. *Glands of involucre without petal-like appendages. (Nos. 8–65)*

B. *St. herbaceous or shrubby, not fleshy: lvs. well developed, the upper colored: stipules minute: infl. cymose.* Section POINSETTIA.

8. **pulchérrima**, Willd. (*E. Poinsettiàna*, Buist. *Poinséttia pulchérrima*, Graham) POINSETTIA. EASTER FLOWER. CHRISTMAS FLOWER. LOBSTER FLOWER. MEXICAN FLAME-LEAF. Fig. 1440. Shrub 2–10 ft high, branched: lvs. ovate-elliptical to lanceolate, entire, sinuate-toothed or lobed, or panduriform, 3–6 in. long, somewhat pubescent, the upper narrower, more entire to even linear-lanceolate and of the brightest vermilion-red: involucres 2–3 lines wide, greenish, with one large yellow gland. Nov.–March. Moist, shaded parts of Trop. Mex. and Cent. Amer. B.M. 3493. G.C. III. 21:125, 193. F.C. 1:33. Mn. 7, p. 67. Gn. M. 2:209.—Sometimes cut, usually used for specimen plants and in masses, often used in decorations. A gorgeous plant. Var. **plenissima**, Hort., has the fls., or most of them, transformed into red bracts, giving a fuller center. G.C. II. 5:17. Gt. 28:182. F.M.

1876:200. Var. **álba**, Hort., has the upper lvs. white. R.H. 1913: 228.—It is not so vigorous, blooms later and requires more heat.

9. **heterophýlla**, Linn. (*E. pandurǽta*, Hort.? *E. havanénsis*, Willd. *E. cyathophóra*, Murr.). Mexican Fire Plant. Hypocrite Plant. Painted Leaf. Fire-on-the-Mountain. Annual Poinsettia. Fig. 1441. Annual, nearly glabrous, 1–3 ft. high: lvs. ovate and sinuate-toothed, or panduriform, or some of them lanceolate or linear and entire, dark green, the upper bright red at least at the base: involucres small with 1 or 2 glands. July–Sept. E. and Cent. U. S. to Peru. Mn. 2, p. 53. Gt. 39, p. 105.—Easily grown from seeds in sunny gardens and also in pots indoors. White and yellow variegated forms are in cult.

BB. *Sts. more or less fleshy, often cactus-like and spiny: lvs. small, none or soon deciduous: infl. few-branched or cyathia single: stipules minute or none (except in E. Fournieri).* Section Euphorbium. Nos. 10–51.

C. *Branches cylindrical or angled, not thorny: lf.-bases not thickened and elevated as podaria: lvs. alternate or crowded on the angles.*

D. *Joints or branches cylindrical or flat.* Subsection Tirucalli.

10. **Tirucálli**, Linn. Milk-Bush. Indian Tree Spurge. A small tree, with a dense crown of slender, cylindrical whorled branches, curving outward then erect: joints about 4 in. long, twigs ¼–½in. thick: lvs. narrow, about 1 in. long, soon falling. S. Asia.—A striking plant for the succulent collection. Easy of cult., often grown outdoors in warm regions.

11. **rhipsaloídes**, Lem., is a closely related African species probably not now in cult., but the name is in use in the trade.

12. **xylophylloídes**, Brongn. Sbrub or tree: trunk cylindrical, much branched; branches flat or 2-angled, ½in. wide, slightly toothed along the edges: lvs. minute, soon deciduous. Madagascar.

DD. *Joints or branches 4–5-angled from the decurrent lf.-bases or comb-like rows of stipules.* Subsection Goniostema (No. 13) and Subsection Pteroneuræ (No. 14).

13. **Fournièri**, André. St. 4–5-angled, the crowded persistent stipules forming comb-like rows on the angles: lvs. large at the apex of the short thick sts.; petioles and stipules red. Madagascar region. R.H. 1896, p. 226. L.B.C. 15:1477 (as *E. lophogona*).



1442. Euphorbia splendens. (×⅓)

14. **pteroneúra**, Berger. A low shrub with erect, jointed branches, ½in. thick, the 5–6 angles formed by sharp low ridges decurrent from the lf.-bases: lvs. reduced, soon deciduous. Mex. (?)—Erroneously grown under the name of *E. collettioídes*, Benth.

CC. *Branches succulent with thickened elevated lf.-bases (podaria).*

D. *Spines 1–2 on each side the lf.-base.* Subsection Diacanthium. Nos. 15–38.

E. *Podaria (lf.-bases) not united into ribs; branches nearly cylindrical: lvs. well developed.*

F. *Bracts bright red.* Class Splendentes.

15. **splendens**, Bojer. Crown of Thorns. Fig. 1442. Sts. 3–4 ft. long, ½–1 in. thick, somewhat climbing, covered with stout spines about an inch long: lvs. few, on the young growth, obovate to oblong-spatulate, thin, bright green, 1–2 in. long: cyathia in long-peduncled dichotomous cymes, near the ends of the branches, each closely subtended by 2 broadly ovate bright red bracts. Madagascar. Flowering all the year but mostly in winter. B.M. 2902. L.B.C. 18:1713. V. 2, p. 74; 14, p. 16. G.C. II. 19:816 (as *E. jacquiniæflora*).—Coolhouse plant. The red bracts in the green lvs. on the sinuous spiny sts. are very striking. It can be trained into ornamental forms. The seedlings have larger sts. and lvs. and double spines, a smaller one below each of the ordinary ones.



1443. Euphorbia neriifolia.

FF. *Bracts not conspicuously colored.* Class Grandifoliæ.

16. **neriifólia**, Linn. Fig. 1443. Arborescent or shrubby: st. obtusely 5-angled; the small mammiform podaria in rows, with short, dark-colored, divergent spines: branches somewhat whorled, bearing obovate-oblong, obtuse, thick lvs., 3–5 in. long, at the summit: small sessile cymes of greenish cyathia in the upper axils. June, July. E. Indies. Gn.M. 6:196.—The large lvs. persistent from autumn to spring. Cristate forms are in cult. Fig. 1443 shows a hedge in W. Indies.

17. **drupífera**, Schum. & Thonn. (*E. grandifólia*, Haw.). Arborescent: st. terete: branches obsoletely 4–5-angled; spines small: lvs. terminal, obovate-cuneate, obtuse or retuse, 6–10 in. long: small cymes axillary, peduncled: caps. drupaceous. Guinea.

18. **mammillósa**, Lem. Low, cespitose: branches less than an inch diam.: podaria elongated, conical, in 5 spiral rows: lvs. and spines small, soon deciduous. Nativity unknown.—Rare in cult. and not well known. Probably the plants grown under this name are something else.

EE. *Podaria united into ribs: branches 2–13-angled: lvs. usually very small or rudimentary.*

F. *Angles of the branches, 2 (rarely 3), the branches flattened.* Class Compressæ.

19. **alcicórnis**, Baker. St. obtusely 5-angled, 9 ft. high or less: branches flat, except the triangular base, ½in. broad: spines short, slender, dark-colored. Madagascar.

FF. *Angles of the branches 3 (sometimes 4), but the main st. often 5-angled.* Class Trigonæ.

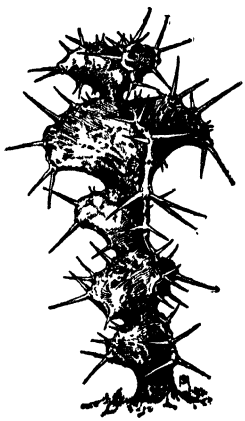
G. *Sides of branches solid green-colored.*

H. *Spine-shields separated by green tissue of ribs.*

20. **antiquórum**, Linn. Shrub, 8–10 ft. high: branches erect, jointed, 1–2 in. thick, the angles repand-dentate; spine pairs about 1 in. apart; spines 1–3 lines long: lvs. very small, roundish. India. See *E. lactea*, No. 23.

21. **grándidens**, Haw. Tree, to 30 ft. high, with trunk as much as 2 ft. diam.: branches slender, ½–¾

in. wide, numerous, whorled, erect-spreading, making a dense rounded head in older plants; sides of branches almost plane; angles deeply sinuate dentate; spine pairs ½–¾in. apart, spines 3–5 lines long, slender, light brown to gray: lvs. very small, triangular. S. Afr.



1444. Euphorbia grandicornis. (×⅓)

HH. *Spine-shields united, forming a continuous horny edge to the ribs.*

22. **grandicórnis,** Goebel. Fig. 1444. Shrub or small tree: branches 3–5 in. wide, deeply jointed, the angles broadly winged, lobed and sinuate, the edge zigzag or wavy; spines large, 1–2 in. long, light colored: lvs. very small, triangular ovate. S. Afr.(?).—A fine plant, with the longest spines and widest wings of all. A rapid grower, the bright pale green contrasting beautifully with the rich light brown of the spines and horny margins on young plants.

GG. *Sides of branches marbled with white or yellow.*

23. **lactea,** Haw. (*E. havanénsis,* Hort., at least in part). Fig. 1445. Similar to *E. antiquorum,* but with a white-marbled area running through the middle of each face of the branches. E. Indies.—One of the most common succulent euphorbias in cult., of fine candelabra form, and making rapid growth. The euphorbias grown for hedges in Fla., W. Indies, etc., are chiefly this species, though some may be *E. antiquorum.* It is often confused with *E. Hermentiana.* Cristate forms are in the trade as *E. lactea monstrosa* and *E. havanensis cristata,* though these should perhaps be referred to *E. antiquorum.*

24. **Hermentiàna,** Lem. Shrub, with closely erect, scarcely jointed branches, about 2 in. thick; sides strongly concave, striped or marbled with white, especially when young, angles closely dentate; spines slender, brown, 2–3 lines long: lvs. lanceolate, ½–2¼ in. long. W. Afr. G.Z. 19:101.—One of the best. The true *E. candelàbrum,* Trem., but probably not the one common in cult. under that name, is distinguished from *E. Hermentiana* by its rudimentary scale-like lvs.

FFF. *Angles of the branches 4–8 (rarely 3 on some branches).* Class POLYGONÆ.

G. *Spine-shields united, forming a continuous horny edge to the ribs.*

H. *Sides of mature branches plane or slightly convex, angles not winged, branches about 2 in. diam.*

25. **Pseudocáctus,** Berger. St. 4–5-angled: branches 3–5-angled, joints tapering upward from a broad base, 4–6 in. long, 2 in. or less thick, the surface with yellow U-shaped marks from center to angles; spines stout, ½in. long, brown to gray. Nativity (?). J.H. III. 60:99 (as *E. lactea*).—Frequent in cult., often under the name of *E. lactea;* also as *E. marmorata* and *E. tessellata.*

26. **cæruléscens,** Haw. (*E. virósa,* and var. *cæruléscens* of Berger). Low, shrubby: st. 4–5-angled: branches 3-angled at base, 4–5-angled above, 2 in. thick; joints 2 in. or less long, the sides bluish glaucous; spines stout, ½in. long: lvs. triangular, scale-like. S. Afr. G.Z. 19:102.—A handsomely colored compactly branched succulent. According to N. E. Brown, *E. virósa,* Willd., is quite a different plant. It is probably not in cult. in Amer.

27. **Echinus,** Hook. & Coss. Branching shrub, with 6-angled st., branches ascending, about 2 in. thick, 5- or more-angled: spine pairs less than ½in. apart; spines ½in. long, red to gray. Morocco. G.Z. 1904:122.

HH. *Sides of mature branches concave, angles more or less winged, branches often 3–4 in. thick.*

28. **triangulàris,** Desf. Tree-like: st. at first 6-angled, later cylindrical: branches whorled, divergent, then ascending, 3–5-angled, 2–4 in. thick; joints 2–12 in. long; spine pairs 3–9 lines apart; spines less than 5 lines long; spine-shields united only on stronger shoots: lvs. small, roundish. S. Afr.(?).

29. **Coöperi,** N. E. Br. Tree-like: whorled ascending branches, 3–5 in. thick, the joints broad at base and tapering upward, 6-angled, spines 5 lines long, black to gray. Natal.—A fine species.

GG. *Spine-shields separate.* See also No. 28.

H. *Sides of mature branches plane or slightly convex, angles not winged, branches less than 2 in. thick.*

30. **resinífera,** Berg (*E. San Sálvador,* Hort.). A much-branched shrub: branches 4-angled, spine-shields triangular-rounded, small, 3–5 lines apart. S.W. Morocco. G.Z. 19:102.—This species yields the euphorbium gum of the ancients.

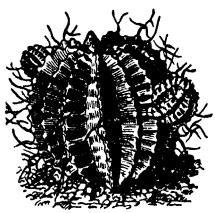
31. **canariénsis,** Linn. Shrub or tree, 12–20 ft. high, with many 4–6-angled, suberect, not conspicuously jointed branches, as much as 3 in. thick; angles subentire; spines 2 lines long, black: lvs. almost none. Canary Isls. Gn. 53, p. 46.—This is one of the most common succulent euphorbias. It is easy to grow and propagates readily from cuttings, as well as from seeds which are frequently produced in cult. Several other species are in cult. under this name.



1445. Euphorbia lactea. No. 23.

HH. *Sides of branches concave to deeply grooved between the ribs, which are more or less winged; branches 2–6 in. thick.* (The species of this group and several others, e. g. *E. tenebrosa*, N. E. Br., *E. acrurensis*, N. E. Br., *E. grandis*, Lem. (*E. neutra*, Berger), *E. controversa*, N. E. Br., *E. Erythræa* N. E. Br., are in cult., probably some in Amer., as *E. abyssinica* or some as *E candelabrum*. The true *E. abyssinica*, Gmel., is not in cult.)

32. **neglécta**, N. E. Br. (*E. abyssínica*, Berger, not Gmel.). Tree: branches 5–8-angled, joints 4–12 in. long, 4–5 in thick, the conspicuous wings marked by swollen veins; spine pairs 1 in. apart, sunken; spines stout, brown, 1–2 lines long: lvs. narrow, 1 in. or more long: flowering eye above the spine-shield. N. Afr. G C III. 20.497. Gn. 52, p. 106.



1446. Euphorbia meloformis (×⅓). No. 44.

33. **símilis**, Berger (*E natalénsis*, Hort, not Bernh.). Differs from *E neglecta* in branches 5-angled: spine pairs on apex of a recurved tooth. lvs. shorter; spines darker; veins in wings not prominent. Natal(?).

34. **discîusa**, N. E. Br. (*E. candelàbrum*, Berger, not Trem, see No. 24). Tree, with 4–5-angled st and branches, slightly jointed: spine pairs 8–10 lines apart; spines 3–5 lines long, stout, dark brown to gray: flowering eye included in the spine-shield. Abyssinia.

FFFF. *Angles of branches 9–13.*

G. *Spine-shields almost always united into a horny margin; grooves between ribs rather shallow: branches about 2 in. thick*

35. **Beaumierâna**, Hook & Coss A shrub to 9 ft. high: branches erect, 9–10-angled; spines short, spreading, red when young. Morocco. J H. III 59:627.

36. **officinârum**, Linn. Shrub: branches 9–13-angled; spines but little spreading, yellowish to gray, 3–6 lines long: lvs. minute. N. Afr. R.H. 1875, pp. 336–7.

GG. *Spine-shields often isolated; grooves between ribs very deep.*

37. **fruticôsa**, Forsk. Low shrub: branches erect, scarcely jointed, 6–9 lines thick, 10–13-ribbed; spines 6–9 lines long, spreading, brown when young Arabia.

38. **Pférsdorfii**, Hort. Trunk round, 1½–2½ in. thick, 9-angled, much branched when old: spines large, 4–9 lines long.—A species not very well known.

DD. *Spines, if any, not in stipular position.* Subsection TREISIA.

E. *Podaria in longitudinal rows or ribs.*

F. *Body cylindrical: sterile infl. transformed into thorns.* Class ANTHACANTHA.

G. *Ribs without prominent cross furrows between podaria.*

39. **heptagôna**, Linn. St. 3–4 ft. high, over 1 in. thick, candelabraform-branched, 5–8-ribbed: ribs broader than high; thorns not numerous, strong, yellow, ¾in. long. lvs. linear-lanceolate, acute. Cape of Good Hope.—According to N. E. Brown the plants of this section and their names are much confused in cult. and without careful study it would be difficult to say just what is being grown under the names of *E. heptagona*, *E. mammillaris*, *E. enopla*, etc.

40. **cereiformis**, Linn. (*E. enneagóna*, Haw.). St. erect, 2–3 ft. high: branches with 9–13 straight ribs, the podaria forming declined teeth: lvs small, triangular; thorns numerous, 4–7 lines long. Cape region.—Cuttings from the branches have a different form from seedlings.

41. **polygôna**, Haw. St. up to 5 ft. high, 5 in. thick, 10–13-ribbed, the ribs high and narrow, often somewhat spiral: thorns 4–5 lines long; lvs. minute. Cape region.

GG. *Ribs with the podaria separated by cross furrows*

42. **mammillâris**, Linn. Low: branches 7–12-ribbed, about 1 in. thick; ribs flat; podaria not prominent; zones of spines up to 1 in. long, alternate with areas free from them. Cape region. **Var. spinôsior**, Berger, is more vigorous and spiny, with more prominent podaria.

43 **submammillâris**, Berger. St. irregularly branched, 1 in. thick: branches with about 5–8 straight ribs, 2 lines high; podaria forming pointed tubercles: lvs. linear; thorns numerous on strong branches, few on others Cape region(?).—Grown as *E. mexicana*, *E. imbricata*, and *E. cereiformis*.

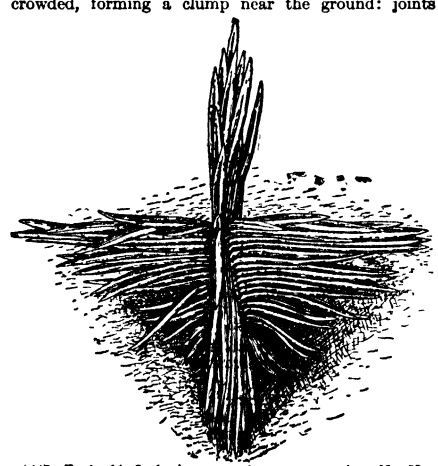
FF. *Body spherical, not thorny.*

44. **meloformis**, Ait. MELON SPURGE. Fig. 1446. Globose or pyriform, 3–5 in. thick, deeply 8–10-ribbed; ribs obscurely tuberculate on the almost acute angles; sides transversely dark and light green-striped, or wrinkled when old: lvs few and small: fls at the depressed apex; the old forked branches of the infl. sub-persistent but not spinose. A few small branches similar to the main st present. S Afr. L B C. 5 436. A G 11:463 —A curious and rare plant, often mistaken for a cactus and showing extreme reduction in xerophytic euphorbias as Mammillaria does for the cacti.

EE. *Podaria in spirals checkering the axis.*

F. *Joints or branches globose to short-cylindrical: glands of the involucre with lobed or comb-like edges.* See also No 51. Class DACTYLANTHES.

45. **globôsa**, Sims (*E glomerâta*, Hort). Low, the spherical or short cylindrical to club-shaped joints crowded, forming a clump near the ground: joints



1447. Euphorbia Lathyris, young plant seen endwise. No. 52

½–2 in. long; podaria very flat, pentagonal: lvs. very small, triangular: peduncle 2–4 in. long; glands of involucre with 3–4 lobes which are green with white pits; flowering all summer. Cape region. B.M. 2624.

46. **ornithopus**, Jacq. Much-branched half-shrub: joints 1 in. or less thick, short-cylindrical; podaria

elongated into conical projections: lvs. small ovate: peduncles short; fls. much as in *E. globosa*, involucral glands erect, the 3–4 teeth pitted and white-marked. Cape region. B.M. 2520. L.B.C. 3:220 (as *E. anacantha*).

47. **anacántha,** Ait. Cespitose sub-shrub, with some joints 4–8 in. long, ¾in. thick: podaria oblong, somewhat projecting: lvs. small, ovate-oblong; cyathia almost sessile at apex of branches; glands divergent, the 3-lobes white with greenish pits. Cape region.

FF *Joints of the branches obscure or none; branches cylindrical, many times as long as thick.*

3. *Sinuous or snake-like branches many, from a thick basal st.; thorns none: lvs. small; glands comb-like.* Class MEDUSEA.

48 **Cáput-Medúsæ,** Linn. (*E. Commélinii*, DC.). MEDUSA'S HEAD. Branches 1–2 in. thick, numerous, declined about the short, obconical st., with ends erect, 6–12 in. long: lvs. linear-lanceolate, about 1 in. long: cyathia single, from short, thick peduncles; glands erect, white. Cape region.—A curious and interesting plant; often seen as single-stemmed plants grown from branch cuttings. *E. parvimámma*, Boiss., is also in cult. under this name. See Suppl. list.

49 **inérmis,** Mill (*E. viperina*, Berger, fide N. E. Br. *E. serpentária*, Hort ?). Smaller: branches about ½in. thick, 12 in long; podaria narrow, in 6–8 somewhat spiral rows: lvs very small, ovate; cyathia ½in. wide, whitish, glands divergent. Cape region. B.M. 7971.

GG. *Sinuous or snake-like branches none; glands simple, flat, without divided appendages. lvs usually large; cyathia usually long peduncled, subtended by several broad bracts.* Class TREISIA.

50. **loricáta,** Lam (*E. Hýstrix*, Jacq, fide N. E. Br.) A shrub, 2–3 ft. high: branches divergent from the base, ½in. thick: lvs. linear, 2–3 in. long: peduncles persistent as numerous brownish red thorns. Cape region.—Some species of the subsection Anthacantha are in cult. under the name of *E. Hystrix*. The names *E. clávа*, Jacq., and *E. coronáta*, Thunb., are used in the trade and belong to closely related if not identical species of S. Afr., probably not in cult. The sts. are smaller and the infl. less spinose than in *E. loricata*.

51 **bupleurifólia,** Jacq. St. ovate-spherical, elongated in age, 3 in. thick, 4–5 in. high: podaria scale-like, imbricated, quadrangular: lvs. at st. apex, 4–8 in. long, lanceolate: fls. long-stalked; peduncle not persistent. Cape region. B.M. 3476.—Seldom cult., and, as it does not branch, cannot be prop. by cuttings. *E. clandéstina*, Jacq., differing in the club-shaped st., 1½–2 in thick, with oblong podaria divergent above, small lvs. and nearly sessile cyathia is listed, probably erroneously, in the trade.



1448. Euphorbia epithymoides. No. 57.

BBB. *Sts. herbaceous or woody, rarely somewhat fleshy, not spiny: infl. umbellate: stipules none.* Section TITHYMALUS

C. *Lvs. below the umbel decussate: tall annual herb.*

52. **Láthyris,** Linn. CAPER SPURGE. MOLE PLANT. Fig. 1447. Annual, 2–3 ft. tall: lvs. long, lance-linear, those of the infl. ovate-acuminate: glands short-horned: caps. somewhat fleshy, ¼–½in. diam. Eu., and naturalized in E. U. S. Rept. Mo. Bot. Gard. 11, pl. 11.—Cult. in old gardens. Caps. sometimes pickled, seeds used as a purgative. Said to drive away moles from its neighborhood (see Cornell Bull. 61:331); for a similar reason known as "gopher plant" in S. Calif.

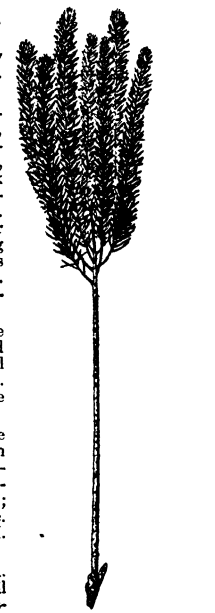
CC. *Lvs. usually clustered at ends of branches: shrubs.* (*Euphorbiodendron*, Millsp.).

53 **atropurpúrea,** Brouss. Branching shrub, 3–6 ft. high: lvs. pale, glaucous green, spreading or drooping, 2–3 in long. umbel 5–10-rayed, cyathia surrounded by large, dark purple, broadly ovate, obtuse, connate bracts; glands ovate. March. Teneriffe. B.M. 3321.—Some other red-leaved species used for bedding in Amer. have been cult. under this name, i.e., a purplish variety of *E. pulcherrima*, and possibly *E. hæmatodes*, Boiss.

54 **Règis-Jùbæ,** Webb. Like the last but lvs. narrowly linear and bracts almost yellow: involucral glands with 2 short horns. Teneriffe.—Some plants under this name are *E. piscatória*, Ait. See Suppl. list.

55 **dendroides,** Linn. A large branching shrub, more foliaceous than the two preceding lvs. linear-lanceolate, obtuse or acute: bracts yellowish, rhomboid-orbicular mucronate; glands truncate or semi-lunate. Medit. region. Gn. 36, p. 203. R.H. 1887:160

56 **fúlva,** Stapf (*E. eldstica*, Altam. & Rose) PALO AMARILLO. Small tree: lvs. lanceolate, acute, pubescent. cyathia few, bracts small, glands ovate: caps. conical, 1 in. long. Mex.—Used for rubber.



1449. Euphorbia Cyparissias (×¼). No. 60

CCC. *Lvs. below the umbel alternate: leafy perennial herbs*

D. *Glands of the involucre oval, entire.*

57 **epithymoides,** Jacq (*E. polychróma*, Kern.) Fig. 1448. Many sts. 1 ft. or more long, forming a hemispherical clump. rays of umbel 5: lvs. oblong, dark green, those of the infl. various shades of yellow at flowering time. May. Eu. B.M. 2258. Gn. 69, p. 295.—A beautiful plant for the formal or informal border.

58. **pilósa,** Linn. Sts. about 18 in. high from a thick rootstock, pilose: lvs. oblong, nearly entire: umbel 5–6-rayed, with similar branches below. caps. 2 lines broad, nearly smooth or hairy, with or without minute warts. Eu. and N. Asia. Var. **májor** is a better form for gardens with beautiful golden yellow foliage.

59. **palústris,** Linn. Differs from *E. pilosa* chiefly in being glabrous or nearly so, more rays in the umbel, and caps. with small but distinct warts on the back. Eu. Gn. 76, p. 499.—The floral lvs. are a bright yellow.

DD. *Glands of involucre truncate, retuse, 2-horned or crescent-shaped.*

E. *Seeds smooth.*

60. **Cyparíssias,** Linn. CYPRESS SPURGE and many local names. Fig. 1449. Many short plume-like branches from the crowns and adventitious root-buds, covered with spreading, narrowly linear, dark green lvs. 1 in. long. Eu. L.B.C. 2:118. G.C. II. 22:469. Rept. Mo. Bot. Gard. 11, pl. 50.—Cult. in old gardens and cemeteries for its moss-like growth. Naturalized and a weed in E. U. S., but rarely producing seed here.

61. **Wúlfenii,** Hoppe. Sts. 3–4 ft. high, forming a clump, densely covered with lanceolate, linear, acute, bluish green pubescent lvs., those of the infl. yellow, or the base of the st. bare later, except for the conspicuous leaf-scars: umbel many-rayed; glands 2-horned. Eu. B. R. 24:6 (as *E. Veneta*). G. 31:103. G.C. III. 39:331. Gn. 57, pp. 440–1; 74, p. 40. G.W. 13, p. 305.

62. **biglandulòsa,** Desf. Differs from *E. myrsinites*, chiefly in the erect sts., lanceolate, acute lvs. and smooth seeds. Sicily to Syria. B.R. 274 (as *E. rigida*).

EE. *Seeds rugose or pitted.*

63. **pínea,** Linn. St. glabrous: st.-lvs. linear; those of the infl. reniform-cordate: rays of umbel 5–7. Eu.

64. **robústa,** Small, and **Pálmeri,** Engelm., are many-stemmed desert plants from W. U. S., about 1 ft. high with small ovate lvs., irregularly crescent-shaped glands and roughened seeds. Rept. Mo. Bot. Garden. 11:pls. 40, 49.—They have been offered for sale, but have little cultural value.

65. **myrsinites,** Linn. The many declined sts. covered with large, fleshy, glaucous, obovate-oblong, concave, pointed lvs. in close spirals: umbel 7–12-rayed; glands and fls. yellow: seeds rugose. Eu.—A plant of old gardens; good for walls and rockeries.

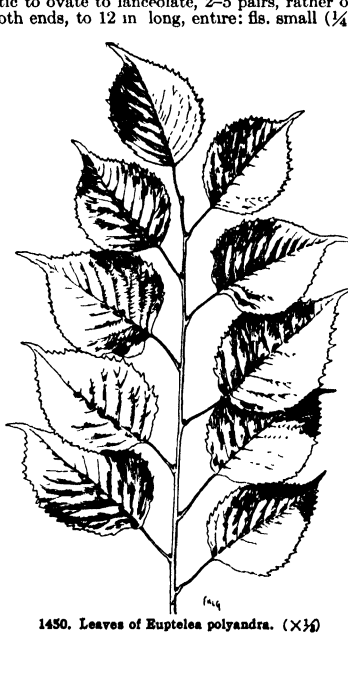
The following have been reported in cult. in Eu but are not in the American trade.

E. aggregàta, Berger. A succulent grown like E. cereiformis.—*E. aléppica,* Linn. Annual of Tithymalus section.—*E. amygdaloides,* Linn. Perennial and almost woody. Common in England.—*E. angulàris,* Klotzsch (E fimbriata, Hort.). A 3-5-angled succulent.—*E. aphýlla,* Brouss. Semi-succulent shrub, near E. Tirucalli. Gt. 37:277.—*E. arbúscula,* Balf. Semi-succulent shrub near E. xylophylloides.—*E. balsamífera,* Ait. Tropical shrub. lvs. at end of branches. Allied to E. dendroides.—*E. Berthelótii,* C. Bolle. Subtropical shrub allied to E. Regis-Jubæ, name used incorrectly in the trade.—*E. Bójeri,* Hook. (E. Breonii.) Semi-succulent, slender, spiny shrub near E. splendens, Hook. B.M. 3527.—*E. bubalina,* Boiss. (Section Treisia). Low, slender, spineless succulent, leafy at apex. R.B. 209 (as E. oxystegia).—*E. Cáctus,* Erenb. Succulent, spiny 3-angled shrub, near E. Hermentiana.—*E. cattimándoo,* Ell. Small, succulent, spiny, 5-angled tree.—*E. cervicórnis,* Boiss.=E. hermata.—*E. chamæsýce,* Linn. Low, opposite-lvd. herb with corolla-like cyathia in clusters.—*E. chardcias,* Linn. Umbellate perennial herb near E. Wulfenii. Gn. 59, p. 447. G.C. II. 13:657.—*E. colletioides,* Benth. Low Mexican shrub lvs. opposite. Plants grown under this name may be E. pteroneura.—*E. Dinteri,* Berger. Spiny, 6–8-angled succulent shrub often grown under names of E. virosa and E. tetragona.—*E. Dregeàna,* Mey. Spineless, almost leafless shrub, near E. Tirucalli.—*E. enópla,* Boiss. Spiny succulent near E. heptagona, and confused with it.—*E. erósa,* Willd. Spiny succulent, near E. mammillaris.—*E. falcàta,* Linn. Annual herb, near E. Aleppica.—*E. fimbriàta,* Hort.=E. angularis.—*E. hamáta,* Sweet (E. cervicornis, Boiss.) Low succulent shrub, leafy at apex, near E. clandestina.—*E. helioscópia,* Linn. Spiny, succulent tree, leafy at apex, near E. neriifolia. I.H. 4, p. 100, desc.—*E. helioscópia,* Linn. Umbellate annual (Section Tithymalus). Rept. Mo. Bot. Gard. 11 pl. 26.—*E. Intisy,* Drake. Semi-succulent tropical shrub, near E. Tirucalli.—*E. Lagáscæ,* Spreng. Annual, near E. pilosa.—*E. Láro,* Drake. Semi-succulent shrub near E. Tirucalli.—*E. laurifólia,* Juss. Tropical shrub, leafy at ends of branches, near E. atropurpurea.—*E. Lediéni,* Berger. Spiny succulent, near E. virosa, grown under the names of E. pentagona, E. cærulea, and E. cærulescens. B.M. 8275.—*E. Lemaireàna,* Boiss. Spiny succulent. Near E. grandicornis.—*E. lophogòna,* Lam. Succulent with fringed angles, near E. Fournieri. B.M. 8076.—*E. macroglypha,* Lem. Spiny, 3-angled succulent.—*E. Mórlothii,* Pax=E. Montieri.—*E. mauritánica,* Linn. Semi-succulent shrub. Near E. Tirucalli.—*E. mellífera,* Ait. Tree, leafy at branch ends. Near E. dendroides. B.M. 1305.—*E. Montièri,* Hook. (E. Marlothii, Pax). Succulent shrub, leafy at the apex, of Section Pseudeuphorbium. B.M. 5534.—*E. Morínii,* Berger. Spiny succulent, near E. cereiformis.—*E. multiceps,* Berger. Succulent. Near E. Caput-Medusæ.—*E. nivùla,* Ham. Spiny, succulent shrub, leafy at apex. Near E. neriifolia.—*E. Nyikæ,* Pax. Succulent tree with 2-angled joints.—*E. obèsa,* Hook. Succulent. Near E. meloformis. B.M. 7888.—*E. obtusifólia,* Poir. Semi-succulent shrub. Near E. Tirucalli.—*E. officinárum,* Linn. Succulent, spiny, 9–13-angled shrub. Near E. Beaumieriana.—*E. Paralias,* Linn. Perennial herb of Section Tithymalus.—*E. parvimámma,* Boiss. Low succulent, without spines. Near E. Caput-Medusæ.—*E. Phillipsæ,* N. E. Br. Succulent, spiny, 9-angled shrub. Near E. Beaumieriana.—*E. pilulífera,* Linn. Low annual with opposite lvs. and inconspicuous cyathia in clusters: glands appendaged.—*E. piscatória,* Ait. Tropical shrub: narrow lvs. at end of branches. Near E. Regis-Jubæ.—*E. plumerioides,* Teysmann. Tropical shrub similar to the previous one.—*E. procúmbens,* Mill. (E. pugniformis, Boiss.) Succulent, not spiny. Near E. Caput-Medusæ. B.M. 8082. R.B. 161.—*E. punicea,* Swartz. Tropical shrub. Near E. atropurpurea. B.R. 190. B.M. 1961. L.B.C. 20:1901. G.C. II. 15:529.—*E. pyrifólia,* Lam. Semi-succulent shrub, leafy at the apex. Near E. lophogona.—*E. Sapinii,* De Wild. Slender, spiny succulent. Near E. cereiformis. G.C. III. 45:66.—*E. Schimperi,* Presl. Semi-succulent shrub. Near E. Tirucalli.—*E. Schimperiana,* Hochst. An African annual of Section Tithymalus. This name perhaps used erroneously for E. Schimperi.—*E. Scolopéndra,* Don=E. stellata.—*E. scopiformis,* Boiss.=E. serpiformis.—*E. serpiformis,* Boiss. Section Arthrothamnus. Slender-branched semi-succulent shrub with opposite, rudimentary lvs.—*E. Sibthorpii,* Boiss. Perennial herb. Near E. Wulfenii.—*E. Stapélia,* N. E. Br. Slender succulent shrub with decurrent lf.-bases. Near E. pteroneura.—*E. spinòsa,* Linn. Umbellate sub-shrub or herb of S. Eu. Section Tithymalus.—*E. stapeliformis,* Hort.=E. stapelioides, Boiss (?). A plant near E. bupleurifolia.—*E. Stapfii,* Berger. Spiny, succulent, 4-angled shrub.—*E. stellæspina,* Haw. Spiny 10–13-ribbed succulent. Near E. cereiformis.—*E. stellàta,* Willd. (E. uncinata, DC., referred here according to N. E. Br.). Spiny succulent with branches V-shaped in cross-section, and clustered on a short thick st.—*E. tetragòna,* Haw. Spiny, succulent 4-angled tree. R.B. 39.—*E. trigòna,* Haw. Spiny, succulent, 3-angled shrub, near E. antiquorum.—*E. tuberculàta,* Jacq. Low succulent, near E. Caput-Medusæ.—*E. uncinàta* =E. stellata.

Other names used but not classified: *E. Amèlia,* Hort.—*E. articulàta,* Hort.—*E. aurèlia,* Hort. (E. Amelia?).—*E. Càput Commélini,* Hort. (E. Caput-Medusæ?)—*E. Caput-odorata,* Hort.—*E. Càput-Stimæ,* Hort.—*E. capénsis,* Hort. (succulent).—*E. colubrina,* Hort.—*E. cylindrica,* Hort.—*E. denùda,* Hort.—*E. de Smetiana,* Hort.—*E. erécta,* Hort.—*E. fundàis,* Hort.—*E. gardeniæfolia,* Hort.—*E. grácilis,* Hort.—*E. Houlletiana,* Hort.—*E. Houllètii,* Hort.—*E. longifólia,* Hort.—*E. móngador,* Hort. (E. mogador, Hort.?).—*E. Millers.*—*E. obtùsa,* Hort.—*E. pavoénsis,* Hort.—*E. pulchra,* Hort.—*E. Pulletiana,* Hort.—*E. Rebútii,* Hort.—*E. saharénsis,* Hort.—*E. waltoniénsis,* Hort.

J. B. S. NORTON.

EUPHÒRIA (name refers to the fact that the plant *carries well* its edible frs.). *Sapindàceæ.* A half-dozen trees in Trop. and Subtrop. Asia, allied to Litchi but differing in having petals and a deeply 5-parted imbricate calyx; both genera are sometimes combined in Nephelium. Lvs. pinnate: fls. regular; petals spatulate or lanceolate, hairy inside, stamens usually 8: fr. globular or ellipsoid, more or less tuberculate or warty, the size of a cherry or plum. The following species is widely cult. in the eastern tropics. *E. Longàna,* Lam. (*Nephèlium Longàna,* Cambess.). Tree, 30–40 ft., with gray bark: lvs. scattered; lfts. opposite or alternate, elliptic to ovate to lanceolate, 2–5 pairs, rather obtuse at both ends, to 12 in. long, entire: fls. small (¼in. or



1450. Leaves of Euptelea polyandra. (×⅓)

less across), yellowish white, in puberulent terminal and axillary panicles; calyx deeply 5–6-lobed; petals about equaling calyx, spatulate fr globose, reddish or purple, ¾in. or less diam., tuberculate or becoming warty or nearly smooth, with an edible aril. India. B.M. 4096. B.R. 1729.—A much-prized fr. in China, under the name of longyen, or linkeng, resembling litchi but smaller and smoother and yellow-brown

L. H B.

EUPHRÀSIA (Greek for *hilarity* or *delight*) *Scrophulariàceæ*. EYEBRIGHT. More than 100 low herbs, of no special horticultural value although some of them are mentioned in connection with alpine-gardening. They are more or less parasitic on roots of other plants: lvs. opposite, dentate or incised: fls small, largely whitish or purplish, in terminal leafy spikes; calyx mostly 4-cleft; corolla 2-lipped; stamens 4, didynamous, ascending under the upper lip: caps. oblong, many seeded, dehiscent The species range in temperate and cold parts of the globe, several of them being N. American.

EUPTÈLEA (Greek *eu*, well, handsome, and *ptelea*, elm) *Trochodendràceæ*. Ornamental woody subjects grown for their handsome foliage; also the red anthers of the precocious flowers are conspicuous in early spring.

Deciduous shrubs or small trees, winter-buds conspicuous, with imbricate dark brown scales lvs alternate, slender-petioled, dentate fls before the lvs, in axillary clusters along last year's branches, perfect, without perianth; stamens many, with large oblong-linear, red anthers carpels many, stipitate, oblique, with a decurrent stigma, developing after the stamens have dropped, growing into a small, slender-stalked obliquely winged 1–4-seeded nutlet —Three species in Japan, Cent and W China, and E Himalayas

They are graceful bushy trees resembling the linden in habit and foliage; the bright green leaves are very slender-stalked, and the tree is conspicuous in early spring from the bright red anthers of its flowers *E. polyandra* has proved hardy at the Arnold Arboretum and possibly *E. Franchetii* is of the same hardiness. They seem to grow well in a loamy well-drained soil and prefer somewhat moist situations. Propagation is by seeds or by grafting on their own roots

polyándra, Sieb. & Zucc Figs 1450, 1451. Shrub or small tree, to 20 ft.: lvs long-petioled, usually roundish ovate, cuspidate, coarsely and irregularly dentate, below pale green and slightly pubescent on the veins, 2–4 in. long: carpels usually 1-seeded, ½in long. April. Japan. S Z 72 S I F 1·41 Gng. 16:162.

Franchètii, Van Tieghem (*E Davidiàna*, Hemsl, not Baill). Tree, to 40 ft : lvs long-petioled, usually roundish-ovate, cuspidate, fairly regularly sinuate-dentate, light green below, 2–4 in. long: carpels usually 2–3-seeded. April Cent and W. China. H.I. 28:2787. V.F. 9.

E. pleiospérma, Hook. f. & Thoms (E Davidiana, Baill). Closely related to E. Franchetii Lvs. glaucous below: carpels somewhat larger. W. China, E. Himalayas.

ALFRED REHDER.

EÙRYA (Greek for *large*, but of no application). *Ternstræmiàceæ* (or *Theàceæ*). Shrubs of S. Asia and Malaya (30 or more species), with small dicecious fls, berry-like frs, and simple, glabrous evergreen lvs.: fls. in axillary clusters, or rarely solitary; petals and sepals 5; stamens 15 or less (rarely only 5), joined to the base of the corolla; ovary usually 3-loculed. Cleyera is by some included in this genus. The euryas are allied to camellias, and require much the same treatment. They are grown for foliage rather than for fls. They require an intermediate temperature and a peaty soil. Prop. by cuttings taken from the tips of growing shoots.

E japónica, Thunb. (*E. Sieboldii*, Hort.), is the common species, and is very variable. The variegated form of it (known in the trade as *E. latifòlia variegàta*) is one of the best glasshouse decorative pot shrubs: lvs. variable in shape, usually ovate-acuminate and irregularly toothed or notched, short-petioled, variously blotched with white. fls. greenish white, in small, axillary clusters. Japan. V. 23:5.

L. H. B

EÙRYALE (mythological name) *Nymphæàceæ* One species, the Indo-Chinese representative of *Victoria regia*, from which it differs in having all the stamens fertile (in Victoria the inner ones are sterile) and in the very small fl and in other technical characters



1451. Flowers of Euptelea polyandra. (Natural size)

E. fèrox, Salisb, is the species. The lvs. are 1–4 ft. across, circular, purple and spiny-ribbed beneath, dark green and uneven above: fls about 2 in. broad, open by day, prickly outside; calyx reddish inside and the 20–30 purple petals shorter than the calyx-lobes; stamens numerous fr a small many-seeded, globular berry, bearing the remains of the calyx on its top; seeds edible B.M 1447.—Long cult in China Treated as an annual. Has attracted little attention since the intro of Victoria. Prop. by seeds only, which are best stored in fresh cold water. Plant in rich earth as for nympheas, at 70–75° F. As far north as Philadelphia and St. Louis it is hardy, sowing itself every season. It is ferociously spiny.

E amazónica, Poepp, still advertised in catalogues, is Victoria regia.

H. S. CONARD.
WM. TRICKER.

EURYÀNGIUM: *Perula*.

EURÝCLES (Greek-made name, of no particular application). *Amaryllidàceæ* Two south hemisphere tunicated-bulbous plants, allied to Hymenocallis and Pancratium. Fls white or whitish, umbellate on peduncles 12–18 in. long; perianth-tube cylindrical, the segms. oblong-lanceolate, ascending and nearly equal, stamens inserted in the throat of the tube: lvs broad and stalked, with prominent curving veins and interlocking veinlets. **E. sylvéstris**, Salisb. (*E. amboinénsis*, Loud.). BRISBANE LILY. Scapes 1–2 ft, bearing an umbel of 10–40 handsome, creamy white fls (2 in. across): lvs. round-cordate, with a very short, blunt point; blooms in May and June in Eu., the lvs appearing later. B.M. 1419 (as *Pancratium amboinense*). B.R. 715 (as *Pancratium australasicum*). R H. 1879, p 456 and p. 457 (as *E. australasica*); 1913, p. 111 G.W. 11, p. 583. G.Z. 24, p. 25. Malaya, Philippines, N. Austral.—Cult. apparently as for pancratiums.

L. H. B.

EÙRYOPS (*large eyes*, because of the prominent fls.). *Compósitæ*, Small shrubs of 25–30 species of Afr. (mostly S. Afr.), Arabia and Socotra, very little known in horticulture. The fls. are yellow, the heads with female rays and tubular 5-toothed perfect disk-fls.; receptacle convex or conical; involucre of 1 series of scales achene wingless and beakless, the pappus of several rows of caducous bristles. These little bushes or undershrubs grow from ½–3 ft., or sometimes 5 ft.,

high. They are bloomed in the greenhouse or grown in the open in mild climates. None seems to be regularly in the trade.

EÙSCAPHIS (Greek, *eu*, handsome, and *scaphis*, vessel; alluding to the shape and the handsome color of the dehiscent capsule). *Staphyleàceæ*. Ornamental woody plant grown for its handsome foliage and the attractive fruits.

Deciduous upright shrub or small tree, glabrous: lvs. opposite, odd-pinnate, stipulate: fls. in terminal upright panicles, perfect; sepals, petals and stamens 5, all of nearly equal length; ovary 2–3-celled, surrounded at the base by an annular disk; styles 2–3, often connate: fr. consisting of 1–3 spreading, leathery dehiscent pods, each with 1–3 black seeds.—One species in Japan and Cent. China. A handsome plant with large pinnate lvs., small whitish fls. in upright panicles followed by attractive brownish red frs. disclosing shining black seeds when opening. It grows in any good garden soil, but is only half-hardy N. Prop. by seeds and greenwood cuttings under glass.

japónica, Dipp. (*E. staphyleoìdes*, Sieb. & Zucc. *Sambùcus japónica*, Thunb.). Shrub, to 10 ft: lfts. 7–11, ovate-lanceolate, glabrous, serrate, 1½–3 in long, each with 2 small stipules: fls. in broad many-fld. panicles to 6 in. long: fr. consisting of 1–3 pods, ½in. long, apiculate, each with 1–3 steel-blue seeds. May, June; fr. Aug., Sept. Japan. S.Z. 67. S.I.F. 1:70.

ALFRED REHDER.

EÙSTOMA (*good mouth*, alluding to the corolla). *Gentianàceæ*. Two or 3 N American large-fld. glaucous opposite-lvd. small herbs. fls. more or less paniculate, single on the peduncles, 5-merous or rarely 6-merous; calyx with narrow keeled lobes; corolla nearly campanulate, white, blue or purple, the lobes oblong or obovate, usually erose; stamens attached on the corolla-throat; ovary 1-celled; stigmas 2: caps. oval or oblong, many-seeded. **E. selenifòlium**, Salisb. (*E. exaltàtum*, Griseb.). Annual, but in S Calif. said to be perennial, 9–15 in. erect: lvs. oblong, glaucous-green: fls. light blue or purple, the corolla-lobes about or nearly 1 in. long, twice exceeding the tube. Fla. to Calif. Offered in Calif.

EÙSTREPHUS (Greek, referring to the climbing habit). *Liliàceæ*. One or two Australian plants, botanically related to Lapageria, but much less showy; in habit suggestive of smilax (*Asparagus medeoloìdes*). Plants more or less woody at base, slender, branching, tall-climbing: lvs. alternate, sessile or short-petioled: fls. 2 to many, in axillary fascicles; perianth-segms. distinct and spreading; stamens 6. **E. latifòlius**, R. Br., is a tall and much-branched half-twining herb, more or less woody at the base, bearing alternate, stiff, linear-lanceolate, short-stalked lvs and small, axillary, drooping light blue fls. with spreading, ciliate perianth-segms.: fr. a dry berry: lvs. 2–4 in long, sharp-pointed: fls less than 1 in. across. B.M. 1245. Of easy cult., either in the glasshouse border or in pots. Very useful for table decoration and for design work.

L. H. B.

EUTÁCTA: *Araucaria*.

EUTÁXIA (from Greek words referring to the attractive appearance). *Leguminòsæ*. Shrubs of Austral., with golden or yellow papilionaceous fls., one of which is offered for greenhouse cult.: lvs. small, opposite, simple and entire: fls. solitary or a few together, or sometimes crowded at ends of branches; standard orbicular, entire or nearly so, exceeding the other petals; stamens free: pod ovate, 2-valved. Said to require general treatment of Chorizema. **E. myrtifòlia**, R. Br. Glabrous, 2–3 ft.: lvs. obovate-oblong to linear, mostly ¾in. or less long: fls. yellow with dark orange keel, solitary or 2–4 together. B.M. 1274 (as Dillwynia). R.B. 26:13. Var. *floribùnda* is listed.

EUTÉRPE (mythological name). *Palmàceæ*, tribe *Arèceæ*. Slender erect spineless palms, with solitary or fasciculate ringed caudices, and grown chiefly for their graceful habit and feathery pinnate foliage.

Leaves terminal, equally pinnatisect; segms. narrowly linear-lanceolate, long, and gradually acuminate or ensiform, membranaceous, plicate, the thickened margins recurved at the base; rachis and petiole 3-sided toward the base, convex on the back, concave above; petiole elongated; sheath very long, cylindrical, entire: spadix paniculately branched: rachis elongated: branches slender, gradually shortening above, usually scaly, thick at the base, erect-spreading in fl.: spathes 2, coriaceous or membranaceous, lanceolate, the lower one shorter, split at the apex, dorsally 2-keeled, the upper one symmetrical, split down the ventral side: bracts bordering the furrows; bractlets ovate-acute: fls. small, white, sessile in the furrows of the spadix: fr. like a pea, purple.—Species about 8. Trop. Amer. and W. Indies. G.C. II. 24:586.

Three species of Euterpe are commonly found in cultivation, namely: *E. edulis*, *E. montana* and *E. oleracea*. These are found under varying conditions in Central and South America and the West Indies, and all three species are valuable as food-producers to the natives of those countries. *E. edulis* grows in great quantities in the lowlands of Brazil, where it is known as the assai palm, owing to the fact that its seeds are macerated in water, and by this means is produced a beverage known as assai *E. oleracea* is the well-known cabbage palm of the West Indies, growing in the lowlands near the coast, while *E. montana* is the mountain cabbage palm, and is frequently found at considerable altitudes in the same islands, and consequently does not attain the great dimensions of *E. oleracea* —The euterpes do not present any special cultural difficulties, being free-rooting and rapid-growing palms; a night temperature of 65° F, and abundant moisture are among their chief requirements. A good turfy loam, with the addition of about one-fifth of stable manure while in the compost heap, provides a suitable soil. From their habit of forming a tall slender stem without suckering from the base, the euterpes are liable to become rather leggy specimens When under cultivation, and for trade purposes, it is advisable to group three or four of the young plants together, thus producing a more bushy specimen. White scale is one of the worst pests to which these palms are subject, and soon ruins the foliage unless care is taken Seeds germinate in a few weeks if sown in a warm greenhouse, and the young plants make better progress when moderately shaded. (W. H. Taplin.)

edùlis, Mart. PARA PALM. ASSAI PALM St 60–90 ft. high, 8 in. thick, flexuous: lvs 10–15, spreading, the lfts. often pendulous; sheaths 3–4½ ft; petiole 1½ ft.; blade 6–9 ft.; segms. linear, spreading, deflexed, 60–80 on each side, densely crowded, 28–36 in. long, ¾–1 in. wide: spadix about 2–3 ft long, bearing numerous rather inconspicuous fls. Brazil.

oleràcea, Mart. CABBAGE PALM. St. 60–100 ft., scarcely 1 ft. diam. at base, attenuate above, flexuous: lvs. arcuate-spreading, 4–6 ft. long, the apex more or less deflexed; segms. pendent, linear-lanceolate, the upper 2 ft. long, 1 in. wide, many-nerved. Brazil. See *Oreodoxa*.

montàna, R. Graham. St. 10 ft. high, swollen at the base, ringed: lvs. 9 ft. long, elliptical-obovate; segms. lanceolate, entire, glabrous, alternate; petiole 2 ft. long, scaly beneath, unarmed; rachis plano-convex below, subtriangular toward the apex: spadices several on the trunk at one time, axillary, much branched; fls. numerous, white. Grenada. B.M. 3874.—Intro. into Botanic Garden at Edinburgh in 1815.

JARED G. SMITH.
N. TAYLOR.†

EUTOCA: *Phacelia.*

EVAPORATING FRUIT. The domestic operation of drying fruit has been practised ever since men looked beyond their immediate wants and stored food for time of greater need. Dried fruit has long been an article of commerce, yet until a few years ago only the most primitive methods were used in drying, and the industry, commercially, was confined to a few favored regions in Europe. The modern industry is not yet a half-century old. Its almost inconceivable growth in America in this brief time is one of the industrial phenomena of the times. Spurred into activity by the encroachment of American products in their markets, the European producers, by the adoption of better methods, and by governmental encouragement, have increased greatly their output of dried fruit. Thus, from an adjunct to fruit-growing for home use, drying fruit has become, within recent years, one of the main branches of horticulture.

An idea of the dried-fruit industry in the United States and of its great growth in recent years may be obtained from the following figures from the census of 1910 for the crop of 1909:

Raisins	111,774,767 pounds, worth	$4,837,933
Prunes	138,498,490 pounds, worth	5,130,412
Peaches	46,843,391 pounds, worth	2,423,083
Apples	44,568,244 pounds, worth	3,088,095
Apricots	29,205,569 pounds, worth	2,277,177
All other fruits	29,438,306 pounds, worth	2,073,695

Adding the valuations given, results in a grand total of $19,840,395 for dried fruits in the year 1909. Comparing this sum with the census of 1900, one finds that the crop in 1899 was valued at $4,757,005 and that the industry, judged by the figures, has increased more than fourfold in ten years.

Fruit may be cured in the sun, or it may be cured in drying-machines, called evaporators That cured in the sun is called by the producer "dried fruit," that in evaporators, "evaporated fruit." By far the larger part of the world's product is cured in the sun. Thus, at least three-fourths of the fruit dried in America is sun-dried in California.

Sun-drying fruit —In countries having a sufficiently warm and dry climate, as Greece and Turkey, and parts of France, Spain and western America, fruit is dried almost wholly in the sun. The fact that in these favored localities the drying capacity is limited only by the acreage of sunshine, makes it certain that the proportion of sun-dried fruit will always be vastly greater than that of evaporated fruit. Drying fruit in the sun is a simple process, but one hedged in by many little arts and methods that facilitate the work and improve the product. In general, the process is as follows: The fruit is graded, bleached by sulfur, if a light-colored product is desired, in the case of prunes dipped or pricked, and is then spread on trays to be exposed to the sun When the drying process is completed, the fruit is again graded, in most cases put through a sweat, and then "finished" in various ways, as by dipping or glossing.

Evaporating fruit.—There are many styles of evaporators, but all possess in common a chamber for the reception of the fruit, through which a current of warm air is forced, or the fruit is forced through the air, or both, the object being to remove the aqueous matter from the fruit as quickly as possible, and the principle being that warm air will absorb more moisture than cool air. The saturated air must not remain in contact with the fruit. Since different fruits exact different conditions, it is necessary to change the temperature and velocity of the air-current in the drying-chamber at will. To make the product homogeneous, current and temperature must be equal in all parts of the evaporator. It is obvious that simplicity in the machine and economy in heat and in room are cardinal virtues in a good evaporator. It is the rule to start the evaporation of large fruits at a low temperature and finish at a high one, but with berries the reverse is true.

Recently two or three patented processes for curing fruit by "dehydration" have been introduced with much promise of betterment in the industry. While the machinery, the methods and the products are quite different in evaporating and dehydrating, the principle in the two operations is practically the same. In both processes the water is removed from the fruit by moving currents of warm air. In evaporation the air is warmed only. In dehydration the air is dried by cooling until the moisture is condensed out and is then warmed and passed over the fruit or vegetable to be cured. By the new process much time is saved and a greater variety of fruits and vegetables can be used.

The following are definitions of the somewhat technical terms used in the industry: *Bleaching* is the process of changing the dark color of fruit to a lighter hue, or of preventing the discoloration; it is generally accomplished by sulfuring. *Bloaters* are prunes which in drying swell up to an abnormal size; they are usually produced by fermentation in over-ripe fruit. *Chops* are dried apples cured without paring or coring to be used in making cider or vinegar. *Dipping* is the process of cutting the skin of fresh prunes to facilitate curing. The operation is performed by submerging the fruit in boiling lye. Cured fruit is sometimes dipped in one of various solutions as a "finishing" process. *Drip* is the syrupy liquid which oozes from prunes in the process of evaporation; it generally characterizes a poor prune or a poor evaporator. *Frogs* are cured prunes having an abnormal shape, a condition caused by curing unripe fruit. *Pricking* is the process of puncturing the cuticle of fresh prunes. It is done by means of a machine, the essential part of which is a board covered with projecting needles, over which the prunes must pass. It accomplishes the same end as lye-dipping. *Sizes* is a term used to indicate the number of cured prunes it takes to make a pound. The "four sizes" known in the markets are 60's–70's, 70's–80's, 80's–90's, 90's–100's. *Sugaring* is the formation of globules of sugar on the cuticle of cured prunes or raisins *Sulfuring* is a process to which fruit is subjected to give it a lighter color. The fruit is exposed to fumes of burning sulfur before being exposed to the sun or put in evaporators. *Sweating* is a process to which cured fruit is subjected before packing; it is put in a room at a high temperature and allowed to become moist. *Waste* is a dried product made from skins and cores of apples and pears and used for vinegar.

Apples and pears are peeled, cored, cut into rings and bleached by being exposed to the fumes of sulfur for about a half hour in preparation for drying or evaporating. Fruits so prepared are placed upon trays for sun-drying and must be cured in the sun for three to five days. In evaporating in the western states, the prepared fruits are placed on trays and passed in from six to twelve hours through the evaporator chamber, but in the East, where the product is chiefly made, the prepared fruit is piled from 4 to 6 inches deep on the floor of a kiln. Here it is left for fourteen to sixteen hours, being turned every two or three hours, until the fruit is no longer sticky, an indication that it has reached the proper stage of dryness. In New York, the law requires that evaporated apples contain not more than 27 per cent of moisture. One hundred pounds of apples will yield from twelve to fifteen pounds of evaporated apples.

Apricots, peaches and nectarines must be fully ripe before drying and without bruises. They are pitted, and may or may not be peeled. If peeled, the operation is done with a machine or with lye, though the use of the latter is considered bad practice. The fruit is placed on the trays cup side up. About three days are required for drying in the sun and about eight hours

for evaporating. The cured product should be of a translucent amber color.

Berries are seldom sun-dried for the markets. For evaporating they are placed on trays in quantities of sixteen to thirty quarts, given a temperature of about 175° at the start, and are finished in four to five hours, at a temperature of about 100°. After being taken from the evaporator, they are piled for sweating in a warm, ventilated room.



1452. Where to dig in removing an evergreen.

Figs for drying must be gathered when fully ripe. Some growers prefer drying in shade rather than in sun. Evaporators are seldom used. The fruit is not allowed to dry hard, and before packing must be well sweated. Usually, for "finishing," they are dipped in salt water or syrup. The drying process requires from five to eight days.

Prunes are allowed to ripen until they fall to the ground. Before being spread on the trays they are dipped or pricked in order to thin or crack the skin, that the moisture may easily escape, and dripping be prevented. Sun-drying requires from one to three weeks, while from twelve to thirty hours are required for evaporation. A thorough sweat prevents the sugaring so common to this fruit. Before packing they are graded in sizes. Dipping as a "finishing" process is practised by many producers. A good prune is soft, smooth and meaty, with loose pit, and of an amber, dark red or golden hue, depending upon the variety.

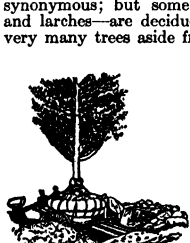
Grapes for raisins are sun-dried. They must be picked when fully ripe, the bunches, and the berries on the bunches, being sorted as the picking progresses. The operation of drying must be watched with care. The process requires from eight to fourteen days, during which time the bunches must be turned at least once. A sweat is given before packing. Raisins are graded into half a dozen or more brands for the market. U. P. HEDRICK.



1453 Digging up an evergreen.

EVERGREENS. In horticulture, evergreens are plants that retain green foliage the year around; they do not shed all their foliage at any one time; in some cases, the individual leaves may remain attached and green for some years, as in many of the Coniferæ, but in all evergreens the old leaves shed after a time when they become so overshadowed or crowded as to be no longer functional. The leaves of pines and spruces may persist three to fifteen years.

In the popular mind, "evergreen" and "conifer" are synonymous; but some conifers—as the taxodiums and larches—are deciduous. Moreover, in the tropics very many trees aside from conifers are evergreen, as notably the palms.



1454. The roots bound up, and tree being loaded.

Evergreens may be classified as coniferous and broad-leaved, the latter including such plants as rhododendron, kalmia, mahonia, box and many others. The number of plants that are evergreen in the latitude of New York City is very large. Few persons recognize the wealth of good winter greenery that may be secured by exercising careful choice of material and providing proper conditions and protection for its growth. There are many very low evergreen plants that may contribute much to the winter interest of a yard or garden, in the way of edgings, masses, rosettes, and ground cover. The following lists indicate the materials that are now at the command of the planter.



1455. The method of binding up the roots.

Beyond the latitude of Lake Erie, the dependable evergreens are mostly conifers. At the Central Experimental Farm at Ottawa, those deciduous plants that hold their foliage fairly late in the autumn are mostly too tender for use. A few good plants, however, are, Oregon grape (Mahonia), bearberry (*Arctostaphylos Uva-ursi*), *Pachysandra terminalis*, shrub yellow-root (*Xanthorrhiza apiifolia*), and *Quercus imbricaria*. The Oregon grape is perhaps the most useful evergreen there for ground-covering. The hardier species of Ligustrum are also fairly satisfactory, but most of the species of this genus leave so much dead wood after winter that in very large masses they are liable to be unsightly. Many attractive conifers are reliable at Ottawa, in the genera Abies, Chamæcyparis, Ginkgo, Juniperus, Picea, Pinus, Pseudotsuga, Taxus, Thuja, Tsuga.

The uses of evergreens are discussed in other places in the Cyclopedia, as under *Arboriculture*, *Herbary*, *Landscape-Gardening*, *Lawn-Planting*, *Perennials*, *Rock-Gardening*, *Screens*, *Shrubbery*, *Topiary Work*, *Wild-Garden*, *Windbreaks*, *Winter-Gardening*. For lists of evergreens for California, see pp. 379–381 (Vol. I).

L. H. B.

Moving large evergreens.

Figs. 1452–1457.

Large evergreens are moved with a ball of earth because they have no dormant period, but carry their foliage and need moisture at all times of the year. It is essential that the ball of earth contains a sufficient amount of small fibrous feeding roots to support the tree and that the tree be kept well watered for two or more seasons until the tree has spread its roots over sufficient area to gather enough rainfall to sustain the normal growth. The extent of fibers in the ball is increased by transplanting and root-pruning. Root-pruning is less essential with trees having an abundance of fibrous roots than with trees having only a few large coarse roots in the central portion. Some trees, as white pine, will survive with a comparatively small number of roots, their drought-resistant qualities enabling them to persist with a small supply of moisture. Other evergreens, as Nordmann's fir, have a long carrot-like taproot, and the tree is likely to die if this is cut and the tree given an inadequate quantity of water. Frequent nursery transplanting is, therefore, necessary with this species.

Trees are dug by starting a trench at a radius from the tree about 3 feet wider than the ball of earth to be taken The roots are cut off on the outside of the trench and the soil dissected out from between the roots back to the size of the ball. These roots are bent around against the ball of earth if they are

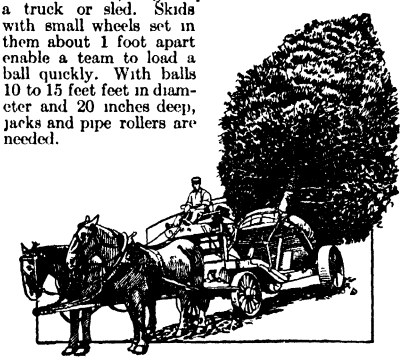


1456. Digging the hole in frozen ground to receive the tree.

flexible enough to bend. If not sufficiently flexible and tractable, they are cut off.

A canvas is made 15 to 24 inches deep, and is made smaller at the bottom by folding over a V and sewing it. This makes it fit a conical ball and, when it is pulled up 3 inches by the cross-lashing at the top, makes it tighter. The canvas has cross-ropes sewed on it with rings at the top and bottom, and on the deeper balls two rows of rings in the middle. The bottom rope is tightened by a wooden lever 20 inches long with four holes, the rope being looped through the holes and the lever thrown over to pull the rope tight. The top rope is then tied and tightened by cross-lashing.

To get the ball free from the subsoil, dig under all around and tip the tree slightly. Level off the bottom with a fork. If there are tap-roots, tunnel under and cut them with a saw. Put a platform as far under as possible and tip the tree back. To get the ball in the center of the platform, put a hammock around the ball and pull. Hold the platform in position by crowbars driven in front of it. Lash the ball to the platform, make an incline, drag the platform out of the hole onto a truck or sled. Skids with small wheels set in them about 1 foot apart enable a team to load a ball quickly. With balls 10 to 15 feet feet in diameter and 20 inches deep, jacks and pipe rollers are needed.



1457. Transporting a large evergreen tree.

Trees over 10 feet need to be tipped over to go under wires. If the canvas is put on tight and at the proper taper, and if the ball is cut flat to fit close to the platform and lashed tight to the platform, the tipping can be done without the ball shaking loose. Sometimes a canvas or burlap bottom can be put between the platform and the ball. In unloading, the tree is stood up, team hooked to the platform and the tree dragged off to the ground. The tree may drop 2 feet without injury. The platforms are dragged to the hole and balls less than 4 feet rolled into the hole. Larger balls have the platform dragged into the hole and the platform pulled out holding the tree in position by a hammock. To straighten the tree, tramp the earth solid under it until it stands erect. Take off the canvas, spread out the side roots, pack the earth and anchor as with deciduous trees. Keep the ball moist; examine it once a month or more often by digging or boring into the ball during the first two years. Evergreens moved with a too small ball or with not enough fibers in the ball or with the watering neglected, may grow 3 inches a year for the first two or three years. If properly moved, they will grow 6 inches or more a year—half their normal growth.

Deciduous trees may be moved with balls of earth by the above method, and it has proved an aid with difficult species, as beech, oak, liquidambar, tulip. Especially when previously transplanted or root-pruned, the above trees 3½ inches in diameter moved with a ball of earth 4 feet in diameter are very successful, while without a ball many are lost or the growth is much slower. Investigation should be made to see whether this is because of less disturbance of the roots or because there is carried with the roots and soil a mycelium of a fungus which aids the roots to take up plant-food and moisture.

The time of year for moving trees is of minor importance. It is over-emphasized by purchaser, landscape architects and nurserymen, and results in heavy financial loss to nurserymen in congesting sales and their own planting in the short spring season. It greatly lessens the total amount of planting needed for forest, shelter-belt, landscape, fruit, and other economic purposes. A nurseryman may plant all the year. Evergreens can be taken up with a ball of earth even in May and June. The new growth may curve down. After June 20, the spruces, and after July 10, the pines, are firm enough not to wilt. August-September sales with a ball of earth are just as successful as April. The ground is warm and the roots grow rapidly; the ground can be made moist. Weather in September is less dry than in May and June.

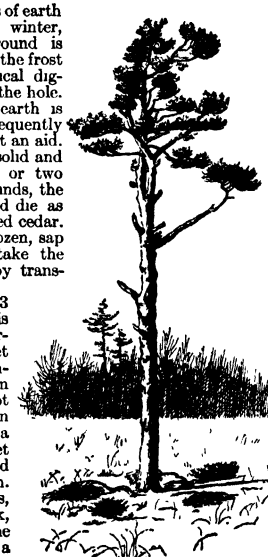


1458. Picea excelsa, the Norway spruce. One of the most popular coniferous evergreens.

Small evergreens up to 2 feet high may be planted in August and September from one part of the nursery to another without balls of earth, if the roots are very carefully dissected out without breaking. There will be more failures if the week following planting is hot and dry.

Planting with balls of earth may continue all winter, especially if the ground is mulched to keep out the frost and permit economical digging of the tree and the hole. The frozen ball of earth is an old method, frequently referred to, but is not an aid. If the ball is frozen solid and remains so for one or two months with dry winds, the top may dry out and die as has occurred with red cedar. If the ball is not frozen, sap can come up to take the place of that lost by transpiration.

A ball of earth 3 feet in diameter is needed for an evergreen 8 to 10 feet high; 4½ feet in diameter for an evergreen 15 feet high, except red cedar which can have a ball 3 feet; a ball of earth 12 feet in diameter is needed for a pine 35 feet high. Root-pruning pines, spruce and hemlock, permits moving the following year with a smaller ball than otherwise. In root-pruning, the trench



1459. Picturesque field pine, remnant of a forest.

can go three-quarters of the way around or three or four of the larger roots can be left across the trench to keep the tree from blowing over. Root-pruning of red cedars is of less advantage and is rarely practised. In New England and northern New York, the pine, spruce and hemlock, have only a few coarse roots just under the surface and no roots extending 2 feet deep. When moved to better-drained soils on the coastal plain, they develop deeper roots and have ten times as many fibers in a ball 4 feet in diameter. The above evergreens with their shallow root-systems can be taken up with a disc of roots, peat and grass 8 inches deep and 3 to 4 feet wide. This can be set on a wagon and trees 10 to 15 feet high easily moved. Less roots



1460. The beauty of young evergreens lies in their symmetry and the preservation of the lower limbs.

will be broken or bare if the ball is tied in burlap. The usual cause of failure in this operation is neglect of watering. Hemlocks and probably other trees will be aided by shading for the first two months.

HENRY HICKS.

Woody evergreens for New England and New York.

B=Broad-leaved evergreens.
S=Semi-evergreen
P=Protected at Arnold Arboretum, Boston.
T=Tender above New York City.

SBT Abelia chinensis.
SBP Abelia grandiflora
BT Abelia uniflora.
T Abies amabilis.
Abies appollinis.
Abies balsamea.
Abies cephalonica.
Abies cilicica.
Abies concolor
Abies Fraseri
T Abies grandis.
Abies homolepis=A. brachyphylla.
Abies magnifica
Abies nobilis.
Abies Nordmanniana.
Abies pectinata=A. Picea.
Abies Picea
T Abies Pinsapo
T Abies shastensis
Abies sibirica.
Abies Veitchii
BT Acæna microphylla
BT Acæna ovalifolia.
BS Akebia lobata
BS Akebia quinata.
B Alyssum saxatile.
B Andromeda floribunda=Pieris floribunda.
B Andromeda glaucophylla.
BP Andromeda japonica=Pieris japonica.
BT Andromeda nitida=Lyonia nitida.
B Andromeda polifolia.
BS Andromeda speciosa=Zenobia speciosa.
BT Arbutus Menziesi.
BT Arbutus Unedo.
B Arctostaphylos Uva-ursi
B Arundinaria chrysantha
B Arundinaria Fortunei var variegata.
B Arundinaria Hindsii.
B Arundinaria japonica.
BT Aubrietia deltoidea.
BT Aucuba japonica
BS Azalea amœna=Rhododendron amœnum.
BT Azara microphylla.
BS Baccharis halimifolia.
BT Baccharis patagonica.
BS Baccharis salicina.
B Bambusa nana
BS Berberis aristata See *Mahonia* for evergreen barberries with compound leaves.
BP Berberis buxifolia.
B Berberis Gagnepainii.
B Berberis ilicifolia, Hort =Neubertii.
BS Berberis Neubertii=B vulgaris×M aquifolium. Foliage intermediate drying and turning brown in winter and both single and trifoliate leaves on same plant.
Berberis Sargentiana (one of the best).
B Berberis stenophylla.
B Berberis verruculosa.
B Berberis Wallichiana, Hort =B. Sargentiana.
BS Berberis Wilsonæ (leaves brown).
BT Bignonia capreolata
Biota orientalis=Thuja orientalis.
Bruckenthalia spiculifiora (light leaf-mulch).
Bryanthus empetriformis.
Bryanthus erectus
Bryanthus taxifolius=Phyllodoce cærulea.
SBP Buddleia japonica.
SBP Buddleia Davidii (variabilis) var magnifica.
SBP Buddleia Davidii var. superba
SBP Buddleia Davidii var. Wilsonii.
BSP Bumelia lanuginosa.
B Buxus japonica
BP Buxus sempervirens.
P Calluna vulgaris, vars. alba, elata, rubra, tomentosa (light leaf-mulch)
SBT Carrieria calycina.
Caryotaxus=Torreya.
Cassiope hypnoides.
Cassiope tetragona.
BT Castanopsis chrysophylla.
BS Ceanothus Fendleri.
T Cedrus atlantica
T Cedrus Deodara
P Cedrus Libani
Cephalotaxus drupacea
P Cephalotaxus Fortunei
B Cercocarpus parvifolius
BS Chamæbatiara millefolium.
Chamæcistus=Loiseleuria.
T Chamæcyparis Lawsoniana
Chamæcyparis nutkaensis (C nootkatensis).
Chamæcyparis obtusa, especially var nana.
Chamæcyparis pisifera
Chamæcyparis sphæroidea
BS Chamædaphne calyculata (leaves brown).
B Chimaphila maculata.
B Chimaphila umbellata.
B Chiogenes hispidula.
T Cistus laurifolius
BS Clematis paniculata.
T Clematis Armandii
BS Cocculus Thunbergii
Corema Conradii
SBP Cotoneaster adpressa
BP Cotoneaster buxifolia
BP Cotoneaster Dammeri
SBP Cotoneaster horizontalis
BP Cotoneaster microphylla
ST Cotoneaster salicifolia
(light leaf-mulch).
Cryptomeria japonica.
T Cupressus Macnabiana.
BS Cytisus capitatus.
BS Cytisus nigricans.
BP Cytisus purgans.
P Daboecia polifolia (light leaf-mulch).
B Daphne Blagayana.
B Daphne Cneorum.
SBP Daphne Houtteana.
BT Daphne Laureola.
BP Daphne pontica.
Diapensia lapponica.
BT Distylium racemosum.
B Dryas octopetala (better with winter shade).
BS Elæagnus umbellata.
Empetrum nigrum.
Ephedra distachya.
Ephedra gerardiana.
B Epigæa repens.
P Erica carnea
T Erica stricta
P Erica Tetralix
P Erica vagans
(light leaf-mulch).
ST Evonymus americana.
BS Evonymus Bungeana var. semipersistens

BT Evonymus japonica.
B Evonymus nana (leaves bronze).
Evonymus nana var. Koopmannii (leaves bronze).
BT Evonymus patens
B Evonymus radicans, in variety, especially vegeta and Carrierei
BT Garrya elliptica
BT Garrya Fremontii.
BT Garrya Veitchu var. flavescens.
B Gaultheria procumbens.
B Gaylussacia brachycera.
BS Genista elata.
BS Genista germanica.
BPS Genista pilosa.
BPS Genista procumbens.
BS Genista tinctoria.
B Hedera helix (tender in exposed places, safer with winter shade)
BS Helianthemum vulgare.
BS Hippophaë rhamnoides.
B Hyssopus officinalis.
BS Hypericum
B Iberis sempervirens.
B Iberis tenoreana
PB Ilex crenata
B Ilex crenata microphylla.
B Ilex glabra
B Ilex opaca
B Ilex rugosa
BT Ilex vomitoria.
BT Jasminum humile=J revolutum, Hort
Juniperus chinensis in variety, especially procumbens.
Juniperus communis in variety, especially fastigiata, hibernica and nana
Juniperus sabina in variety, especially humilis, prostrata and tamariscifolia
Juniperus virginiana in variety, especially globosa, procumbens and tripartita.
B Kalmia angustifolia
B Kalmia glauca
B Kalmia latifolia
B Ledum groenlandicum.
B Ledum palustre
B Leiophyllum buxifolium.
B Leucothoë axillaris
B Leucothoë Catesbæi.
BS Leucothoë racemosa
T Libocedrus decurrens.
BS Ligustrum Ibota var myrtifolium.
BS Ligustrum strongylophyllum.
BST Ligustrum ovalifolium
B Ligustrum Prattii
BS Ligustrum vulgare
B Linnæa borealis
Loiseleuria procumbens.
BS Lonicera fragrantissima.
BS Lonicera Henryi
BS Lonicera japonica (= L Halleana) in variety
BS Lonicera similis var Delavayi
BS Lonicera Standishii
BS Lonicera Standishii var lancifolia.
BS Lonicera xylosteum
BS Lycium chinense
BS Lycium halimifolium=L vulgare
Lycopodium annotinum.
Lycopodium clavatum
Lycopodium complanatum.
Lycopodium lucidulum
Lycopodium obscurum
BT Lyonia nitida=Andromeda nitida.
BS Magnolia glauca
B Mahonia Aquifolium
B Mahonia Fortunei
BP Mahonia japonica
B Mahonia nepalensis
B Mahonia nervosa
B Mahonia repens (most hardy)
B Mitchella repens
} Formerly included in Berberis.
BT Osmanthus Aquifolium.
B Pachysandra terminalis.
B Pachystima Canbyi
BP Pachystima Myrsinites.
BT Pernettya angustifolia.
BT Pernettya mucronata.
BT Phillyrea decora
Phyllodoce cærulea=Bryanthus taxifolius.
B Phyllostachys flexuosa.
B Phyllostachys Marliacea.
B Phyllostachys violascens.
Picea Abies=P excelsa.
Picea ajanensis.
Picea Alcockiana.
Picea alba=P canadensis.
Picea Engelmanni.
Picea excelsa=P. Abies
Picea excelsa var. Barryi.
Picea excelsa var. clanbrasiliana.
Picea excelsa var. Ellwangeriana.
Picea excelsa var. Gregoriana.
Picea excelsa var. Maxwellii.
Picea excelsa var. pendula.
Picea excelsa var pumila.
Picea excelsa var pygmæa.
Picea excelsa var pyramidalis.
Picea Mariana=P nigra.
Picea Menziesii=P. pungens.
Picea nigra and var Doumetii.
Picea omorika
Picea orientalis
Picea polita=P. Torano.
Picea pungens.
Picea rubra
T Picea sitchensis.
Pieris=Andromeda
Pinus austriaca.
Pinus Banksiana=P. divaricata.
Pinus cembra
Pinus densiflora and var pumila.
Pinus divaricata
Pinus echinata
Pinus edulis.
T Pinus excelsa.
Pinus flexilis
T Pinus Jeffreyi
Pinus montana
Pinus monticola
Pinus palustris
Pinus parviflora
Pinus ponderosa.
Pinus resinosa.
Pinus rigida
Pinus Strobus
Pinus sylvestris.
Pinus Tæda.
Pinus Thunbergii.
Pinus virginiana
B Polygala chamæbuxus
B Potentilla tridentata (leaves brown-purple).
BP Prunus Laurocerasus var schipkaensis
Pseudotsuga taxifolia=P mucronata or P. Douglasii.
BT Pyracantha coccinea var Lalandi
BT Pyracantha coccinea var pauciflora
Pyxidanthera barbulata.
BA Quercus imbricaria
BT Quercus macedonica.
BTS Quercus Libani
BS Quercus Turneri.
Retinospora decussata=Thuja orientalis var. decussata.
Retinospora dubia=R ericoides, Hort
Retinospora Ellwangeriana
Retinospora ericoides, Zucc =Chamæcyparis sphæroidea var ericoides
Retinospora ericoides, Hort =Thuja occidentalis ericoides.
Retinospora filicoides
Retinospora filifera
Retinospora juniperoides=R decussata.
Retinospora leptoclada, Hort =Chamæcyparis sphæroidea var andelyensis
Retinospora lycopodioides.
Retinospora meldensis.
Retinospora obtusa.
Retinospora pisifera.
Retinospora rigida=R decussata.
Retinospora Sieboldii=R. decussata.
Retinospora squarrosa, Sieb & Zucc =Chamæcyparis pisifera var squarrosa
Retinospora squarrosa, Hort.=R decussata.
BT Rhamnus Alaternus
BTS Rhamnus hybrida
B Rhododendron arbutifolium.
B Rhododendron brachycarpum.
B Rhododendron californicum.
B Rhododendron carolinianum=R punctatum, in part
B Rhododendron catawbiense.
B Rhododendron caucasicum.
B Rhododendron ferrugineum.
B Rhododendron hirsutum
B Rhododendron maximum.
B Rhododendron Metternichi.
B Rhododendron minus=R. punctatum, in part
B Rhododendron myrtifolium.
BT Rhododendron ponticum.
B Rhododendron præcox var. "Early Gem" (flowers often caught by early frost).
B Rhododendron Wilsoni, Hort.=R arbutifolium (true Rhododendron Wilsoni is tender and not cultivated in the United States)
B Rhodothamnus chamæcistus=Rhododendron chamæcistus.
BS Rosa wichuraiana
BS Rubus laciniatus (leaves bronze).
BS Rubus spectabilis var. plena=R fruticosus.
BS Ruta graveolens.
B Salvia officinalis.
Sciadopitys verticillata.
T Sequoia sempervirens.
T Sequoia Washingtoniana.
BT Smilax laurifolia
SB Spiræa cantoniensis.
Taxus baccata in variety, especially repandens, which is the most hardy English yew.
Taxus canadensis.
Taxus cuspidata (best and hardiest of all yews).

Taxus cuspidata var. brevifolia or nana.
Teucrium chamædrys.
T Thuja gigantea=T. plicata
Thuja japonica
Thuja occidentalis in variety, especially plicata.
Thuja orientalis in variety, especially decussata.
T Thujopsis dolobrata.
Bs Thymus Serphyllum.
Bs Thymus vulgaris.
Torreya nucifera.
T Torreya taxifolia.
Tsuga canadensis.
Tsuga carolinana.
Tsuga diversifolia.
Tsuga heterophylla.
Tsuga mertensiana.
Tumion=Torreya
T Ulex europæus
B Vaccinium macrocarpon.
B Vaccinium oxycoccus.
B Vaccinium Vitis-Idæa.
B Viburnum rhytidophyllum.
B Vinca minor.
B Yucca filamentosa.
B Yucca flaccida
B Yucca glauca=Y. angustifolia.
Bs Zenobia speciosa nitida
Bs Zenobia speciosa var pulverulenta.

RALPH W. CURTIS.

Broad-leaved evergreens for Washington and the South.

Broad-leaved evergreens hardy at Washington, D.C. The evergreens and half evergreens of foregoing list are also good.

Abelia floribunda.
Aucuba himalaica.
Aucuba japonica.
Aucuba japonica var. concolor
Buxus balearica
Buxus sempervirens var. arborescens
Buxus sempervirens var Handsworthii
Buxus sempervirens var subfruticosa
Cotoneaster Simonsii (nearly deciduous at Washington)
Cotoneaster thymifolia (nearly deciduous at Washington)
Daphne Laureola.
Elæagnus pungens var. reflexa.
Eriobotrya japonica.
Evonymus japonica var. macrophylla.
Garrya elliptica.
Ilex aquifolium.
Ligustrum japonicum
Ligustrum lucidum.
Ligustrum lucidum var. aureo-marginatum
Ligustrum Quihoui (half evergreen)
Ligustrum sinense (half ever-
Magnolia grandiflora [green)
Nandina domestica
Osmanthus Aquifolium
Phillyrea angustifolia
Photinia serrulata.
Prunus Laurocerasus var Bertini
Prunus Laurocerasus var colchica
Prunus Laurocerasus var. schipkaensis
Prunus Laurocerasus var rotundifolia.
Pyracantha coccinea
Rhododendron amœnum
Rhododendron arbutifolium
Rhododendron carolinianum
Rhododendron Hinodegiri
Rhododendron minus



1461. Picea pungens. The two small tufts at the right are P. excelsa var. Maxwelli

Broad-leaved evergreens hardy at Norfolk and South

Berberis congestiflora
Berberis Darwinii
Elæagnus pungens var maculata.
Elæagnus pungens var. Simonii
Gardenia jasminoides.
Gardenia jasminoides var Fortunei
Ilex cornuta
Laurus nobilis
Laurus regalis
Leucothoë acuminata.
Magnolia fuscata.
Magnolia Thompsoniana.
Mahonia Fortunei
Mahonia nepalensis.
Mahonia trifoliata
Photinia serrulata.
Prunus caroliniana
Prunus lusitanica.
Quercus acuta
Quercus Darlingtonii.
Quercus sempervirens
Yucca aloifolia.
Yucca Treculeana

The following list of broad-leaved evergreens hardy at Arnold Arboretum may also be expected to thrive at Washington.

Abelia grandiflora.
Arctostaphylos Uva-ursi.
Azara microphylla.
Buddleia japonica.
Bumelia lanuginosa.
Bumelia lycioides.
Buxus japonica
Buxus sempervirens.
Cistus laurifolius
Cotoneaster buxifolia
Cotoneaster microphylla
Daphne Blagayana.
Daphne Cneorum
Daphne pontica.
Ilex crenata.
Ilex glabra.
Ilex opaca.
Ilex vomitoria.
Kalmia angustifolia.
Kalmia latifolia.
Leucothoë axillaris.
Leucothoë Catesbæi.
Mahonia japonica.
Pachistima Canbyi
Pachistima Myrsinites.
Pernettya angustifolia.
Pernettya mucronata.
Phillyrea decora.
Pieris floribunda.
Pieris japonica
Prunus Laurocerasus.
Pyracantha coccinea var. Lalandii
Pyracantha coccinea var. pauciflora
Rhododendron amœnum
Rhododendron indicum
Yucca filamentosa and varieties.
Yucca flocculosa and varieties
Yucca glauca.
Zenobia speciosa and varieties.



1462 Young trees of Pinus ponderosa, useful in the Rocky Mountain region.

A list of broad-leaved evergreens in addition to those recommended for Norfolk, Virginia, for the South Atlantic and Gulf Coast regions and as far inland as Augusta and Montgomery. Those marked "S" thrive only in the warmest sections.

Arbutus Unedo
Ardisia crenulata
Berberis fascicularis.
Bumelia angustifolia
Bumelia tenax.
Camellia japonica (S)
Cinnamomum Camphora (S).
Cleyera japonica
Cytisus canariensis
Cytisus filipes
Cytisus monspessulanus
Gardenia florida
Gardenia Fortunei
Gardenia radicans
Helianthemum oeymoides.
Illicium anisatum (S).
Leucothoë acuminata.
Prunus lusitanica.
Prunus versaillensis.
Ligustrum nepalense
Metrosideros floribunda (S).
Myrtus communis.
Nerium odorum.
Nerium Oleander.
Nerium splendens.
Olea fragrans
Othera japonica=Ilex integra.
Pittosporum Tobira.
Quercus suber
Ruscus aculeatus.
Thea Bohea
Trachycarpus Fortunei (S).
Viburnum odoratissimum.
Viburnum suspensum.
Viburnum Tinus
Viburnum sandankwa.

F. L. MULFORD.

Plants that are evergreen on the middle Great Plains.

It must be remembered that on the Great Plains the conditions vary enormously, and that few plants naturally range over the whole area, or are capable of being successfully grown in artificial plantations throughout the whole area Two special localities are frequently mentioned in the list. Arbor Lodge is the arboretum established by the late J. Sterling Morton at Nebraska City, within a few miles of the Missouri

River The University Arboretum is at Lincoln, Nebraska, on the high prairies 60 miles west of the Missouri River.

Trees.

Abies balsamea (not common).
Abies cephalonica (Arbor Lodge, University Arboretum).
Abies cilicica (Arbor Lodge).
Abies concolor (common).
Abies nobilis (Arbor Lodge).
Abies Nordmanniana (Arbor Lodge).
Abies Picea (Arbor Lodge)=A. pectinata
Abies Pinsapo (Arbor Lodge).
Abies Veitchii (Arbor Lodge; University Arboretum).
Chamæcyparis pisifera (Arbor Lodge)
Juniperus scopulorum (native in western portion).
Juniperus virginiana (native in eastern portion)
Juniperus virginiana var aurea variegata (University Arboretum).
Juniperus virginiana var elegantissima (University Arboretum).
Juniperus virginiana var. glauca (University Arboretum)
Picea Alcockiana (Arbor Lodge, University Arboretum).
Picea canadensis (common)=P. alba.
Picea Engelmanni (rare)
Picea excelsa (common)=P Abies
Picea excelsa var inverta (University Arboretum).
Picea excelsa var. pumila (University Arboretum)
Picea excelsa var pumila compacta (University Arboretum).
Picea mariana (Arbor Lodge)=P. nigra.
Picea orientalis (Arbor Lodge)
Picea nigra (University Arboretum)=P. mariana
Picea nigra var Doumetti (University Arboretum).
Picea Parryana (common)=P. pungens
Picea polita (Arbor Lodge, University Arboretum)=P Torano
Pinus austriaca (very common, University Arboretum)
Pinus austriaca var. cebennensis (monspeliensis) (University Arboretum).
Pinus cembra (Arbor Lodge)
Pinus divaricata (common)=P. Banksiana
Pinus laricio (Arbor Lodge).
Pinus massoniana (Arbor Lodge)
Pinus montana (Arbor Lodge, University Arboretum).
Pinus resinosa (not common).
Pinus rigida (Arbor Lodge).
Pinus scopulorum (native in western portion)
Pinus strobus (common)
Pinus sylvestris (very common)
Pseudotsuga taxifolia (common)=P Douglasii
Taxodium distichum (not common)
Taxus canadensis (Arbor Lodge)
Thuya occidentalis (common).
Thuya orientalis (Arbor Lodge, University Arboretum)
Tsuga canadensis (Arbor Lodge)

Shrubs

Arctostaphylos Uva-ursi (native in western portion).
Berberis ilicifolia (University Arboretum)
Buxus (not common, tender at University Arboretum).
Evonymus japonica (University Arboretum)
Evonymus nana? (University Arboretum)
Evonymus radicans (University Arboretum)
Hedera helix (rarely hardy, tender)
Ilex opaca (rarely planted, tender)
Juniperus chinensis (University Arboretum).
Juniperus communis var aurea (University Arboretum, tender)
Juniperus communis (native in western portion, University Arboretum)
Juniperus communis var hibernica (University Arboretum, tender).
Juniperus sabina var prostrata (University Arboretum).
Juniperus stricta (University Arboretum)
Ligustrum Ibota (half evergreen, University Arboretum)
Ligustrum ovalifolium (evergreen, half hardy; University Arboretum)
Ligustrum ovalifolium var aurea (half evergreen, hardy, University Arboretum)
Ligustrum vulgare (half evergreen, University Arboretum)
Ligustrum vulgare var buxifolium (evergreen, hardy, University Arboretum)
Ligustrum vulgare var. fructealba (half evergreen; University Arboretum).
Lonicera japonica var Halliana
Mahonia Aquifolium (native in western portion)
Rhododendron maximum (rarely planted; tender).
Smilax hispida (half evergreen, native).
Yucca filamentosa (common)
Yucca glauca (native in western portion).

Herbs.

Equisetum hiemale (native throughout).
Equisetum lævigatum (native throughout).
Equisetum scirpoides (native throughout).
Equisetum variegatum (native throughout).
Iris germanica
Iris pumila
Mamillaria missouriensis (native in western portion).
Mamillaria viviparus (native in western portion).
Opuntia arborescens (native in southwestern portion).
Opuntia camanchiana (native in southwestern portion).
Opuntia fragilis (native throughout).
Opuntia humifusa (native throughout).
Opuntia polyacantha (native throughout).
Opuntia tortispina (native in southern portion).
Pellæa atropurpurea (native throughout).
Salvia officinalis (common).
Selaginella rupestris (native throughout).
Vinca minor (common).

Rosettes.

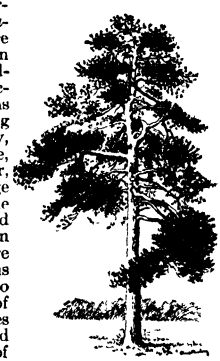
Many herbaceous plants have rosettes of green leaves throughout the winter, the following being the more conspicuous on the Great Plains.

Capsella Bursa-pastoris (throughout the region, common cruciferous weed, introduced long ago and known as "shepherd's purse")
Dianthus, Plantago, Rumex } (several species).
Fragaria virginiana (throughout the region).
Geum canadense (throughout the region).
Hieracium longipilum (in eastern portion).
Œnothera biennis (throughout the region).
Pentstemon grandiflorus (throughout the region).
Pyrola chlorantha (in the western portion).
Pyrola elliptica (in the western portion).
Pyrola secunda (in the western portion).
Taraxacum officinale (throughout the region); not green in University Arboretum, Lincoln, except where covered by snow
Taraxacum erythrospermum.

CHARLES E. BESSEY.

EVERLASTINGS. A term applied to flowers or plants that retain their shape and other characteristics after being dried; equivalent to the French word "immortelle." With everlastings are also included various artificial or manufactured articles that imitate flowers or plants.

The most important commercially of the flowers that retain their form and color in a dried state have been the French immortelles, *Helichrysum arenarium*. These flowers are used very extensively in France in their natural yellow color, for the manufacture of memorial wreaths and crosses, which, being constructed very compactly, are exceedingly durable, even in the severest weather, and are exported in large numbers to all parts of the world The flowers bleached white, or bleached and then dyed in various colors, are also shipped in enormous quantities, either direct to this country or by some of the large exporting houses of Germany In the United States, however, the use of these immortelles has fallen off on account of the high duty.



1463. A mature field tree of Pinus ponderosa.

Approaching the French immortelles in aggregate value have been the so-called "cape flowers," *Helichrysum grandiflorum*, which formerly reached an enormous sale in this country, and they largely supplanted the immortelles on account of their silvery texture and greater beauty every way. They are naturally white, but require bleaching in the sun to give them the desired luster. They came from the Cape of Good Hope, and reached this country mainly from Hamburg. Of recent years, these products have been less important in the American trade because of the uncertainty of the crop, poor quality, and the competition of artificial materials There is now being made in Germany an artificial "cape flower;" this flower is made from paper and waxed, and is an excellent imitation African cape. Large quantities of these goods are being imported into this country, and they have given great satisfaction to all florists that have used them. Probably in time the German product will

entirely supersede the natural African cape, more particularly as each flower has a wire stem which the florists attach to the toothpicks or sticks, and this saves considerable labor.

The common everlasting of American and English country gardens, *Helichrysum bracteatum*, is the only one of these flowers grown to any extent in North America, and more or less extensive cultivation of it, commercially, has been practised in this country but a large percentage is still imported. These plants come in white, straw and brown colors naturally, and take readily to a variety of artificial tints; together with *Ammobium alatum* and the well-known globe amaranth, *Gomphrena globosa*, they are grown and used to a considerable extent by the country folk in the construction of the many forms of wreaths, stars, and other Christmas forms, which they sell in the city markets in large quantities, but their sale by wholesalers and jobbers for general consumption is very limited. *Statice incana*, cultivated or wild from the swamps of southern Europe, and Gypsophila in several species are used to a considerable extent; and the sale of statice especially, which is popular in combination with cape flowers in memorial designs, is quite an item with the dealers in florists' supplies.

Of the dried grasses, the pampas plumes of California, *Cortaderia argentea*, native of South America, are the only American production attaining any great commercial importance. Their beautiful silky plumes, unapproached by any other horticultural product, are used in enormous quantities for decorative purposes, and are an important item of American export. They are used mainly in a sun-bleached state, but more or less dyeing, often parti-colored, is also done. *Bromus brizæformis* is the most extensively used of the smaller grasses It is mostly imported from Europe. It can be imported, however, including duty, for about 25 per cent less than it is possible to grow it in this country. It is handled in the natural state. *Briza maxima*, another popular grass, is grown in Italy. *Briza media*, a medium-sized grass, and *Briza minima*, the flowers of which are as fine as sawdust, are also handled in the same way as *Briza maxima*, very little of the *B. minima* being used dyed, however. *Phleum pratense*, *Stipa pennata*, and various kinds of oats have more or less commercial value, being used considerably in the manufacture of imitation flowers and straw goods, but from a florist's standpoint they are not important The most important commercially of the imported grasses is the Italian wheat, the quantities used in this country for the manufacture of sheaves for funeral purposes being enormous, and increasing yearly. It comes in many grades of fineness and length of stem. In this country all attempts to cultivate it in competition with the European product have failed. Of late years, a decorative natural grass called "Minerva" and treated artificially is being imported in large quantities, and is used by florists in combinations, making a very effective setting-off to flowers in basket decoration.

Much use is now made in this country of the dried twigs and foliage of ruscus This is grown in Italy, and is shipped to Germany where it is prepared and dyed in many attractive colors. It holds its form well. It is made up into wreaths and other articles, and provides a good foliage effect.

Enormous use is now made of magnolia leaves prepared and colored in brown, red and green. In former years these goods were secured from Germany and Italy, but they are no longer imported for the reason that they are prepared in this country as good, if not better than they are on the other side, and much cheaper. They are gathered and prepared in Florida, and shipped to all parts of the United States, put in cartons containing about 1,000 leaves They are used very extensively by all classes of florists on account of their lasting qualities and fine appearance They have almost entirely superseded the galax leaf, which has been in use for so many years in the making up of mortuary emblems.

A number of our native composites—of the genera Gnaphalium, Antennaria and Anaphalis—are called everlastings, and are often used in home decorations, particularly in the country; but they have no commercial rating.

There is an increasing demand for artificial decorative articles, to be used alone and in conjunction with fresh cut-flowers; they are now being used by the best florists and plantsmen. The demand for decorative artificial flowers, plants and like materials, has grown to such an extent that there are now a large number of businesses devoted exclusively to the manufacture of them. This is well illustrated in the product called "Japanese wood frieze," in appearance resembling very much the well-known worsted and silk chenille. It is made from wood-fiber colored in shades to represent the colors of immortelles. This frieze or wood chenille, when worked up in various designs, so closely resembles immortelles that the difference between them can hardly be detected

One of the interesting artificial greens is the "sea moss" It is an alga-like hydroid (one of the animal kingdom), known as *Sertularia argentea*, which is commonly distributed along our Atlantic coast northward from New Jersey to the Arctic The long moss-like strands are dyed bright green, and the "plant" is used in making table decorations and jardinière pieces. It is sometimes called "air plant" The apparent lateral minute buds clothing all the branches are, of course, the shelter for the zooids of the colony during life. There is another one (*Aglaophenia struthionides*) found on the Pacific coast, which is even more beautiful, and which is put to the same decorative uses, and is known there as the ostrich plume, the branches having a beautiful pinnate arrangement along the two sides of a single axis. These sea-mosses are dried, the dirt picked out, and then dyed and fixed in a preparation to make them permanent. They are likely to have an unpleasant odor.

H. Bayersdorfer.
Wm. N. Reed.†

Everlastings for home use.

After much experience with the growing of everlastings for home winter decorations, the three following species have been found the best for plantings *Helichrysum monstrosum*, the double form of *H. bracteatum*, known as "golden ball," *Acroclinium* (*Helipterum*) *roseum flore-pleno*, and the Chinese lantern plant, *Physalis Francheti*. These are easily grown, are free bloomers and give better and brighter color in their dried state than other forms. They have a certain warmth in color that is appreciated in zero weather

The helichrysum and acroclinium are started in the greenhouse or hotbed during the latter part of March, planting them out in full sun as soon as all danger of frost is past. Any good garden soil suits them.

It is most important that the flowers of the acroclinium be picked just as soon as the buds show color, even if they look almost too small, because if too far advanced the ray petals open up flat, exposing the center, which will soon turn brown when dried and spoil the effect. Those cut early will open up part way, presenting only their full color. In full blooming season they should be picked daily. With the helichrysum one can wait until the bud is of fairly good size but all the smaller ones will open up also when dried Those fully open or showing the center at all will turn brown. With both plants pluck off all foliage, place in bundles and hang them, heads down, in some dry closet. They should be examined at times, as in the drying the stems shrink and the flower may fall down. They should remain in this dry shelter until the house is heated in the

fall, reducing the moisture in the air, otherwise the dry flower-stems would absorb the moisture and become limp.

A certain number of "droopers" is wanted when arranging a bouquet, in order to avoid stiffness. These are easily secured. Take a long sheet of a pliable cardboard about 8 inches wide, tack one edge lengthwise on the top of a shelf, at the front bringing it out and downward so as to form a half circle, and fasten it there. Then lay the freshly picked flower-stems on the shelf, heads hanging down. It is sometimes necessary to place a book or some weight on the stems to keep them in place. They will dry in this curved form. Brown split bamboo baskets make good vases, as they harmonize well with the deep orange of the golden ball and the pink of the acroclinium. A wire mesh in these baskets enables the flowers to be arranged more easily. As there is no green foliage used, it is well to use some short-stemmed flower in the center, midway between the basket and the tallest flowers. These "flecks" of color relieve the bareness of the stems.

The Chinese lantern plant (*Physalis Franchetii*) is an easily grown perennial, spreading at the roots. The seed-pods are very ornamental, retaining their brilliancy of color when dried, the colors ranging from a pale green to orange and red. They hang like inverted balloons, on slender peduncles and lose their graceful appearance unless the main stem that carries them can be curved outward when dry. They have to be treated differently from the others. Boards on a partition in a wood-shed may be used, driving tacks, one each side, close up to the side of the bottom of the main stem, the heads of the tacks overlapping the stick. Run the stem up straight for about 6 inches, then curve to right or left and fasten in same manner. Then, when dried, the lanterns will hang clear of the stem. The seed-pods of the balloon vine, *Cardiospermum Halicacabum*, work in well among the lanterns. Cut away part of the side of the lantern, and see the brilliant wick inside.

W. C. Egan.

EVÒDIA (Greek, *pleasant odor*). *Rutàceæ*. Ornamental woody plants grown chiefly for their handsome foliage.

Deciduous or evergreen trees or shrubs: trunk with smooth bark: winter-buds naked: lvs. opposite, petioled, simple or pinnate with entire punctate lfts: fls. in terminal or axillary panicles or corymbs, unisexual, usually 4-merous, less often 5-merous; sepals imbricate; petals valvate or slightly imbricate; stamens 4–5, at the base of a cupular disk: carpels 4–5, each with 2 ovules, nearly free or connate, with a cylindric style, at maturity dehiscent, 2-valved, 1–2-seeded.—About 50 species in E. Asia, from Korea and N. China to S. Asia, Austral and Polynesia. Allied to Zanthoxylum which is easily distinguished by its alternate lvs.; very similar in habit and foliage to Phellodendron which besides in the berry-like frs. differs in the winter buds being inclosed in the base of the petiole, while in Evodia they are borne free in the axils.

The cultivated hardy species are strong-growing deciduous trees with rather large pinnate leaves of aromatic odor when bruised, and with whitish flowers in terminal broad panicles followed by small capsules exposing glossy black seeds when opening. *Evodia Danielli* has proved hardy at the Arnold Arboretum. *E. glauca* and *E. Henryi*, are somewhat tenderer. There are also a few tropical species from New Guinea, rarely cultivated as warmhouse evergreens; they are little known and their correct names have not yet been determined. Propagation is by seeds and of the warmhouse species by cuttings of half-ripened wood; probably also by root-cuttings.

A. *Frs. obtuse or only mucronulate at the apex.*

glauca, Miq. (*E. Fargesii*, Dode). Tree, to 50 ft.: lfts. 5–11, usually 7, on slender slightly hairy stalks, ¼–½in. long, elliptic-ovate to oblong-lanceolate, long-acuminate, broadly cuneate or rounded at the base, minutely crenulate, glaucous below and glabrous except hairs along the midrib near the base, 2½–4 in. long; infl. corymbose, 6–8 in. broad, nearly glabrous; pistil of the staminate fls. glabrous: fr. about ¼in. long, finely pubescent. June; fr. Sept. Cent. China.

AA. *Frs. strongly beaked.*

Hénryi, Dode. Tree, to 35 ft.: lfts. 5–9, short-stalked, ovate-oblong to ovate-lanceolate, long-acuminate, rounded or narrowed at the base, finely crenulate, glaucescent or pale green below and glabrous, 2½–4 in. long; infl. paniculate, 2–2½ in. across; fr. reddish brown, sparingly hairy, ¼in. long, with slender beaks about half as long. June; fr. Sept. Cent. China. See page 3568.

Daniélli, Hemsl. (*Zanthóxylum Daniélli*, Bennett). Small tree. lfts. 7–11, ovate to oblong-ovate, acuminate with an obtusish point, rounded at the base, sometimes subcordate or broadly cuneate, pale green below and glabrous except hairs along the midrib and sometimes on the veins, 2–3½ in. long: infl. corymbose, 4–6 in. across: fr. nearly ⅛in. long, slightly hairy or nearly glabrous, with a rather short, usually hooked beak. June; fr. Sept. N. China, Korea.

E. élegans, Hort. Evergreen lvs. 3-foliolate, lfts. linear-lanceolate, undulate and crenate, resembling Aralia elegantissima. New Guinea. F. E. 1899: 291. Gng. 12: 404. G. 21: 273.—*E. formòsa*, Hort. A similar species, intro. in 1900 by Sander & Co. This and the preceding are warmhouse evergreens and belong probably to species already described.—*E. officinàlis*, Dode. Allied to E. glauca. Small tree. lfts. 5–11, ovate to elliptic-oblong, acuminate, pubescent and light green beneath: infl. pubescent: fr. glabrous. Cent. China.—*E. rutecárpa*, Hook. f. & Thoms. Allied to E. glauca. Small deciduous tree: lft. short-petioled, broader, pubescent on both sides: infl. smaller and denser, with stout pedicels, pubescent. Japan, Himalayas. S. Z. 1: 21 (as Boymia rutaecarpa.—*E. velutina*, Rehd. & Wilson. Allied to E. Henryi, but lvs. and young branchlets densely short-pubescent: fruiting corymb 4–8 in. across. Cent. China.

Alfred Rehder.

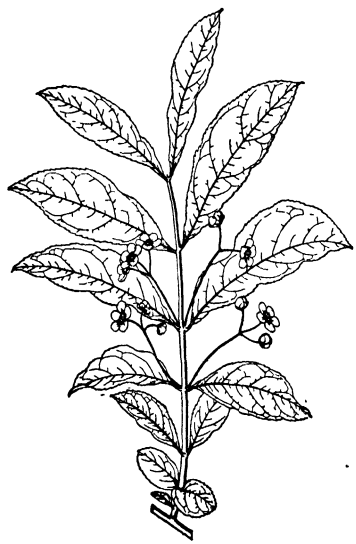
EVÓLVULUS (*to unroll*, because not twining as in Convolvulus) *Convolvulàceæ*. Prostrate or erect annual or perennial herbs or sub-shrubs, rarely planted or grown in greenhouses. The genus differs from Convolvulus in having 2 styles 2-cleft, stigmas always narrow, corolla often open or rotate, and not twining: lvs. entire, small: fls. small, in summer and autumn; sepals 5, the calyx not bracted at base, coroila blue, rose or white, 5-angled or shortly 5-lobed. The species are about 80, in warm regions, several in the U. S. *E. purpùro-cærùleus*, Hook., of Jamaica, appears to be the only species prominently mentioned horticulturally, and this is seldom planted. 1–2 ft., woody at base: lvs. small, lanceolate-acute: fls. purplish, terminal, the corolla rotate, white-centered and purple-rayed. B.M. 4202.

EVÓNYMUS (ancient Greek name). Often spelled *Euonymus*. *Celastràceæ*. Spindle-Tree. Woody plants, erect or climbing, grown chiefly for their handsome foliage and the attractive fruits.

Deciduous or evergreen shrubs or small trees with usually more or less 4-angled branches, mostly erect, rarely creeping or climbing by rootlets. winter-buds usually conspicuous with imbricate scales. lvs. opposite, petioled, usually serrate, and mostly glabrous: fls. small, in axillary cymes, 4–5-merous, generally perfect; style and stamens short, the latter inserted on a disk: fr. a 3–5-lobed, somewhat fleshy caps, each dehiscent valve containing 1 or 2 seeds inclosed in a generally orange-colored aril, the seed itself is white, red or black.—About 120 species in the northern hemisphere, most of them in Cent. and E. Asia, extending to S. Asia and Austral.

The spindle-trees are of upright or sometimes procumbent or creeping habit, with rather inconspicuous greenish, whitish or purplish flowers in axillary cymes; very attractive in fall, with their handsome scarlet,

pink or whitish, capsular fruits, showing the bright orange seeds when opening, and with the splendid fall coloring that most of the species assume, especially *E. alata, E. Maackii, E. sanguinea, E. verrucosa, E. europæa* and *E. atropurpurea*. The wood is tough, close-grained and light-colored, often almost white, and used, especially in Europe, for the manufacture of small articles. The bark of *E. atropurpurea* has medical



1464. Evonymus obovata. (×⅓)

properties.—Most of the cultivated deciduous species, except those from Himalayas, are hardy North, while of the evergreen ones only *E radicans* is fairly hardy, and, on account of its greater hardiness, is often used North as a substitute of the ivy for covering walls, rocks and trunks of trees, climbing if planted in good soil, to a height of 15 and sometimes 20 feet. *E. europæa*, and South, the evergreen *E japonica* are sometimes used for hedges

The spindle-trees are not particular as to the soil and are well adapted for shrubberies. Propagation is by seeds which are usually stratified and sown in spring, or by cuttings of ripened wood in fall. The evergreen species grow readily from cuttings of half-ripened wood under glass in fall or during the winter in the greenhouse. Varieties are sometimes grafted or budded on stock of their typical species.

INDEX.

acuta, 16.
alata, 3
albo-marginata, 15.
americana, 1, 2, 9.
angustifolia, 1
aperta, 3
argenteo-marginata, 16.
argenteo-variegata, 15, 16.
atropurpurea, 6, 9.
atrorubens, 6.
aurea, 15
aureo-marginata, 15.
aureo-variegata, 15
brevipedunculata, 8.
Bungeana, 13.
calocarpa, 12.
Carrierei, 16
camptoneura, 8.
columnaris, 15.
europæa, 6, 11.
flavescens, 15.
gracilis, 16
Hamiltoniana, 10, 13. and suppl. list.
hians, 11
japonica, 15, 16.
kewensis, 16.
krautschovica, 14.
Koehneana, 12.
Koopmannii, 5.
latifolia, 7
leucocarpa, 6.
Maackii, 10.
macrophylla, 15.
medio-picta, 15.
microphylla, 15.
minima, 16.
nana, 5, 6.
obovata, 2.
pallens, 15.
patens, 14.
picta, 16.
pulchella, 15.
pyramidalis, 15.
radicans, 16.
repens, 16.
reticulata, 16.
robusta, 15
roseo-marginata, 16.
sanguinea, 8
sempervirens, 13.
Sieboldiana, 12, 13, 14, and suppl. list.
striata, 3.
subtriflora, 3.
Thunbergiana, 3.
variegata, 2.
vegeta, 16.
verrucosa, 4
viridi-variegata, 15.
vulgaris, 6
yedoensis, 12.

INDEX, CONTINUED.

A. *Foliage deciduous.* Nos. 1–13.

B. *Caps. tuberculate, depressed-globose: fls. 5-merous.*

1. **americàna,** Linn. STRAWBERRY BUSH. Upright shrub, to 8 ft.: lvs ovate-lanceolate or oblong-lanceolate, usually acute at the base, acuminate, crenately serrate, 1½–3 in long: peduncle slender, few-fld ; fls. yellowish or reddish green: fr. pink. June; fr Sept.–Oct From S N. Y. south, west to Texas L B C. 14: 1322 B B. (ed. 2) 2:491. Var **angustifòlia,** Wood (*E. angustifòlia,* Pursh). Lvs. lanceolate or linear-lanceolate, half-evergreen S.

2 **obovàta,** Nutt. (*E. americàna* var. *obovàta,* Torr. & Gray). Fig 1464. Procumbent shrub, with rooting st. and erect branches, to 1 ft : lvs obovate or elliptic-obovate, crenately serrate, light green, 1–2 in long: fls. purplish· caps usually 3-celled May; fr Aug., Sept. From Canada to Ind and Ky G F 9 385 (adapted in Fig. 1464).—It may be used for covering the ground under large trees, or for borders of shrubberies. Var. **variegàta,** Hort , has the lvs marked pale yellow.

BB. *Caps smooth· fls. generally 4-merous*

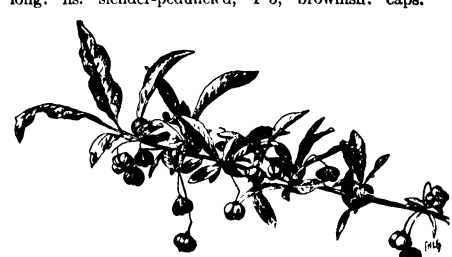
C. *Fr. divided to the base into 4 or less nearly separate pods.*

3. **alàta,** Maxim. (*E. Thunbergiàna,* Blume *E. striàta,* Loes) Spreading shrub, to 8 ft branches stiff, with 2–4 broad, corky wings· lvs elliptic or obovate, acute at both ends, sharply serrate, 1–2 in long, fls 1–3, short-peduncled, yellowish caps purplish, small, seeds brown with orange aril May, June; fr. Sept , Oct China, Japan S I F 1 63 F E 32·54. Var **subtriflòra,** Franch & Sav Branches not winged· fls. 1–5 Var **apérta,** Loes Aril open at the apex, disclosing the black seed Cent. China —This species is one of the handsomest, the lvs turn bright crimson in autumn, the small, but numerous frs are brightly colored and in winter the shrub is conspicuous by its broadly winged branches.

CC *Fr. more or less 3–5-lobed.*

D. *Branches densely warty*

4. **verrucòsa,** Scop Erect shrub, to 6 ft.: lvs. ovate-lanceolate, crenately serrulate, acuminate, 1–2½ in. long: fls. slender-peduncled, 1–3, brownish: caps.



1465. Evonymus europæa. (×⅓)

deeply 4-lobed, yellowish red; seed black, not wholly covered by the orange aril. May, June; fr. Aug. S. E. Eu., W. Asia. H.W. 3, p. 55.

DD. *Branches smooth.*

E. *Anthers yellow.*

F. *The caps. with obtuse lobes.*

5 **nàna,** Bieb. Low shrub, to 2 ft., with slender, often arching or sometimes procumbent and rooting

branches: lvs. linear or linear-oblong, mucronulate, entire or remotely denticulate and revolute at the margins, ½–1½ in. long: fls. slender-peduncled, purplish: caps. deeply 4-lobed, pink; seed brown, not wholly covered by the orange aril. May, June; fr. Aug. W. Asia to W. China —Handsome shrub for rockeries and rocky slopes; forming a graceful, pendulous, standard tree if grafted high on *E. europæa*. Fr. ripens in Aug., earliest of all species. Var. **Koðpmannii,** Beissn. (*E. Koðpmannii*, Lauche). Lvs. larger and broader.

6. **europæa,** Linn. (*E. vulgàris*, Mill.). Fig. 1465. Erect shrub or sometimes small tree, to 20 ft.: lvs. ovate or oblong-lanceolate, acuminate, crenately serrate, 1½–2½ in. long fls. yellowish, in few-fld. cymes: caps. 4-lobed, usually pink May. Eu. to E. Asia. B B. (ed. 2) 2.492. H.W. 3, p. 53.—Varying with narrower and broader lvs. There are also several varieties with variegated lvs and some with frs. of different colors, as var. **atrórubens,** Rehd. (*E. vulgàris* var. *atrórubens*, Schneid. *E. europæa fr atropurpùreo*, Hort), with deep purple frs, var. **leucocárpa,** DC (*E europæa fr álbo*, Hort), with whitish frs, and var **atropurpùrea,** Arb Kew, with rather narrow purplish lvs. Var. **nàna,** Lodd, is a dwarf, dense, and strictly upright form with elliptic to elliptic-lanceolate lvs. 1–1½ in, or on vigorous shoots, to 2½ in long. it hardly ever flowers and is tenderer than the type.



1466 Evonymus radicans.

FF. *The caps. with winged lobes: lvs. broad.*

7. **latifòlia,** Scop. Shrub or small tree, to 20 ft: winter-buds elongated, acute, about ½in. long: lvs. obovate-oblong, acuminate, crenately serrate, 2–4 in. long: fls. yellowish, often 5-merous, in slender-peduncled, rather many-fld. cymes: caps. pink, large, with winged lobes. May, June; fr. Sept. S. Eu, W Asia. B.M 2384. Gn. 39, p 213. Gt 53, p 30. G. 4:235. H.W. 3, p. 54. F.S.R. 3, p. 29.—A very decorative species, with handsome foliage and large pendulous frs.

8. **sanguínea,** Loes. Shrub or small tree, to 20 ft.: winter-buds elongated, acute: branchlets nearly terete: lvs. broadly oval or ovate to elliptic-ovate, acute, broadly cuneate or rounded at the base, densely fimbriate-serrulate, dull green above, paler below and slightly reticulate, 1¾–4 in. long: cymes lax, long-peduncled; fls. usually 4-merous: fr. purple, slightly lobed, 4-winged, the wings ¼–½in. long; aril orange, entirely covering the black seed June; fr. Sept. Cent. and W. China. Var. **brevipedunculàta,** Loes Peduncles about 1 in. long. W China. Var. **camptonetùra,** Loes. Lvs. oval or ovate to elliptic-ovate, veins curved (broader in the type and veins nearly straight). Cent. and W. China

EE. *Anthers purple.*

F. *Fls. purple.*

9. **atropurpùrea,** Jacq. (*E. americàna*, Hort). Burning Bush. Shrub or small tree, to 20 ft.: lvs elliptic, acuminate, obtusely serrate, pubescent beneath, 1½–5 in. long. fls. purple, in slender-peduncled, many-fld. cymes: caps. deeply 3–4-lobed, scarlet. June; fr. Oct. E. N. Amer., west to Mont. B B. (ed. 2) 2:491.

FF. *Fls. yellowish or whitish.*

G. *Petioles one-fifth to one-sixth as long as the lf.; lvs. acute or gradually acuminate: fr. pink.*

H. *Lvs. oblong to ovate-oblong, broadest about or below the middle.*

10. **Maàckii,** Rupr (*E Hamiltonàna*, Dipp., not Wall). Large shrub or small tree, glabrous. lvs elliptic-oblong to oblong-lanceolate, acuminate, gradually narrowed toward the base, serrulate, 2–3 in long and ¾–1¼ in. broad: cymes small, about ¾in across fr pink, 4-lobed, about ½in across; aril orange-red, usually closed, rarely slightly opened at the apex. June: fr Sept. N. E. Asia.

11 **hians,** Koehne. Large shrub lvs ovate-oblong, short-acuminate, rounded or broadly cuneate at the base, serrulate, 2½–4½ in. long and 1–1¾ in. broad: cymes rather long-stalked, small; stamens with very short filaments. fr. pink, turbinate, deeply 4-lobed, ½in across, aril blood-red, open at the apex and disclosing the blood-red seed. June; fr. Sept Japan S.I F. 2:39 (as *E. europæa*).

HH. *Lvs. generally obovate or obovate-oblong, to 2½ in. broad.*

12 **yedoénsis,** Koehne (*E Sieboldiàna*, Rehd, not Blume). Large shrub. lvs. usually obovate, sometimes elliptic, broadly cuneate at the base, abruptly acuminate, serrulate, 2–5 in. long and 1½–2½ in. broad: cymes long-stalked, rather dense and many-fld.: fr. pink, deeply 4-lobed, ½in. across; aril orange, usually closed. June; fr. Sept Japan. Gt. 53, p. 31. S.T S 1:62. F.E. 31:125. Var. **calocárpa,** Koehne. Fr. bright carmine. Var. **Koehneàna,** Loes Lvs. hairy on the veins below. Cent. China.

GG. *Petioles usually a third to a fourth as long as the lf., lvs. abruptly long-acuminate: fr. pale yellowish or pinkish white.*

13. **Bungeàna,** Maxim Shrub, to 15 ft., with slender branches: lvs. slender-petioled, ovate-elliptic or elliptic-lanceolate, long-acuminate, finely serrate, 2–4 in. long: fls. in rather few-fld. but numerous cymes: fr. deeply 4-lobed and 4-angled; seeds white or pinkish, with orange aril June; fr. Sept., Oct. China, Man-

churia, M.D.G. 1899:569.—Very attractive with its rather large, profusely produced frs., remaining a long time on the branches. Var. **semipersístens,** Schneid. (*E. Hamiltoniàna* var. *semipersístens,* Rehd. *E Sieboldiàna,* Hort, not Blume) Lvs elliptic, long-acuminate, half-evergreen, keeping its bright green foliage S. until mid-winter: fr. bright pink, usually sparingly produced and ripening very late.

AA. *Foliage evergreen or half-evergreen (see also the preceding var.).*

B. *Lvs. rather thin, half-evergreen.*

14. **pàtens,** Rehd. (*E. kiautschòvica* var. *pàtens,* Loes. *E. Sieboldiàna,* Hort, not Blume). Spreading shrub, to 10 ft., the lower branches sometimes procumbent and rooting: branchlets obscurely 4-angled, minutely warty: lvs. elliptic to elliptic-oblong, rarely obovate-oblong, acute, cuneate at the base, crenately serrulate, bright green above: cymes 2–3 in. across, loose, slender-peduncled: fr subglobose, pink; seed pinkish brown, covered entirely by the orange aril. Aug., Sept.; fr. Oct, Nov. Cent. China. S.T.S 1:64—Hardy as far north as N Y, in sheltered positions to Mass One of the best shrubs for winter-effect on account of its abundant late-ripening frs and the handsome foliage remaining on the branches until spring except when destroyed by severe frost.



1467. Evonymus radicans.

BB. *Lvs. thickish, evergreen.*

15. **japónica,** Linn Upright shrub, to 8 ft, with smooth and slightly quadrangular or striped branches: lvs. obovate to narrow-elliptic, cuneate at the base, acute or obtuse, obtusely serrate, shining above, 1½–2½ in long: fls. greenish white, 4-merous, in slender-peduncled, 5- to many-fld cymes. caps. depressed, globose, smooth, pink. June, July; fr Oct S Japan. S I F. 2:39 B R 30:6—A very variable species. Var. **macrophýlla,** Sieb. (var. *robústa,* Hort.). Lvs oval, large, 2½–3 in. long. Var. **microphýlla,** Sieb. (*E. pulchélla,* Hort. *Eùrya macrophylla,* Hort.). Lvs small, narrow-oblong or oblong-lancelate. Var. **columnàris,** Carr. (var. *pyramidàlis,* Hort). Of upright, columnar habit: lvs. broadly oval There are many varieties with variegated lvs.; some of the best are the following: Var. **argénteo-variegàta,** Regel Lvs edged and marked white. Var. **aûreo-variegàta,** Regel. Lvs. blotched yellow. Lowe, 49. Var **álbo-marginàta,** Hort. Lvs. with white, rather narrow margins Var. **mèdio-pícta,** Hort. Lvs. with a yellow blotch in the middle. Var. **pállens,** Carr. (var. *flavéscens,* Hort) Lvs. pale yellow when young; similar is var. **aûrea,** Hort, but the yellow is brighter and changes more quickly to green. Var. **víridi-variegàta,** Hort. (var. *Duc d'Anjou,* Hort.). Lvs large, bright green, variegated with yellow and green in the middle. Var. **aûreo-marginàta,** Hort. Lvs. edged yellow. F.E. 16:436; 29:815.

16. **radícans,** Sieb. (*E. japónica* var. *radícans,* Regel. *E. rèpens,* Hort.). Figs. 1466, 1467. Low, procumbent shrub, with often trailing and rooting or climbing branches, climbing sometimes to 20 ft. high: branches terete, densely and minutely warty: lvs. roundish to elliptic-oval, rounded or narrowed at the base, crenately serrate, usually dull green above, with whitish veins, ½–2 in. long: fls. and fr. similar to the former, but fr. generally of paler color. June, July; fr. Oct. N. and Cent. Japan R.H. 1885, p 295. G C. II. 20:793. M.D. 1906, p 219.—Closely allied to the former, and considered by most botanists as a variety, also very variable. Var **Carrièrei,** Nichols. (*E. Carrièrei,* Vauv.). Low shrub, with ascending and spreading branches lvs. oblong-elliptic, about 1½ in. long, somewhat shining. G.W. 8, p. 16. Var. **argénteo-marginàta,** Rehd. Lvs. bordered white. Var. **rôseo-marginàta,** Rehd. Lvs. bordered pinkish. Var **reticulàta,** Rehd. (var *picta,* Hort, var. *argénteo-variegàta,* Hort. *E. gráculis,* Sieb.) Lvs marked white along the veins. R H. 1876, p 354: 1878, p 135. G W. 1, p. 475 A G. 19:37. Var **mínima,** Simon-Louis (*E. kewénsis,* Hort). Lvs. marked like those of the preceding variety but smaller, ¼–½in. long.

Var. **végeta,** Rehd. Low spreading shrub, to 5 ft., usually with a few prostrate rooting branches at the base, and climbing high, if planted against a wall. lvs. broadly oval or almost suborbicular, acutish or obtusish, crenately serrulate, 1–1¾ in long, those of the rooting branchlets smaller and thinner and generally ovate. Japan. S.T S. 1:65. M D.G. 1908:13—Handsome and hardy shrub; the frs. appear in great profusion and remain on the branches a long time. Var. **acúta,** Rehd. (*E japónica* var. *acùta,* Rehd). Rooting and climbing: lvs. elliptic or ovate-elliptic, acute or short-acuminate, serrulate, with the veins below slightly elevated. Cent. China.

E Aquifòlium, Loes & Rehd Evergreen shrub, to 10 ft lvs. coriaceous, nearly sessile, ovate to ovate-oblong, spiny sinuate-dentate fr 4-lobed, usually solitary W China One of the most striking species on account of its holly-like lvs —*E sphinàta,* Wall. Usually creeping or climbing, with rooting branches lvs ovate-lanceolate fr. spiny Himalayas B M 2767—*E fimbriàta,* Hort, not Wall =E. pendula—*E grandiflòra,* Wall Shrub, to 12 ft lvs obovate or obovate-oblong, finely and acutely serrate fls white ¼ in. across fr globose, yellow, aril scarlet Himalayas, W China—*E Hamiltoniana,* Wall Allied to E Maackii Small tree lvs oblong-lanceolate, acuminate, finely and irregularly serrulate, 2½–4 in long anthers yellow fr pink, turbinate, 4-lobed. Himalayas Probably not in cult, the plant cult under this name is E Maackii—*E lanceifòlia,* Loes Allied to E hians Shrub or tree, to 30 ft lvs firm at maturity, lanceolate to elliptic-oblong, crenately serrulate, 3–6 in long anthers purple fr 4-lobed, pale, aril orange, open at the apex, seed crimson Cent and W China—*E. macróptera,* Rupr Allied to E latifolia Lvs obovate or obovate-oblong, cuneate at the base cymes many-fld fr with 4 narrow wings ½–¾in long Japan N E Asia I T 6 121. **Hardy**—*E occidentàlis,* Nutt Shrub, to 15 ft winter-buds rather large lvs ovate or elliptic-lanceolate, irregularly serrulate fls. 5-merous, purple. fr slightly lobed Ore, Calif—*E oxyphýlla,* Miq Shrub or small tree lvs ovate or obovate, acuminate, rather large, serrulate fls 5-merous, purple or whitish fr globose Japan—*E. péndula,* Wall (E fimbriata, Hort) Evergreen, small tree, with pendulous branchlets lvs oblong-lanceolate, sharply serrate, shining, 3–6 in long fr with 4 tapering wings P F G 2 55. F S 7, p 71—*E plénipes,* Koehne Allied to E latifolia Lvs cuneate at the base, petioles flat, not grooved fr acutely 5-angled, scarcely winged Japan M D 1906, p 62 Gt 53, p 29—*E. sacchalinénsis,* Maxim. Allied to E latifolia. Lvs. ovate-oblong, crenate-serrulate cymes very long-peduncled, fls. purple fr distinctly winged, convex at the apex N E Asia—*E Sargentiàna,* Loes & Rehd Evergreen shrub lvs obovate to oblong-obovate, abruptly acuminate, remotely crenate-serrate, 2–3½ in long, fr oblong-obovoid, 4-angled W China.—*E. Semenòvii,* Regel & Herd Allied to E europæa Small shrub lvs lanceolate, serrulate. cymes usually 3-fld, fr. 4-lobed with obtuse lobes Turkestan—*E semiexsérta,* Koehne Allied to E Maackii Lvs oblong or oblong-lanceolate, crenate-serrate, 2–5 in long fr light pink, aril orange, open, with the blood-red seed almost half exposed. Japan—*E Sieboldiàna,* Blume Allied to E. Maackii. Lvs slender-petioled, elliptic to oblong, acuminate, serrulate fr not lobed, strongly 4-ribbed Japan M D 1906, p 62 Not in cult.; the plants cult. under this name belong to E yedoensis, E. patens or E. Bungeana var. semipersistens.

ALFRED REHDER.

ÉXACUM (classical name, of no significance to these plants). *Gentianàceæ.* Herbs treated either as annuals or biennials or perennials, with flowers of white, lilac, blue or dark purplish blue, cultivated in a very few greenhouses.

Very rarely suffruticose· dwarf or tall and paniculate-branching: lvs. sessile, clasping or short-stalked, ovate or lanceolate, mostly 3–5-nerved: fls. small or attaining 2 in. across, rotate, pedicelled or not, in forking cymes;

calyx 4–5-parted, the segms. keeled, winged or flat and 3-nerved; corolla-lobes 4 or 5, ovate or oblong, twisted; stamens 4 or 5, attached to the throat, with very short filaments, the anthers opening by apical pores that finally enlarge nearly to the base: fr. a globose 2-valved caps.—Species about 30, in Trop. and Subtrop. Asia, Malaysia, Trop. Afr., Socotra.

Plants of *E. affine* flower in summer. If specimens in 5-inch pots are desired, sow in March of the same year; for larger specimens, sow in August of the preceding year. The plants must be kept in a cool but not draughty greenhouse or frame in summer, and shaded from fierce sunlight. They usually are given warmhouse conditions.

A. *Lvs. with stalks often ½in. long.*

affine, Balf. St. cylindrical, 1–2 ft. high, much branched from the base lvs 1–1½ in. long, elliptic-ovate, faintly 3–5-nerved sepals with a broad wing on the back; corolla 6–9 lines wide, lobes almost rounded. Socotra B.M. 6824 A F 13:1104 Gng. 6:229. R H. 1883, p. 512. Gt. 32.1108. G C. II. 21:605.

AA. *Lvs. nearly or quite stalkless.*

B. *Corolla-lobes rounded.*

zeylánicum, Roxbg. Annual. st. 4-sided, branched only above: lvs becoming 3 in. long, strongly 3-nerved, elliptic-oblong, acuminate, narrower than in *E. affine,* and tapering fls blue, 1½ in across, in terminal, leafy corymbs, sepals broadly winged, corolla-lobes obovate, obtuse Ceylon B M 4423 (sky-blue, with a dash of purple) R H 1859, p 238 J F. 1 43. H F. II. 2.60.

BB. *Corolla-lobes usually tapering to a point.*

macránthum, Arn (*E zeylánicum* var. *macránthum*). Fig. 1468 St cylindrical, slightly branched lvs as in *E. zeylanicum,* though perhaps more variable from base to summit fls purplish blue, 2 in across In both species there is a narrow ring of yellow at the mouth, to which the conspicuous clusters of stamens are attached Ceylon B M 4771 (deep purplish blue). G C III 15 331. R H 1911, p 31. J H III 42.182; 51.259 —The best of the genus. The rich, dark blue is worth striving for.

Fórbesii, Balf Bushy and shrubby: lvs triangular or ovate-lanceolate, 1¼ in across at base fls upwards of ½in across, purple or violet-purple, in terminal racemes, the anthers yellow and prominent Socotra. G C III 31.93. G 23·679 G W 6, p 290 G M. 45:81.—A good plant for intermediate temperature, blooming well in a 6-in. pot.

WILHELM MILLER.
L. H. B †

EXCŒCÀRIA (from Latin *excæcare,* referring to its effect on the eyes) *Euphorbiàceæ.* Tropical trees or shrubs with poisonous milky juice rarely cultivated for ornament

Glabrous· lvs. alternate or opposite, usually entire (or crenate to serrate): infl. usually in axillary spikes; fls. dœcious or monœcious, calyx imbricate; sepals 2–3, free or connate at base; petals none; stamens 2–3, erect in bud; filaments free; ovary 3-celled, 3-ovuled: seed not canaliculate —About 25 species in the Old World tropics. Related to Stillingia and Sapium.

bicolor, Hassk. (*Cróton bicolor,* Hort.), with the opposite lvs red beneath is sometimes cult for ornament in European greenhouses or outdoors in the tropics. *E. Agallócha,* Linn., AGALLOCHA, BLINDING TREE, RIVER POISON, etc., with alternate lvs, is a well-known poisonous tree of the coasts of S. Asia. J. B. S. NORTON.

EXHIBITIONS of horticultural products have been both a concomitant and a stimulant of progress in American horticulture. The great international expositions ushered in by the Centennial Celebration of 1876 at Philadelphia, through the opportunities afforded for the comparison of products, have been the means of unusual education in the indentification of varieties. No amount of descriptive literature can compare with this method of acquiring accuracy in naming and describing fruits, flowers, and vegetables.

The interest in these great exhibitions by the growers of soil products indicates a peculiarity of this class of producers They are the ones to reap the smallest direct result, and yet they have always been willing to give freely of their productions to swell the volume of these great fairs and emphasize the possibilties of the localities in which they lived. They would even pay their own expenses to attend these fairs and explain to the world how they succeeded in growing such attractive things. No producers of the useful things of life will compare with the horticulturist in willingness to impart to his fellow the secrets of his



1468. Exacum macranthum (×¼).

success National, state, district and township exhibitions have thus become great methods of disseminating information of value to the horticulturist—educators of the people.

For many years the most prominent feature of fruit shows was the nomenclature of the exhibit. In vegetables it was the size of the specimen, in flowers the number of sorts and their tasteful arrangement. People flocked together to identify varieties, to see the big things and to satisfy esthetic longing. Later the art in exhibiting products was given more attention, and wonderful creations have resulted from combinations and artistic arrangement.

Exhibitions have been the favorite opportunities of bringing out new and valuable sorts and often the usefulness of a variety dates from some particular fair at which it was prominently displayed Notable instances of this were the grapefruit, which was shown in quantity for the first time at the great New Orleans exhibition; the Kieffer pear, which was a distinguishing

feature of a meeting of the American Pomological Society in Philadelphia; the Niagara grape, which was featured at a winter meeting of New York fruit-growers. Striking examples of this are found in the annals of floral exhibits. The dissemination of the most delightful strains of carnations and chrysanthemums dates from some particular fair or "show."

In recent years, the experiment stations of the country have added greatly to their usefulness in preparing technical exhibits for winter exhibitions of horticultural societies, helping their progressive work, through graphic illustrations of the results which they have obtained in growing products under varying conditions, and having in mind the demonstration of problems of value to growers.

One of the most recent developments has been the opportunity given students of agricultural colleges of putting into practice the knowledge of varieties which they have acquired in the naming of various collections as a competitive drill

The products of glass farming have been brought into prominence through national, state, and local horticultural societies in their annual exhibitions, and the great seedhouses of the country have used these exhibitions as avenues for the dissemination of new and valuable varieties. Nurserymen have successfully utilized exhibitions in publishing to the world not only their new creations but their methods of propagation.

During recent years the initiative of the American Pomological Society has been followed by many other organizations in perfecting a scale of points for judging exhibits of horticultural products. By this means, more accurate methods have come into use at our great fairs, and, in the hands of experts, the judgments rendered have been far more satisfactory and useful.

A most important result of exhibitions has been the acquirement of the knowledge that varieties vary a great deal as the result of climatic conditions and differences in soil, and it is found as an outcome of these comparisons that certain localities are especially adapted to certain varieties in which they reach their highest perfection. This is illustrated in the Rocky Ford cantaloupe, the Albemarle Pippin, certain strains of carnations, and head lettuce The facts brought out through these comparative exhibits are leading to scientific investigations concerning the conditions which produce these variations which will be of great use to the producers, as well as deep interest to the scientist.

Commercial problems are finding their solution through exhibitions which illustrate styles of packing and kinds of packages and general attractiveness in presenting the products to the consumer. Already these exhibitions have brought to the attention of law-makers the importance of uniform legal requisitions concerning methods of marketing throughout the land.

The most recent development of values resulting from horticultural exhibits of great utility has been the carrying of the methods of comparison instituted there to the growing of products on the farm and in the garden, orchard and vineyard, thus awakening a deeper interest in the factors which affect the production of horticultural creations and a recognition of the uses of these creations in landscape art. Thus an abiding interest has been awakened in the development of the science as well as the art of horticulture through the adoption of new and improved methods of production and widening the usefulness of the products.

CHARLES W. GARFIELD.

Exhibitions of plants and flowers.

Floral exhibitions undoubtedly had their origin, in part, in the desire to display publicly the products of one's skill and to attain renown and a position of preëminence among one's fellows by successful rivalry and the demonstration of superior cultural abilities But, in addition to this factor of self-interest and excusable pride, the laudable spirit that seeks to promote a taste for ornamental gardening and floriculture in general, and to acquire knowledge and diffuse information concerning it, has from the first been a powerful incentive; and it cannot be questioned that public floral exhibitions have contributed most substantially to the advancement of refinement and good taste and exercised a potent and salutary influence on the domestic life, health, morals and happiness of the respective communities in which they have been held

Exhibitions of plants and flowers, as usually conducted, may be broadly divided into two classes· (1) Those whose particular purpose is to demonstrate advancement in cultural methods and exploit new and improved varieties and which are calculated to interest primarily the trade and professional gardeners The unavoidably monotonous system of staging exhibits in such an affair is well known To the general public, its salient points are scarcely apparent, and the elements which often appeal most strongly to the professional are all but lost on the average visitor. It has been demonstrated over and over again, that as an attraction for the people who look for entertainment in a show and are willing to pay for the privilege of seeing it, this sort of an array is fundamentally deficient (2) If public support is sought, the first requisite is that the public fancy be considered and catered to and the character and scope of the exhibition be such as the people care to take an interest in A practical demonstration of the uses of flowers and plants and their appropriate arrangement for the various events of social or home life will invariably excite curiosity and interest when prim rows of dozens and fifties of competitive blooms will often fail to awaken appreciative response. It is to be regretted that the so-called retail florist trade has so long been neglectful of its duty and its opportunity as a supporter of and participator in the flower shows. Without the assistance and cooperation of the experienced decorator and artistic worker in flowers, these affairs must invariably fall short of their mission and their educational possibilities How to overcome the indifference of this branch of commercial floriculture toward these enterprises which should bring immeasurable benefit to their industry is one of the serious problems for which those who believe in flower shows must find a solution before the ideal of what a horticultural exhibition should be can be realized

The direct cost of installing a public flower show is no small matter and many a commendable enterprise has failed through lack of sufficient income properly to finance it. Rent of hall, music, advertising, premiums, tables, vases, management, labor and a host of incidentals must be taken carefully into consideration, and to launch any such project, under conditions now existing, without some form of endowment, subscription, guaranty or other definite and reliable resource, apart from the uncertain sale of admission tickets, is merely tempting fate and taking chances on misfortune.

The grouping of pot-plants for effect calls for talents of a high order. Arrangements of this kind, which are so indispensable in giving character to a flower show that will appeal to the artistic eye as effective studies in form and color, are indeed rarely seen. Two almost universal faults are excessive formality in contour of the group and overcrowding of material, and it not infrequently happens that when a studied effort has been made for irregularity of outline, the result is still unnatural and often almost grotesque. The promiscuous mixing together of incongruous subjects, as, for example, hardy conifers, tropical palms, geraniums and orchids in one group, is all too common A taste-

ful grouping of plants of congenial character will always inspire enthusiastic admiration among cultured and discriminating visitors, and if the flower pots are hidden from sight by moss or other natural material, the pleasing effect will usually be further enhanced, particularly in the case of plants which might naturally grow together.

It is well known among flower-growers that the time of day, the condition of development, and other factors have a considerable influence on the keeping qualities of their product A sojourn in a cool, dark room over night with stems deeply immersed in fresh water is really an essential with many flowers if they are to remain for any time in good condition in the atmosphere of an exhibition hall. Nothing is more disfiguring in a flower show than a lot of wilted blooms. Much depends upon the style of vases used Vases spreading at the top and narrowing to a point at the bottom, while perhaps the most graceful in form, are very destructive to flowers, the small quantity of water available at the base of the stems soon becoming heated and impure Constant changing of water, and keeping down the temperature of the hall will help to preserve the exhibits Table baskets and dinner-table exhibits generally, as often arranged, scarcely last until the first visitors are admitted Only those in which the flower-receptacles are such as contain water can give any satisfaction in a flower show.

The background against which flowers are shown, as the color and material of the walls, covering of tables, and so on, has much to do with the general impression, favorable or otherwise, on the visitor Green—the natural foliage green—is unquestionably the "middle of the road" background hue for flowers Back of and beyond green, the neutral grays and browns, and sometimes pure white, are pleasing and satisfactory. It is worth noting that, while terra-cotta or flower-pot tones are usually beyond reproach as a background for living green, yet a brick wall is a disheartening condition for the purpose, showing that it is not alone color which decides the appropriateness of exhibition hall walls or drapery

The number of specimens usually shown in cut-flower classes depends upon the kind of flowers, the ingenuity of the schedule-makers, and the demands of the occasion The more extensive and pretentious the exhibition, the larger should be the classes Roses and carnations in half-dozens, for example, have little value in a large exhibition Fifties and hundreds alone will impress the visitors When individual blooms, or groups composed of individual varieties are displayed, much depends upon the taste shown in color-arrangement. This is especially important with such subjects as chrysanthemums, dahlias, gladioli and sweet peas, all of which afford wide scope for demonstration of taste in exquisite blending, contrasting and gradation of color-tones, qualities which should count for much in the final decisions of the judges. The question of the height of tables or platforms on which flowers are shown is one which should be carefully considered in planning an exhibition There are flowers which should be looked down upon if their full beauty is to be seen. Others must arch overhead to display their graces, and there are many intermediate steps. As a rule, exhibition tables are set too high

One main reason for the flower show being its educational value, the proper and legible labeling of species and varieties is essential In no other respect are our exhibitions so deficient A neat label, attached so it can be read without handling, and legible at a fair distance, is something rarely seen at a flower show, while obtrusive advertising cards or award cards frequently spoil the beauty of an otherwise creditable staging

Competitive exhibitions properly conducted and entered into with the right spirit are, as before said, calculated to accomplish much good for the art of horticulture Emulation in a friendly contest for honors is a strong factor in the success of a show, but the kind of rivalry which stimulates jealousies, envenoms disappointment and incites to angry protests over judges' decisions, is one of the most mischievous elements that can intrude upon the scene. In order to discourage the protesting habit and minimize the demoralizing influence of questionable decisions, great care should be exercised always in the selection of competent, disinterested and impartial judges Their names should be announced a sufficient time in advance so that every intending exhibitor may know who is to pass upon his exhibits

It is now a generally established custom to inclose the name of an exhibitor in an envelope bearing only the class number, the identity of the exhibitor not to be disclosed until after the judging has been completed. Some very excellent systems of cards, record books, envelopes, and so on for this purpose have been devised and are in general use. WM. J. STEWART.

Exhibition of fruits. Fig. 1469.

The educational value of carefully planned exhibitions of fruits can scarcely be overestimated. That this fact is appreciated in increasing measure each year is demonstrated by the growing number of such exhibitions that are being held throughout the country Commercial fruit regions do much of their advertising by means of these annual affairs, and there are few towns or hamlets, however unpretentious, without their yearly fruit show promoted by the grange, the school, the church, or some other organization whose aim is progress in country affairs

Foresight, with careful attention to details, is essential if the possibilities of an exhibition are to be developed to the utmost. The larger number of such events are held in the fall, since fall is Nature's harvest season for fruits This means that preparation must begin in midsummer to insure the greatest measure of success There are many things that the grower can do at this time to secure high-class fruit for exhibition purposes, and no other should be considered.

The best fruit is often found near the top of the tree, if thorough spraying has been done. It is the best because conditions there are most nearly ideal for its development As the fruit increases in size and the weight upon the branches becomes greater, the side branches settle more closely together, while the topmost branches and those most nearly upright in habit of growth, always advantageously situated, have an increased opportunity to receive the abundance of air and sunlight so essential to normal and perfect fruit. Fruit on such branches invariably possesses the highest color of any on the tree, and color is of vital importance for the matter in hand. The color may be heightened and the size increased if the fruit is thinned until the specimens hang 6 inches or more apart. A branch may be headed back, and occasionally one may be removed entirely to the benefit of those remaining, if good judgment is used. This matter of thinning is of considerable importance in the securing of high-class exhibition fruit, whether the fruit be apple, orange, or grape.

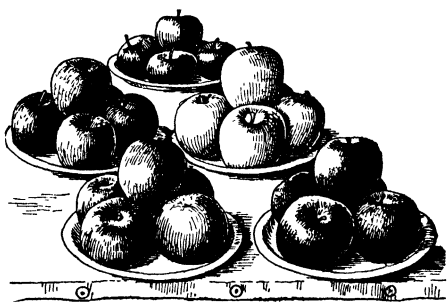
The production of exhibition specimens by abnormal processes—as by ringing or girdling—is not allowable, unless for the express purpose of showing what can be accomplished by such practices: fruits produced by such means should not be shown in comparison or competition with specimens produced under recognized and standard methods.

The specimens should be allowed to remain attached to the parent plant as long as possible. The longer they remain thus, the more intense will be their color and the greater will be their size. Pears especially

increase very rapidly in size just before maturity. The picking should be done by hand and with the greatest care. Many an excellent specimen has been ruined by careless handling. The stems should remain intact. The picker should remove, not a sufficient number of specimens to meet the requirements under which the exhibit is held, but many times that number. A bushel, or even a barrel, of seemingly high-class fruit will often yield after the most rigid inspection but a single plate of perfect specimens.

The actual selection of the specimens to be exhibited is the most difficult and perplexing problem connected with this work. Fundamental to a successful solution of this problem is a thorough knowledge of the variety, an intimate acquaintance with the characters of a normal specimen, and a fine discrimination in the balancing of these characters and in the attaching of the proper values to each.

The external factors that must be considered are size, form, color, uniformity, and freedom from blemishes. The criteria to be used in the inspection of the



1469. Good exhibition plates of apples.

first three factors are the attributes of a typical normal specimen of the variety when grown under conditions favorable to its development. The largest apple is not necessarily the best; in fact, great size is usually obtained at the expense of some equally desirable factor. The extra-large specimen is always an abnormal specimen and, as such, is not to be sought. It is in regard to this factor, however, that many exhibitors make their first mistake. A safe rule to follow is to choose the specimen combining large size with the highest color. This rule will almost invariably eliminate the abnormally large specimen.

The form of the specimen should be true to the prevailing type of the section in which it grows. Occasionally different sections produce different types, as, for example, the New York and the Oregon-grown Esopus. One is as true to type as the other, but the two types should never be mixed on the same plate or in the same package

Of all external factors, none exceeds in importance the quality of color. High color always sets up in the mind the presumption of excellence; the higher the color, the more pronounced seems to be the presumption, though it is not always justified. Color is also an indication of fitness, of approaching maturity, but a specimen maturing far in advance of its companions should be regarded with suspicion lest it harbor a worm that may emerge at a most inopportune moment if it escapes detection. Polishing a specimen to enhance its color should not be practised. The operation removes the bloom, which is more beautiful than the high polish because it is natural.

The factor of uniformity implies that one specimen should resemble every other specimen as nearly as it is possible for the human eye and hand to make it. It is a literal application of the expression "as nearly alike as two peas." A single specimen of highest order should not be retained for a moment if its companions are on a more nearly equal though somewhat lower plane of excellence.

Freedom from blemishes implies that the specimen is perfectly sound. A blemish may be anything from a bruise, a broken stem, or a stem puncture to a scale-mark or scab-spot. In an age when knowledge of preventive measures is so widespread and so accessible, evidence of injury from insect or disease should completely exclude a specimen from consideration. Needless to say, the condition of the specimen should be as sound as the season permits, showing neither flabbiness nor physiological disintegration of the tissues.

The factor of quality is also worthy of consideration, though it is of more importance in case of collections in which one variety is exhibited against another than in case of different specimens of the same variety Granted that size, form, and color are normal, the factor of quality will usually take care of itself.

There is need of a standardization of requirements under which fruit exhibits are held. These requirements should be based on trueness to type and all that the term implies, and the values attached to the different characters concerned should be fixed in proportion to their relative importance for the purpose in hand. Such a statement appears in the following score-card for apples, which is in somewhat common use in the eastern United States.

Size	10
Form	10
Color	20
Uniformity	15
Quality	20
Freedom from blemishes	25
Total.	100

This score-card may be no more nearly correct than many others, but it represents a concerted effort to fix a satisfactory standard There should be more of this work for every fruit.

Score-cards for other fruits have been adopted by particular exhibitions and institutions as the following for grapes·

Form of bunch	10
Size of bunch	15
Size of berry	10
Color	10
Bloom	5
Freedom from blemish	20
Flavor	25
Firmness	5
Total	100

There is need also of a general agreement as to the number of specimens to be exhibited on a single plate. The rules now governing all large exhibitions in the East require that plates of apples, peaches, pears, and quinces shall contain five specimens; of the smaller fruits a sufficient number to fill a 6-inch plate; and of grapes three clusters.

Fruit to be sent away for exhibition should be carefully packed. A bushel box is a satisfactory package for this purpose, being better than a larger package in which the pressure on the fruit is greater. Each specimen should be wrapped, and the box should be well lined with excelsior or other material. Extra specimens should be included to replace those that are injured in any way.

In selecting the room in which the exhibition is to be held and in setting up the fruit, one prime factor should always be kept in mind—there should be nothing in the room to detract in any way attention from the fruit. To this end, the walls should be plain or

even bare. The decorations should be few, simple, and in harmony with the colors of the fruit, that is, substantial and perfectly plain. Red and white make a very effective combination for ceiling decorations, if decorations seem desirable. Plain white is best for draping the tables. If electric lights are present, the shades may be covered with red crepe paper. This will give a quiet and subdued effect to the room when the lights are on and will be in keeping with the other decorations. The tables should be covered with a material that will throw the fruit into sharp relief without attracting attention to the covering itself. Oatmeal paper, gray-green in color, answers these specifications very well. Six- or eight-inch papyrus plates are better than smooth-pressed paper plates or the wooden plates and need no covering.

The fruit should be set up in such a way that a mass effect is produced, which impresses the observer with the fruit and with nothing else This means that all the fruit must be on the same level. Shelves or tiers one above the other are not desirable. In other words, every detail should be subordinated to bringing out as sharply as possible the fruit that is on exhibition It is therefore highly undesirable to place labels on the top of a specimen, as is so often done. The observer notes first of all a vast and meaningless sea of tags and after that perhaps the fruit The label may be pinned into the plate in such a way that it is unnoticeable except on close inspection, when it can be plainly seen. A satisfactory label is a plain white card with three lines on it, the first for the variety name, the second for the name of the exhibitor when permissible, and the third for the section from which the fruit comes. If the exhibit is to attain its highest educational value, the varieties must be correctly named and the names correctly spelled

In general, it will be better to group varieties together in order that comparisons may be made between the different plates By so doing an opportunity is afforded for a study of variations of fruits grown under different methods of management and in different sections in which climatic conditions are unlike. Occasionally grouping by sections may be desirable, especially if there are general and marked contrasts between the same varieties as grown in different sections.

The plates should not be crowded on the tables lest the eye become confused and the fruit appear to be a jumble of specimens lacking orderly arrangement. The background of paper covering the table should be visible between every plate, not in order that it may be seen, but because it will serve to set off each plate as a separate unit meriting for the moment undivided attention.

Finally, the specimens should be arranged in the same order on every plate and the plates should be in perfect alignment in every direction Not only this, but when the angles formed by the specimens on a plate are right angles, as in case of apples with four specimens on the bottom and one on top at the center, the angles should assume the same direction as those of the table top

The same rules hold for the selection of fruit for barrels, boxes, or other packages as for single plates. The arrangement should be such as to bring out the fruit and subordinate the package, exemplified in the bank of boxed fruit.

C. S. Wilson.

Exhibition of vegetables.

The exhibition of vegetables is usually an important feature at county district and state fairs, and often at farmers' institutes, horticultural society meetings and conventions of vegetable-growers. Vegetables are also likely to occupy a prominent place in county or state exhibits at state, national or international shows or expositions. The exhibits may be competitive or non-competitive. In the former case they are usually made by the individual producers; in the latter case, they are more often made by a company, development bureau, or an institution, primarily for advertising or educational purposes. In either case, they have some educational value, even the individual exhibitor learning by comparison of his exhibit with others.

Competitive exhibits are of two kinds: (1) those in which the exhibit consists of a specified quantity of a given kind of vegetable, e g., one dozen table carrots, and (2) those which consist of a collection or display of vegetables alone, or combined with other products of the soil Vegetables in exhibits that are designed primarily for advertising or educational purposes usually form only a part of some general exhibit.

In making exhibits in competition with the products of other exhibitors, the successful competitors are usually those who give most careful attention to the selection, preparation and installation of their exhibits.

In making single exhibits, care should be taken to show the exact quantity or number of specimens mentioned in the entry list. At county fairs, especially, exhibitors are prone to make their "pecks" or "half-pecks" exceedingly small if exhibition material is scarce or time limited The present tendency is to specify in premium lists the number of specimens, whenever this is feasible, rather than a given bulk, and to disqualify exhibits which do not conform to the requirement in this respect.

In selecting specimens which are to form a single exhibit, very few inexperienced persons appreciate the importance of uniformity in size and type Sometimes an exhibit will be very creditable with the exception of one or two specimens These odd specimens may be very good as individuals, but differ much in size or type from the other specimens and detract seriously from the value of the exhibit

Vegetables on exhibition should be clean Root crops should usually be washed. Onions are best prepared by careful brushing. Cauliflower and cabbage should be carefully trimmed; tomatoes, eggplant and melons wiped with a moist cloth Celery, lettuce and endive should be gathered with the roots on, carefully washed, and displayed with the roots immersed in water so that the plants will not wilt

The arrangement of the specimens in a single exhibit is also important When the judging is by comparison, only those exhibits which attract the immediate attention of the judge will be likely to receive careful consideration if the number of entries is at all large. Under such conditions it often happens that the arrangement of the specimens is fully as effective in securing careful examination of the exhibit as is the perfection of the specimens themselves In the case of many kinds of vegetables, if the number of specimens is not over one dozen, the exhibit can often be displayed very advantageously on plates or trays If one peck or one-half bushel is prescribed, splint baskets are desirable receptacles. In any case, the appearance of the exhibition room will be greatly enhanced if the receptacles used for all the single exhibits are as uniform as the nature of the products will permit. With this end in view, it is desirable that the management furnish the receptacles.

In the exhibitions held by thoroughly established organizations which give special attention to vegetables, there is likely to be a recognized appropriate method of disposing the specimens of each kind of vegetable in or upon a given type of receptacle. At county fairs, each exhibitor usually exercises his own ingenuity both as to type of receptacle and method of arrangement; and the result is at least lacking in monotony To show at its best, every exhibit should be characterized by neatness and simplicity in arrangement.

The principles involved in making a general display

including a number of different kinds of vegetables are much the same as for making individual exhibits: the specimens must be selected with care, thoroughly cleaned, and attractively arranged. In addition, the character and arrangement of the exhibit as a whole must be given careful attention. Very often, general displays fail in effectiveness because the number of specimens of each kind is too limited or the different specimens of the same kind are too much scattered through the exhibit, instead of being massed so that they would make an impression upon the spectator. Exhibitors are likewise inclined to weaken the character of an exhibit by introducing a few specimens each of numerous species or varieties that are little known or of small commercial importance. These are often scattered promiscuously through the exhibit and detract the attention from the main features. The general effect of the exhibit as a whole is of prime importance.

Non-competitive exhibits of vegetables for advertising or educational purposes are usually confined to a comparatively few species or varieties in a given exhibit In exhibits made for advertising some particular section or locality, the vegetables are likely to be merely a minor part of a general exhibit, and to consist of specimens likely to attract attention by reason of their unusual size rather than any other noteworthy feature

Certain kinds of vegetables lend themselves readily to the making of purely educational exhibits to illustrate the influence of differences in soil treatment or cultural methods or the results of treatment for plant diseases In such exhibits, it is unwise to attempt to illustrate the results of many different treatments in one exhibit It is much better to concentrate the attention of the spectator upon one or two striking results than to try to demonstrate a number of minor variations. If the latter method is attempted, the effectiveness of the display will be destroyed, for the passing observer recognizes only striking contrasts. For example, if a number of different fertilizer treatments have been employed, and all give marked results as compared with the check (the unfertilized plat), it would be unwise in an educational exhibit to attempt to illustrate the proportionate yields from all the treatments. Only the yields of the check plat and one or two others should be given The casual observer can see three things at a glance, but not a dozen

In making an educational exhibit to represent differences in yields, the quantities shown should represent yields from definite areas of ground, such as one-hundredth or one-thousandth of an acre; and the specimens should be arranged in such a way that the differences will be most apparent.

In arranging an exhibit to illustrate the results of treatment for plant diseases, e g, treatment of seed potatoes for the control of scab, it is better to sort the specimens from each plat into "diseased" and "sound," and to display them in two contiguous piles, than to mix the diseased and sound promiscuously in the same pile.

The educational value of all exhibits, whether competitive or non-competitive, is greatly enhanced if careful attention is given to the proper labeling of the various parts or features of each exhibit. Conspicuous legends of a concise nature are of some benefit to even the casual observer, and are greatly appreciated by the few who are specially interested in the particular exhibit or the matter it is designed to illustrate. JOHN W. LLOYD

EXÓCHORDA (from *exo*, external, and *chorde*, a cord, referring to the chord belonging to the external part of the placenta on the ventral side of the carpels). *Rosàceæ*. PEARL-BUSH. Ornamental shrubs grown chiefly for the showy racemes of pure white flowers.

Deciduous: winter-buds conspicuous, with imbricate scales: lvs. alternate, petioled, entire or serrate: fls. in terminal racemes, polygamo-dioecious; calyx-tube broadly turbinate, calyx-lobes and petals 5; stamens 15–25, at the margin of a large disk, short; carpels 5, connate, styles distinct fr. a 5-angled, deeply furrowed caps, separating into 5 bony, 1–2-seeded carpels; seeds winged —Three species in China and Turkestan.

The pearl-bushes are slender-branched shrubs with rather thin bright green foliage and very showy white flowers *E Korolkowii* is hardy North *E racemosa* and *E Giraldii* are at least hardy as far north as Massachusetts. They grow best in a well-drained loamy soil and in a sunny position Propagation is by seeds, or by softwood cuttings taken from forced plants, taken in summer from the open they root slowly and with difficulty; also by layering.

racemòsa, Rehd (*E grandiflòra*, Lindl *Amelánchier racemòsa*, Lindl) Fig 1470 Slender spreading shrub, to 10, rarely to 15 ft, glabrous· lvs elliptic to elliptic-oblong or oblong-obovate, entire or on vigorous shoots serrate above the middle, 1½–2½ in. long, whitish below, petioles about ½in. long. racemes 6–10-fld; fls 2 in across, pure white, short-stalked, petals roundish, clawed, stamens 15 fr turbinate, about ½in long April, May China B M 4795 F. S 9 954. L I 11–12 Gt 47: 1455 R H 1889, p 128, 1896, pp 324, 325 J H III 34 483, 53 285 G C II 16 73, III 7·613. Gn 58, p 315; 60, p 232; 62, p 161, 66, p 141 A F 6 643 Gng 5 97 F E 30 117; 31 971 G M 44 531 M D G 1901 321, 1905. 254; 1906 561 G W 10, p 430. H F. 1867 250. Var **prostràta,** Hort A form with prostrate branches —The species is among the showiest shrubs blooming in May



1470. Exochorda racemosa. (×⅓)

Giráldii, Hesse (*E racemòsa* var. *Giráldii*, Rehd) Similar to the preceding. lvs oval or elliptic, entire, very rarely crenate-serrate, petiole about 1 in long, usually red fls very short-stalked or nearly sessile; petals obovate, gradually narrowed into the claw, sometimes toothed, stamens 25 30 N W China M D G 1909·295 G W 16, p 450 Var **Wilsonii,** Rehd (*E. racemòsa* var *Wilsonii*, Rehd). Lvs. elliptic to oblong, occasionally serrate; petioles ½–¾ in. long, usually green· stamens 20–25. Cent China.

Korolkówii, Lav (*E. Álbertii*, Regel *E grandiflòra* var *Álbertii*, Aschers & Graebn) Upright, slender-branched shrub, to 12 ft., glabrous: lvs oblong, to oblong-oblanceolate, obtuse or acute, gradually narrowed toward the base, entire, but the lvs. of the stronger shoots often serrate above the middle and at the base with 1 or few small narrow lobes, 1½–2½ in. long. racemes 5–8-fld; fls 1½ in across; petals narrowly obovate; stamens 25· caps. ¾in. long, ovoid, pointed. April, May. Turkestan. G W. 16, p. 451. G. 31:505.—This is one of the earliest shrubs to burst into leaf in spring; it is of more upright habit and with

darker and denser foliage than the preceding, but not so floriferous.

macrántha, Lemoine (*E racemòsa* × *E. Korolkówii*). Similar to *E. racemosa*, but of more upright habit and more vigorous: lvs. generally obovate or oblong-obovate, bright green, entire on vigorous shoots crenate, 2–3 in long. racemes 8–10-fld ; fls. 1¾–2 in. broad; petals obovate, narrowed into the claw; stamens about 20 April, May Of garden origin. R H 1903, pp. 18, 64 M D G. 1902:484. G.W. 16.449.

ALFRED REHDER.

EXOGÒNIUM: *Ipomœa.*

EXORRHÌZA (*exo*, out, outside, *rhiza*, root; alluding to the large aerial roots above the ground). *Palmàceæ*, tribe *Cocoíneæ* High-growing pinnate-leaved palm.

Stem or trunk straight, smooth, supported at the base by large aerial, spiny roots: lvs. large, pinnate. Allied to Kentia, but distinguished by the imbricate sepals of the staminate fls, the elongated subulate filaments of the stamens, by the roundish ovate sepals of the pistillate fls and by the parietal ovule In Kentia the ovule is basal and erect Cult as in Kentia. The following species flowered at Kew in 1901.

Wendlandiàna, Becc. (*Kéntia Exorrhìza*, Wendl). Often more than 60 ft high but in cult reaching only 24 ft.. lvs 10–12 ft long, pinnæ alternately arranged, 1–2 in from each other, becoming 4 ft long and 2 in. broad, 8–10-nerved spadix appearing below the lvs., enveloped in thick, coriaceous boat-shaped spathes; spadices 2, much longer than the spathes Fiji Isls. B.M. 7797. N TAYLOR †

EXOSTÉMMA (name alludes to the exserted stamens) *Rubiàceæ* Evergreen trees and shrubs of W Indies and other parts of Trop Amer, by some united with Rustia There are upwards of 20 species They are little known as warmhouse subjects, and the name does not appear in the trade It is probable that the general treatment given Cinchona and similar things will apply to them Lvs opposite fls white, various in size and arrangement, corolla salver-form, the lobes 5 and spreading and narrow, stamens 5, inserted in the bottom of the corolla-tube, long-exserted; disk annular: fr. an oblong, cylindrical or club-shaped 2-valved caps The fls. are commonly axillary or in terminal corymbs.

EXPERIMENT STATIONS. Every state of the Union, every island dependency of the United States, and every province of the Dominion of Canada has one experiment station for agriculture supported by public funds. A very few of the states have two stations, one being the regular federal agency in the state and the other being usually an institution established and maintained directly by the state and representing the movement that began before the passage of the federal experiment station act.

By the middle of the last century, the discussion for institutions or agencies to make experiments in agriculture was well under way. It was not till 1875, however, that any legislative body made an appropriation for the establishing of such an institution This was in Connecticut Other stations followed in several states, some of them under direct legislative enactment and others being organizations within colleges or college departments of agriculture These movements were marked in North Carolina, New York, New Jersey, Ohio, Massachusetts, and other states. The movement in the United States for a national system of experiment stations took form in a bill for the purpose introduced into Congress in 1882 by Hon. C. C. Carpenter of Iowa The bill finally to become a law was introduced in the House of Representatives by Hon William H. Hatch of Missouri; this became law March 2, 1887, by the signature of President Cleveland It appropriates $15,000 to each state for the purpose of establishing an agricultural experiment station, to be located at the land-grant college unless the state shall determine otherwise

A second act, supplementing the Hatch Act, was approved March 16, 1906, by President Roosevelt, it having been introduced and carried to passage by Hon Henry C Adams, of Wisconsin This appropriates $15,000 to each state "for the more complete endowment and maintenance" of the stations, with the understanding and requirement that it shall support fundamental researches About $1,500,000 is therefore expended annually by the federal government for the maintenance of experiment stations in the forty-eight states, aside from similar grants for stations in Porto Rico and Hawaii, expenditures in the Philippines through the War Department, and in Alaska and Guam directly through the United States Department of Agriculture, and there is also a large and important expenditure in the Department of Agriculture itself, both for supervision and for investigation The states also contribute heavily to the experiment station work The total revenue in the United States for the year ended June 30, 1912 was $4,068,240 09

By law, reports are to be issued at least quarterly by the different experiment stations These institutions are now issuing numerous bulletins, circulars and reports on an astonishing range of subjects and of the greatest importance to the people The publications of the United States Department of Agriculture are very extensive and of the highest technical and general value

In Canada, the experiment station movement was practically parallel with that in the United States The Act for a dominion system was passed in 1886 One central station, or "central experimental farm," was established at Ottawa, and the stations in the provinces are branches of it and under the administration of its director The grant of Parliament for the year 1913–1914 for the maintenance of the system of experimental farms was $900,000

In both the United States and Canada, horticulture is one of the important subjects of experiment and research Usually this work is in charge of a separate officer, commonly known as a "horticulturist," and the number of associates and helpers may be several or many The extent of horticultural research is now large and it is rapidly increasing Persons desiring to be in touch with this work should apply to the experiment station in the state or province or to the national department, and a list of these institutions is given below For further history and discussion of Experiment Stations in the two countries, see pp 422–430, Vol IV, Cyclo Amer Agric

In the United States the address of the experiment station and of the college of agriculture is usually the same post-office In New York, there is a state station at Geneva as well as the federal station and college at Ithaca, in Ohio, the experiment station is at Wooster, and the college is part of the State University at Columbus; in Georgia, the station is at Experiment and the college at Athens, in the University, in Connecticut, the federal station is at New Haven, and the college at Storrs, in other states the post-offices of the two are the same

Canada.

The Dominion or headquarters institution is the Central Experimental Farm, Ottawa, Ontario

Alberta.

Experimental Station, Lacombe
Experimental Station, Lethbridge

British Columbia.

Experimental Farm, Agassiz
Experiment Stations, at Invermere, and at Sidney on Vancouver Island.

The writer does not overlook the body of good work being turned out by the American experimenters in horticultural lines, but this is not the subject of the present discussion.

The training of research workers.

The diverse character of experimentation in horticulture as set forth indicates somewhat the training that investigators in this field should have It follows from the importance attached to science in horticulture, that thorough training in the sciences is imperative, but the distinctions here made indicate just as clearly that a person trained in the sciences and not in the art and business of horticulture is sadly handicapped. We may put down as the first essential in the mental equipment of the research worker, a broad and severe scientific training The second essential is, perfect familiarity with garden, orchard and greenhouse plants and methods of handling their products It is not sufficient that the horticultural experimenter know but the industry in which he may specialize. Knowledge of what is done in the greenhouse, for example, is indispensable to the experimenter with fruits, offering him suggestions at every turn Whatever knowledge a man may possess of the needs and care of plants in any field of agriculture will be helpful in a specialized field. Perhaps the ability to correlate science and art should be put down as a third essential.

But at present chief emphasis must be laid on the scientific training. The art of horticulture is sufficiently well taught in agricultural colleges, and the money-earning value of an education is in most institutions over-emphasized. The atmosphere of practicums and money-making which prevails in most of our colleges is not one in which investigators are born and bred Instead, for the proper training of a horticulturist there should be an atmosphere of investigation for investigation's sake, of sound learning, of appreciation of science not only in its applications but as pure science and for its disciplinary value. It is desirable, almost imperative, that one training to become a horticulturist should take a post-graduate course in which special attention may be devoted to the sciences and the problems of horticulture.

Equipment for research.

Less need be said about the material equipment for horticultural research than the mental make-up of the worker. The nation and the states have been free in the expenditure of money for experimental work Not a few horticultural departments in the experiment stations of the country are over-equipped with land, buildings and laboratories—the things that money can buy. Certain it is that the output from the institutions conducting research is not in proportion to the money spent or to the number of men on the staff. The fact that equipment and materials do not create, needs emphasis everywhere in horticultural experimentation. The custom of obtaining money to build up a department without specific work to be done is a vicious one from which there must in time be a reaction. Opportunity, equipment and problem should go together, and all these are valueless without a man with initiative, ideas, and training to use them. There are probably more over-equipped departments in horticulture than under-equipped ones. Large experimenting is sometimes small experimenting and small experimenting large experimenting.

In one particular, however, the horticultural departments of the country are sadly under-equipped. There are no comprehensive plantations of economic plants in the experiment stations of the United States. The amelioration of plants is the chief work in horticulture and it would seem that the establishment of economic gardens is imperative, since material to be used advantageously must be near at hand. At least one station in every distinct agricultural region in the country should have an economic garden where may be found the food plants of the world suitable for the region. This should be an agricultural garden, not a plant museum to show the curious and the ornamental; in it agriculture must be dominant, not recessive.

Organization for research.

Horticulture is composed of so many industries and involves so many sciences that its problems are too diverse and too complex to permit of many definite statements in regard to organization for research. But several generalities may be set down as essentials to a good organization: (1) There must be a man in command—a broadly trained man. (2) The position of the experimenter should be permanent, subject only to efficiency. (3) The time and thought of the investigator must not be taken up with other activities, as administration, teaching, extension work and the like. (4) The organization must be permanent, to give continuity, coherence and exhaustiveness to the work. (5) The organization should usually correspond with the subdivisions of horticulture rather than the sciences upon which it is founded. That is, there should be pomologists, gardeners and florists, rather than botanists, chemists and entomologists (6) Money and effort should be concentrated upon a few comprehensive problems that can be exhaustively carried to sound conclusions. Too many experiments are but fragments of a larger problem, discovered to be such, they are often discarded after waste of time and money

The third of the essentials just given needs amplification The greatest deterrent to good work in experimentation is the association of research with teaching either in the classroom or from the institute platform. So much of the time and energy of men having these dual-purpose positions is taken by the more present, and therefore more pressing, work of teaching that they are often investigators only in name. In every institution where teaching and investigating are combined, the demand is naturally strongest from students, and investigation suffers There are, it is true, advantages in the combined position of teacher and investigator, but few indeed are the cases in which the disadvantages do not outweigh them and always the research work suffers

There should be cooperation between the horticultural experimenters in the several states and the United States Department of Agriculture A most pathetic spectacle in our agricultural institutions is that of isolated men attacking one and the same problem, duplicating results, often duplicating errors and in either case wasting public funds So far as possible there should not be overlapping of experimental work, unless duplication is desirable to make more certain the results In the latter case the work should be jointly planned and from time to time compared and adjusted to secure efficiency and economy. The Society for Horticultural Science is an excellent clearing-house in which the official horticultural experimenters in North America may interchange ideas and adjust their work.

Theories in horticulture are so general, facts so numerous, evidence of one kind or another so easily adduced, that the temptation is strong to state a theory, supply facts from the many already known, adorn the work with a dash of personally collected evidence and call the result an experiment. Such work lacks coherence and is incomplete. Few, indeed, are the horticultural investigators who make their work invincible by exhaustiveness. Again, the urgent call for results has led to the study of problems admitting of hurried conclusions rather than those that are fundamental, and for this reason much work is unfinished and inconclusive. The superb exhaustiveness of Darwin's work, much of it horticultural experimentation, should furnish inspiration and method to investigators in this

field of agriculture in particular. All call to mind that the "Origin of Species" is but a short statement of the theory of evolution which is then shown to be an impregnable fact by a vast amount of evidence over which Darwin labored for twenty years, biding time until his views reached full maturity. There is every temptation to publish prematurely, but permanent work is that which is completely worked out. Besides, given time, investigation is easier, material coming of itself which, under speed, would have required travail of mind to bring forth.

The immediate field.

In conclusion it may be well to state, as a record of the times, and for possible suggestive value, some of the present problems of horticulture

Experimentation is needed in the oldest of horticultural operations—pruning. It must be approached through physiological botany. We know next to nothing about the feeding of plants and the influences of the food elements on plant-products—current methods of fertilizing are largely arbitrary. Many questions having to do with sex are before us. There is need of more precise knowledge about bud-formation and the setting and dropping of fruits. There is yet much to be done in the classification and description of horticultural plants. More than elsewhere in agriculture, horticultural plants are inter-planted as in catch-crops, cover-crops and in crop-rotation; the inter-relationships of plants and the effects of crop residues, therefore, must be studied. Greater knowledge of the associations of plants would throw new light on the relations of climates and soils to plant-growing—plant ecology We have not yet reached the limit of improvement in any cultivated species and plant-breeding must be given attention. The relationships of parasites and hosts involving the whole matter of predisposition, resistance and immunity offer a series of problems The good and bad effects of sprays, quite aside from their insecticidal or fungicidal functions, are worthy of study. Much has been written but very little is really known about the reciprocal influences of stock and graft The whole matter of stocks needs experimental attention, fruit-growers in particular having little to guide them in the choice of stocks for the several fruits We know that cultivated plants vary greatly. are any of the variations heritable or do they appear and disappear with the individual? A study of the last problem would bring one to a much-needed investigation of mutations. Acclimatization deserves consideration. There yet remain many native plants worthy of domestication. Forcing of plants brings up many problems; as, the influence of heated soils and atmospheres, soil sterilization, artificial lights in place of sunlight, the use of electricity in forcing growth and the physiological disturbances of the plant brought about by the changed environment. Lastly, those who ship and store horticultural products are calling for experimental aid to solve their many problems.

EXTENSION TEACHING IN HORTICULTURE.

Extension work is the effort made by an institution of higher learning to carry outside its own walls and directly to the people, any form of helpful educational influence. A state university, or institution that derives financial support from the state, may legitimately be called upon to give instruction to the people who cannot attend its courses, if means are provided for the performance of this office. Such an institution no longer fulfils its complete function when it confines itself to teaching students who come to it and to the investigation of problems within its laboratories. A strong college of arts and science, necessarily the center of the great university of today, may extend its educational ideals and its higher educational functions to the people of the state as well as to the students who reside within it. The professional schools of law, medicine, education, engineering, journalism, agriculture and others (articulated with the college of arts and science, to make up the university) are each investigating the problems of their respective fields and gathering information that may be carried to the people of the state, through organized extension work More and more the people are coming to depend upon this information as a basis for better enactment, better municipal functions, better sanitation, better regulations as to health, better civic improvement of all phases, and last, but not least, better agriculture, better roads, and a higher plane of country life.

Extension work in horticulture is that phase of organized extension activity that has to do with better production, better handling and better marketing of horticultural products and the higher efforts of living to which this work contributes.

Horticultural extension is conducted by means of private letters, lectures, publications, correspondence courses, demonstration schools, demonstration experiments, and the like.

Private correspondence —Every fruit-grower, gardener, florist or other horticultural worker may encounter special problems upon which he needs individual advice. The horticultural department in any of our leading colleges of agriculture is called upon to answer thousands of letters of inquiry every year. Each of these inquiries is referred to the member of the horticultural staff best qualified to handle it. Many of these inquiries entail special letters. Some of them may be more fully answered by sending circulars or bulletins.

Publications.—Departments of horticulture disseminate much information through bulletins, circulars of information and press notices These bulletins are the published results of the investigation of special problems by the members of the horticultural staff. Circulars of information are more popular treatises of horticultural subjects of interest in the state, and pertaining to which the department has gathered information of interest. Press notices are usually timely topics or seasonal advice furnished the press of the state to publish at the opportune time for their readers If an insect or disease appears suddenly and promises to become widespread, due to unusual conditions, it often may be checked by prompt action. Unusual weather conditions may sometimes call for unusual methods of management of plants or of crops

The publication may take the form of an organized reading-course effort without assuming to construct and conduct correspondence courses

Extension lectures.—Hundreds of lectures on horticultural topics are given by members of the horticultural staff, at schools, teachers' meetings, civic improvement societies, commercial club meetings, nurserymen's conventions, canners' associations, fruit-growers' organizations, florists' clubs, and other gatherings. In this way something of the work of the Department may be carried to every organized body in the state which is interested in a phase of horticulture.

Surveys.—That the department of horticulture may be of special service to a horticultural center, or special horticultural industry, a careful survey of the horticultural conditions as they exist may be desirable. Such a survey may determine what varieties are proving most profitable, which of the prevailing methods of management are yielding the most satisfactory results, what are the difficult problems that need investigation and what are the reasons for successes or failures. The average result may throw much light upon what is already proving best in the neighborhood. A question that is vexing the average grower may have been answered by the work of the best growers, whose results show the answer to the question. As an example of the plan and possibilities of such surveys may

be mentioned the orchard survey of some of the leading apple-growing counties of New York. A measure of the commercial value of spraying is secured by statistical results from sprayed and unsprayed orchards. The commercial value of orchard tillage as compared with orchards growing in sod is shown by the returns from each class of orchard. The best methods of greenhouse construction and management for particular crops may be determined and explained in the same way.

Extension schools.—In many states, extension schools of horticulture are held for the purpose of carrying special horticultural instruction to a neighborhood. Such schools often consist of lectures and demonstrations in a subject of immediate interest For example, just previous to harvesting a fruit crop a school in fruit-packing may be held. The methods and advantages of proper packing are presented by means of lectures. This is followed by practical laboratory periods in which those in attendance learn to do the work of proper packing. In a similar way, pruning, spraying and other phases of fruit-production are being taught in brief periods of one or two days or a week, the time varying with the needs of the community and the character of the subject taught; or situations with vegetable-growers and florists may be met.

Correspondence courses —Some schools teach courses in horticulture by correspondence. Certain subjects are capable of being taught in this way. Outlines for the lessons are mailed to the student. Prescribed reading is required and directions for observations and original work and study of plants are formulated. Examinations usually consist of written reports made by the student, embodying a statement of the results secured by him. These reports usually show whether or not the student has grasped the subject and wherein he may need further suggestions and study.

Boys' and girls' clubs.—A movement that is destined to have a very profound influence is the organization of boys' and girls' clubs for the study of subjects relating to horticulture. Often this club work takes the form of contests in gardening or in the production of some special garden crop, such as tomatoes. Organization is best effected through cooperation with the schools or somebody that can direct the work of each local club. Printed sheets are mailed the club members, from time to time, giving instruction in the details of the work and the conditions governing the contest. Prizes are usually awarded at the local contests and sometimes the prize-winners compete in a state contest.

Cooperative demonstrations and experiments.—A very efficient means of promoting the productive growth of any horticultural interest is by means of cooperative demonstrations conducted on the grounds of some energetic grower, whose conditions fairly represent the neighborhood. The ground may be leased by the institution or offered by the local grower. Experiments are carefully outlined to test some problem of interest, such as spraying, comparison of methods of pruning or of cultivation or planting, the use of fertilizers, determination of the merits of particular flowers or vegetables, or other question which the community needs to have worked out. A representative of the horticultural staff visits the grounds as often as is necessary to oversee proper conduct of the work and to record the results of the experiment. Whenever results are secured that are of benefit to the growers, a meeting is held for the purpose of explaining and observing these results and demonstrating the methods for the benefit of those who may profit by adopting them. This form of extension affords the means not only of presenting to the grower facts and methods already known, but it also works new problems out for the neighborhood by securing results that are adapted to their special local requirement. It makes the work convincing; the growers themselves have a hand in it and feel that it is their own; they grow into an understanding of it as the work grows; it gives a new pride and a new power in working for superior methods. While this is perhaps the most productive form of extension work, its scope is, of course, necessarily limited by the fact that working force and funds are not available for handling more than a limited number of the pressing problems in a state at one time.

General considerations.—Incidentally there are other ways by which extension work may be accomplished. Enough already has been accomplished to show that organized extension work has a large and increasing influence upon the horticulture of a state.

Like any other great movement in behalf of human progress, the measure of success of extension work in horticulture depends largely on its proper organization. It offers a multitude of opportunities for work that the world needs to have done As indicated above, the work is approached in numerous ways Unless properly organized there is danger of scattered effort, duplication, and failure to follow up results so as to give stability and permanence. It should be a factor in the organized extension work of the entire institution of which it is a part. The question then arises as to whether the work should be undertaken by a separate corps of workers, especially trained for the purpose, and acting under the direction of an extension department head, or whether, since it relates to a special professional field, it should be carried by the officers of the department of horticulture in the college and experiment station. To the writer, the latter seems to be the more rational arrangement. It is no doubt true that if a corps of men do extension work exclusively, with no definitely organized relation to college teaching and experiment station investigation, there will be a tendency to lose touch with higher educational ideals and failure to take to the people the stimulus of productive investigation and the last word in scientific advancement. Undoubtedly there is a tendency, especially on the part of younger men who have the faculty of appealing to the popular audience, to become satisfied with the plaudits of the multitude, and to strive only to enthuse and amuse, unless they are closely connected with college and station work. While one function of extension work may be to inspire and exhort, the day has passed when that alone is sufficient. The commercial horticulturist has reached a plane of development when he needs definite helpful instruction. Attractive letters and lectures are no longer sufficient. He needs, in addition, so far as it is possible to supply it, definite demonstrations of how to do his work according to the most approved methods. The men most closely in touch with strong college teaching and station investigation should be the best fitted to supply this need.

Furthermore, the college teacher or investigator equally needs intimate contact with the commercial grower and his problems. His problems are the problems of the teacher and the investigator. The above conclusions do not dispute the fact that an individual may have especial talent and taste for extension work and lack the plodding patience to make a strong investigator. He may largely devote his time to extension if only the organization keeps him closely linked with college and station men. On the other hand, a productive investigator may not best succeed as a popular lecturer and may give most of his time to investigation. His help may be indispensable in solving some of the difficult problems that arise in the field of extension. The organization of the individuals doing college and station work, ought to afford that union of relationship that will enable the director of extension to call the department of horticulture to his aid. The organization within the department should be best able to supply this need by calling upon the individual best fitted to meet the specific demand.

J. C WHITTEN.